

2020 Program

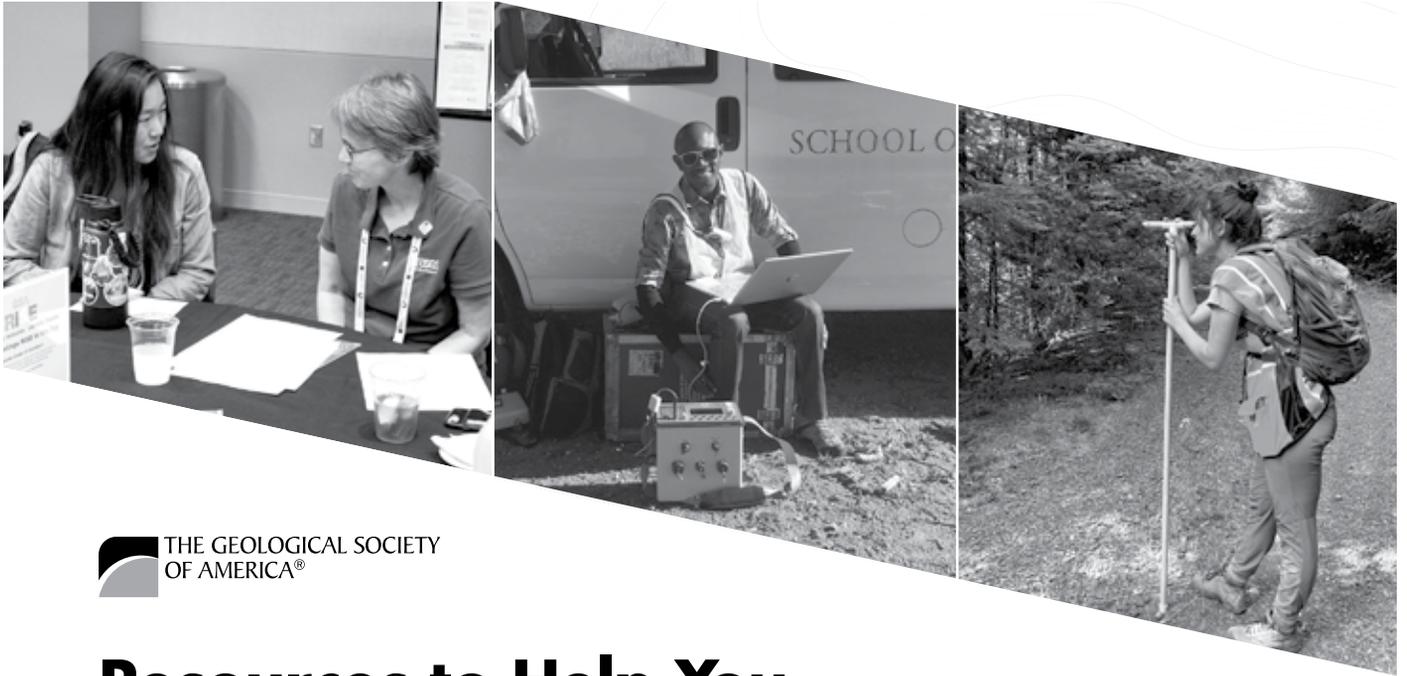
VOL. 52, NO. 5

North-Central

18–19 May
Duluth, Minnesota, USA

www.geosociety.org/nc-mtg





Resources to Help You Launch Your Geoscience Career

- **Funding**—travel awards, scholarships, and research grants
- **Field Experiences**—field trips, GeoCorps America, Geoscientists -in-the-Parks, field camp scholarships
- **GeoCareers**—workshops, webinars, resume clinics, mentoring
- **Research**—journals, conferences, field forums, and meetings
- **Meetings and Networking**
- **Leadership**—Student Advisory Council, Committees

The mission of the Geological Society of America (GSA) is to advance geoscience research and discovery, service to society, stewardship of Earth, and the geosciences profession.

For more information visit the GSA Foundation booth in the exhibit hall or visit our website
www.geosociety.org/edu-career

Topographic pattern courtesy of Freepik.com

FINAL PROGRAM
FOR
ABSTRACTS WITH PROGRAMS

54th Annual Meeting
NORTH-CENTRAL SECTION, GEOLOGICAL SOCIETY OF AMERICA
17-19 May 2020
Duluth Entertainment Convention Center

Duluth 2020: Superior Rocks!



Committee for the 2020 Meeting

General Chair	Karen Gran
Vice Chair	Harry Jol
Technical Program Chair	Chad Wittkop
Field Trips	Carrie Jennings
Short Courses	Josh Feinberg
Exhibits	Erik Brown
Sponsorships	Howard Mooers
Treasurer	Doug Ricketts
Student Programs/Student Volunteer Chair.	Juk Bhattacharyya
Student Program Representative	Collin Roland
Local Student Program Representative	Emilie Richard
Canadian Liaison	James Teller
Industry Liaison.	Leah Gruhn

North-Central Section GSA Officers for 2019–2020

Chair	Karen Gran
Vice Chair	Harry Jol
Secretary	Nancy Williams
Student Representative	Collin Roland
Past Chair	Tina Niemi
Past Vice-Chair	Jejung Lee
Members-at-large.	Lucas Zoet, Michael Wolf, B. Brandon Curry

Sponsors

We are grateful to the entities and individuals who made substantial contributions to help underwrite the costs of the meeting. Their names will be prominently displayed at the meeting. Our sponsors as of press time are:

Gold Level

(\$5,000–\$9,999)

Enbridge



Silver Level

(\$1,000–\$4,999)



Iron Level

(\$500–\$999)



Aggregate Level

(\$100–\$499)



NOTICE

By registering for this meeting you have acknowledged that you have read and will comply with the GSA Code of Conduct for Events (full code of conduct listed on inside back cover). If you have any concerns about behavior that may violate the Code, please contact:

GSA Executive Director, Vicki McConnell, vmconnell@geosociety.org

GSA Ethics and Compliance Officer, Nan Stout, gsaeventscode@gmail.com

You may also stop by the registration desk or the GSA Bookstore to have the named individuals directly contacted via phone.

General Information



Location

Perched on the western tip of Lake Superior, Duluth offers unparalleled beauty and natural amenities. The meeting is being held at the Duluth Entertainment Convention Center, within walking distance of the thriving Canal Park district and downtown Duluth. Field trip opportunities let you explore a range of geologic history: step back into the Precambrian to the Duluth complex or Mesabi Iron Range, trek up to the Gunflint Trail to see ejecta from the Sudbury impact, explore Quaternary history recorded in proglacial lake deposits, investigate modern processes ranging from landslides to peatlands to environmental remediation, or learn more about the depths of Lake Superior onboard the Research Vessel *Blue Heron*. Welcome to the Northland!

Venue

The meeting location is the Duluth Entertainment and Convention Center (DECC) (350 Harbor Dr., Duluth, MN 55802), within the Canal Park district near downtown Duluth. The technical program on Monday and Tuesday, 18–19 May, will be held in the City Side Convention Center within the DECC. Registration and field trip check-in are on the first floor of the City Side Convention Center. All field trips leave from Entrance B. Short courses and the opening reception on Sunday, 17 May, are being held in the Harbor Side Convention Center at the DECC.

Weather

It's still spring in May in Duluth, MN. Average temperatures range from 41° F for the low to 62° F for a high. Averages hide the fluctuations, though, and you can easily expect temperatures between the 20s and the 70s, and sometimes it snows in May. Even if you are not coming from too far away, it is likely to be chillier than home, especially down by Lake Superior. Please bring layers.

Geology of Duluth

Duluth sits within a failed midcontinent rift, from a time when Laurentia attempted to break apart 1.1 billion years ago. The stacked lava flows of the North Shore Volcanic Group and intrusive complexes like the Duluth Complex are evidence of this major event in Duluth's history. After rifting ceased after ~25 million years of activity, crustal subsidence occurred within the rift valley. The valley filled with sediments (now seen as sandstones in eastern Minnesota and northern Wisconsin). Pleistocene glaciation eroded many of those sediments within the Lake Superior basin, carving the vast depression now filled by the lake. As the Superior lobe retreated at the end of the last glaciation, meltwater pooled beyond the terminus forming a proglacial lake generally

referred to as glacial Lake Duluth. The lake once rose over 150 meters higher than the modern lake level, covering the southwest end of the lake in fine-grained glaciolacustrine sediments. As ice continued to retreat, multiple outlets opened up, dropping the lake level repeatedly until it lay below its current level. As isostatic rebound has raised the outlet, Lake Superior rose to its modern elevation.

Today, the landscape we see reflects all of that history: the rugged hills of Duluth composed of intrusive igneous rocks from the midcontinent rift, the stacked lava flows along the shoreline, the glacial striations across much of the bedrock, with clay-rich glacial tills and glaciolacustrine sediments capping it all. The dynamic landscape left behind by the glaciers continues to evolve, giving rise to steep rivers and bedrock waterfalls cascading into Lake Superior.

Travel Directions

From the Airport:

Follow road to stop sign. Take right onto Haines Road. At second set of stoplights (1.5 miles), take left onto Hwy 53/194. Go straight, through many stoplights until you see the lake. Turn right onto Mesaba Avenue. Get into the left lane and turn left at first stoplight. Immediately turn right onto Lake Avenue. Follow Lake Avenue to the bottom of the hill and over I-35. Turn right onto South Lake Avenue. After first set of stoplights, turn left onto Harbor Drive.

Parking and more directions can be found at <https://decc.org/parking-directions/directions/>

By car from the south:

Take I-35 north for Duluth. Take exit 256-B onto Lake Avenue. At stoplights, turn right onto Harbor Drive.

By car from Wisconsin:

Follow Hwy 53/Hwy 2 to Superior, WI. Continue on Hwy 53 North over the Blatnik Bridge. Merge onto I-35 North (exit to right after going over harbor on bridge). Take exit 256-B onto Lake Avenue. At stoplights, turn right onto Harbor Drive.

By car from the North Shore/Thunder Bay:

Follow Hwy 61 south to Duluth. Turn left onto I-35 south (stoplights at the Holiday gas station). Take exit 256-B onto Lake Avenue. At stoplight on exit ramp, turn left. Immediately get into right lane. Turn right onto South Lake Avenue. After first set of stoplights, turn left onto Harbor Drive (right after William A. Irvin ship).

By car from Iron Range:

Follow Hwy 53 south to Duluth. Continue straight past the Miller Hill Mall and through many stoplights until you can see the lake. Turn right onto Mesaba Avenue. Get into

the left lane, and turn left at first stoplight. Immediately turn right onto Lake Avenue. Follow Lake Avenue to the bottom of the hill and over I-35. Turn right onto South Lake Avenue. After first set of stoplights, turn left onto Harbor Drive.

By Air:

Duluth is home to the **Duluth International Airport (DLH)**, served by United and Delta from Chicago and Minneapolis. The Duluth Transit Authority (DTA) connects the airport to the downtown transit station via bus route 8 on weekdays. On weekends, bus route 5 services the airport. Several hotels, including the Holiday Inn Downtown, offer an airport shuttle. The **Minneapolis/St. Paul International Airport (MSP)** is a 2.5 or 3 hour drive from Duluth. Ground transportation between Duluth and MSP is available through the Groome Transportation shuttle service, Landline airport bus, and the Jefferson Lines bus. Many of these ground transportation options will drop you off at the DECC or at area hotels.

Parking at DECC:

Parking at the DECC is \$5/day. If you need to park overnight, please tell the booth operator and they will charge you for multiple days (\$5/day). If you need to leave and return, take your ticket with you and show it to the booth operator when you return. Additional parking options exist in Canal Park by the hour or by the day.

Skywalk system:

Downtown Duluth is connected to the DECC conference center via a series of skywalks. They are generally on the 2nd floor of the buildings. The best way to get from the Holiday Inn to the DECC is to cross over I-35 in the skywalk.

Accommodations:

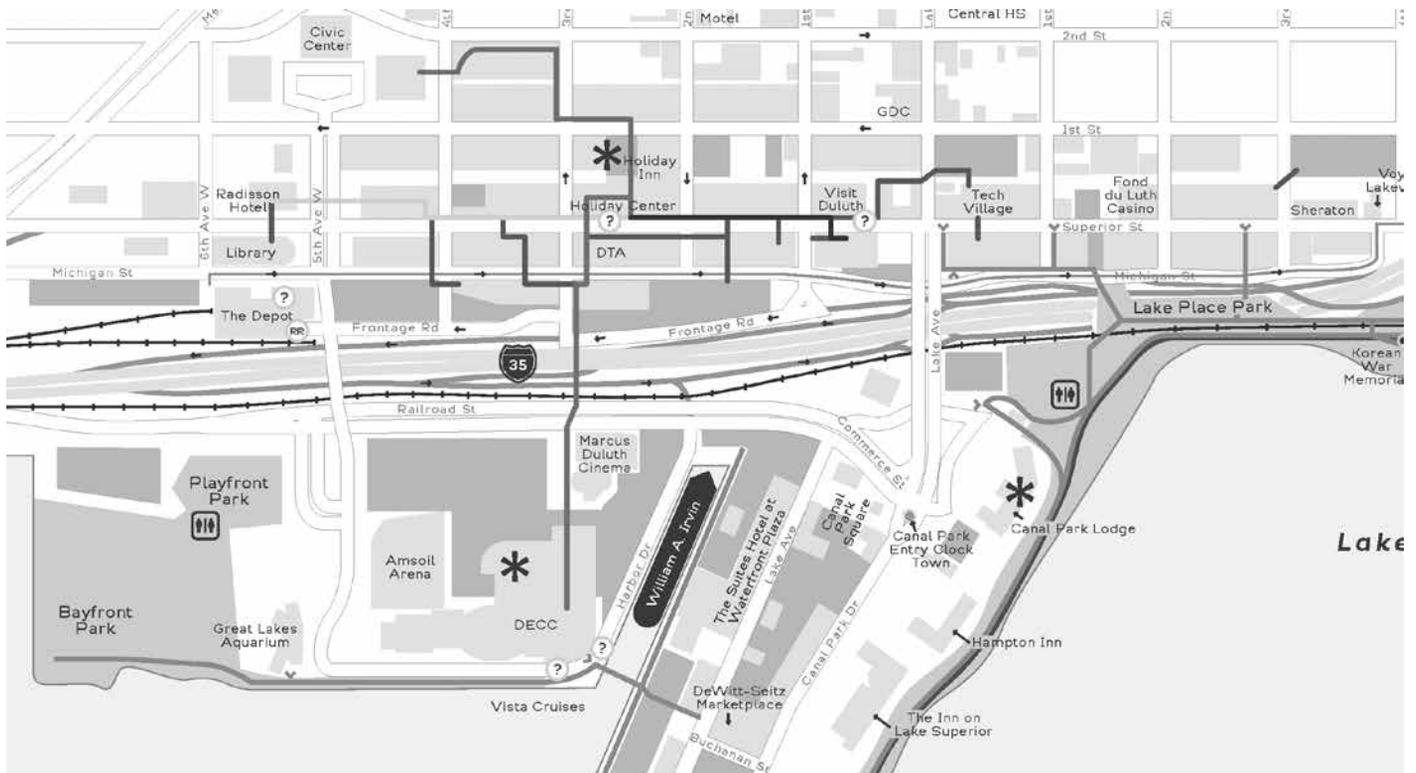
Rooms have been reserved at the Canal Park Lodge (+1-218-279-6000), and at the Holiday Inn & Suites (+1-218-722-1202) in downtown Duluth. The Holiday Inn is connected to the DECC via the downtown skyway system. Please call hotels directly.

DECC Convention Centers:

The DECC has two convention centers, the Harbor Side Convention Center and the City Side Convention Center. Registration, technical sessions, exhibits, and field trip departures all take place in the City Side Convention Center. Short courses and the welcome reception on Sunday take place in the Harbor Side Convention Center.

Meeting App and Abstracts

A web-based app is available for this meeting. This app allows you to view and search the meeting program and create your own schedule of events to attend. You can also view the full abstracts text from this app. Please download the app at <https://gsa.confex.com/gsa/2020NC/meetingapp.cgi>.



Map showing the location of the DECC and the two conference hotels: Canal Park Lodge and Holiday Inn. The DECC is connected to downtown via a series of skywalks, shown here. It is also along the Lakewalk walk/bike trail that runs from Bayfront Park, through Canal Park, and east to 60th Ave E. Map edited from Downtown skywalk map.

Registration

Registration is required for anyone attending technical sessions, field trips, short courses, or exhibits. On-site registration is on the 1st floor of the City Side Convention Center with the following schedule:

Sunday, 17 May: 3–7 p.m.
 Monday, 18 May: 7 a.m.–5:30 p.m.
 Tuesday, 19 May: 7 a.m.–3 p.m.

