

Geologically Speaking

A Michigan Section AIPG Publication

Inside This Issue:

WMU Crosses the Pond to Ireland!

Critical Minerals in Michigan and the MGS

Regulatory Roundup!

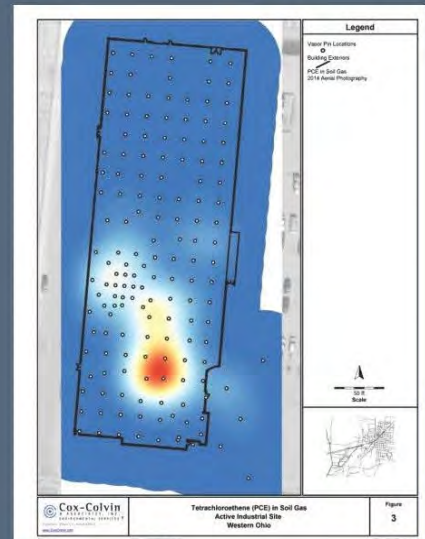
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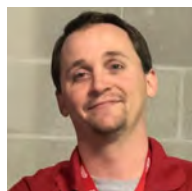
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Front Cover: The May 10, 2024 northern lights display as viewed from Ionia, Michigan. Photo by Adam Heft. The photo was taken using an iPhone 14 without a tripod, and is unenhanced..

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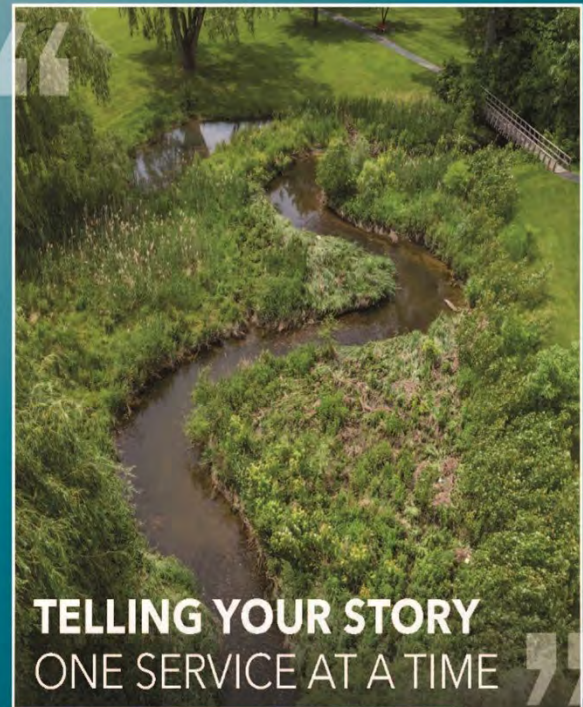
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Geology Crossword #16 Solution

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C	L	E	A	V	A	G	E											G	

Across

1. A process in cooling magma
6. Complex organic polymers in sediment
10. Lacking in oxygen for respiration
11. Analysis method using x-rays
13. Highly saline waters
15. When oxic and reducing agents combine
16. Education, abbr.
18. Spectroscopy method of analysis
21. Calcite dissolution occurs here
22. The maximum dissolved concentration
24. Something dissolved in a solvent
25. A plane of weakness

Down

2. Not an exercise fad
3. Ocean layer between 200 and 1000 m
4. Something acceptable
5. Not a Matrix dynamic duo
7. A static condition
8. Unsaturated; not Vader
9. A diagram of someone to pay
12. Flaky white mica; altered feldspar
14. They love iron
17. Physical & chem. processes in sediment
19. Indicative of pressure solution
20. Symmetrical ingrowth of multiple crystals
23. Soft precipitate of calcium carbonate

From the President's Desk

"Put me in coach, I'm ready to play!" Perfect song for spring with baseball and softball in full swing! I was a softball player in high school and beyond – could not get enough of the game. I also coached some as well including my son's baseball team in his early years. It was fun to help foster young boys and girls while coaching a sport that I love. I especially enjoyed how you could see their progress with each game and their confidence building with each achievement. I also learned a lot from the kids, patience of course and that you can find a lot of baseball skill drills on the internet! As Phil Collins said, "In learning you will teach, and in teaching you will learn". I learned much from those kids.

In my opinion, coaches as well as mentors are keys to a successful career and even life. I have had coaches for sports and for work and they not only taught me life lessons, but also gave me skills that improved my game. Coaches are there to help you improve performance to achieve goals within a defined timeframe. Mentors on the other hand focus beyond immediate goals, encompassing broader personal and professional growth by imparting their knowledge and experience. These resources are so valuable that I highly recommend taking advantage whenever possible to give you that edge in your career and in life.

Public speaking is one of those areas where I have used a coach. When I get nervous, I tend to have trouble getting the words out and I find I have a mild stutter. I also used to say "um" a lot – have you ever noticed this when watching others speak? Once my public speaking coach counted the number of times I said "um" in a speech I was giving, after that, it became so apparent. In fact, once I started noticing it, I could hardly get through a speech without stammering when I was about to say "um". However, after practice and practice with my coach, I was able to overcome (or at least minimize it). Next time you are speaking, watch for those filler words such as "you know", "like", or "um".

I have had multiple mentors throughout my career too. Mentors have helped me in various ways, such as serving as a reference, offering professional advice, and challenging me to think critically about my career path. When I was first trying to determine what area of geology I wanted to practice, I had a mentor named Ham, yes that's right Ham. He was a wise geologist in the gold mining industry. One of the best things he said to me that helped me decide what I wanted to do was, "if you want to live wherever you want to, get into groundwater because everyone needs clean water". From that point on, I started focusing on hydrogeology and started my first job in my hometown which is where I wanted to live. When my 25-year career in environmental consulting unexpectedly changed, my mentor asked the question "do you want to continue in consulting or try something new?". Ultimately, I chose to do something new and have really enjoyed the challenge and change of learning more about the utility and energy industry. It was a perfect change

for me at this time in my life and provides the perfect work-life balance that is so important to me.

One of my favorite things to do is to help others achieve their goals and dreams. "The greatest good you can do for another is not just to share your riches but to reveal to them their own" (Benjamin Disraeli). Did you know that AIPG has a mentoring program (www.aipg.org)? You can sign up to be a mentor or if you are looking for a mentor, all you do is review the list of mentors and reach out to the one that you want to learn more about. It is that simple. Mentoring is a reciprocal relationship where both the mentor and mentee learn, grow and contribute to each other's success. Whether you're a mentor or a mentee, the impact can be transformative!

Just as a baseball team thrives under the watchful eyes of coaches, so do individuals flourish when guided by mentors. Coaches, like seasoned managers, dissect the game's intricacies, refining skills, and strategies. They're the ones who fine-tune the swing, tweak the pitch, and instill discipline. Meanwhile, mentors, are like veteran players who offer more than technical prowess. They share life's playbook-the unwritten rules, the setbacks, the triumphs. They offer encouragement during the ninth inning, urging us to swing for the fences even when the count is against us. Both coaching and mentoring are essential to growth and well-being. So, whether you are stepping up to the plate or guiding someone else's journey, remember: the game isn't just about winning, it's about the bonds forged, the lessons learned, and the legacy left behind.

May your innings be filled with wisdom, resilience, and the joy of passing the torch to the next generation! Get a mentor. Be a mentor.

Have a wonderful summer and see you at our next event!

Amy

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Secretary's Report

The Michigan section AIPG Executive Committee meets monthly on the first Friday with a few deviations due to schedules. During the monthly one-hour meetings, Executive Committee board members have discussed and planned various topics, highlighted by month below:

The Executive Committee has been meeting monthly since the new year both virtually and in-person. We held a Section meeting in February which was held at the Vistatech facility located in Livonia. The topic of the section was **"Advances in Phytoremediation for Sustainable Nature-Based Treatment for Contaminated Groundwater Removal and in-situ Degradation"** given by Renee Murphy from Instrinsyx Environmental.

We held a second Section meeting in May which was held at the Kellogg Hotel and Conference Center located in Lansing. The topic of the meeting was **"Michigan's Leaking Underground Storage Tank Cleanup Program: A 2024 Perspective"** given by Steve Beukema, PhD, from EGLE's Remediation and Redevelopment Division. Registration for the Environmental Risk Management Workshop in June is SOLD OUT! The Section's Golf Outing in September is still open. More updates coming soon!

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.

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AIPG Michigan Section 20th Annual Golf Outing

September 10, 2024 Golf Outing
Fox Hills – Golden Fox Golf Course
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Ready, Set, Go! Golf carts at Fox Hills; photo from Fox Hills Golf Course photo gallery.

Greetings everyone! I am pleased to announce that this year's golf outing is scheduled and will be held on September 10th once again at the beautiful Fox Hills club and will feature their championship Golden Fox course in Canton, Michigan! The Michigan Section is deep in the planning phases for our 20th Annual AIPG Golf Outing. Please spread the word to your suppliers and fellow colleagues, and plan to bring your A-game, drivers, polished irons, and fancy putters (or just be willing to play 18 holes and have a good time!). The rolling picturesque landscape and rolling topography paired with an excellence in design and construction will make the engagement suitable for the stiffest of competition and cozy enough for us humans to just enjoy.

Please also consider a sponsorship this year as we really could not have this event without our new and returning sponsors. There are several different levels of sponsorship listed on the event page and event flier. These sponsorship opportunities offer great exposure to some of the most influential professionals in our industry. Sponsors are also requested to include with their sponsorship a gift basket of at least \$30 in value that will be raffled off with the rest of the prizes. Last year we raised approximately \$300 from the gift baskets alone and we are ready to beat that amount with an even better event this year!

All money raised is put toward the Michigan Section's awards programs and helps support our student chapters.

To ensure continued success, please join us by; participating, sponsoring, soliciting sponsors, and/or donating prizes or items. Volunteers are also highly encouraged and very welcome!

This event is a great opportunity to spend time with colleagues and celebrate the closing end of a busy "summer field work" season here in our beautiful state of Michigan. It is open to everybody, so please come and take advantage of the opportunity as so many others have done in the past. You need not be an avid golfer to participate; all are welcome!

The registration is open and can be completed at the event website here: [American Institute of Professional Geologists - 20th Annual Golf Outing \(eventregisterpro.com\)](https://www.eventregisterpro.com). If necessary, a hard copy registration form, along with a check covering the registration costs, can also be submitted to Kalan Briggs at briggsk2@michigan.gov or mailed to 630 Piper Road, Haslett, MI 48840. Feel encouraged to take advantage of the "Early Bird" discount if you register/pay for golf by August 1, 2024.

We hope to see you on September 10, 2024!

Editor's Note: Registration and information flyer for the 2024 Michigan Section AIPG Golf Outing can be found at the end of this edition of *Geologically Speaking*...

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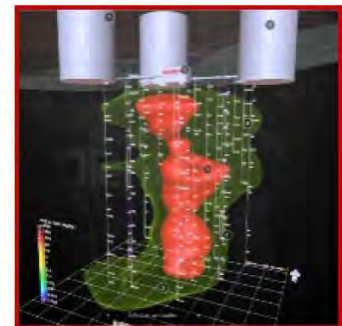
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Where in Michigan?

The January 2024 edition of *Geologically Speaking* featured a photograph of the 2.1-2.2 Ga Siamo Slate at the roadcut in Negaunee. No one correctly identified 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, and the name and age of the uppermost bedrock formation it sits on) will win AIPG swag! Submit your entry via email to the editor; only one per person per issue please.

Don't forget to check out the feature article "Geology in Michigan" in this issue (as well as the last several editions) that presents a geologic feature of interest 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 or country 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.



Invitation to Our Members!

Do you have a case study to share?

The Michigan Section AIPG promotes knowledge sharing and would like to feature 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.

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 or because your IT group may classify it as junk or a bulk sending.

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!

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Western Michigan University AIPG Student Chapter: Crossed the Pond to Ireland

By Moira A. Burns

W

"You never know what you can do until you try, and very few try unless they have to" ~ C.S. Lewis.

This past year, 13 students from Western Michigan University's AIPG Student Chapter embarked on an 11-day journey within the North Atlantic's Emerald Isle. While the trip itself was only 11 days, the preparation took months of work. Taking 13 students and one faculty sponsor (Photo 1) anywhere can



Photo 1: Group photo of the 13 students and faculty sponsor Tom Howe with Western Michigan Alumni Dr. Sita Karki. Photo provided by Moira Burns.

be expensive, let alone to a different continent. In the beginning of the year, when we decided that our hearts were set on Ireland for the destination of our yearly trip, we were told by many that we might've been 'too ambitious'. Organizing a trip that big is a daunting task. Booking places to stay, updating passports, exchanging currency, and raising funds can be a lot for one student chapter to do. Despite discouragements telling us that we should 'aim lower', we did it. After months of fundraising through rock sales, hosting events, and even calling alumni for donations, we made it possible. For just \$300 each, 13 students were able to take the trip of a lifetime to see and experience the culture, history, and geologic wonders that Ireland had to offer.

Once we arrived in Dublin and adjusted to driving on the opposite side of the road, we finally began our journey and drove all over Ireland! Our first geologic stop was at The Cliffs of Moher, an Upper Carboniferous sedimentary basin composed of shales and flagstones. Here, on the west coast of Ireland's famous Wild Atlantic Way, we were fortunate enough to meet up with Dr. Eamon Doyle—the official geologist for The Burren and Cliffs of Moher! Dr. Doyle explained the geology of the area and even pointed out the different types of trace fossils like feeding trails and burrows that can be seen in the walkways of the geopark (Photo 2). At the Burren, we saw Carboniferous limestones, formed from the remnants of marine organ-



Photo 2: Dr. Eamon Doyle pointing out and explaining trace fossils to group members: Brandon Tulban, Jordan Gibbs, Moira Burns, Thomas Howe, Gabe Fox, and Mary Howe. Photo provided by Moira Burns.

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isms during the period when the region was submerged beneath a warm and shallow sea.