On-site registration fees

	Full Meeting	One Day
Professional member	US\$240	US\$190
Professional member 70+	US\$150	US\$110
Early career professional member	US\$180	US\$130
Professional nonmember	US\$295	US\$195
Student member	US\$100	US\$75
Student nonmember	US\$135	US\$85
K–12 professional	US\$60	US\$45
Guest or spouse	US\$60	n/a
Field Trip/Short Course Only	US\$40	n/a

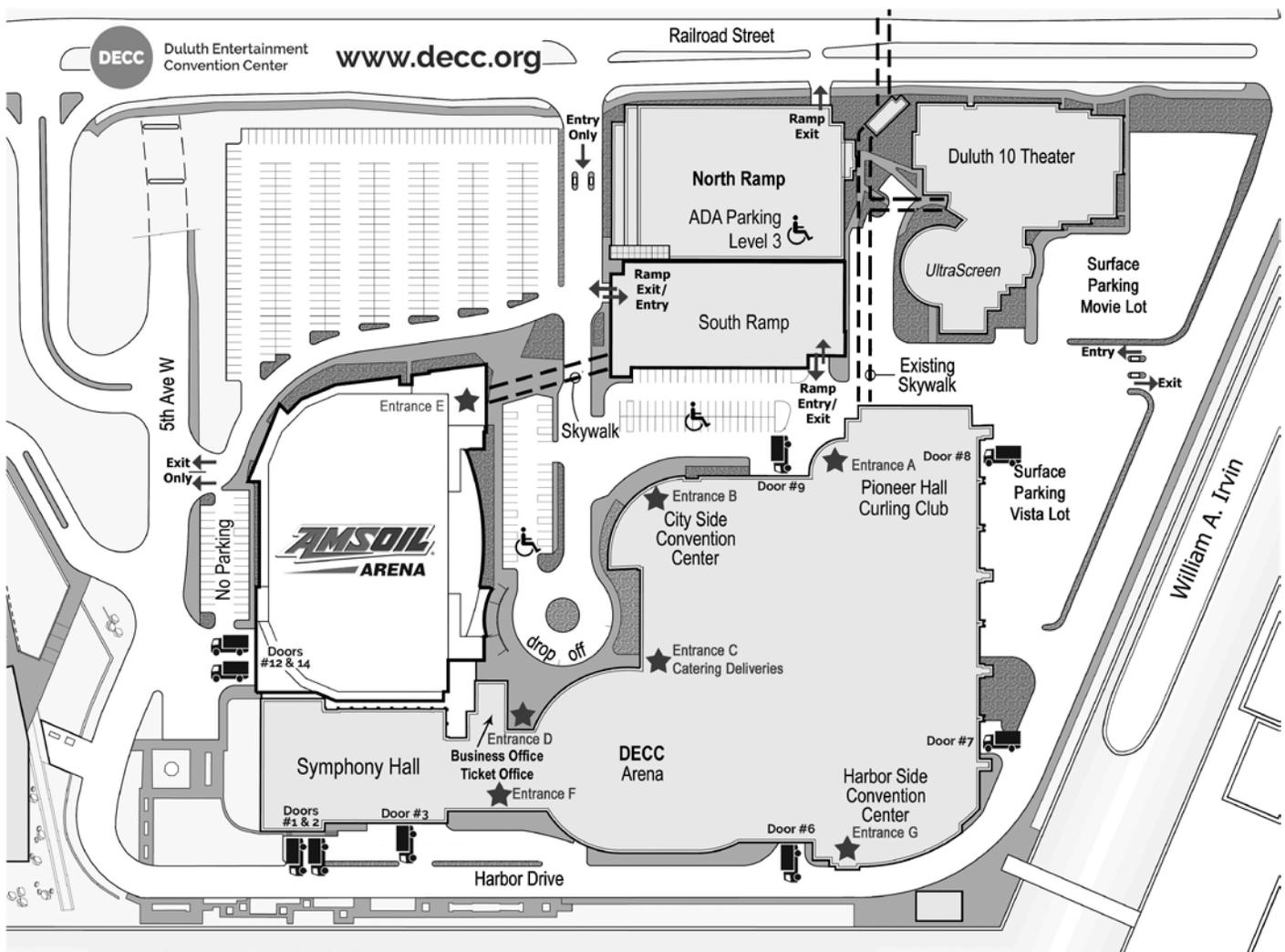
Tribal and community college professional members: Professional members from tribal and community colleges should register at the professional member rate, and apply to be reimbursed the difference between the professional member and early career member early two-day registration rate after the conference (\$65). Please see GSA staff at the Registration booth for more information.

K–12 students may register at the K–12 professional rate.

Guest registration is intended for non-geoscientist spouses or friends and does not include attendance at technical sessions, field trips, or short courses. A registered professional, a student, or a K–12 professional must accompany guest registrants. Students and K–12 teachers must show a current ID at check-in to obtain special rates.

Cancellations, Changes, and Refunds

All requests for additions, changes, and cancellations must have been made in writing to GSA Headquarters and received by 20 April. There will be no refunds for cancellations received after this date and no refunds for on-site registrations. Preregistration refunds will be mailed from GSA Headquarters after the meeting.



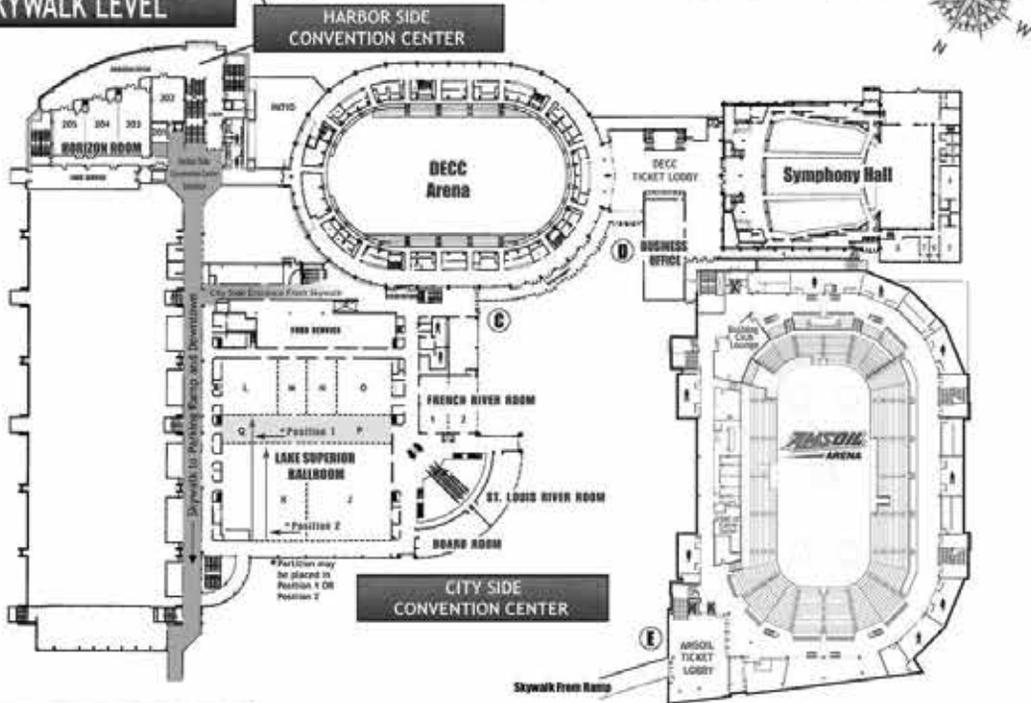
Map showing plan for the DECC, with the City Side Convention center and Harbor Side Convention Center.



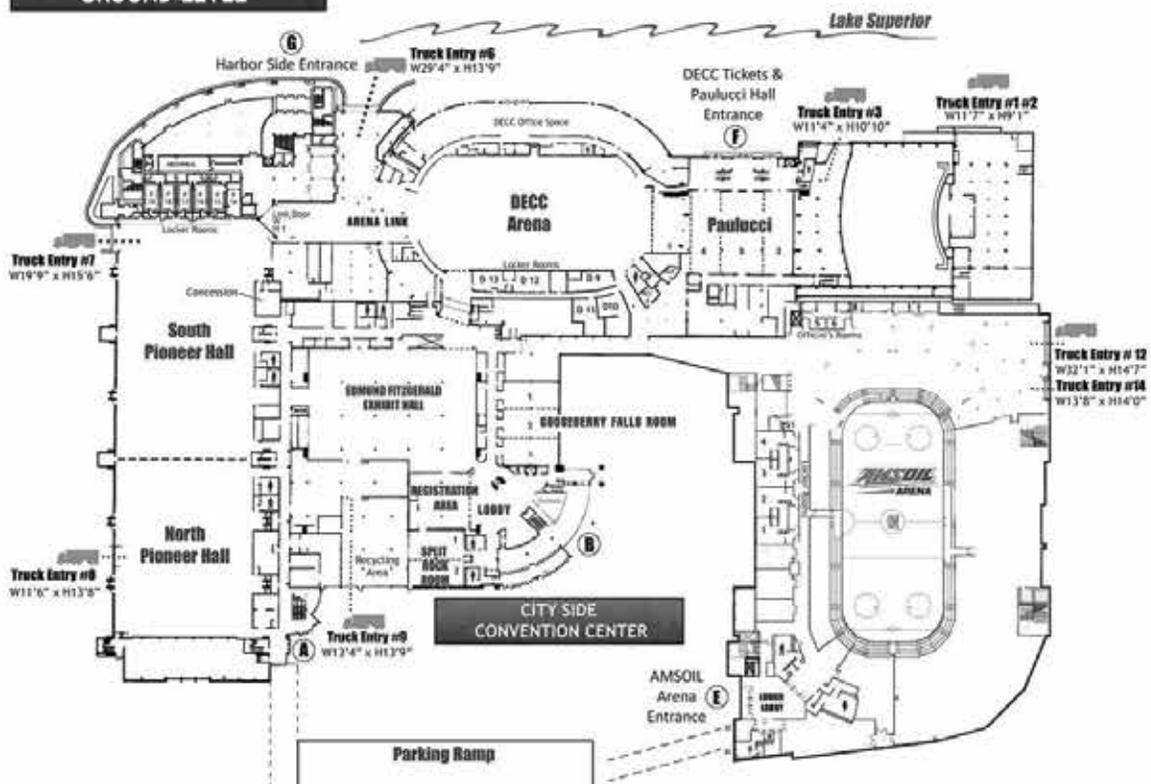
DECC Duluth Entertainment Convention Center

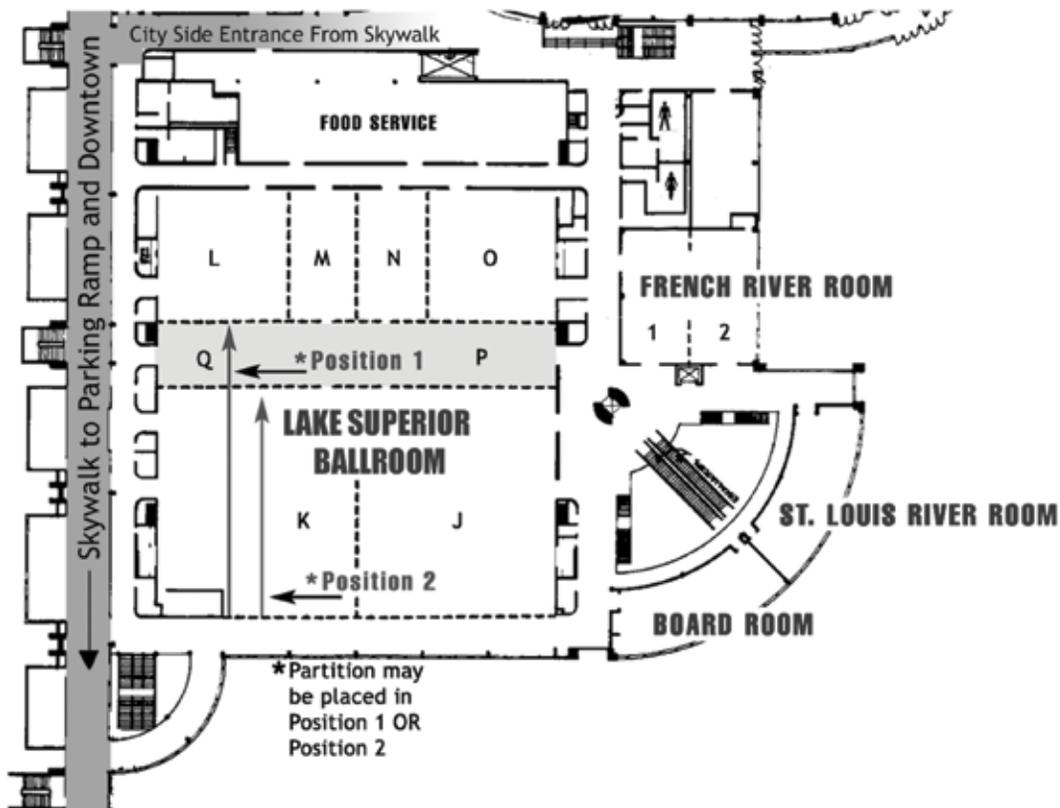
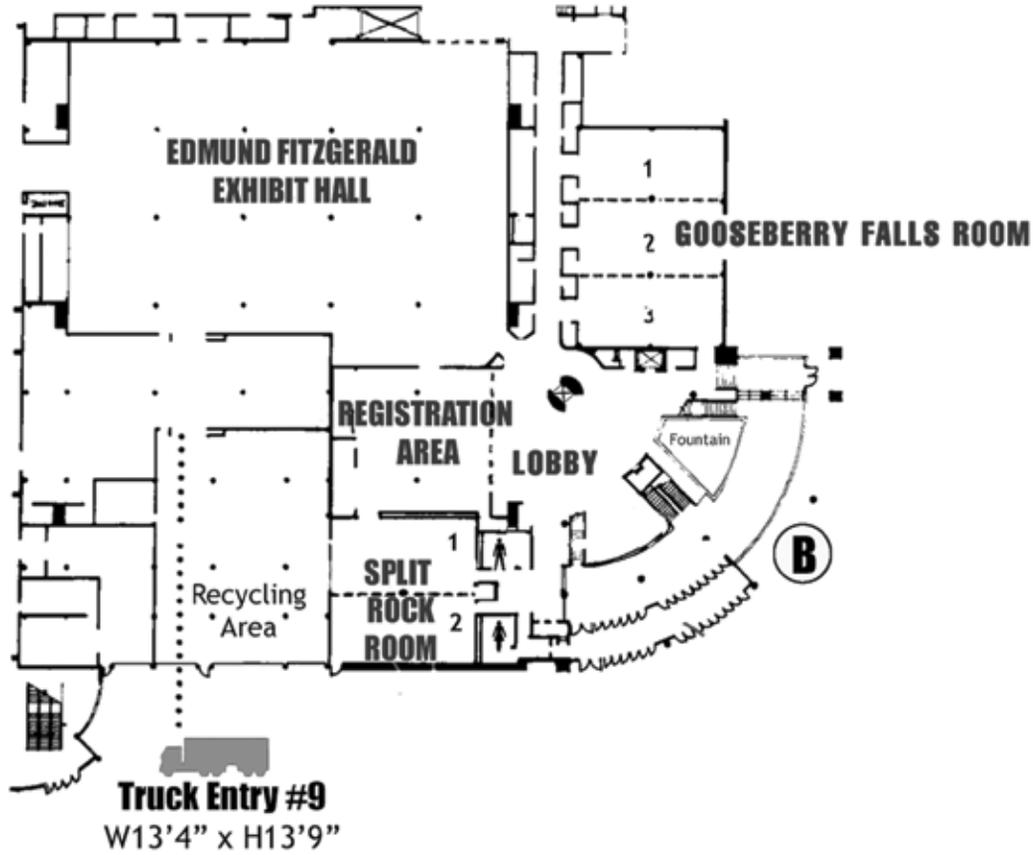
FLOOR PLANS

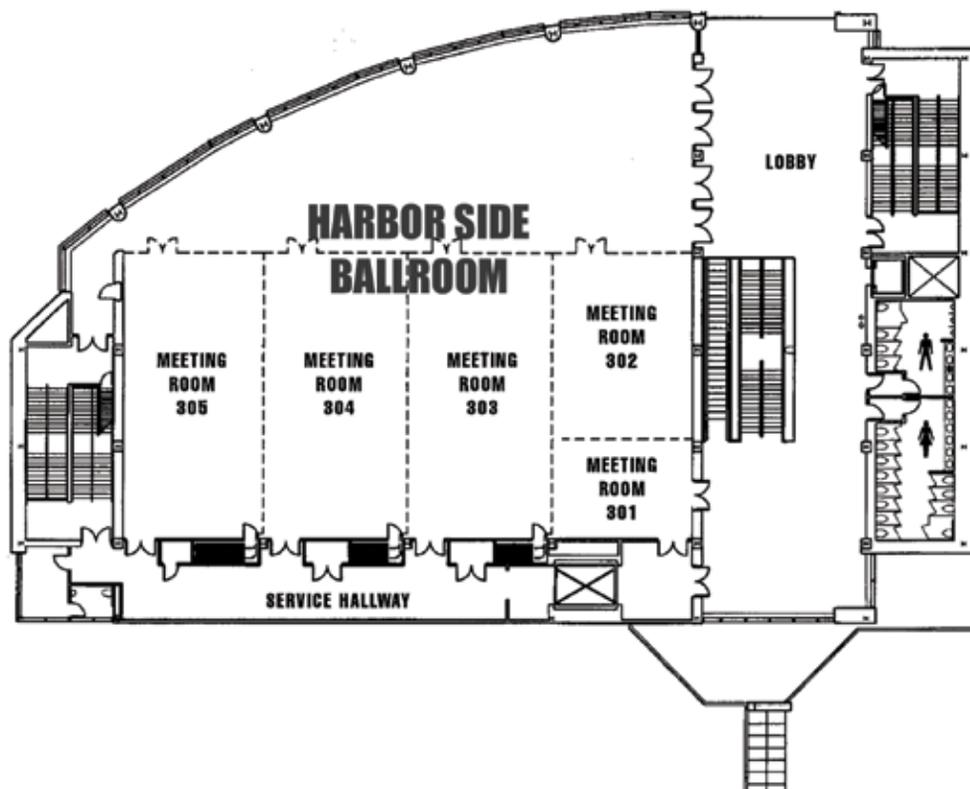
SKYWALK LEVEL



GROUND LEVEL







Continuing Education Credits

The North-Central Section Meeting offers an excellent opportunity to earn CEUs toward your continuing education requirements for your employer, K–12 school or professional registration. Please check the meeting website after the meeting to download your CEU certificate.