Following that, we got to see one of the world's longest free-hanging stalactites in Doolin Cave. This stalactite is over 7.3 meters (24 feet) in length! Roughly 350 million years in age, the giant stalactite formed from acidic water flowing from a nearby shale that began dissolving limestone, eventually dripping through the cave ceiling (Photo 3). The Doolin Cave was one of my favorite places we



Photo 3: Student chapter group members on a tour of the Doolin Cave observing the giant stalactite. Photo provided by Moira Burns.

visited but I was also a little uneasy while being there, I think this was the deepest I have ever been underground (almost 200 ft). However, I was in absolute awe at just how close we could get to the stalactite (while still being safe of course). In a sense it was humbling, to see just how big it was, while also understanding how long a time it would take to form a stalactite that big. Many geologists may find it relatively easy to grasp the vast expanse of geological time conceptually. However, witnessing the continuous processes of stalactite formation, from dripping to building, compels one to perceive their own life within the grand context of geological timescales. While

that alone could send someone into a spiral of questioning how effective their existence is in the grand scheme of things. I think it's really cool. Even though a lot of geologic processes like mountain building, dolomitization, and the chemical weathering that it took to make the Doolin Cave stalactite can take millions of years, we can still see some of the processes right before our eyes. THAT is what makes geology so cool.

Another geologic wonder that we stopped at was Giant's Causeway. Located all the way on the north coast of Northern Ireland, Giant's Causeway contains over 40,000 interlocking hexagonal basalt columns that formed as a result of a volcanic fissure eruption at the start of the Paleogene period, roughly 60 million years ago (Photo 4). This place was unlike anything any of us had ever seen previously! Before this trip I had no idea rocks could form this way, the basalt looks this way because while the molten rock cooled and contracted, it was relieved by fractures that intersected at 120-degree angles, which created six-sided polygons.



Photo 4: Student chapter members: Lila Rode, Alexa Hempel, Mina Bohl, and Garret Link standing on the columnar basalt at Giant's Causeway. Photo provided by Moira Burns.

By far my favorite place we visited was Malin Head. Located on the Inishowen peninsula in Donegal, Malin Head is the most northern part of the island of Ireland, at a latitude 55.38°N. The rocky cliffs are made of schist and quartzite and the upper bluffs are blanketed with glacial and periglacial drift that slopes downward to a basal rocky cliff that cuts into bedrock. These cliffs overlook the

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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.

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Lough Foyle 100 meters above seal level. Visiting Malin Head was like stepping into another world (which is probably why Disney chose to film part of Star Wars VIII: The Last Jedi there), and like Doolin Cave, it too made me a bit uneasy. It's not every day that you get to look over a cliff and see giant crashing waves that are 100 meters below you (Photo 5).

All in all, I'm super thankful that I was able to go on

fundraise for our trip to Ireland, we gave it our all any-ways. If we wanted to reach our goal of going to Ireland, we knew we had to put in the work, and that's exactly what we did. Dedicating oneself to a seemingly unattainable goal and wholeheartedly committing to a cause is no simple task. Accomplishing such a goal requires both passion and a supportive network of people, which is exactly what we have in our student chapter!



Photo 5: Student chapter members: Anna Sauger and Lila Rode sitting on a cliffside at Malin Head . Photo provided by Moira Burns.

this trip. Our trip was a trip of a lifetime, places like Giant's Causeway and Malin Head are bucket-list level travel destinations for people. Being a college student is expensive, if it weren't for the countless hours of work and effort that the club put into fundraising, none of us would have been able to go. I learned a lot about the geology of Ireland on this trip and I had so much fun travelling and spending time with the student chapter members. One thing I didn't expect though, was the life lesson I learned in preparation for this trip. I learned that the student chapter and I can achieve more than we ever thought we could. Even though many discouraged us from trying to

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 AIPG publication *Geologically Speaking*.

Critical Minerals and the Michigan Geological Survey:

Part 1, Critical Mineral Systems in the Upper Peninsula

By Robert Mahin, CPG-11275

In 2018, the U.S. Geological Survey (USGS) released a list of critical minerals defined as “non-fuel mineral or mineral material essential to the economic or national security of the U.S., and which has a supply chain vulnerable to disruption” (Burton, 2022). The list was updated in 2022 to a total of 50 critical minerals/elements. Since 2021, President Biden has made the domestic supply of critical minerals a national priority. The Precambrian terrane of Michigan’s western Upper Peninsula (UP) is rich in a variety of minerals and mineralizing systems and is poised to figure significantly in the nation’s effort to identify and assess critical minerals.

With federally appropriated funding, recently augmented by the Infrastructure Investment and Jobs Act, the USGS Earth Mapping Resource Initiative (Earth MRI) is collaborating with State geological surveys for geologic mapping and critical mineral assessments, as well as inventorying and characterizing mine wastes. This partnership has enabled the Michigan Geo-

logical Survey (MGS) to plan a series of critical mineral assessments and geologic mapping projects of the western half of Michigan’s UP. To spearhead this effort, three UP-based, Precambrian geologists were hired in the last half of 2023 and are now based in the Northern Michigan Geologic Repository in the town of Gwinn.

As part of Earth MRI the USGS and their partner State geological surveys have identified broad ‘focus’ areas within the United States known to, or with the potential to, host deposits containing critical minerals, as shown in Figure 1. (Dicken et al., 2022). These focus areas are based on favorable geology and/or mineral deposit occurrences and are categorized using a mineral system/deposit type framework. In the UP, the USGS and the MGS identified a number of broad focus areas; those of primary interest to the MGS are summarized in Table 1.

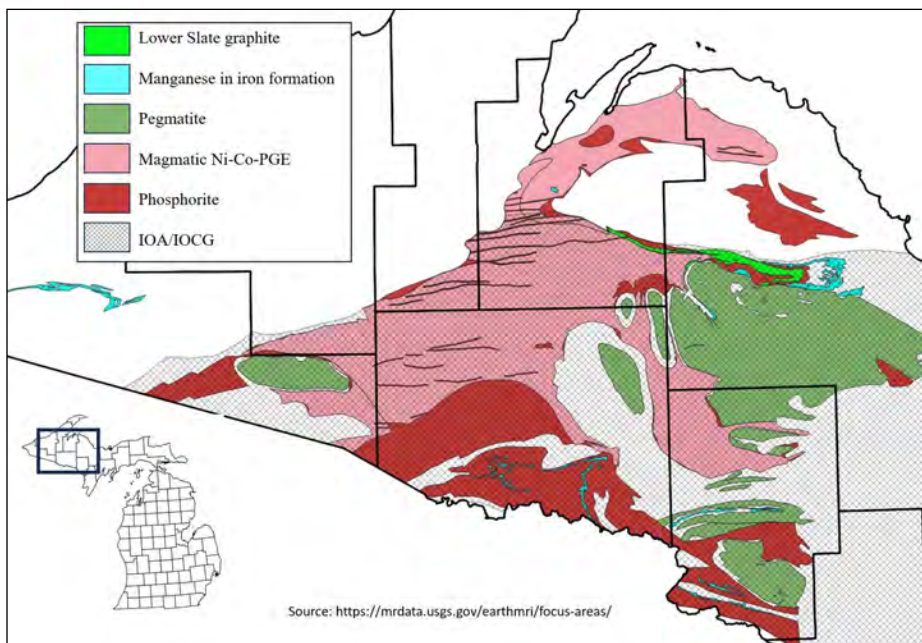


Figure 1: USGS Earth MRI Areas of Focus.

The existence and potential for some critical minerals is well-established in the UP, such as magmatic sulfide Ni-Cu-Pt-Pd-Co, exemplified by the active Eagle Mine. Other resources in Table 1, such as graphite, manganese, and phosphate, have been documented in the UP but have received little or no attention. Additional critical minerals, such as rare-earth elements, beryllium, and fluorspar in pegmatites, granites, and iron-oxide-copper-gold deposits (IOCG), have scant information, but the UP is considered by the USGS to have permissive geology for them. The MGS is currently working with the USGS on prioritizing which focus areas and related mineral systems have the greatest promise. The following is a summary some of the critical mineral systems in the UP.



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Table 1. USGS-MGS Critical Mineral Focus Areas for the Upper Peninsula

Name of focus area	Mineral system	Deposit type(s)	Critical minerals definitely known in the focus area	All critical mineral commodities in the deposit types
Midcontinent Rift magmatic sulfide Ni-Cu-PGE	Mafic magmatic	Nickel-copper-PGE sulfide	Nickel, Co, PGE	Co, Ni, PGE, Te
Manganese (Mn) in iron-formations	Marine chemocline	Iron-manganese	Manganese	Co, Mn
Graphite in black shales	Metamorphic	Graphite (carbonaceous sed)	Graphite	
Humboldt Granite	Porphyry Sn (granite-related)	Porphyry/skarn		Be, Sc, W, Sn
Humboldt Granite	Magmatic REE	Peralkaline syenite/granite/rhyolite/alaskite/pegmatites		Be, Fl, Hf, Nb, REE, Ta, Te, V, Zr
Southern Complex pegmatites	Porphyry Sn (granite-related)	Pegmatite LCT		Be, Ce, Li, Nb, Sc, Ta, Sn
Mesoproterozoic Phosphate	Marine chemocline	Phosphate		Co, REE
Peavey Pond Complex	IOA-IOCG	Iron oxide apatite; Iron oxide copper gold		Co, REE
Western Upper Peninsula, IOCG	IOA-IOCG	Iron oxide apatite; Iron oxide copper gold		Co, REE

Modified from Dicken et al., 2022

Magmatic Nickel-Copper-Cobalt-PGE

The 2022 list of critical minerals added nickel because of its importance to stainless steel, superalloys, and rechargeable batteries. Platinum, palladium (PGE), and cobalt were already on the list. One of the richest sources of these metals is the mafic magmatic mineral system. Magmatic sulfide deposits form from primitive mantle-derived magmas containing elemental nickel, copper, and PGE. As the magma burns its way up through the crust and assimilates sulfur-bearing country rock, liquid metal-sulfide droplets may form. Being denser than the magma, sulfide droplets can accumulate in traps in the magmatic plumbing system where magma flow is interrupted and potentially form an economic deposit. The Precambrian Midcontinent Rift System (MRS), which formed the world-famous native copper deposits of the Keweenaw, is now widely recognized for its potential to host world-class magmatic nickel, copper, cobalt, and PGE sulfide deposits due to the discovery of the high-grade Eagle Mine in Marquette County, Michigan and the Tamarack deposit in Minnesota. In 2014, the Eagle Mine began production with a pre-mine reserve of 5.16 million tonnes grading 3.1% nickel and 2.6% copper and a projected seven year mine-life (Lundin, 2014). A satellite deposit, Eagle East, was discovered in 2015 and though smaller at 1.3 million tonnes, it boasted some of the highest grades for a stand-alone magmatic deposit: at 5.2% nickel, 4.2% copper, and 3.5 grams per tonne Pt+Pd+Au (Clow et al., 2017). In late 2023, Eagle announced plans to extend mining to 2029 (Beronja, 2023).

Efforts to identify magmatic sulfide deposits, especially conduit-type deposits, rely heavily on airborne geophysics due



Figure 2: Core from the Eagle Mine, Marquette County. The high-grade massive sulfide core of Eagle consists of pentlandite, chalcopyrite, and pyrrhotite and averages 6% nickel and 4% copper.

to limited outcrop and the deposits relatively small size. Magnetic anomalies over sulfur/sulfide-bearing host rocks, such as the Michigamme Formation metasediments, can be indications of an intrusion or dike that might be part of an MCR-related plumbing system. Currently, exploration companies are active in the region in the search for another Eagle-type deposit and Earth MRI has prioritized the western UP as an area of interest for future airborne geophysics.

Graphite

Graphite is a major component in lubricants, batteries, and



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fuel cells. In the Early 1900's small surface mines attempted to exploit the graphitic Lower Slate Member of the Michigamme Formation. Studies conducted by Michigan Technological University and the Geological Survey Division (MTU/DNR) in the 1980's assessed the graphite content of the Lower Slate from the historical pits and scant outcrops. Graphite-rich slate was identified over a 30-mile strike length (Hwang et al., 1986). Carbon content of three surface samples from over this distance averaged 17% to 30%. (Hwang et al., 1986). On the order of three billion tons of graphitic material in the Lower Slate has been suggested (Peterman et al., 1987). A series of drill holes by companies searching for uranium in the 1980's intersected numerous intervals of graphitic Lower Slate and were the subject of additional studies by (MTU/DNR). The Northern Michigan Geologic Repository retains much of this drill core (Figure 2). The MGS plans to revisit these holes and provide an updated assessment of the graphite resource using modern analytical methods.

Manganese

Manganese is important to steelmaking and is also used in batteries. In the UP it largely occurs in banded iron formation. Although documentation is scant, historical reports do yield



Figure 3: Graphite-bearing drill core from the Lower Slate Member.

some information. The Iron Gogebic, River-Crystal Falls, Marquette, and Menominee iron districts of Michigan all reportedly contained some manganiferous iron ore. James et al. (1968) reported that mines in the Riverton Iron Formation in 1943 and 1951 produced manganiferous iron ore with 11.3 and 4.11% Mn, respectively. The Champion and Taylor iron mines in the Marquette district contained an exotic suite of manganese minerals. An evaluation of potential manganese resources in iron formation will likely focus on resampling the vast iron mining waste piles of the UP.

Phosphate/Phosphorite

Phosphorite deposits can contain rare-earth elements. Isolated occurrences of phosphorite in iron formation and in basal breccias of the Michigamme Formation were noted by Mancuso et al. (1974) and by Cannon and Klasner (1976). The occurrences are relatively small, isolated, and little else is known about them. The MGS has collected samples from one occurrence for trace element analyses.

Rare Metals and Rare Earths

Pegmatites have the potential to contain many critical elements including beryllium, cesium, lithium, niobium, scandium, tantalum, and tin. The Archean Southern Complex granite-gneiss terrane of Marquette, Dickinson, and Gogebic counties hosts numerous pegmatites. A small number of these have been sampled, and published reports indicated that anomalous amounts of rare earth elements were found. As yet, no significant lithium or tantalum-bearing pegmatites or accumulations of other critical minerals have been identified. Published USGS geologic maps and reports (for example, James, et al., 1961), however, suggest significantly more pegmatites exist than have been sampled. The MGS has started to sample



Figure 4: Beryl-bearing pegmatite from Dickinson County.

pegmatites and plans to complete a comprehensive geochemical reconnaissance of pegmatites in 2024.