Special Events and Activities

Sunday, 17 May

First Time Attendees Workshop. 5–5:30 p.m., Harbor Side Convention Center, Room 202.

Icebreaker Welcome Reception. 5–7 p.m., Harbor Side Convention Center Ballroom, 3rd floor. Enjoy light snacks and a complimentary beverage while connecting with your colleagues. Listen to short talks by students advertising their posters and oral presentations.

Student Lightning Talks. 5:30–7 p.m., Harbor Side Convention Center Ballroom, 3rd floor. Please join us for an informal lightning talk session during the Welcome Reception. Students, indicate your interest in giving a lightning talk when you register for the meeting. If you have questions, please contact Collin Roland at cjroland@wisc.edu.

Monday, 18 May

Session Chair Orientation. 7–7:15 a.m., French River Room 1. Session chairs are requested to attend this orientation meeting. This meeting includes a review of session time management, AV procedures, and other information affecting the conduct of the day’s sessions.

Coffee/Tea Break. 9:30–10 a.m. Lake Superior Ballroom KJ.

Posters/Exhibits Reception. 4–6 p.m., Lake Superior Ballroom KJ. Enjoy snacks and a drink while discussing science over poster presentations and exhibits.

Monday Student Social Hour. 5:30–7 p.m. Students are welcome to gather at Hoops Brewing for food and networking. Hoops Brewing is located at 325 S. Lake Ave. in Canal Park.

Tuesday, 19 May

Session Chair Orientation. 7–7:15 a.m., French River Room 1. Session chairs are requested to attend this orientation meeting. This meeting will include a review of session time management, AV procedures, and other information affecting the conduct of the day’s sessions.

GSA Campus Representatives Recognition and Technical Advisory Board Meeting. 7–8 a.m., Board Room. This complimentary breakfast for Campus Reps is held to say Thank You for all you do. If you are a campus representative or are interested in becoming one, please plan to attend this celebratory event.

Coffee/Tea Break. 9:30–10 a.m., Lake Superior Ballroom KJ.

Geology Club Officer Meetup. 2–3 p.m., Gooseberry Falls Room. If you are a geology club officer or are interested in starting a club on your campus, please come meet-up with other club representatives to hear about their activities, goals, and accomplishments.

Posters/Reception. 4–5:30 p.m., Lake Superior Ballroom. Enjoy snacks and a drink while discussing science over poster presentations and exhibits.

Business Meetings

Monday, 18 May

GSA North-Central Section Management Board Meeting. 6:30–8 a.m., Board Room.

GSA North-Central Section Open Meeting. 5–5:30 p.m., Lake Superior Ballroom.

Student and Early Career Opportunities

There are many opportunities especially geared towards student and early career attendees. To learn more, go to www.geosociety.org/mentors or contact Jennifer Nocerino at jnocerino@geosociety.org.

Career Mentoring Luncheons—GSA Student Members

Roy J. Shlemon Mentor Program in Applied Geoscience. Mon., 18 May, noon–1:30 p.m., Gooseberry Falls Room. GSA student members will have the opportunity to discuss career prospects and challenges with applied geoscientists from various sectors over a FREE lunch.

John Mann Mentors in Applied Hydrogeology Program. Tues., 19 May, noon–1:30 p.m. Gooseberry Falls Room. GSA student members interested in applied hydrogeology or hydrology as a career will have the opportunity to network with professionals in these fields over a FREE lunch.

Career Workshop Series

Interested in career advice? This three-part series will feature career development planning, an exploration of geoscience job sectors, and information on best practices for crafting a résumé and cover letter. No registration is required, and everyone is welcome.

Geoscience Career Workshop Part 1: Career Planning and Networking. Mon., 18 May 9–10 a.m., Gooseberry Falls Room. Your job hunting process should begin with career planning, not when you apply to jobs. This workshop will help you begin this process and will help you practice your networking skills. This section is highly recommended for freshmen, sophomores, and juniors. The earlier you start your career planning the better.

Geoscience Career Workshop Part 2: Geoscience Career Exploration. Mon., 18 May, 10–11 a.m., Gooseberry Falls Room. What do geologists in various sectors earn? What

do they do? What are the pros and cons to working in academia, government, and industry? Workshop presenters and professionals in the field will address these issues.

Geoscience Career Workshop Part 3: Cover Letters, Résumés and CVs. Tues., 19 May, 9–10 a.m., Gooseberry Falls Room. How do you prepare a cover letter? Does your résumé need a good edit? Whether you are currently in the market for a job or not, learn how to prepare the best résumé possible. This course reviews numerous résumés helping you to learn important résumé dos and don'ts.

Student Volunteers

Take advantage of work opportunities to earn free meeting registration. Student volunteers are required to work a total of 5 hours to receive free registration. Student volunteers should check in at the Student Volunteer Room in Split Rock 1 by the Registration area. Questions can be directed to the student programming chair, Juk Bhattacharyya at bhattachaj@uww.edu.

Geology Club Officer Meetup

If you are a geology club officer or are interested in starting a club on your campus, please come meet-up with other club representatives and discuss your activities, goals, and accomplishments, Tues, 19 May, 2–3 p.m., Gooseberry Falls Room.

Presentation Awards

Awards for the best graduate and undergraduate student posters and oral presentations are supported by the GSA *North-Central Section* and by the *Great Lakes Section–SEPM (Society for Sedimentary Geology)*. Questions can be directed to Nancy Williams, gsanorthcentralsection@gmail.com.

Opening Night Events

First time Attendees Workshop. Sun, 17 May, 5–5:30 p.m., Harbor Side Convention Center Room 202. Learn how to get the most out of your first North-Central Section Annual Meeting! This short workshop will be held Sunday evening and cover general information, highlight special events, discuss best practices and the code of conduct, and answer any questions you may have.

Student Lightning Talks. Sun, 17 May, 5:30–7 p.m., Harbor Side Ballroom, 3rd Floor. Please join us for an informal lightning talk session during the Welcome Reception. Lightning talks provide an opportunity to draw people to your poster or talk, or just to sharpen your presentation skills. Lightning talks must be three minutes (or less) and the three-minute limit will be enforced. Speakers may include up to two slides in their presentation, not including a title slide. The session is a great opportunity to meet other students and learn about their research. Everyone is encouraged to attend, but speakers must be undergraduate or graduate students. Indicate your interest in giving a lightning talk when you register for the meeting. If you have questions, please contact Collin Roland at cjroland@wisc.edu.

Duluth Lakewalk

Explore the Duluth Lakewalk with your fellow students! Join us for a short lunchtime stroll through Canal Park to the shoreline of Lake Superior on Monday and Tuesday. Meet at the DECC entrance B at 12:50 p.m. We will depart promptly at 1 p.m. and arrive back in time for afternoon technical sessions. All are welcome!

Monday Student Social Hour

Students are welcome to gather at Hoops Brewing on Monday evening from 5:30–7 p.m. for food and networking. Hoops Brewing is located at 325 S. Lake Ave. in Canal Park.

Exhibits:

Exhibits are located in the Lake Superior Ballroom KJ on the 2nd floor. Their hours are:

Set up: Sunday, 17 May	3–7 p.m.
Open: Monday, 18 May	8 a.m.–6 p.m.
Open: Tuesday, 19 May	8 a.m.–3 p.m.
Teardown: Tuesday, 19 May	3 p.m.–7 p.m.

Exhibitors (as of print time in early March)

American Institute of Professional Geologists
Enbridge
GSA 2021 Section Booth
GSA Foundation
GSA Bookstore
Michigan Tech Geological and Mining Engineering
and Sciences
Minnesota Department of Natural Resources
Minnesota Groundwater Association
National Association of State Boards of Geology
North Dakota State University
Northeast Technical Services
Talon Metals
Twin Metals Minnesota LLC
University of Minnesota
University of Minnesota Duluth, Department of Earth &
Environmental Sciences

Technical Program:

Please see technical sessions schedule on page 13. The meeting's Technical Program consists of Theme and Discipline Sessions, arranged in oral and poster sessions. The Technical Program begins at 8 a.m. and ends no later than 5:30 p.m. on Mon.–Tues., 18–19 May. Please direct questions related to the following sessions to the Technical Program Chair, Chad Wittkop at chad.wittkop@mnsu.edu.

Speaker Ready Room

The Speaker Ready Room is located on the 1st floor in the Split Rock 2 room. It is available at the following times:

Sunday, 17 May	3–7 p.m.
Monday, 18 May	6:30 a.m.–6 p.m.
Tuesday, 19 May	6:30 a.m.–3 p.m.

Oral Presentations:

Oral sessions have 20 minutes per presentation (17 minutes for presentation with 3 minutes for questions and discussion). All presentations are displayed as PowerPoint presentations in technical sessions, and presentations should be prepared using a 16:9 ratio. The Speaker Ready Room can be used to check presentations prior to uploading files. We ask that oral presenters upload their presentations the night before for morning sessions, and at least 2 hours prior to the beginning of their session for afternoon sessions. Monday morning speakers should upload their talks by 7 a.m. on Monday.

Poster Presentations:

Each poster board is 3.5' x 5.5' (landscape), and posters can be hung with tacks (provided). Posters will be located in the Lake Superior Ballroom KJ adjacent to exhibitors. Posters should be hung by 8:30 a.m. and remain up all day. Poster presenters are expected to be at their posters from 3:30 to 5:30 p.m. on the day they are presenting. Presenters should take their posters down by 6 p.m. on the day of their presentation. Any posters not taken down may be discarded.

Session Chair Orientations:

Each Session Chair is expected to attend a 15-minute "Session Chairs Orientation" in the French River 1 room on the morning of the day on which your session is to take place. Orientation sessions run from 7–7:15 a.m. This meeting will include a review of session time management, AV procedures, and other information affecting the conduct of the day's sessions.

Session Chairs are expected to strictly adhere to the technical program schedule and to limit speakers to their allotted time. If a speaker does not appear for an assigned time slot, session chairs should call a break or discussion period and begin the following presentation at its scheduled time.

A student volunteer is assigned to each oral session. Session Chairs are asked to meet with the assigned student volunteer before the start of the session. The volunteers are there to help the sessions run smoothly and to contact the AV Coordinator in the event of technical problems.

Field Trips

All field trips will check in and leave from Entrance B at the DECC City Side Convention Center. Questions about field trips should be directed to the Field Trips Chair, Carrie Jennings at cjennings@freshwater.org.

For field trip guides, our field trips we will be using *Flyover Country*, a mobile app created by Shane Loeffler and others at the University of Minnesota. It allows you to explore the geology and natural history below your flight, along a hike, or on a field trip. The app is funded by the National Science Foundation (NSF) and available for free on both Android and iOS. GSA has also collaborated with Flyover to make former guidebooks available on this platform. You can learn more and download the app at FlyoverCountry.io.

Pre-Meeting Trips

FT1. Northern Minnesota Peatland and Soil Research Tour. Sat., 16 May 9 a.m.–Sun., 17 May, 5 p.m. Cost: \$300. Max: 20. Co-Leaders: Ed Nater and Stephen Sebestyen.

Tour the USFS Marcell Experimental Forest (www.nrs.fs.fed.us/ef/marcell/) and the DOE-funded SPRUCE (mnspruce.ornl.gov) long-term research sites and learn about ongoing research on ecosystem response, peatland hydrology, and mercury and sulfur biogeochemistry. The second day will focus on research sites that explore soil and ecosystem impacts of invasive earthworm species in forests near Itasca State Park.

FT2. Geology Field Trip along the Mesabi Iron Range with Fossil Collecting. Sun., 17 May, 7:45 a.m.–7 p.m., Cost: US\$95. Max: 33. Co-Leaders: Allyse Freeman and John Westgaard.

Participants will tour the Mesabi Iron Range to see both geologic and historic sites including a mine overlook, a historical mine tour at the Hill Annex State Park, and the Minnesota Discovery Center, the Museum of the Iron Range in Chisholm. There will be ample time to collect Late Cretaceous marine fossils from mine spoil at Hill-Annex State Park.

FT4. The Sandstone Karst of Pine County, Minnesota. Sun., 17 May, 7:30 a.m.–6 p.m. Cost: US\$115. Max: 22. Co-Leaders: Calvin Alexander and Greg Brick.

Visit the sinkholes, sinking streams, large springs and caves that have developed in the very pure quartz sandstone of the Hinckley Sandstone of Pine County, Minnesota. These classic karst geomorphic features are developed near Askov, Minnesota and Banning State Park.

During the Meeting

FT5. Walking Tour of Minnesota Point. Mon., 18 May, 4–6 p.m. Cost: Free. Max: 24. Co-Leaders: Harry Jol and Andy Breckenridge.

The barrier bar complex formed by Wisconsin and Minnesota Points is the geomorphic feature that defines the ‘Twin Ports’ of Superior and Duluth. The objective of the walking tour is to introduce participants to world’s largest freshwater baymouth bar and discuss various topics including coastal progradation and erosion, aeolian foredunes, effects of recent lake level changes and continuing research including piping plover restoration, subsurface imaging and coring. The target audience of the field trip are K–12 teachers and students, but all are invited.

FT6. Geology under the Surface: Lake Superior and the Research Vessel *Blue Heron*—Morning Trip. Tues., 19 May, 8 a.m.–noon. Cost: \$15. Max: 15. Co-Leaders: Doug Ricketts and Nigel Wattrus.

Join us on a cruise aboard the University of Minnesota’s research vessel, the *Blue Heron*. During the cruise, scientists will demonstrate the scientific capabilities of the vessel including a suite of coring and geophysical instruments. Participants will observe features resulting from post-glacial isostatic rebound.

FT7. Geology under the Surface: Lake Superior and the Research Vessel *Blue Heron*—Afternoon Trip. Tues., 19 May, 1–5pm. Cost: \$15. Maximum 15. Co-Leaders: Doug Ricketts and Nigel Wattrus. A second chance to join us on a cruise aboard the University of Minnesota’s research vessel, the *Blue Heron*. During the cruise, scientists will demonstrate the scientific capabilities of the vessel including a suite of coring and geophysical instruments. Participants will observe features resulting from post-glacial isostatic rebound.

Post-Meeting

FT8. Minnesota’s Minerals, Mining, and the Environment of the Mesabi Iron Range. Wed., 20 May, 7 a.m.–6 pm. Cost: \$85. Max: 22. Co-Leaders: Megan Kelly and Heather Arends.

Spend the day in the oldest continuously operating mining district in North America. Tour stops at Minnesota mine features and operations, and state-run facilities including one of the largest publicly available drill core libraries in the U.S. and a research site focused on environmental aspects of mining in Minnesota.

FT9. Slope Stability, Extreme Floods, and Implications for Restoration in the Duluth Area. Wed., 20 May, 8:45 a.m.–5 pm. Cost: \$40. Max: 16. Co-Leaders: Emilie Richard; Karen Gran; Faith Fitzpatrick; Marty Melchior.

Geomorphic responses to extreme floods across the Upper Midwest have been dramatic and costly. Resiliency of stream restoration projects has been mixed. We will visit urban and forested streams in the Duluth area and northern Wisconsin with damages from culvert failures and mass wasting following floods in 2012 and 2018. From rock fall zones along near-vertical bedrock cliffs to rotational slumps in glacial sediments, few places in the Midwest offer such a variety of mass-wasting processes. We will tour several geologically unique and dynamic areas to discuss how slopes fail in the post-glacial landscape of Northeast Minnesota.

FT10. Duluth to Two Harbors—Transect through the Duluth Complex and Base of the North Shore Volcanic Group. Wed., 20 May, 8 a.m.–6 p.m. Cost: \$100. Max: 22. Co-Leaders: Jim Miller and Terry Boerboom, Minnesota Geological Survey.

This trip profiles the basal section of Mesoproterozoic (1.1 Ga) volcanic, intrusive, and sedimentary rocks that comprise the Midcontinent Rift between Duluth and Two Harbors. After visiting the basal sedimentary and volcanic section of the MCR west of Duluth, we will focus the morning’s effort on the mafic intrusive rocks of the Duluth Complex. Outcrops along Skyline Parkway leading to downtown Duluth including exposures of the well-differentiated Duluth Layered Series and the overlying Anorthositic Series. In the afternoon, we will visit shoreline exposures between Duluth and Two Harbors that highlight various components of the North Shore Volcanic Group. These include pahoehoe- and aa-topped basalt flows, porphyritic basalts, flow-banded rhyolite flows, interflow sandstone units, and hypabyssal mafic sills. All of the stops are within 25 miles of Duluth, and will require attendees to be able to traverse locally uneven terrain and steep slopes.

FT11. Sediments, Landforms, and Proglacial Lake History in Western St. Louis County, Minnesota. Wed., 20 May, 7:30 a.m.–5:30 p.m. Cost: \$95. Max: 17. Co-Leaders: Jennifer McDonald; Kaleb Wagner; Andy Breckenridge.

This trip explores sediments and landforms associated with the Laurentide Ice Sheet in northeastern Minnesota. Recent Minnesota Geological Survey mapping highlights the activity of the Koochiching lobe and the St. Louis sublobe. New varve records relate this activity to the retreat of the Rainy lobe from the Vermilion moraine.

FT12. Geologic Setting of the 1850 Ma Sudbury Meteorite Impact Layer on the Gunflint Trail, Northeastern Minnesota. Wed. May 20, 7:30 a.m.–Thurs., 21 May 6 p.m. May. Cost: \$285. Max: 24. Leader: Mark Jirsa.

Well-exposed examples of Archean, Paleoproterozoic, and Mesoproterozoic rocks contain and bracket the Sudbury Impact Layer. The stratigraphic top of Paleoproterozoic iron-formation is marked by shock-induced deformation and is overlain by ejecta that resulted from Sudbury meteorite impact nearly 500 miles to the east in Ontario. Participants will enjoy a night at the historic Gunflint Lodge on the Gunflint Trail.

Short Courses

All Short Courses except Short Course 7 take place on Sunday, 17 May in the Harbor Side Convention Center, 2nd floor. Short Course 7 takes place on Saturday, 16 May off-site. For additional information, please contact the Short Course Chair: Josh Feinberg, feinberg@umn.edu.

SC1. Navigating the path to Professional Licensure. Sun. 17 May, 1–4 p.m., Harbor Side Convention Center, Room 203. Fee: \$0. Instructor: Keith B. Rapp.

This short course provides students and young and seasoned geoscientists the information needed to understand how to become a licensed Professional Geologist. Thirty-two states and territories regulate the profession of geology through licensure. This course helps navigate the process through the ASBOG examination.

SC2. 3D modeling using Structure from Motion and Terrestrial Laser Scanning. Sun. 17 May, 9 a.m.–5 p.m., Harbor Side Convention Center, Room 205. Fee: \$20. Instructors: Stephanie S. Day and Zachary Phillips.

Participants will practice two 3D modeling techniques for use in the field or laboratory. Exploring both Structure from Motion and Terrestrial Laser Scanning, we will discuss the pros and cons, what environments are most appropriate for each method, and the possibilities of a combined approach.

SC3. Programming IoT Monitoring Stations Built on the Arduino Framework with the EnviroDIY Modular Sensor Library. Sun. 17 May, 9 a.m.–4 p.m., Harbor Side Convention Center, Room 202. Fee: \$70. Instructors: Beth A. Fisher and Anthony K. Aufdenkampe.

Learn to program an Arduino-framework data logger to perform all required functions of a solar-powered monitoring station that collects data from research-grade environmental sensors, transmits to a data portal, and puts sensors to sleep to conserve energy between logging intervals using the EnviroDIY Modular Sensors library.

SC4. Professional Ethics for Engineers and Geologists (2 PDH). Sun. 17 May, 9 a.m.–11 a.m., Harbor Side Convention Center, Room 203. Fee: \$40. Instructor: Karl D. Everett.

This ethics course is designed to meet the requirements of the ethics-related professional development hours (2 PDHs) required for licensed geoscientists, engineers, and soil scientists for recertification in Minnesota. The course is designed to help maintain and improve skills and knowledge associated with ethics in professional workplace scenarios. The instructor, Karl Everett, is a Professional Engineer (MN) and Geologist (WI) with over 30 years of engineering and environmental experience, will use real life examples and documented ethic cases for demonstrating proper ethical behavior for professionals. Provides 2 PDH.

SC6. Workflow for Unmanned Aerial Systems UAS. Sun. 17 May, 8 a.m.–noon, Harbor Side Convention Center, Room 204. Fee: \$0. Instructors: Scott M. Galetka and Martin Goettl.

The short course covers projects since UW-Eau Claire and Bayfield County has started the Unmanned Aerial System UAS program. Topics covered include how do you get started and running with a UAS Program from a government perspective, going beyond getting your license, equipment and software. This includes reviewing successful and unsuccessful workflows of a variety of projects.

SC7. Workshop: The Role of Geoscience in Environmental Health through Food Sovereignty. Sat. 16 May, 8 a.m.–7 p.m., Fee: \$75. Instructors: Wendy Smythe; Rebecca Webster; Mary Beth Jäger; Noor Johnson.

Geoscience directly impacts environmental sustainability and health and food sovereignty. The purpose of this short course is to bring together Native American/Alaska Native (NA/AN) tribal communities, leaders, elders, and cultural practitioners, faculty, students, geoscience and health professionals who engage in various aspects of geoscience, food sovereignty, and human health to emphasize both the importance geoscience plays in environmental sustainability and monitoring and the interconnectedness of geoscience in food sovereignty and thus human health.

Technical Session Schedule

Monday, 18 May 2020			
Session	Time	Sponsor/Description	Location
1	8:00 AM	D3. Indigenous-Centered Research, Education, and Strategies to Facilitate Learning in Geosciences (GSA <i>Geoscience Education Division</i>)	French River Room 2
2	8:00 AM	T1. Insights into Processes of Proterozoic Crustal Growth, Modification, and Stabilization in the North-Central U.S. Continental Interior	French River Room 1
3	8:00 AM	T17. Geochemical Cycling of Environmentally Relevant Elements	Lake Superior Ballroom O
4	8:00 AM	T21. Flash Floods, Landslides, and Debris Flows in the Midcontinent (GSA <i>Quaternary Geology and Geomorphology Division</i>)	Lake Superior Ballroom L
5	8:00 AM	T23. Cores to Drones: Understanding Shoreline Behavior, Processes, and Coastal Landscape Changes in the Great Lakes (GSA <i>Quaternary Geology and Geomorphology Division</i>)	Lake Superior Ballroom MN
6	8:00 AM	T32. Unique Geology and Geoheritage of the Lake Superior Region (<i>Geochemical Society</i>)	Saint Louis River Room
7	8:30 AM	D1. Caves, Karst, and the Hydrogeology of Fractured Bedrock Aquifers (Posters) (GSA <i>Karst Division</i>)	Lake Superior Ballroom KJ
8	8:30 AM	D2. Geophysics, Magnetism, and Remote Sensing (Posters) (GSA <i>Geophysics and Geodynamics Division</i>)	Lake Superior Ballroom KJ
9	8:30 AM	D3. Indigenous-Centered Research, Education, and Strategies to Facilitate Learning in Geosciences (Posters) (GSA <i>Geoscience Education Division</i>)	Lake Superior Ballroom KJ
10	8:30 AM	D5. Paleoclimate, Paleontology, and Sedimentology (Posters)	Lake Superior Ballroom KJ
11	8:30 AM	T13. Geoarchaeology: Exploring the Connections Between Humanity and Geology (Posters)	Lake Superior Ballroom KJ
12	8:30 AM	T17. Geochemical Cycling of Environmentally Relevant Elements (Posters)	Lake Superior Ballroom KJ
13	8:30 AM	T18. It's a Small (Microbial) World (Posters)	Lake Superior Ballroom KJ
14	8:30 AM	T21. Flash Floods, Landslides, and Debris Flows in the Midcontinent (Posters) (GSA <i>Quaternary Geology and Geomorphology Division</i>)	Lake Superior Ballroom KJ
15	8:30 AM	T23. Cores to Drones: Understanding Shoreline Behavior, Processes, and Coastal Landscape Changes in the Great Lakes (Posters) (GSA <i>Quaternary Geology and Geomorphology Division</i>)	Lake Superior Ballroom KJ
16	8:30 AM	T37. Undergraduate Research (Posters) (<i>Council on Undergraduate Research Geosciences Division</i> ; GSA <i>Geoscience Education Division</i>)	Lake Superior Ballroom KJ
17	1:30 PM	D1. Caves, Karst, and the Hydrogeology of Fractured Bedrock Aquifers (GSA <i>Karst Division</i>)	Lake Superior Ballroom MN
18	1:30 PM	D2. Geophysics, Magnetism, and Remote Sensing (GSA <i>Geophysics and Geodynamics Division</i>)	French River Room 2

Monday, 18 May 2020 (continued)			
Session	Time	Sponsor/Description	Location
19	1:30 PM	T2. Intrusive Rocks of the Midcontinent Rift	French River Room 1
20	1:30 PM	T18. It's a Small (Microbial) World	Lake Superior Ballroom O
21	1:30 PM	T22. Drainage Basin Evolution, Fluvial Geomorphology, and Fluvial Processes of the Great Plains, Great Lakes, and Upper Mississippi River Basin (GSA <i>Quaternary Geology and Geomorphology Division</i>)	Lake Superior Ballroom L
Tuesday, 19 May 2020			
Session	Time	Sponsor/Description	Location
22	8:00 AM	D4. Novel and Classical Approaches to Deciphering Records of the Precambrian Earth	Saint Louis River Room
23	8:00 AM	T4. Petrology, Mineralogy, and High-Temperature Geochemistry	Lake Superior Ballroom L
24	8:00 AM	T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet I: Bringing Multiple Tools to Bear (GSA <i>Quaternary Geology and Geomorphology Division</i>)	Lake Superior Ballroom O
25	8:00 AM	T12. All Things Aeolian (GSA <i>Quaternary Geology and Geomorphology Division</i>)	French River Room 1
26	8:00 AM	T26. Groundwater Quality Degradation and Protection: Water Quality Assessment, Modeling and Uncertainty Analysis, and Water Supply Management (Minnesota <i>Ground Water Association</i>)	Lake Superior Ballroom MN
27	8:00 AM	T36. Teaching, Learning, and Research in Geoscience Education (<i>National Association of Geoscience Teachers (NAGT)</i> ; GSA <i>Geoscience Education Division</i>)	French River Room 2
28	8:30 AM	D4. Novel and Classical Approaches to Deciphering Records of the Precambrian Earth (Posters)	Lake Superior Ballroom KJ
29	8:30 AM	T4. Petrology, Mineralogy, and High-Temperature Geochemistry (Posters)	Lake Superior Ballroom KJ
30	8:30 AM	T9. Paleontology of the Upper Midwest: Glimpses into Five Seashores (Posters)	Lake Superior Ballroom KJ
31	8:30 AM	T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet: Bringing Multiple Tools to Bear (Posters) (GSA <i>Quaternary Geology and Geomorphology Division</i>)	Lake Superior Ballroom KJ
32	8:30 AM	T24. Lakes as Sentinels of Environmental Change (Posters)	Lake Superior Ballroom KJ
33	8:30 AM	T26. Groundwater Quality Degradation and Protection: Water Quality Assessment, Modeling and Uncertainty Analysis, and Water Supply Management (Posters) (Minnesota <i>Ground Water Association</i>)	Lake Superior Ballroom KJ
34	8:30 AM	T29. Addressing Habitat, Water, Ecosystem, and Sustainability Issues through Interdisciplinary Work (Posters) (GSA <i>Geobiology and Geomicrobiology Division</i> ; GSA <i>Hydrogeology Division</i> ; GSA <i>Environmental and Engineering Geology Division</i> ; GSA <i>Soils and Soil Processes Division</i>)	Lake Superior Ballroom KJ

Tuesday, 19 May 2020 (continued)			
Session	Time	Sponsor/Description	Location
35	8:30 AM	T31. Preventing, Responding to, and Understanding the Long-Term Behavior of Crude Oil and Petroleum in Terrestrial and Aquatic Environments (Posters)	Lake Superior Ballroom KJ
36	1:30 PM	D6. Structural Geology, Tectonics, and Impact Structures	Lake Superior Ballroom L
37	1:30 PM	T9. Paleontology of the Upper Midwest: Glimpses into Five Seashores	French River Room 2
38	1:30 PM	T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet II: Bringing Multiple Tools to Bear (GSA <i>Quaternary Geology and Geomorphology Division</i>)	Lake Superior Ballroom O
39	1:30 PM	T24. Lakes as Sentinels of Environmental Change	Lake Superior Ballroom MN
40	1:30 PM	T29. Addressing Habitat, Water, Ecosystem, and Sustainability Issues through Interdisciplinary Work (GSA <i>Geobiology and Geomicrobiology Division</i> ; GSA <i>Hydrogeology Division</i> ; GSA <i>Environmental and Engineering Geology Division</i> ; GSA <i>Soils and Soil Processes Division</i>)	French River Room 1

Schedule of Events

EVENT	TIME	LOCATION
SATURDAY, 16 MAY		
SC7. Workshop: The Role of Geoscience in Environmental Health through Food Sovereignty (Short Course)	8 a.m.–7 p.m.	
FT1. Northern Minnesota Peatland and Soil Research Tour (Field Trip)	9 a.m.	City Side Convention Center, Entrance B
SUNDAY, 17 MAY		
FT4. The Sandstone Karst of Pine County, Minnesota (Field Trip)	7:30 a.m.–6 p.m.	City Side Convention Center, Entrance B
FT2. Geology Field Trip along the Mesabi Iron Range with Fossil Collecting (Field Trip)	7:45 a.m.–7 p.m.	City Side Convention Center, Entrance B
SC6. Workflow for Unmanned Aerial Systems UAS (Short Course)	8 a.m.–noon	Harbor Side Convention Center, Room 204
SC3. Programming IoT Monitoring Stations Built on the Arduino Framework with the EnviroDIY Modular Sensor Library (Short Course)	9 a.m.–4 p.m.	Harbor Side Convention Center, Room 202
SC2. 3D modeling using Structure from Motion and Terrestrial Laser Scanning (Short Course)	9 a.m.–5 p.m.	Harbor Side Convention Center, Room 205
SC1. Navigating the Path to Professional Licensure (Short Course)	1–4 p.m.	Harbor Side Convention Center, Room 203
Exhibitor Set up	3–7 p.m.	Lake Superior Ballroom KJ
Registration	3–7 p.m.	Reception/Registration Area
Speaker Ready Room	3–7 p.m.	Split Rock 2
First Time Attendees Workshop	5–5:30 p.m.	Harbor Side Convention Center, Room 202
Icebreaker Welcome Reception	5–7 p.m.	Harbor Side Convention Center Ballroom, 3rd Floor
Student Lightning Talks	5:30–7 p.m.	Harbor Side Convention Center Ballroom, 3rd Floor
MONDAY, 18 MAY		
Speaker Ready Room	6:30 a.m.–6 p.m.	Split Rock 2
Session Chair Orientation	7–7:15 a.m.	French River Room 1
Registration	7 a.m.–5:30 p.m.	Reception/Registration Area
Exhibits Open	8 a.m.–6 p.m.	Lake Superior Ballroom KJ
Morning Oral Technical Sessions		
D3. Indigenous-Centered Research, Education, and Strategies to Facilitate Learning in Geosciences	8 a.m.–noon	French River Room 2
T1. Insights into Processes of Proterozoic Crustal Growth, Modification, and Stabilization in the North-Central U.S. Continental Interior	8 a.m.–noon	French River Room 1