Iron-oxide apatite and iron-oxide-copper-gold deposits (IOA/IOCG) are a relatively new class of ore mineralization. IOA/IOCG mineral systems are generally considered to be complex, deep-seated magmatic-hydrothermal systems that contain economic copper and gold grades. These also commonly contain significant volumes of iron-rich breccia and are associated with widespread sodic-calcic alteration (Groves et al.,



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2010). Cobalt and REE can also be an economic component, which is why these deposits are of interest for critical minerals. The western UP hosts multiple favorable rock types for IOA/IOCG mineralization, including early Proterozoic gneiss domes with related metamorphic nodes. The doming may be related to known retrograde hydrothermal overprinting associated with Cu-Fe sulfide, REE-bearing fluor-apatite, and monazite



Figure 5: Drill core with anomalous fluorite (purple) mineralization in gneiss from the Watersmeet gneiss dome, Gogebic county.

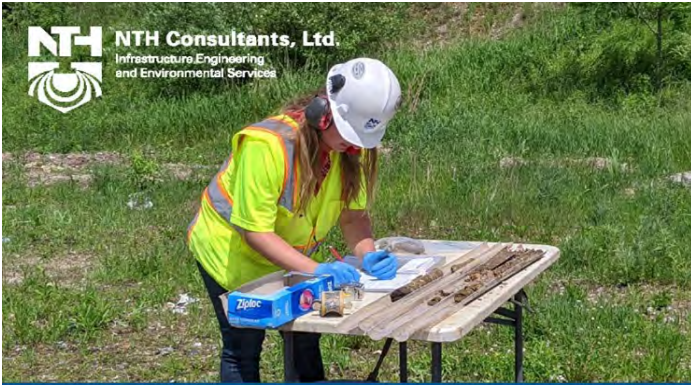
anomalies, which may represent an IOA/IOCG signature (Dicken et al., 2022).

The Peavey Pond Complex in Iron and Dickinson counties is a complicated intrusive complex comprised of metagabbros, metanorites, metadiorite, metatonalite, granodiorite, and granite. Hydrothermal, metamorphic mineralizing fluids may have moved along major structures in the area to potentially produce an IOA/IOCG (Dicken et al., 2022).

The MGS is currently working on geologic map, literature, and historical drill log compilations for these mineral systems in preparation for mapping and geochemical reconnaissance in 2024. Part 2 of this series will highlight in more detail the MGS's role in assessing critical minerals in the UP.

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Coming Events

June 8, 2024: AIPG National Executive Committee Meeting (Virtual). For details and an invite, email Cathy Duran at cld@aipg.org.

June 11-12, 2024: Michigan Section AIPG 13th Environmental Risk Management Workshop, Data Driven Decision Making. Ralph A. MacMullan Conference Center, Roscommon, MI. Look for additional information in this edition of *Geologically Speaking*.

June 21, 2024: AIPG National Executive Committee Meeting (Virtual). For details and an invite, email Cathy Duran at cld@aipg.org.

July 19, 2024: AIPG National Executive Committee Meeting (Virtual). For details and an invite, email Cathy Duran at cld@aipg.org.

August 10-13, 2024: AIPG Annual Meeting, Durango, Colorado. Details forthcoming in Apr/May/June 2024 TPG.

August 2024: Ishpeming Gem & Mineral Show, Ishpeming Elks Club, 597 Lake Shore Dr., Ishpeming.

September 2024: Joint Michigan Section AIPG/MAEP meeting. Date, speaker, and location to be announced.

September 2024: Michigan Section AIPG Field Trip to the new Soo Lock while under construction. Details forthcoming; watch for an announcement this summer!

September 20, 2024: AIPG National Executive Committee Meeting (Virtual). For details and an invite, email Cathy Duran at cld@aipg.org.

October 11-13, 2024: 79th Greater Detroit Gem, Mineral, & Fossil Show. Macomb Community College, 14500 E. 12 Mile Road, Warren. Details at: <https://www.michmin.org/show-info>.

October 2024: Central Michigan's Annual Gem, Mineral, Fossil, Lapidary & Jewelry Show, Ingham County Fairgrounds, 700 East Ash Street, Mason.

December, 2024: Michigan Section AIPG Annual Meeting. Location, speaker and presentation TBA.

February 13-16, 2025: 70th Anniversary Tucson Gem & Mineral Show, Tucson, Arizona. "Shades of Green—Experience the Magic!"

May 2025: Kalamazoo Rock, Gem, Fossil & Mineral Show. Kalamazoo County Expo Center, 2900 Lake Street, Kalamazoo.

October, 2025: 62nd AIPG Annual Meeting, St. Louis, Missouri.

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:

Christopher Carew, CPG-12195; Joshua Bridges, ECP-1114; Spencer Sienkiewicz, ECP-1115; Janelle Myers, MEM-3590; Mary Sherwood, MEM-3579; Grace Babiarz, SA-12090; Sydney Bussineau, SA-12052; Andrew Chiles, SA-12091; Casey Dolen, SA-12086; Lili Faulkner, SA-12104; Sofia Foreman, SA-12075; Kristen Hasbrouck, SA-12100; Collin Houston, SA-12089; Ryan John, SA-12087; Ruth Kanipiau, SA-12105; Sara Kavousi, SA-12106; Joseph Kock, SA-12101; Stephanie List, SA-12069; Sydney Lockhart, SA-12092; Timothy McNamara, SA-12053; Chris Mitchell, SA-12040; Ashley Popko,

SA-12088; Ryan Schwiderson, SA-12067; Parker Shukwit, SA-12103; Lee Simmons, SA-12102; Erika Snell, SA-12085; Loren Solomon, SA-12042; and Stephen Udota, SA-12048.

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.

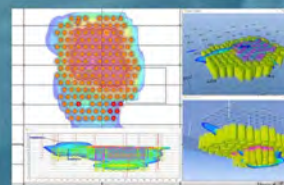
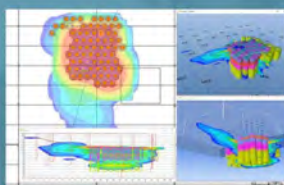
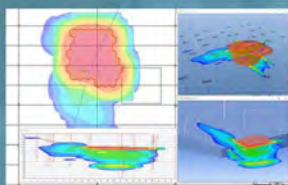


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Regulatory Roundup

Since the last Regulatory Roundup column, the breaking news has been the issuance of the first-ever nationally, legally enforceable drinking water standard for per- and polyfluoroalkyl substances (PFAS). The announcement was made by the Environmental Protection Agency in a [news release](#) on April 10, 2024. The news release also included an investment of \$1B through President Biden's Investing in America agenda to address PFAS in drinking water.

Michigan's PFAS Action Response Team (MPART) has been at the forefront leading on addressing the "forever chemicals" and is evaluating how to integrate the federal standards into existing programs and agencies. Michigan will continue to regulate under the State's rules, while working with drinking water systems throughout the state to prepare for these welcomed new federal standards. Stay tuned for more information in upcoming columns and subscribe to the MPART Agency Weekly [Updates](#).

On February 27, 2024, Governor Whitmer signed House Bill 4826 of 2023 enacting [Public Act 9 of 2024](#). The act repeals sections of the Administrative Procedures Act that reference the Environmental Rules Review Committee (ERRC). Part 201 (Environmental Remediation) of the Natural Resources and Environmental Protection Act, PA 451 of 1994, as amended was also amended to remove reference to the ERRC. The ERRC was originally established under Public Act 267 of 2018 to oversee rule-making of the Department of Environment, Great Lakes, and Energy (EGLE).