EVENT	TIME	LOCATION
T17. Geochemical Cycling of Environmentally Relevant Elements	8 a.m.–noon	Lake Superior Ballroom O
T21. Flash Floods, Landslides, and Debris Flows in the Midcontinent	8 a.m.–noon	Lake Superior Ballroom L
T23. Cores to Drones: Understanding Shoreline Behavior, Processes, and Coastal Landscape Changes in the Great Lakes	8 a.m.–noon	Lake Superior Ballroom MN
T32. Unique Geology and Geoheritage of the Lake Superior Region	8 a.m.–noon	Saint Louis River Room
Poster Sessions: Authors will be present from 3:30 to 5:30 p.m.		
D1. Caves, Karst, and the Hydrogeology of Fractured Bedrock Aquifers (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
D2. Geophysics, Magnetism, and Remote Sensing (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
D3. Indigenous-Centered Research, Education, and Strategies to Facilitate Learning in Geosciences (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
D5. Paleoclimate, Paleontology, and Sedimentology (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T13. Geoarchaeology: Exploring the Connections Between Humanity and Geology (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T17. Geochemical Cycling of Environmentally Relevant Elements (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T18. It's a Small (Microbial) World (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T21. Flash Floods, Landslides, and Debris Flows in the Midcontinent (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T23. Cores to Drones: Understanding Shoreline Behavior, Processes, and Coastal Landscape Changes in the Great Lakes (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T37. Undergraduate Research (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
Geoscience Career Workshop Part 1: Career Planning and Networking	9–10 a.m.	Gooseberry Falls Room
Coffee/Tea Break	9:30–10 a.m.	Lake Superior Ballroom KJ
Geoscience Career Workshop Part 2: Geoscience Career Exploration	10–11 a.m.	Gooseberry Falls Room
Roy J. Shlemon Mentor Program in Applied Geoscience	noon–1:30 p.m.	Gooseberry Falls Room
Duluth Lakewalk for Students	12:50–1:30 p.m.	City Side Convention Center, Entrance B
Afternoon Oral Technical Sessions		
D1. Caves, Karst, and the Hydrogeology of Fractured Bedrock Aquifers	1:30–5:30 p.m.	Lake Superior Ballroom MN
D2. Geophysics, Magnetism, and Remote Sensing	1:30–5:30 p.m.	French River Room 2
T2. Intrusive Rocks of the Midcontinent Rift	1:30–5:30 p.m.	French River Room 1
T18. It's a Small (Microbial) World	1:30–5:30 p.m.	Lake Superior Ballroom O
T22. Drainage Basin Evolution, Fluvial Geomorphology, and Fluvial Processes of the Great Plains, Great Lakes, and Upper Mississippi River Basin	1:30–5:30 p.m.	Lake Superior Ballroom L
Posters/Exhibits Reception	4–6 p.m.	Lake Superior Ballroom KJ
Monday Student Social Hour	5:30–7 p.m.	Hoops Brewing located in Canal Park
FT5. Walking Tour of Minnesota Point (Field Trip)	4–6 p.m.	City Side Convention Center, Entrance B

EVENT	TIME	LOCATION
TUESDAY, 19 MAY		
Speaker Ready Room	6:30 a.m.–3 p.m.	Split Rock 2
Session Chair Orientation	7–7:15 a.m.	French River Room 1
GSA Campus Representatives Recognition and Technical Advisory Board Meeting	7–8 a.m.	Board Room
Registration	7 a.m.–3 pm	Reception/Registration Area
Exhibits Open	8 a.m.–3 pm	Lake Superior Ballroom KJ
FT6. Geology under the Surface: Lake Superior and the Research Vessel Blue Heron—Morning Trip (Field Trip)	8 a.m.–noon	City Side Convention Center, Entrance B
Morning Oral Technical Sessions		
D4. Novel and Classical Approaches to Deciphering Records of the Precambrian Earth	8 a.m.–noon	Saint Louis River Room
T4. Petrology, Mineralogy, and High-Temperature Geochemistry	8 a.m.–noon	Lake Superior Ballroom L
T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet I: Bringing Multiple Tools to Bear	8 a.m.–noon	Lake Superior Ballroom O
T12. All Things Aeolian	8 a.m.–noon	French River Room 1
T26. Groundwater Quality Degradation and Protection: Water Quality Assessment, Modeling and Uncertainty Analysis, and Water Supply Management	8 a.m.–noon	Lake Superior Ballroom MN
T36. Teaching, Learning, and Research in Geoscience Education	8 a.m.–noon	French River Room 2
Poster Sessions: Authors will be present from 3:30 to 5:30 p.m.		
D4. Novel and Classical Approaches to Deciphering Records of the Precambrian Earth (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T4. Petrology, Mineralogy, and High-Temperature Geochemistry (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T9. Paleontology of the Upper Midwest: Glimpses into Five Seashores (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet: Bringing Multiple Tools to Bear (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T24. Lakes as Sentinels of Environmental Change (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T26. Groundwater Quality Degradation and Protection: Water Quality Assessment, Modeling and Uncertainty Analysis, and Water Supply Management (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T29. Addressing Habitat, Water, Ecosystem, and Sustainability Issues through Interdisciplinary Work (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
T31. Preventing, Responding to, and Understanding the Long-Term Behavior of Crude Oil and Petroleum in Terrestrial and Aquatic Environments (Posters)	8:30 a.m.–5:30 p.m.	Lake Superior Ballroom KJ
Geoscience Career Workshop Part 3: Cover Letters, Résumés and CVs	9–10 a.m.	Gooseberry Falls Room
Coffee/Tea Break	9:30–10 a.m.	Lake Superior Ballroom KJ
John Mann Mentors in Applied Hydrogeology Program	noon–1:30 p.m.	Gooseberry Falls Room
Duluth Lakewalk for Students	12:50–1:30 p.m.	City Side Convention Center, Entrance B
FT7. Geology under the Surface: Lake Superior and the Research Vessel Blue Heron—Afternoon Trip (Field Trip)	1–5 p.m.	City Side Convention Center, Entrance B

EVENT	TIME	LOCATION
Afternoon Oral Technical Sessions		
D6. Structural Geology, Tectonics, and Impact Structures	1:30–5:30 p.m.	Lake Superior Ballroom L
T9. Paleontology of the Upper Midwest: Glimpses into Five Seashores	1:30–5:30 p.m.	French River Room 2
T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet II: Bringing Multiple Tools to Bear	1:30–5:30 p.m.	Lake Superior Ballroom O
T24. Lakes as Sentinels of Environmental Change	1:30–5:30 p.m.	Lake Superior Ballroom MN
T29. Addressing Habitat, Water, Ecosystem, and Sustainability Issues through Interdisciplinary Work	1:30–5:30 p.m.	French River Room 1
Geology Club Officer Meetup	2–3 p.m.	Gooseberry Falls Room
Exhibitor Teardown	3–7 p.m.	Lake Superior Ballroom KJ
Posters/Exhibits Reception	4–5:30 p.m.	Lake Superior Ballroom KJ

WEDNESDAY, 20 MAY

FT11. Sediments, Landforms, and Proglacial Lake History in Western St. Louis County, Minnesota (Field Trip)	7:30 a.m.–5:30 p.m.	City Side Convention Center, Entrance B
FT12. Geologic Setting of the 1850 Ma Sudbury Meteorite Impact Layer on the Gunflint Trail, Northeastern Minnesota (Field Trip)	7:30 a.m.	City Side Convention Center, Entrance B
FT10. Duluth to Two Harbors—Transect through the Duluth Complex and Base of the North Shore Volcanic Group (Field Trip)	8 a.m.–6 p.m.	City Side Convention Center, Entrance B
FT9. Slope Stability, Extreme Floods, and Implications for Restoration in the Duluth Area (Field Trip)	8:45 a.m.–5 p.m.	City Side Convention Center, Entrance B

Technical Sessions

NOTICE

In the interest of public information, the Geological Society of America provides a forum for the presentation of diverse opinions and positions. The opinions (views) expressed by speakers and exhibitors at these sessions are their own and do not necessarily represent the views or policies of the Geological Society of America.

A no-smoking policy has been established by the Program Committee and will be followed in all meeting rooms for technical sessions.



NOTE INDEX SYSTEM

Numbers (3-4, 15-4) indicate session and order of presentation within that session.

* denotes speaker

MONDAY, 18 MAY 2020

MORNING ORAL TECHNICAL SESSIONS

SESSION NO. 1

D3. Indigenous-Centered Research, Education, and Strategies to Facilitate Learning in Geosciences (GSA Geoscience Education Division)

8:00 AM, Duluth Entertainment Convention Center, French River Room 2

Wendy Smythe and Prajukti Bhattacharyya, Presiding

- 8:00 AM **INTRODUCTORY REMARKS**
- 1-1 8:05 AM Mooers, Howard D.*; Breckenridge, Rachel B.; Neville, Melinda; Dalbotten, Diana: **INSTITUTIONAL BARRIERS TO THE ESTABLISHMENT OF 2+2 STEM PROGRAM IN TRIBAL RESOURCES FOR REMOTE DELIVERY TO TRIBAL COLLEGES**
- 1-2 8:25 AM Nyblade, Madeline*; Bloomquist, Jeremy; Bunting, Perry; Caldwell, Trinity; Chapman, Eric; Charwood, LeAnn; Colvin, Jamie; Dalbotten, Diana; Davenport, Mae; Dockry, Micheal; Duqain, McKaylee; Graveen, Joe; Hedin, Kari; Howes, Riley; Howes, Tom; Kesner, Shannon; King, Hannah Jo; Kuester, Brayden; Larkin, Dan; Matson, Laura; Mullen, Brena; Ng, G.-H. Crystal; O'Hara, Patrick; Santelli, Cara; Schmitter, Riley; Schuldt, Nancy; Torgeson, Josh; Vogt, Darren; Waheed, Alexander; Weiss, Chad; White, Lilah: **FIRST WE SHOULD CONSIDER MANOOMIN (WILD RICE): CO-PRODUCING INTERDISCIPLINARY ECOLOGICAL KNOWLEDGE AND CO-PROTECTING INDIGENOUS RESOURCE SOVEREIGNTY**
- 1-3 8:45 AM Neville, Melinda*; Mooers, Howard D.; Breckenridge, Rachel B.; Dalbotten, Diana: **INDIGENIZING GEOSCIENCE CURRICULA AT LEECH LAKE TRIBAL COLLEGE**
- 1-4 9:05 AM Westgaard, John*; Hanks, H. Douglas: **THE DEVELOPMENT AND IMPLEMENTATION OF A VOLUNTEER INTERPRETER PROGRAM TO AUGMENT A STATE PARK FOSSIL TOUR: EFFORTS OF THE HILL ANNEX PALEONTOLOGY PROJECT**

- 1-5 9:25 AM Crabtree, Stephen*: **GEOSCIENCE OUTREACH TO ELEMENTARY AND MIDDLE-SCHOOL STUDENTS IN RURAL, WESTERN MINNESOTA: PITFALLS AND PROGRESS**
- 9:45 AM **BREAK**
- 1-6 10:00 AM Smythe, Wendy F.*: **INDIGENOUS GEOSCIENCE LEARNING: COMMUNITY-CENTERED GEOSCIENCE EXPERIENCES AND CURRICULUM**
- 10:20 AM **DISCUSSION**
- 1-7 11:20 AM Smythe, Wendy F.*; White, Lisa D.; Bowser, Gillian: **FIELDWORK INSPIRING EXPANDED LEADERSHIP AND DIVERSITY (FIELD): OVERCOMING BARRIERS TO FIELDWORK IN PALEONTOLOGY**
- 11:40 AM **CONCLUDING REMARKS**

SESSION NO. 2

T1. Insights into Processes of Proterozoic Crustal Growth, Modification, and Stabilization in the North-Central U.S. Continental Interior

8:00 AM, Duluth Entertainment Convention Center, French River Room 1

Daniel Holm, David Malone and John Craddock, Presiding

- 8:00 AM **INTRODUCTORY REMARKS**
- 2-1 8:05 AM Craddock, John P.*; Malone, David: **A PALEOMAGNETIC AND STRUCTURAL STUDY OF THE PROTEROZOIC (1868 MA) GABBROIC XENOLITH, MARSHFIELD TERRANE, WISCONSIN DAM, WISCONSIN**
- 2-2 8:25 AM Hallett, Benjamin W.*: **PETROLOGIC INSIGHT INTO THE P-T HISTORY OF HIGH GRADE METAPELITES OF THE INTERNAL ZONE OF THE PENOKEAN-YAVAPAI OROGENIC BELT, NORTHERN WISCONSIN**
- 2-3 8:45 AM Holm, Daniel*; Medaris, L. Gordon; McDannell, Kalin; Schneider, David A.; Schulz, Klaus J.; Singer, Brad S.; Jicha, Brian R.: **AGE AND SIGNIFICANCE OF DEFORMED POST-PENOKEAN MAFIC DIKES FOR GROWTH AND OVERPRINTING OF PROTEROZOIC PROVINCES IN CENTRAL WISCONSIN, SOUTHERN LAKE SUPERIOR REGION**

- 2-4 9:05 AM Medaris, L. Gordon*; Singer, Bradley S.; Jicha, Brian R.; Malone, David H.; Schwartz, Joshua J.: **GEON 14 MAGMATISM, DEFORMATION, AND METASOMATISM IN THE SOUTHERN LAKE SUPERIOR REGION: DEFINING THE BARABOO OROGENY**
- 2-5 9:25 AM Craddock, Erica Powers*; Malone, David; Craddock, John P.: **RECONNAISSANCE PALEOMAGNETIC STUDY OF THE ~1450 MA WOLF RIVER BATHOLITH, WISCONSIN**
- 9:45 AM **BREAK**
- 2-6 10:00 AM Malone, David H.*; Stein, Carol; Craddock, John P.; Stein, Seth A.: **NEOPROTEROZOIC SEDIMENTATION IN THE LAURENTIAN MIDCONTINENT: DETRITAL ZIRCON PROVENANCE OF THE JACOBVILLE SANDSTONE, LAKE SUPERIOR BASIN, USA AND CANADA**
- 2-7 10:20 AM McDannell, Kalin*; Holm, Daniel; Schneider, David A.; Medaris, L. Gordon; Schulz, Klaus J.; Singer, Brad S.; Jicha, Brian R.: **⁴⁰AR/³⁹AR K-FELDSPAR THERMOCHRONOLOGY RESULTS FROM THE SOUTHERN LAKE SUPERIOR REGION: REHEATING AND STABILIZATION OF PROTEROZOIC LITHOSPHERE RELATED TO LATE PROTEROZOIC MAGMATIC UNDERPLATING**
- 2-8 10:40 AM Malone, David*; Freiburg, Jared T.; Holland, Mark E.; Malone, Shawn J.: **PALEOPROTEROZOIC-CAMBRIAN TECTONIC EVOLUTION OF CENTRAL LAURENTIA: EVIDENCE FROM DETRITAL ZIRCON GEOCHRONOLOGY OF BASAL CAMBRIAN STRATA IN THE DEEP ILLINOIS BASIN, USA**

SESSION NO. 3**T17. Geochemical Cycling of Environmentally Relevant Elements**

8:00 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom O

Cara Santelli, Tingying Xu and Jacqueline Mejia, Presiding

- 8:00 AM **INTRODUCTORY REMARKS**
- 3-1 8:05 AM Kroening, Sharon E.*: **MINNESOTA'S EXTENSIVE MONITORING OF URBAN CONTAMINANTS IN GROUNDWATER**
- 3-2 8:25 AM Plechacek, Amy*; Scott, Sean; Gotkowitz, Madeline; Ginder-Vogel, Matthew: **INVESTIGATION OF SOLUTE SOURCES TO THE MIDWESTERN CAMBRIAN-ORDOVICIAN AQUIFER SYSTEM OF EASTERN WISCONSIN**
- 3-3 8:45 AM Haas, Lisa D.*; Roden, Eric; Ginder-Vogel, Matthew; Zambito, James J.: **MICROBIALY-MEDIATED PYRITE OXIDATION IN THE TUNNEL CITY GROUP AND WONEWOC FORMATION SANDSTONES OF TREMPLEAU COUNTY, WI**
- 3-4 9:05 AM Islam, Raisa*; Swanner, Elizabeth: **UNCOVERING THE INTERMEDIATES IN PYRITE FORMATION UNDER FERRUGINOUS CONDITIONS**
- 3-5 9:25 AM LaFond-Hudson, Sophia*; Johnson, Nathan; Pastor, John; Dewey, Brad: **ROOT SURFACES OF AQUATIC PLANTS ARE AN OVERLOOKED SITE OF IRON AND SULFUR IMMOBILIZATION**
- 9:45 AM **BREAK**
- 3-6 10:00 AM Sabuda, Mary*; Rosenfeld, Carla; DeJournett, Todd; Wuolo-Journey, Karl; Schroeder, Katie; Santelli, Cara: **REMOVAL OF SELENIUM FROM MINNESOTA INDUSTRIAL AND MUNICIPAL WASTEWATERS BY COMMON SOIL FUNGI**
- 3-7 10:20 AM Ritchey, Robin*: **ANALYSIS OF BIOGEOCHEMICAL CONDITIONS RESPONSIBLE FOR MERCURY METHYLATION IN THE SNAKE RIVER**
- 3-8 10:40 AM Erickson, Melinda L.*; Malenda, Helen F.; Berquist, Emily C.: **GEOCHEMICAL EVOLUTION OF GROUNDWATER AFTER DRINKING WATER WELL INSTALLATION: EFFECTS ON GEOGENIC ARSENIC**
- 3-9 11:00 AM Wayman, Sarah*; Wood, Leah; Filippelli, Gabriel; Levy, Jonathan; Krekeler, Mark P.S.: **INITIAL TRANSMISSION ELECTRON MICROSCOPY (TEM) INVESTIGATION OF**