State department budgets are another significant legislative action in the spring every year, the governor and the legislature have been working on proposed budgets for the next fiscal year. [House Bill 5499 of 2024](#) was passed the Senate vote on May 22, 2024. [Senate Bill 768](#) passed in the House on May 21, 2024.

Senate Bill 271 of 2023 was signed by Governor Whitmer in November 2023 as [Public Act 235 of 2023](#) and took effect 90 days after the signing amending the Clean and Renewable Energy and Energy Waste Act.

The following article from Gongwer News Service dated February 8, 2024 provides additional information on the implementation of PA 235 of 2023.

PSC Orders Launch Implementation Of Renewable Energy Laws

"Members of the Public Service Commission issued seven orders which formally begin the process of imple-

menting laws passed by the Legislature to quadruple the state's renewable energy mandate, and to put the siting of large-scale renewable energy projects under its jurisdiction.

Under the law changes, the state will require a 100 percent renewable energy portfolio by 2040, with requirements for 50 percent of the state's energy to come from renewable sources by 2030 and 60 percent by 2035.

The siting of large-scale solar and wind energy projects will also fall under the PSC's jurisdiction under the legislation passed last year.

A group last month formally announced its push to create a ballot committee in an effort to reverse the siting law change (See Gongwer Michigan Report, January 4, 2024).

The first order deals with PA 233 of 2023, the change in siting authority to PSC jurisdiction. Under the order, PSC staff will begin meeting with stakeholders in March to develop recommendations on application filing instructions and guidance dealing with compatible renewable energy ordinances. These are to be filed with the commission by June 21.

Provisions dealing with energy waste reduction efforts and the required spending on programs for low-income customers under PA 229 of 2023 are the focus of the second order. Commission staff are to work with utilities, other state departments, low-income advocacy groups and other interested parties to develop strategies around income verification and program coordination to ensure access to low-income energy waste reduction programs. Comments are due by July 17 and reply comments are due by August 9.

A third order set the dates for Michigan electric providers to file amended renewable energy plans in 2024 and 2025 under PA 235 of 2023, which deals with the renewable energy mandate. Comments in this case are due by March 8 with reply comments due by March 22.

The increase of the distributed generation cap from 1 percent to 10 percent under PA 235 is the purpose of the fourth order. Comments on issues related to this topic are due by March 26, 2024, with reply comments due by April 16.

For the fifth order, PA 231 of 2023 is taken up, dealing with provisions including requiring the PSC to consider climate, environmental justice and affordability in long-term energy planning. Studies on the potential for energy

waste reduction, demand response and electrification of transportation, buildings and industry must be underway by the commission by September 30.

The order also requires commission staff to file a red-line version of the Michigan Integrated Resource Planning Parameters and Integrated Resource Plan Filing Requirements by September 30. A straw proposal dealing with providing formats and guidelines for municipal electric utilities, cooperative electric utilities and alternative electric suppliers to submit a clean energy plan within the requirements of PA 235 is due on that date, as well

PSC staff will also be required to hold sessions with interested parties regarding the implementation of PA 231 and PA 235 related to the two IRP items and straw proposal under the fifth order. The studies of all three items are due to be filed by July 31, 2025.

In the sixth order, energy storage provisions under PA 235 are the key item. PSC staff is directed to draft a straw proposal to help in determining a standard methodology for determining rate regulated and alternative energy suppliers' individual energy storage targets. This is to be filed by May 31. Comments on the straw proposal are due by August 1. Investor-owned utilities are also required to file energy storage reports.

The final order deals with provisions in PA 235 requiring a PSC study and report to be issued to the governor and Legislature on electric issues unique to the Upper Peninsula. Staff are to engage with utilities and stakeholders to develop the study and file it by November 22. At least one public hearing to help gather input to aid the report will be required."

Several other bills have been introduced this spring including alternative energy sources, asbestos, PFAS, waste management, and water pollution. We encourage you to watch for activity on these bills and to speak up and lend your knowledge of the science and professional experience expertise to our lawmakers to help guide policymaking in our state and beyond. For more bill information and legislative activities, we encourage you to click the search tools.



Michigan legislative bill [search](#)



Michigan Administrative Code Rulemaking System [search](#).

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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 submittals for the Member's Corner were submitted 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.

The Michigan Geological Survey YouTube Channel: <https://www.youtube.com/channel/UCYiVGS-w9PE5iLhvOG2UR3g>.

Geology Professor Shawn Willsey YouTube Channel: <https://www.youtube.com/@shawnwillsey>.

The AIPG YouTube Channel: <https://www.youtube.com/channel/UCZJVHi1yAPLJe1AksLOV3pA>.

I Want To Publish Your Articles!



Hey everyone, I would like to encourage you to submit your articles for publication! As the Michigan Section Editor, and also the 2021-24 National Editor, I am working to put together two top-quality publications for our members. This is not a one person job. This is where you come in. I welcome your technical articles, case

studies, opinion pieces, mini field guides, and letters to the Editor.

The guidelines are pretty simple for articles for *Geologically Speaking*. All submissions must be professional and may not violate the AIPG code of ethics. They also may not have been submitted for publication elsewhere.

While most submissions will be accepted, we do not accept articles that are a sales pitch for a product or company.

The deadline for submitting articles for *TPG* is two months before the start of the quarter for which the *TPG* edition is published. Thus, February 1 is the deadline for the Apr/May/June edition.

Please submit your articles of no more than 3,200 words in MS Word format directly to me or to Dorothy Combs at National Headquarters at aipg@aipg.org. All graphics (photos, figures, or tables) should be submitted in .jpg, .tiff or other standard format at 300 dpi. Please ensure your graphics are clean and easy to read to make things easier for the editorial staff. Complete information on submitting an article may be found on National's website at: <https://aipg.org/page/TPGInformation>.

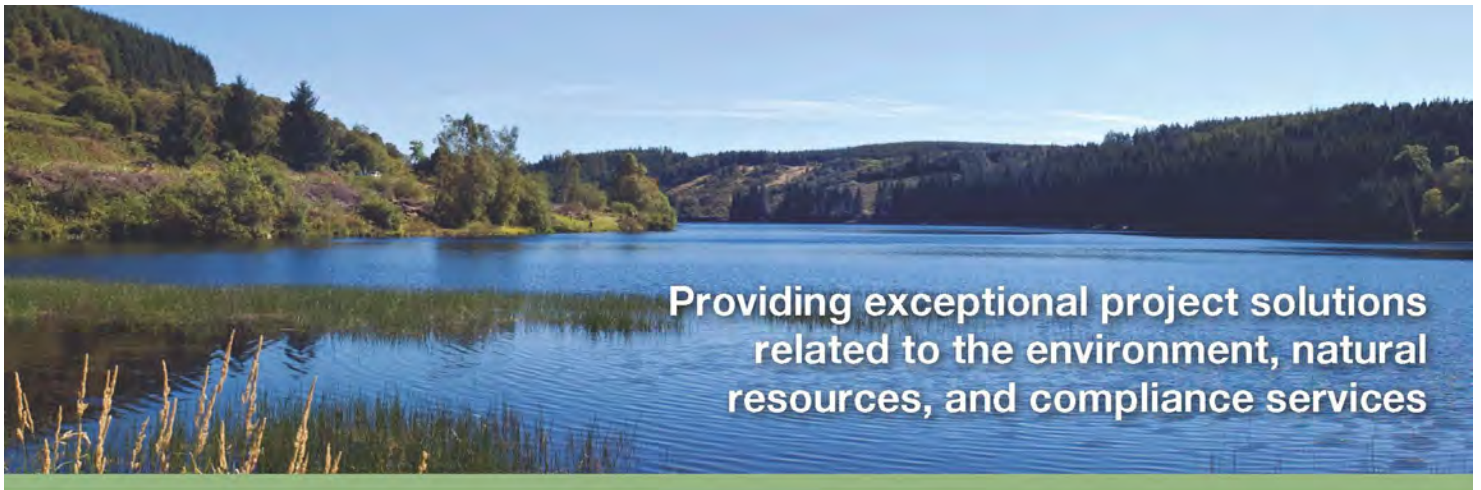
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New director appointed to lead Michigan Geological Survey!