FINE PARTICULATE FROM SURFICIAL SEDIMENT IN KABWE, ZAMBIA: NEW CONSTRAINTS ON THE NATURE OF METALS OF ENVIRONMENTAL CONCERN IN A MAJOR LEAD IMPACTED REGION

- 3-10 11:20 AM Chen, Michael A.*; Kang, Peter: **A MICROFLUIDIC STUDY OF THE EFFECTS OF INCOMPLETE MIXING ON CALCITE DISSOLUTION**

SESSION NO. 4**T21. Flash Floods, Landslides, and Debris Flows in the Midcontinent (GSA Quaternary Geology and Geomorphology Division)**

8:00 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom L

Carrie Jennings, Karen B. Gran and Thomas Oommen, Presiding

- 4-1 8:00 AM Van Wyk de Vries, Maximilian*: **DOES DEGREE OF CREVASSING INFLUENCE SUPRAGLACIAL LANDSLIDE RUNOUT?**
- 4-2 8:20 AM Oommen, Thomas*; Weidner, Luke; DePrekel, Kirsten; Vitton, Stanley: **INVESTIGATING LARGE LANDSLIDES ALONG THE ONTONAGON RIVER IN THE UPPER PENINSULA OF MICHIGAN**
- 4-3 8:40 AM Jennings, Carrie E.*; Gran, Karen B.; DeLong, Stephen B.; Bartley, Julie K.; Blumentritt, Dylan; Breckenridge, Andy J.; Dahly, Derek T.; Day, Stephanie S.; Engle, Zachary; Hammer, Morena; Kurak, Ethan; Larson, Phillip H.; McDermott, Jeni A.; Richard, Emilie M.; Swanson, Melissa; Triplett, Laura D.: **A LANDSLIDE INVENTORY FOR MINNESOTA**
- 4-4 9:00 AM Swanson, Melissa; Larson, Phillip H.*; Wickert, Andrew D.; Jennings, Carrie; Gran, Karen B.; DeLong, Stephen B.: **SPATIAL DISTRIBUTION AND CHARACTER OF MASS WASTING IN THE MINNESOTA RIVER VALLEY: CASE STUDY OF A REACH FROM NEW ULM TO ST. PETER**
- 4-5 9:20 AM Day, Stephanie S.*; Nixon, Charles Idell; Jennings, Carrie; Gran, Karen B.; DeLong, Stephen B.; DeLong, Whitney M.; Ostrand, Megan; Marolt, Samuel D.; Halvorson, Victoria Elizabeth; Sullivan, Micheal: **LANDSLIDES IN THE RED RIVER VALLEY, MINNESOTA**
- 9:40 AM **BREAK**
- 4-6 9:55 AM Richard, Emilie M.*; Dahly, Derek T.; Rehwinkel, Rayann W.; Gran, Karen B.; Breckenridge, Andy J.; DeLong, Stephen B.; DeLong, Whitney M.; Engle, Zachary T.; Jennings, Carrie E.; Wickert, Andrew D.: **LANDSLIDES IN NORTHEAST MINNESOTA: INVENTORY MAPPING AND SUSCEPTIBILITY ASSESSMENT**
- 4-7 10:15 AM DeLong, Stephen B.*; Engle, Zachary T.; Hammer, Morena; Richard, Emilie M.; Gran, Karen B.; Breckenridge, Andy J.; Jalobeanu, Andre: **REVISITING THE 2012 DULUTH, MN EXTREME PRECIPITATION EVENT: CHARACTERIZING THE EXTENT AND MAGNITUDE OF LANDSLIDES, EROSION, AND SEDIMENTATION USING REPEAT LIDAR AND OBJECT-BASED IMAGE ANALYSIS**
- 4-8 10:35 AM Engstrom, Jackson J.*: **A WATERSHED SCALE FLOOD INUNDATION FREQUENCY ANALYSIS**

SESSION NO. 5**T23. Cores to Drones: Understanding Shoreline Behavior, Processes, and Coastal Landscape Changes in the Great Lakes (GSA Quaternary Geology and Geomorphology Division)**

8:00 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom MN

Erin P. Argyilan, John W. Johnston and Todd A. Thompson, Presiding

- 8:00 AM **INTRODUCTORY REMARKS**
- 5-1 8:05 AM Mihindukulasooriya, Lorita*; Campbell, Alisha; Herzberg, Amanda; Brown, Victoria; Mabry, Brenna S.: **EVALUATING MULTIPLE ALGAL MONITORING METHODS AND FACTORS AFFECTING PHYTOPLANKTON DISPERSAL UNDER OPPOSING HYDROLOGICAL CONDITIONS IN A GREAT LAKES ESTUARY**

Monday, 18 May 2020

- 5-2 8:25 AM Perello, Melanie*; Little, Clinton; Westerbur, Amber: **ASSESSING SHORELINE CHANGE ON MINNESOTA'S NORTH SHORE: ESTIMATING EROSION RATES AND IDENTIFYING HAZARD AREAS**
- 5-3 8:45 AM Mickelson, David M.*; Stone, Jeff; Hochschild, Jason: **CONTINUING HIGH LAKE LEVELS ARE LEADING TO SEVERE EROSION OF WESTERN LAKE SUPERIOR'S CLAY BLUFFS IN WISCONSIN**
- 5-4 9:05 AM Volpano, Chelsea A.*; Zoet, Lucas K.; Rawling, J. Elmo; Theuerkauf, Ethan J.: **NUMERICAL MODELLING OF LAKE MICHIGAN SHORELINE EROSION: TWO RIVERS, WISCONSIN**
- 5-5 9:25 AM Roland, Collin J.*; Zoet, Lucas K.; Rawling, J. Elmo; Cardiff, Michael: **FREEZE/THAW PROCESSES DRIVE SEASONAL MASS WASTING ON COLD-REGION COASTAL BLUFFS: EXAMPLE FROM A CASE STUDY IN SOUTHEASTERN WISCONSIN**
- 9:45 AM **BREAK**
- 5-6 10:00 AM Yurk, Brian P.; Hansen, Edward*; DeVries-zimmerman, Suzanne; Bodenbender, Brian E.: **MAPPING SURFACE CHANGES RESULTING FROM INDIVIDUAL STORM EVENTS IN A COASTAL DUNE COMPLEX USING AN UNMANNED AERIAL SYSTEM**
- 5-7 10:20 AM Spitzer, Elizabeth M.*; Theuerkauf, Ethan J.: **USING DRONE AND NEARSHORE BUOY DATA TO PREDICT EROSION AND OVERWASH AT A LAKE MICHIGAN BEACH: APPLICATION OF THE USGS STORM-IMPACT SCALE MODEL TO THE GREAT LAKES**
- 5-8 10:40 AM Morrison, Sean*; Johnston, John W.; Lepper, Kenneth: **REFINING THE LATE HOLOCENE OUTLET PALEOHYDROGRAPH FOR LAKE MICHIGAN-HURON WITH THE IPPERWASH PALEOHYDROGRAPH OR CLOSEST AND MOST COMPLETE STRANDPLAIN OF BEACH RIDGES TO THE OUTLET**
- 5-9 11:00 AM Johnston, John W.*; Argyilan, Erin P.; Lepper, Kenneth; Thompson, Todd A.: **PALEOHYDROGRAPHIC RECONSTRUCTIONS FROM STRANDPLAINS OF LATE HOLOCENE BEACH RIDGES IN THE UPPER LAURENTIAN GREAT LAKES: PAST MILESTONES, CURRENT STATUS AND VITAL GAPS IN RESEARCH**
- 5-10 11:20 AM Argyilan, Erin P.*: **THE CONNECTIONS BETWEEN LITTORAL DRIFT DISTURBANCE, LAKE LEVEL, SHORELINE BEHAVIOR AND COASTAL RESILIENCE ALONG THE SOUTHERN SHORELINE OF LAKE MICHIGAN, NORTHWEST INDIANA**
- 11:40 AM **CONCLUDING REMARKS**

SESSION NO. 6

T32. Unique Geology and Geoheritage of the Lake Superior Region (Geochemical Society)

8:00 AM, Duluth Entertainment Convention Center, Saint Louis River Room

Erika Vye, William I. Rose, Jim Miller and James M. DeGraff, Presiding

- 8:00 AM **INTRODUCTORY REMARKS**
- 6-1 8:05 AM Lizzadro-McPherson, Daniel J.*; Mueller, Sophie A.; DeGraff, James M.: **REMAPPING THE KEWEENAW FAULT AND DISCOVERY OF RELATED STRUCTURES IN MICHIGAN'S HISTORIC COPPER DISTRICT**
- 6-2 8:25 AM Mueller, Sophie A.*; Lizzadro-McPherson, Daniel J.; DeGraff, James M.: **ANALYSIS AND INTERPRETATION OF FOLDS AND FAULT SEGMENTS ALONG THE KEWEENAW FAULT SYSTEM, MICHIGAN**
- 6-3 8:45 AM Rose, William I.*; Vye, Erika C.: **KEWEENAW SHORELINES: SHALLOW WATER SCIENCE, HISTORY, EDUCATION AND GEO TOURISM**
- 6-4 9:05 AM Rose, William I.*; Rush, Stephen; Scappettone, Jennifer; Biolo, Carrie: **GEOHERITAGE AND THE ARTS: BUILDING AWARENESS USING THE KEWEENAW MINES**

- 6-5 9:25 AM DeGraff, James M.*; Rose, William I.: **DIGITAL CAPTURE AND PRESERVATION OF HISTORIC MINING DATA FROM THE KEWEENAW COPPER DISTRICT, MICHIGAN**
- 9:45 AM **BREAK**
- 6-6 10:00 AM Miller, James D.*; Green, John C.: **TEACHING THE GEOLOGIC HERITAGE OF MINNESOTA'S NORTH SHORE AT THE NORTH HOUSE FOLK SCHOOL, GRAND MARAIS**
- 6-7 10:20 AM Roblee, Stephen; Rose, William I.; Vye, Erika C.*: **SHIPWRECK EXPLORATION WORKSHOP IN NEARSHORE KEWEENAW WATERS**
- 6-8 10:40 AM Vye, Erika*; Rose, William I.; Meadows, Guy: **CONNECTING RESEARCH AND COMMUNITY - A KEWEENAW LAKE SUPERIOR NATIONAL MARINE SANCTUARY**
- 6-9 11:00 AM Green, John C.*: **THE FIRST GEOLOGICAL SURVEY OF MINNESOTA'S NORTH SHORE: THE OWEN/NORWOOD REPORT OF 1852, ITS HISTORICAL CONTEXT, AND ITS PLACE IN THE EVOLUTION OF GEOLOGICAL SCIENCE**

POSTER TECHNICAL SESSIONS

SESSION NO. 7

D1. Caves, Karst, and the Hydrogeology of Fractured Bedrock Aquifers (Posters) (GSA Karst Division)

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

Booth #

- 7-1 1 Patterson, Jeremy R.*; Cardiff, Michael: **TOWARDS UNDERSTANDING PERIOD DEPENDENCE IN FLOW PROPERTIES OF A FRACTURED BEDROCK AQUIFER**
- 7-2 2 Carpenter, Philip J.*; Castillo, Luis Bautista; Salazar, Emilio; Garcia, Aimee: **GEOPHYSICAL IDENTIFICATION OF FRACTURES AND KARST CONDUITS ALONG THE RUTA DE LOS CENOTES AND HOLBOX FRACTURE ZONE, NORTHEAST YUCATÁN PENINSULA, MÉXICO**
- 7-3 3 Bonin, B.J.*; Brick, Greg; Jennings, Carrie: **BEDROCK COLLAPSE IN ST. PETER SANDSTONE**
- 7-4 4 Larson, Erik B.*; Sumrall, Jonathan B.: **KARST OF THE EASTERN UPPER PENINSULA, MICHIGAN**
- 7-5 5 Simpson, Dakota G.*; Fitzpatrick, David B.; Liles, Preston; Barnett, Samantha; Pearson, Logan; Testa, Maurice P.; Larson, Erik B.: **GRIKES OF THE HIAWATHA NATIONAL FOREST: DISSOLUTIONALLY ENLARGED JOINTS OF MICHIGAN'S UPPER PENINSULA**

SESSION NO. 8

D2. Geophysics, Magnetism, and Remote Sensing (Posters) (GSA Geophysics and Geodynamics Division)

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

Booth #

- 8-1 6 Seaman, Zachariah*; Henson, Harvey; Burkett, Francesca; Apgar, Alexandra: **GROUND-PENETRATING RADAR EXPERIMENTATION IN LOSSY SOIL CONDITIONS: EXAMPLES FROM IMAGING BURROWING CRAYFISH**
- 8-2 7 Apgar, Alexandra*; Henson, Harvey; Seaman, Zachariah; Seaman, Kailey M.; Henson, Angela: **EXPLORATION OF THE MORRISON FORMATION *CAMARASAUROS* BONE BEDS USING GROUND-PENETRATING RADAR**
- 8-3 8 Seaman, Kailey M.*; Henson, Harvey; Seaman, Zachariah; Apgar, Alexandra; Henson, Angela: **STRATIGRAPHIC AND GEOCHEMICAL OBSERVATIONS WITH GROUND PENETRATING RADAR (GPR) OF THE UPPER MORRISON FORMATION NEAR THERMOPOLIS, WY, USA**

- 8-4 9 Finch, Stephanie R.*; Feinberg, Joshua: **DEVELOPMENT OF 3D-PRINTED HALBACH CYLINDER FOR TEACHING AND RESEARCH IN GEOMAGNETISM**
- 8-5 10 Dahle, Jordan R.*; Day, Stephanie S.; Laabs, Benjamin; Munroe, Jeffrey S.: **DETECTING ROCK GLACIER MOVEMENT WITH UAS-BASED PHOTOGRAPHY AND TOTAL STATION SURVEYS, GREAT BASIN NATIONAL PARK, NEVADA**
- 10-8 22 Liles, Preston*; Pearson, Logan; Barnett, Samantha; Simpson, Dakota G.; Fitzpatrick, David B.; Larson, Erik B.; Testa, Maurice P.: **THE CHALLENGES OF USING FIELD COLLECTED GIGAPAN MICRO- AND MACRO-SIZED IMAGES TO CREATE ACCURATE 3D RENDERS AND MODELS**
- 10-9 23 Fox, James J.*; Nadon, Gregory C.: **AN EARLY MISSISSIPPIAN GILBERT DELTA DEPOSIT WITHIN THE BLACK HAND SANDSTONE OF CENTRAL OHIO**
- 10-10 24 Snider, Dale Michael*; Goswami, Arghya: **A COMPREHENSIVE REVIEW OF THE BAY OF BENGAL SEDIMENT, TECTONICS, AND CLIMATE**

SESSION NO. 9***D3. Indigenous-Centered Research, Education, and Strategies to Facilitate Learning in Geosciences (Posters) (GSA Geoscience Education Division)***

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

- Booth #
- 9-1 11 Peele, Sarah*; Smythe, Wendy F.: **INDIGENOUS KNOWLEDGE COUPLED WITH GEOSCIENCE TO EXAMINE INDIGENOUS FOOD SOVEREIGNTY**
- 9-2 12 Dalbotten, Diana*; Berthelote, Antony R.; Bueno Watts, Nievita: **THE GEOSCIENCE ALLIANCE - CARRYING FORWARD ANCESTRAL KNOWLEDGE TO WORK THROUGH TODAY'S CHALLENGES--A REPORT ON THE FOURTH NATIONAL GEOSCIENCE ALLIANCE CONFERENCE**
- 9-3 13 Taylor, Jennifer M.*; Kenyon, Lindsey M.; Hamelin, Clémentine: **OUTREACH THROUGH SCIENCE AND ART: GRADUATE STUDENT-LED INTERDISCIPLINARY COLLABORATIONS WITH COMMUNITY ARTISTS**
- 9-4 14 Shannon, Jeremy M.*: **WORKING 9 TO 5 – A NEAR-SURFACE FIELD GEOPHYSICS COURSE THAT'S JUST LIKE A JOB (BUT WITHOUT THE PAY!)**

SESSION NO. 10***D5. Paleoclimate, Paleontology, and Sedimentology (Posters)***

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

- Booth #
- 10-1 15 Wedel, Steven*; Petersen, Sierra V.; Zhang, Jade; Winkelstern, Ian Z.; Lohmann, Kyger C.: **TEMPERATURE AND OXYGEN ISOTOPE SEASONALITY OF THE LAST INTERGLACIAL (MIS-5E) FROM ANALYSIS OF STABLE AND CLUMPED ISOTOPES OF BERMUDA BIVALVES**
- 10-2 16 O'Hora, Heidi E.*; Petersen, Sierra V.; Scholz, Serena R.; Vellekoop, Johan: **CLUMPED ISOTOPE ANALYSIS OF THE CRETACEOUS-PALEOGENE MASS EXTINCTION LINKED TO VOLCANICALLY INDUCED GLOBAL WARMING**
- 10-3 17 Colombi, Carina E.*; Santi Malnis, Paula; Martínez, Ricardo; Drovandi, Juan Martín; Correa, Gustavo; Soria, Tatiana: **PALEOENVIRONMENTAL CRISIS ACCOMPANIED PALEOFAUNISTIC CHANGES AT TRIASSIC-JURASSIC BOUNDARY, NW ARGENTINA**
- 10-4 18 Colombi, Carina E.*; Rogers, Raymond R.: **TRACKING AUTHIGENIC MINERAL CEMENTS IN RELATION TO LITHOLOGY AND PALEOENVIRONMENT: A CASE STUDY IN THE TRIASSIC ISCHIGUALASTO FORMATION OF NORTHWESTERN ARGENTINA**
- 10-5 19 Mitchell, Michaela G.*; Ciampaglio, C.N.; Peterman, David J.; Shell, Ryan; Fuelling, Lauren J.; Jacquemin, Stephen J.: **CHANGES IN CHONDRICHTHYAN TOOTH NICHE SPACE ACROSS THE PERMIAN-TRIASSIC BOUNDARY**
- 10-6 20 Peterman, David J.*; Inoue, Shinya; Mikami, Tomoyuki; Ciampaglio, Charles N.: **WHY WERE AMMONITE SUTURES SO COMPLEX? AN INVESTIGATION OF LIQUID RETENTION IN THE SEPTAL MARGINS OF AMMONOID SHELLS**
- 10-7 21 Ansolabehere, Julia*; Bush, Rosemary T.: **CELL WALL UNDULATION AS SHADE PROXY IN *CERCIDIPHYLLUM JAPONICUM* LEAVES**
- 11-1 25 Boyd, Matthew*; Surette, Clarence; Garvie, Monica; Birch, Kira: **ARCHAIC (MIDDLE) PERIOD ARCHAEOLOGY AND PALEOENVIRONMENTS OF THE THUNDER BAY REGION, NORTHWESTERN ONTARIO, CANADA**
- 11-2 26 Schaetzl, Randall J.*; Hambacher, Michael: **CHARACTERISTICS, USES AND AGE OF CACHE PITS IN THE LOWER GRAND RIVER VALLEY, SOUTHWESTERN MICHIGAN**
- 11-3 27 Jones, Daniel S.; Cooper, Aspen; Bakovic, Mile; Pajovic, Goran; Borovinic, Nikola; Tostevin, Gilbert; Monnier, Gilliane*: **APPLYING HIGH-THROUGHPUT RRNA GENE SEQUENCING TO ASSESS MICROBIAL CONTAMINATION OF A 40-YEAR OLD EXPOSED ARCHEOLOGICAL PROFILE**
- 11-4 28 Vang, Duabchi*; Anderson, Jackelyn R.; Langfield, Katherine; Ihinger, Phillip D.: **CHARACTERIZATION OF 18TH CENTURY FRENCH GLASS TRADE BEADS FROM FORT MACKINAC, MI AND FRANCE: CHEMISTRY AND INFRARED SPECTROSCOPY**
- 11-5 29 Vest, Jordan*; Patrick, Jessica; Dawson, Claudia; Seibert, Zoey; McLeod, Claire; Krekeler, Mark P.S.: **USING INDUSTRIAL MINERALOGICAL APPROACHES TO COMBAT VIOLENCE AGAINST WOMEN, ABDUCTIONS AND HUMAN TRAFFICKING: PRELIMINARY REFLECTIVE SPECTROSCOPY INVESTIGATIONS OF MAKEUP**

SESSION NO. 11***T13. Geoarchaeology: Exploring the Connections Between Humanity and Geology (Posters)***

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

- Booth #

SESSION NO. 12***T17. Geochemical Cycling of Environmentally Relevant Elements (Posters)***

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

- Booth #
- 12-1 30 Erickson, Melinda L.*; Yager, Richard M.; Kauffman, Leon J.; Wilson, John T.: **DRINKING WATER QUALITY IN THE GLACIAL AQUIFER SYSTEM, NORTHERN USA: GEOCHEMICAL PROCESSES INFLUENCE GROUNDWATER CONTAMINANT PATTERNS**
- 12-2 31 Wedal, Megan R.*; Sabuda, Mary; Mejia, Jacqueline; Santelli, Cara: **SMALL FUNGI, BIG (SELENIUM) PROBLEM: TRACKING THE REMOVAL OF ELEVATED SELENATE CONCENTRATIONS BY *ALTERNARIA ALTERNATA***
- 12-3 32 Doepke, Lauren*; Dawson, Claudia; Vest, Jordan; Oglesbee, Traister; Sturmer, Daniel M.; Blakemore, Daniel; McLeod, Claire; Krekeler, Mark P.S.: **A REVIEW OF THE CURRENT UNDERSTANDING OF THE MINERALOGY AND GEOCHEMISTRY OF MINE WASTE FROM TONOPAH, NEVADA: IMPLICATIONS FOR RECYCLING AND ENVIRONMENTAL HEALTH**
- 12-4 33 Gutierrez, Melida*; Qiu, Xiaomin: **GEOCHEMICAL CHARACTERIZATION OF STREAM SEDIMENTS FROM A HISTORICALLY CONTAMINATED SITE**

SESSION NO. 13

T18. It's a Small (Microbial) World (Posters)

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ
 Authors will be present from 3:30 to 5:30 PM

- | Booth # | |
|---------|--|
| 13-1 | 34 Tashjian, Allegra*; Noyce, Genevieve; Megonigal, J. Patrick: EXAMINING THE EFFECTS OF ELEVATED ATMOSPHERIC CO₂ AND WARMING ON SOIL REDOX POTENTIAL |
| 13-2 | 35 Kuester, Brayden*; Sabuda, Mary; Mejia, Jacqueline; Santelli, Cara: EFFECT OF ORGANIC CARBON SOURCE AND CONCENTRATION ON RADIAL GROWTH OF FILAMENTOUS FUNGI IN THE PRESENCE AND ABSENCE OF SELENITE |
| 13-3 | 36 Kees, Eric*; Murugapiran, Senthil; Hamilton, Trinity L.: TEMPERATURE AND PH CONSTRAIN TAXONOMIC DIVERSITY AMONG THERMOPHILIC CYANOBACTERIA |
| 13-4 | 37 Frisk, Madilyn*; Hickson, Thomas A.: IMPLICATIONS OF GEOCHEMICAL SIGNATURES OF MICROBIALITES IN A MIOCENE LAKE SYSTEM |
| 13-5 | 38 Parkinson, Alexis E.*; Cloutis, Edward A.; Applin, Daniel M.; Turenne, Nathalie N.; Connell, Stephanie A.; Kuik, Jesse C.; Kubanek, Krista: THE IDENTIFICATION, DETECTION AND ANALYSIS OF THROMBOLITES USING SPECTROSCOPY TO FURTHER UNDERSTAND THE EVOLUTION, ADAPTATIONS, AND PRESERVATION OF EARLY LIFE |

SESSION NO. 14

T21. Flash Floods, Landslides, and Debris Flows in the Midcontinent (Posters) (GSA Quaternary Geology and Geomorphology Division)

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ
 Authors will be present from 3:30 to 5:30 PM

- | Booth # | |
|---------|---|
| 14-1 | 39 Engle, Zachary T.*; DeLong, Stephen B.; Bartley, Julie K.; Blumentritt, Dylan; Breckenridge, Andy J.; Day, Stephanie S.; Gran, Karen B.; Jennings, Carrie E.; Larson, Phillip H.; McDermott, Jeni A.; Triplett, Laura D.; Wickert, Andrew D.: TOWARDS DESIGN OF A LANDSLIDE INVENTORY GEODATABASE FOR MINNESOTA |
| 14-2 | 40 Link, Sophie*; Matti, Blake; McDermott, Jeni A.; Endres, Matt; Jennings, Carrie; Kurak, Ethan; Gran, Karen B.; DeLong, Stephen B.; DeLong, Whitney M.; Engle, Zachary; Wickert, Andrew D.: LIDAR-BASED IDENTIFICATION AND CLASSIFICATION OF LANDSLIDES IN THE MINNEAPOLIS-ST PAUL METROPOLITAN AREA, MINNESOTA |
| 14-3 | 41 Krippner, Kiara*; Allison, Matt; Triplett, Laura D.; Bartley, Julie K.; DeLong, Stephen B.; DeLong, Whitney M.; Engle, Zachary; Gran, Karen B.; Jennings, Carrie; Wickert, Andrew D.: LANDSLIDE CHARACTERIZATION IN THE LOWER MINNESOTA RIVER VALLEY |
| 14-4 | 42 Nixon, Charles Idell*; Day, Stephanie S.; Balas, Benjamin; Jennings, Carrie; DeLong, Whitney M.: AN ASSESSMENT OF LIDAR VISUALIZATION TECHNIQUES TO AID IN AUTOMATED FEATURE EXTRACTION |
| 14-5 | 43 Tenison, Christina N.*; Rech, Jason A.: USING RELATIVE ELEVATION MODELS TO INFORM STREAM RESTORATION PROJECT DESIGN IN THE MIDWEST |
| 14-6 | 44 Frank, Garrett*; Meghani, Nooreen A.; Anders, Alison: AGE ISN'T EVERYTHING; GLACIAL MELTWATER FLOW PATHS INFLUENCE POST-GLACIAL DRAINAGE DENSITY |

SESSION NO. 15

T23. Cores to Drones: Understanding Shoreline Behavior, Processes, and Coastal Landscape Changes in the Great Lakes (Posters) (GSA Quaternary Geology and Geomorphology Division)

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ
 Authors will be present from 3:30 to 5:30 PM

Booth #

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| 15-1 | 45 Phillips, Andrew C.*; Barklage, Mitchell: OFFSHORE GEOLOGIC MAPPING BY PROBING AND SUBBOTTOM IMAGING, ILLINOIS BEACH STATE PARK, WESTERN LAKE MICHIGAN |
| 15-2 | 46 Dodge, Stefanie E.*; Zoet, Lucas K.; Rawling, J. Elmo; Theuerkauf, Ethan J.: THE EFFECTS OF ICE ON COASTAL EROSION |
| 15-3 | 47 Palaseanu-Lovejoy, Monica; Kincare, Kevin A.*; Becker, Richard; Yellich, John A.: GLACIAL BLUFF LANDSLIDES, LAKE MICHIGAN: A RESPONSE TO HIGH WATER LEVELS, PRECIPITATION, AND WIND STORMS |
| 15-4 | 48 Huot, Sebastien*; Zurbuchen, Julie; Simms, Alexander R.: EPISODIC COASTAL PROGRADATION IN SOUTHERN CALIFORNIA: EVIDENCES FROM GROUND-PENETRATING RADAR, RADIOCARBON AND LUMINESCENCE DATING DURING THE LAST MILLENNIUM |
| 15-5 | 49 Gibbs Schnucker, Sara*; Lepper, Kenneth: A SURVEY OF TOMBOLOS IN LAKE SUPERIOR |

SESSION NO. 16

T37. Undergraduate Research (Posters) (Council on Undergraduate Research Geosciences Division; GSA Geoscience Education Division)

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ
 Authors will be present from 3:30 to 5:30 PM

- | Booth # | |
|---------|--|
| 16-1 | 50 Hammer, Morena N.*; Burley, Paul D.; Mooers, Howard D.: KARST MAPPING DENSITY IN THE PORTSDOWN CHALK FORMATION |
| 16-2 | 51 Walton, Christina*; Elder, Katie; Weremeichik, Jeremy M.; Grote, Todd: AN INVESTIGATION OF EPIKARST IN THE MUSCATATUCK GROUP (MIDDLE DEVONIAN) |
| 16-3 | 52 Ahumada, David*; Beierle Pavek, Karissa; Mugavero, Dominic; Eichers, Celeste; Olthoff, Kaeden; Paige Owens, Christina; Tyler, Haley; Leonard, Karl W.: INTERPRETATIONS OF QUATERNARY LANDSCAPE DEVELOPMENT IN THE BUFFALO RIVER VALLEY USING SEDIMENTOLOGIC AND STRATIGRAPHIC ANALYSIS: MSUM REGIONAL SCIENCE CENTER IN WEST-CENTRAL MINNESOTA |
| 16-4 | 53 Kosugi, Yoko*; Kramar, David; Leonard, Karl W.: USING GIS AND MACHINE-LEARNING TO RECOGNIZE SUBTLE LANDSCAPE FEATURES ASSOCIATED WITH GLACIAL LAKE AGASSIZ |
| 16-5 | 54 Lurz, Rachel C.*; Lowell, Thomas V.: MELTING ICE PATTERNS AND TOPOGRAPHICAL CHANGES ASSOCIATED WITH DIFFERENT SURFACE COVERS AT THE TERMINUS OF THE MATANUSKA GLACIER, AK |
| 16-6 | 55 Halvorson, Victoria Elizabeth*; Laabs, Benjamin J.: MODELING EQUILIBRIUM LINE ALTITUDES OF MOUNTAIN GLACIERS IN THE WESTERN UNITED STATES DURING THE LAST GLACIAL MAXIMUM |
| 16-7 | 56 Wolfe, Erica*; Sodeman, Alexander D.; Fisher, Timothy G.: MORPHOLOGICAL CONNECTION BETWEEN PAIRED TUNNEL CHANNELS, BURIED TUNNEL CHANNELS, AND SUBAERIAL CHANNELS OF THE HURON-ERIE LOBE, ACROSS THE INDIANA, MICHIGAN AND OHIO TRISTATE AREA |
| 16-8 | 57 Nelson, Emily P.*; Laabs, Benjamin J.; Munroe, Jeffrey S.: NUMERICAL MODELING OF VALLEY GLACIERS TO INFER PLEISTOCENE CLIMATE IN THE BIGHORN RANGE OF WYOMING |
| 16-9 | 58 Meltzer, Eve*; Zoet, Lucas K.; Iverson, Neal R.: CRYSTALLOGRAPHIC ANALYSIS OF EXPERIMENTALLY DEFORMED ICE |
| 16-10 | 59 Goldade, Briana*; Laabs, Benjamin J.; Day, Stephanie S.: TRACKING THE EVOLUTION OF SEASONAL PRAIRIE SNOW IN EASTERN NORTH DAKOTA WITH UAS-BASED REPEAT AERIAL PHOTOGRAPHY |
| 16-11 | 60 Kutz, Nolan*; Carpenter, Philip J.: LAVA TUBE EXPLORATION ON MARS USING SHARAD RADARGRAMS AND HIGH-RESOLUTION DIGITAL TERRAIN MODELS |