May 23, 2024

KALAMAZOO, Mich.—Western Michigan University is delighted to announce the appointment of Sara Pearson, an alumna of the Department of Geological and Environmental Sciences, as the incoming director of the Michigan Geological Survey (MGS), effective July 1, 2024.

In her new position, Pearson will lead efforts to achieve MGS's mission to expand cutting-edge geological research, collect and preserve geological samples, furnish vital public data and analysis, and facilitate a deeper understanding of Michigan's geological landscape to empower informed decision-making and foster sustainable development of our natural resources. Since 1837, the initial activities of the MGS have provided data about Michigan's mineral and rock resources, then water supplies, mineral and rock resources, energy resources and natural hazards, all to serve the public interest.

Pearson brings over two decades of comprehensive experience, culminating in her most recent role as the source water unit supervisor at the Michigan Department of Environment, Great Lakes and Energy (EGLE). Beginning her career in environmental consulting, Pearson ascended from a field geologist to a project manager, specializing in environmental remediation. Transitioning to the public sector with EGLE, Pearson led numerous statewide initiatives, with a strong focus on augmenting program efficiency and public access to critical environmental data. Her recent efforts have concentrated on advocating for best practices in contamination prevention, especially source water protection and sustainable water resource management.

Notably, Pearson has been a member of the WMU Geosciences Advisory Board since 2012.

"We are delighted to welcome Sara Pearson as the new Director of the Michigan Geological Survey," says Dr. Heather Petcovic, chair of the Department of Geological and Environmental Sciences. "Her exceptional track record and unwavering commitment to high-quality science in the public interest positions her as the ideal candidate to lead the MGS into its next phase of success."

With the recent allocation of multiple grants totaling \$14 million in funding for the MGS from the State of Michigan, Pearson's deep expertise and extensive track rec-

ord in leadership is expected to propel MGS initiatives forward, continuing its tradition of excellence in geological research and education. The new funding will bolster core operations, establish an expanded Michigan Geological Repository for Research and Education core repository facility, facilitate statewide geological mapping, aggregate research and exploration for critical minerals, and enhance student and professional training programs.

Pearson expressed her enthusiasm for the opportunity, saying, "I have a vision that MGS will be the leading authority in Michigan for geological research and promoting sustainable and responsible use of the state's geological and water resources to benefit our people and environment."

Pearson succeeds John Yellich, who assumed the role of MGS director in 2013 and was instrumental in the successful acquisition of several grants that laid the groundwork for an ambitious vision of a fully operational and thriving geological survey.

"Sara Pearson brings the additional benefit of a long history of understanding the need to identify and protect our natural resources and now Michigan has a functional Geological Survey to begin to meet those objectives," says Yellich.

Pearson joins MGS assistant director and Director of the Michigan Repository for Research and Education Dr. Autumn Haagsma, twelve full-time research and staff geologists with support staff, and more than 50 part-time staff and WMU student researchers at the MGS.



Sara Pearson, hiking on an Icelandic glacier with her husband, fellow geologist Adam Heft.

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Students - Reminder

Don't Forget: Each Student Chapter must submit two articles for publication in *Geologically Speaking* each year to qualify for Section funding. Send the articles to Adam Heft at [ad-am.heft@wsp.com](mailto:adam.heft@wsp.com).

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...

AIPG is among many member societies under the **American Geosciences Institute (AGI)**. The National Academy of Sciences issued a directive in 1948 to create AGI to establish a geoscience network of associations with a wide range of expertise and knowledge about our planet. AIPG's goals align with the mission of AGI in providing information services to geoscientists, promoting and strengthening geoscience education, and increasing public awareness of the importance of geosciences in society.

Additionally, from AGI's website:
AGI provides:

[Scholarly Information](#) aggregating research vital to geoscientists' work

[Education and Outreach](#) for schools and the public

[Public Policy](#) facilitating the flow of information between geoscientists and decision makers

[Workforce Development](#) research and analysis of career paths

[Publications](#) that inform on a range of geoscience topics and news

[AGI's Center for Geoscience and Society](#)

[News](#) on what's happening now in the geoscience community

[Recognition of excellence](#) in the geosciences

The benefit of being a member society of AGI is that we can pool resources and connect with an even broader network of geoscientists. In addition to

member societies like AIPG, international associates, trade associates, liaison organizations, and regional associates are also part of the AGI Federation.

Source: <https://www.americangeosciences.org/about>

AIPG Bylaws

Section 10.1 of the National Bylaws reads:

10.1 Associated Societies

The Institute may, by affirmative vote of the Executive Committee, associate or ally with duly organized groups or societies that serve the needs of Members and Adjuncts of the Institute in topically and/or geographically defined areas; and that by objects, aims, constitutions, bylaws, or practice are functioning in harmony with the purposes of the Institute. Such association or alliance shall not place the Institute or any of its Sections in a subservient or subordinate relationship to the groups or societies which thereby become associated or allied, nor shall it create a financial liability for the Institute or any of its Sections.¹

1. For example, AIPG has entered into Associated Society relationships with the American Geosciences Institute, the Association of American State Geologists, and the Geological Society of America.

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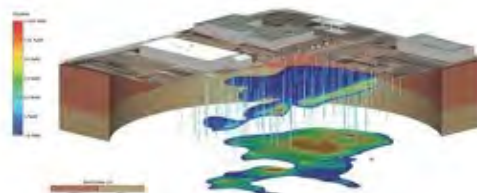
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ASBOG Exams

The ASBOG Fundamentals of Geology (FG) and Practice of Geology (PG) examinations are now administered using Computer Based Testing (CBT). Both exams are given on the third Friday in March and the first Friday in October each year. All examinees must be certified to take the examination at an approved Prometric/Iso-Quality Testing (IQT) testing facility. There are multiple testing centers located throughout Michigan.

Central Michigan University qualifies candidates to take the FG examination in Michigan and surrounding states. The next scheduled examination date is Thursday, October 3 and Friday, October 4, 2024. (Two days will be available to accommodate anticipated demand.)

There are three fees for taking the FG examination: \$50 CMU administration fee, \$200 ASBOG examination fee, and \$75 Prometric testing center seat fee. **For October, the deadline to apply through CMU is August 15th.**

Complete information on applying to take the FG exam is available at se.cmich.edu/asbog. Useful information to help prepare for the FG Exam can be found in the ASBOG Candidate Handbook, which is accessible on the [ASBOG website](#).

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 seven members would be glad to hear from you. AIPG is your organization. Please help keep it relevant and interesting for all by participating.



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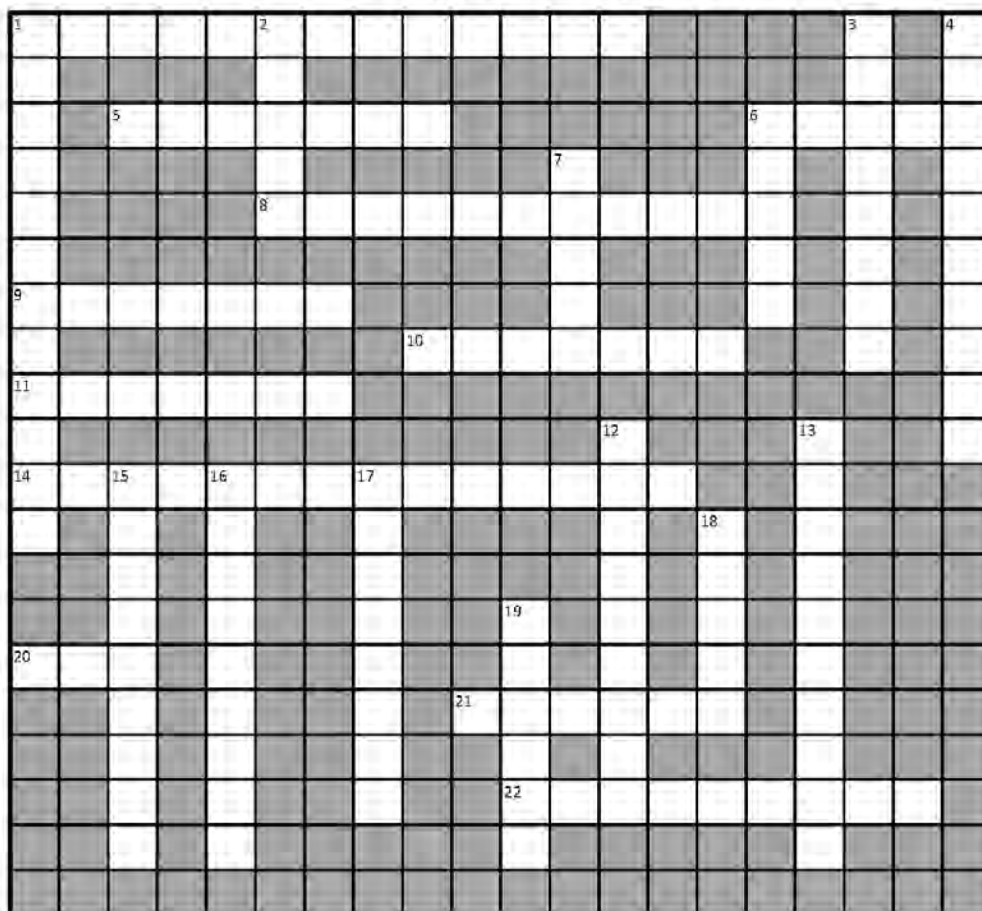
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Geology Crossword #17



Across

1. Earliest life form
5. Has a shell matrix
6. Fourth Greek letter
8. Not used to cool oneself
9. Formed by recrystallization of lime mud
10. Can be physical or chemical
11. A type of potato chip
14. Planes, trains and autos are examples
20. Your name when in serious trouble
21. Deserving respect and worth its cost
22. Study of tracks and traces

Down

2. Repetitive turbidite sequence
3. Likely forms in arid environments
4. Process describing physical & chemical changes in sediments
7. Angular, poorly sorted rubble
12. Not a chocolaty cereal
13. The giving of sworn evidence
15. "Dry" gypsum
16. Jacobsville, as example
17. Not an aluminum foil
18. Antrim and Ellsworth
19. Not for wrapping babies

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



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Many thanks to the Michigan Section AIPG Sponsors and Exhibitors!

We Acknowledge your support for our events:

- Environmental Risk Management Workshop
- Golf Outing
- Section Meetings
- Scholarship Program
- And of course—*Geologically Speaking!*

20th Annual AIPG Michigan Section Golf Outing

Tuesday September 10, 2024

The 20th Annual AIPG Michigan Section Golf Outing promises to be another successful event. Proceeds generated from the outing benefit the AIPG Michigan Section Student Chapters and educational awards, 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. **Registration will be open on February 1, 2024.**

This year's outing will be once again at the beautiful Fox Hills and specifically their world class Golden Fox course in Plymouth, Michigan.

Place: Fox Hills – Golden Fox
8768 N. Territorial
Plymouth, MI 48170

Event: 18-Hole Scramble

Date: September 10, 2024

Registration: 7:45 to 8:45 am

Shotgun Start: 9:00 am

Registration

Register/Pay by **August 1**, \$700/foursome, \$200/Individual

Register/Pay after **August 1**, \$800/foursome, \$225/Individual

Golfer 1: _____

Golfer 2: _____

Golfer 3: _____

Golfer 4: _____

Registration and payments can be completed at the link below

[American Institute of Professional Geologists - 20th Annual Golf Outing \(eventregisterpro.com\)](https://eventregisterpro.com)
Additionally, registration can be done manually by completing this form and mailing it and a check to the information below. Please make sure to provide the point of contact for your foursome and the names of all golfers:

Make Checks to:
Michigan AIPG
630 Piper Road
Haslett, Michigan 48840
Attn: Kalan Briggs briggsk2@michigan.gov

Call 248-635-4576, or e-mail Kalan
to reserve your place!

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Registration Includes: Continental Breakfast, green fees, range balls, lunch at turn, networking opportunities, and dinner. Also includes: 50-50 drawing, raffle prize baskets, and Grand Prize raffles along with other prizes including, Putt-4 Dough for \$2,500, men's and women's Longest Drive and Closest-to-Pin contests, and goodie bags for all participants!

20th Annual AIPG Michigan Section Golf Outing

Tuesday September 10, 2024

Sponsor Package Information

Sponsorship pricing levels are detailed below. We would like to humbly request that all sponsors assemble and donate a charity basket for raffling. Charity baskets can be of any theme and requested to be of minimum \$35 value (or more). Raffles tickets will be sold throughout the event with winners being drawn at the end of the event immediately following event ceremony and announcements.

Executive Sponsor - \$2,000 (2 available)

- **1 foursome** and 33% discount for additional golfers
- Highest visibility signage at the event, including at dinner
- Corporate recognition at the awards presentation

Beverage Sponsor - \$800

Investment includes:

- Signage at the club house and on the beverage cart.
- Corporate recognition

Breakfast/Luncheon Sponsor - \$600

Investment includes:

- Signage at the breakfast and at the turn grill/tent.
- Corporate recognition

Hole-in-one Sponsor - \$600 (2 available)

- Signage on all Par 3 Holes.

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 - \$250 (25 available)

Investment includes:

- Choice of tee box or green signage

Skill Sponsor – \$300 (4 available)

Investment includes:

- Tee box signage
 - Corporate recognition
- "Longest Drive", "Closest to Pin" awards to Male/female for each.

Putt-4-Dough Sponsor – \$400

Investment includes:

- Signage on the putting contest 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: - \$400

Investment includes:

- Signage and option to provide a photographer from your organization.

Goodie Bag Sponsor - Give-away items for 100 or more golfers (open and encouraged for all sponsors!)