AFTERNOON ORAL TECHNICAL SESSIONS

- 16-12 61 Beeck, Jazlyn B.*; Rasmussen, Mark; Swanner, Elizabeth: **PEDOGENIC CARBONATE CONCRETIONS IN IOWA'S LOESS SOILS: A MODERN CARBON SINK?**
- 16-13 62 Ahumada, David*; Beierle Pavek, Karissa; Mugavero, Dominic; Eichers, Celestte; Paige Owens, Christina; Carr, Jackson; Okeibunor, Vanessa; Leonard, Karl W.: **A QUATERNARY MOLLUSCAN ASSEMBLAGE FROM A POST-GLACIAL/FLUVIAL DEPOSIT IN THE BUFFALO RIVER VALLEY: MSUM REGIONAL SCIENCE CENTER IN WEST-CENTRAL MINNESOTA**
- 16-14 63 Okkonen, Madeline T.*; Rilett, Rachel M.; Riemersma, Peter E.; Winkelstern, Ian Z.: **MICROBIALITE GROWTH AND DISTRIBUTION WITHIN FISH LAKE, MICHIGAN**
- 16-15 64 Grove, Joseph*; Dallmann, Adam L.; Voegelé, Kristyn; Ullmann, Paul Victor; Nellerhoe, Ron: **CONTEXTUALIZING A NEW, LARGE ALLOSAURUS SKELETON FROM WYOMING INTO STRATIGRAPHIC PERSPECTIVE WITHIN THE LATE JURASSIC MORRISON FORMATION**
- 16-16 65 Weinrich, Noah*: **HUNTER-SCHREGER BAND CONFIGURATION AND MICROWEAR OF OLIGOCENE AGE HYRACODON AND SUB-HYRACODON TOOTH ENAMEL**
- 16-17 66 Moen, Jaelen*; Egelhof, Jessica; Moatari-Kazerouni, Afsoon: **INSTRUCTION AND LEARNING THROUGH FOSSIL COLLECTIONS IN THE GEOLOGY DEPARTMENT: INSPIRED BY MUSEUMS**
- 16-18 67 Nolen, Daniel J.*; Thaisen, Kevin Glenn: **IT IS BETTER TO BE METEORITE THAN METEOR-WRONG: ANALYSIS AND CLASSIFICATION OF POTENTIAL IRON METEORITE SPECIMEN**
- 16-19 68 Karuza, Lukas*; Konecke, Brian A.; Wolf, Michael B.: **GEOCHEMICAL ANALYSIS AND HEAT-TREATMENT OF NATURAL SAPPHIRES FROM MOZAMBIQUE AND TANZANIA IN OXIDIZING AND REDUCING CONDITIONS**
- 16-20 69 Gamet, Nolan George*; Doran, Krystyna E.; Student, James J.; Sirbescu, Mona-Liza: **DISTRIBUTION OF TRACE ELEMENTS IN SPODUMENE: INSIGHTS FROM PRELIMINARY P-XRF RESULTS**
- 16-21 70 Humpula, Jarrett*; Sirbescu, Mona-Liza; Student, James J.: **PRELIMINARY TEXTURAL ANALYSIS TO CONSTRAIN THE FORMATION (OR DEFORMATION?) OF TINTON PEGMATITES, NORTHERN BLACK HILLS, SOUTH DAKOTA**
- 16-22 71 Campo, Chloe*; Knesel, Kurt: **PRE-ERUPTIVE TEMPERATURES AND ERUPTION DYNAMICS OF RHYOLITE LAVA, NIMBIN RHYOLITE DOME COMPLEX, EASTERN AUSTRALIA**
- 16-23 72 Weimer, Joshua J.*; Hallett, Benjamin W.: **CHARACTERIZING GRANULITE FACIES METAMORPHISM OF THE PICURIS OROGENY, TAOS RANGE, NEW MEXICO**
- 16-24 73 Boor, Elizabeth*; Carpenter, Logan; Krauss, Heidi N.; Wojtowicz, Emily; Brengman, Latisha Ashley; Goodge, John W.; Hansen, Vicki L.: **ORIGIN OF NEOARCHEAN METASEDIMENTARY ROCKS NEAR PIKE LAKE, VERMILION DISTRICT, NORTHEAST MINNESOTA**
- 16-25 74 Ali, Shah Bilawal*; Malone, David H.; Arkle, Jeanette C.; Strasser, Jeffrey C.: **DETRITAL ZIRCON GEOCHRONOLOGY OF THE CAMBRIAN FLATHEAD AND DEADWOOD SANDSTONE OF WYOMING AND SOUTH DAKOTA: AN ANALYSIS OF PROVENANCE AND SEDIMENT DISPERSAL PATTERNS**
- 16-26 75 Sell, Michael*; Arkle, Jeanette C.; Wolf, Michael B.: **HEAVY MINERALOGY OF BEDLOAD SEDIMENT IN THE UPPER MISSISSIPPI RIVER AND THE INFLUENCE OF TRIBUTARIES**

SESSION NO. 17

D1. Caves, Karst, and the Hydrogeology of Fractured Bedrock Aquifers (GSA Karst Division)

1:30 PM, Duluth Entertainment Convention Center, Lake Superior Ballroom MN

E. Calvin Alexander Jr., Anthony Runkel, Erik B. Larson and Maurice P. Testa, Presiding

1:30 PM **INTRODUCTORY REMARKS**

- 17-1 1:35 PM Barry, John D.*; Runkel, Anthony C.; Walsh, James F.; Crisman, David P.; Aley, Tom; Alexander, E. Calvin: **USING TRACERS AND BOREHOLE CHARACTERIZATION TO UNDERSTAND FLOW AND RECHARGE IN CRYSTALLINE ROCK**
- 17-2 1:55 PM Hart, David J.*; Bhattacharyya, Prajukti: **EXAMPLES OF FRACTURE CONNECTIVITY IN WISCONSIN'S PRECAMBRIAN CRYSTALLINE BEDROCK**
- 17-3 2:15 PM Runkel, Anthony C.*; Meyer, Jessica R.; Steenberg, Julia R.; Retzler, Andrew J.; Pehme, Peeter E.; Parker, Beth L.; Tipping, Robert G.: **FRACTURE STRATIGRAPHY LINKED TO DEPTH-DISCRETE MULTILEVEL BOREHOLE MONITORING IN LOWER PALEOZOIC BEDROCK OF THE CENTRAL MIDCONTINENT, NORTH AMERICA**
- 17-4 2:35 PM Kang, Peter*: **PREDICTING ANOMALOUS TRANSPORT IN THREE-DIMENSIONAL DISCRETE FRACTURE NETWORKS**
- 17-5 2:55 PM Streitz, Andrew*: **THE SENTINEL LAKES PAIRED GROUNDWATER/SURFACE WATER NETWORK'S INVESTIGATION OF THE MOVEMENT OF PHOSPHORUS AND CHLORIDE**
- 17-6 3:15 PM Alexander, E. Calvin*: **FIVE DECADES OF SINKHOLE MAPPING IN MN – A PUNCTUATED EVOLUTIONARY PROCESS**
- 17-7 3:35 PM Brick, Greg*: **MINNESOTA CAVES: HISTORY AND LORE**
- 3:55 PM **CONCLUDING REMARKS**
- 4:00 PM **DISCUSSION**

SESSION NO. 18

D2. Geophysics, Magnetism, and Remote Sensing (GSA Geophysics and Geodynamics Division)

1:30 PM, Duluth Entertainment Convention Center, French River Room 2

Kevin L. Mickus, Michele D. Stillinger and Stephanie S. Day, Presiding

- 18-1 1:30 PM Delong, Ashley*; Mickus, Kevin L.: **MAGNETOTELLURIC STUDY OF THE LITHOSPHERE IN THE NORTH CENTRAL USA**
- 18-2 1:50 PM Frederiksen, Andrew*; Pokar, Parth; Barrow, Eddie; Revenaugh, Justin; van der Lee, Suzan: **SEISMIC ANISOTROPY ACROSS AND ALONG THE MID-CONTINENT RIFT**
- 18-3 2:10 PM Kendrick, Alex; Knight, Rosemary; Johnson, Carole D.; Liu, Gaisheng; Hunt, Randall J.*; Butler, James J.: **ASSESSMENT OF NMR LOGGING FOR ESTIMATING HYDRAULIC CONDUCTIVITY IN GLACIAL AQUIFERS**
- 18-4 2:30 PM Moskal, Rebecca*; White, John C.; Malzone, Jonathan M.; Hennen, Sadie: **ELECTRICAL RESISTIVITY TOMOGRAPHY (ERT) APPLIED TO AN INVESTIGATION OF RIDGETOP WETLAND HYDROGEOLOGY IN THE DANIEL BOONE NATIONAL FOREST, ROWAN COUNTY, KENTUCKY**
- 18-5 2:50 PM Sadeghiamirshahidi, Mohammadhossein*; Vitton, Stanley; Oommen, Thomas: **ANALYSIS OF HIGH HORIZONTAL STRESSES IN PRECAMBRIAN ROCKS OF NORTHERN MINNESOTA AND MICHIGAN AND THEIR EFFECT ON FOUNDATION CONSTRUCTION**

Monday, 18 May 2020

- 18-6 3:10 PM Phillips, Zachary*; Day, Stephanie S.: **STRUCTURE FROM MOTION STUDY OF EROSION FROM MOBILE RIVER ICE**
- 18-7 3:30 PM Clement, Annaka M.*; Gibbs Schnucker, Sara; Tackett, Lydia S.: **ENHANCING MORPHOMETRIC ANALYSIS AND STUDENT ACCESSIBILITY IN PALEONTOLOGICAL RESEARCH THROUGH STRUCTURE-FROM-MOTION 3D MODELING: TESTING HYPOTHESES ABOUT MESOZOIC PREDATOR-PREY INTERACTIONS**

SESSION NO. 19

T2. *Intrusive Rocks of the Midcontinent Rift*

1:30 PM, Duluth Entertainment Convention Center, French River Room 1

Joshua Feinberg, Nicholas L. Swanson-Hysell and Mark J. Severson, Presiding

- 19-1 1:30 PM Bleeker, Wouter*; Hamilton, Michael A.; Smith, Jennifer; Kamo, Sandra L.; Hollings, Pete; Cundari, Robert; Easton, Robert Michael: **THE MIDCONTINENT RIFT AND ITS MINERAL SYSTEMS: OVERVIEW AND TEMPORAL CONSTRAINTS OF NI-CU-PGE MINERALIZED INTRUSIONS**
- 19-2 1:50 PM Clark, Ryan J.*; Peate, David W.; Kusick, Allison R.; Horkley, L. Kenneth; McFarlane, Christopher R.M.: **U-PB BADDELEYITE AGE LINKS THE OSBORNE ANOMALY (NE IOWA) TO THE EARLY (1,150 MA) PHASE OF MIDCONTINENT RIFT ACTIVITY**
- 19-3 2:10 PM Miller, James D.*; Sauer, Sarah: **THE LAYERED SERIES AT DULUTH: EVIDENCE FOR A PLUTONIC-VOLCANIC CONNECTION**
- 19-4 2:30 PM Swanson-Hysell, Nicholas L.*; Zhang, Yiming; Schmitz, Mark D.; Crowley, James L.; Hoaglund, Steven A.; Miller, James D.: **INTEGRATING THE CHRONOSTRATIGRAPHIC RECORD OF MIDCONTINENT RIFT VOLCANISM WITH THE HISTORY OF INTRUSIVE ACTIVITY**
- 19-5 2:50 PM Zieg, Michael J.*: **THE BLACK STURGEON SILL: INSIGHTS INTO FORMATION OF MODAL AND COMPOSITIONAL LAYERING**
- 19-6 3:10 PM Zhang, Yiming*; Swanson-Hysell, Nicholas L.; Avery, Margaret S.: **THE RICH PALEOMAGNETIC RECORD OF PROTEROZOIC MIDCONTINENT RIFT INTRUSIVES: AN UPDATED SYNTHESIS WITH A NEW POLE FROM THE BEAVER RIVER DIABASE**
- 19-7 3:30 PM Eufrazio de Oliveira, Igor; van der Lee, Suzan*: **TOWARDS A UNIFYING LITHOSPHERIC MODEL FOR THE MID-CONTINENT RIFT**

SESSION NO. 20

T18. *It's a Small (Microbial) World*

1:30 PM, Duluth Entertainment Convention Center, Lake Superior Ballroom O

Elizabeth Swanner and Cody Sheik, Presiding

- 20-1 1:30 PM Putman, Lindsay I.*; Brazelton, William J.; Hyer, Alex; Kubo, Michael D.Y.; Hoehler, Tori M.; Cardace, Dawn; Schrenk, Matthew O.: **MICROBIAL COMMUNITY RESPONSES TO DRILLING INDUCED PERTURBATIONS IN A HARD ROCK AQUIFER**
- 20-2 1:50 PM Schuler, Christopher J.*; McDermott, Jill M.; Dowd, William S.; Santelli, Cara; Toner, Brandy M.: **MINERALOGICAL HETEROGENEITY AND THE DEEP CONTINENTAL BIOSPHERE**
- 20-3 2:10 PM Hyde, Emily*; Sheik, Cody; Katsev, Sergei; Petersen, Madelyn; Schreiner, Kathryn: **UNDERSTANDING THE ROLE OF MICROBES IN THE FRESHWATER SEDIMENT CRYPTIC SULFUR CYCLE USING METAGENOMICS AND METATRANSCRIPTOMICS**
- 20-4 2:30 PM Natwora, Kaela E.*; Sheik, Cody: **COMPARISON OF NITROGEN FIXATION RATES ACROSS THE LAURENTIAN GREAT LAKES (LGL)**

2:50 PM **BREAK**

- 20-5 3:05 PM Callaghan, Jake*: **NOVEL ARCHAEOAL LINEAGES UTILIZING RUBISCO IN LAKE SUPERIOR SEDIMENTS**
- 20-6 3:25 PM Bennett, Annastacia C.*; Hamilton, Trinity L.: **PHOTOTROPHIC COMMUNITY DISTRIBUTION ALONG A GEOTHERMAL STREAM: INSIGHTS INTO CARBON CYCLING IN VERSATILE PHOTOTROPHS**
- 20-7 3:45 PM Dzombak, Rebecca M.*; Sheldon, Nathan D.: **USING PAIRED GEOCHEMISTRY AND METAGENOMICS TO EXPLORE SOIL CRUSTS AS ANCIENT TERRESTRIAL ANALOGUES**
- 20-8 4:05 PM Hickson, Thomas A.*; Lamb, Melissa A.; Frisk, Madilyn: **LACUSTRINE MICROBIALITES IN THEIR STRATIGRAPHIC ARCHITECTURAL CONTEXT, MIOCENE HORSE SPRING FORMATION, LAKE MEAD REGION, NEVADA**

SESSION NO. 21

T22. *Drainage Basin Evolution, Fluvial Geomorphology, and Fluvial Processes of the Great Plains, Great Lakes, and Upper Mississippi River Basin (GSA Quaternary Geology and Geomorphology Division)*

1:30 PM, Duluth Entertainment Convention Center, Lake Superior Ballroom L

Phillip Herman Larson, Andrew D. Wickert and Douglas J. Faulkner, Presiding

- 21-1 1:30 PM Cho, Se*; Braudrick, Christian A.; Dolph, Christine; Day, Stephanie S.; Dalzell, Brent J.; Wilcock, Peter R.: **SIMULATION OF FLUVIAL SEDIMENT DYNAMICS THROUGH STRATEGIC ASSESSMENT OF STREAM GAGING DATA: A TARGETED WATERSHED SEDIMENT LOADING ANALYSIS**
- 21-2 1:50 PM Sieren, Benjamin*; Headley, Rachel M.; Huckins, Casey J.: **A SEDIMENTOLOGICAL CHARACTERIZATION OF HURON MOUNTAIN STREAMS FOR APPLICATION TO FUTURE ECOLOGICAL STUDIES**
- 21-3 2:10 PM Fitzpatrick, Faith*: **ACCOUNTING FOR GEOMORPHIC AND HABITAT DIVERSITY FOR REHABILITATION OF URBAN LOWLAND STREAMS IN THE GREAT LAKES REGION, USA**
- 21-4 2:30 PM Scott, Larissa*; Gran, Karen B.: **HABITAT QUALITY FOLLOWING A CHANNEL RECONFIGURATION PROJECT: STEWART RIVER, MINNESOTA, USA**
- 2:50 PM **BREAK**
- 21-5 3:05 PM Anders, Alison M.*; Meghani, Nooreen A.; Frank, Garrett: **WHAT CAN WE LEARN ABOUT FLUVIAL EVOLUTION FROM SPATIAL VARIABILITY IN DRAINAGE DENSITY IN THE GLACIATED US CENTRAL LOWLANDS?**
- 21-6 3:25 PM Meghani, Nooreen A.*; Anders, Alison: **LONG PROFILES OF MIDWESTERN RIVERS CAN REVEAL NUANCES OF POST-GLACIAL FLUVIAL NETWORK DEVELOPMENT**
- 21-7 3:45 PM Wickert, Andrew D.*; Anderson, Robert S.; Mitrovica, Jerry X.; Carson, Eric C.; Naylor, Shawn: **A BURIED WATERFALL ON A BACKWARDS MISSISSIPPI: HOW ICE-SHEET-DRIVEN DRAINAGE REVERSAL AND ISOSTATIC ADJUSTMENT ACTIVATED LANDSCAPE EVOLUTION IN THE UPPER MIDWEST**
- 21-8 4:05 PM Morrison, Sean*; Kantack, Keith M.: **UTILIZING TABLET-BASED DATA COLLECTION FORMS IN GEOMORPHIC ASSESSMENTS: BEST PRACTICES IN DATABASE MANAGEMENT**

TUESDAY, 19 MAY 2020**MORNING
ORAL TECHNICAL SESSIONS****SESSION NO. 22*****D4. Novel and Classical Approaches to Deciphering Records of the Precambrian Earth***

8:00 AM, Duluth Entertainment Convention Center, Saint Louis River Room

Robert W.D. Lodge, Athena Eyster and Erik L. Gulbranson, Presiding

- 8:00 AM **INTRODUCTORY REMARKS**
- 22-1 8:05 AM Jirsa, Mark A.*; Chandler, Val W.: **MAPPING MINNESOTA'S PRECAMBRIAN BEDROCK**
- 22-2 8:25 AM Olson, Trent*; Peate, David W.; Clark, Ryan J.: **A PRELIMINARY ANALYSIS OF STRATIGRAPHIC COMPOSITIONAL VARIATIONS IN THE ARCHEAN OTTER CREEK IGNEOUS COMPLEX, NW IOWA**
- 22-3 8:45 AM Lodge, Robert W.D.*; Brock, Natalie Marie; Ma, Chong; Hudak, George J.: **TRACE ELEMENT SYSTEMATICS AND CHEMOSTRATIGRAPHY OF MAFIC-DOMINATED ASSEMBLAGES: EXAMPLES FROM THE ARCHEAN SUPERIOR PROVINCE**
- 22-4 9:05 AM Brengman, Latisha Ashley*; Stewart, Esther K.; Stolze, Danielle; Faust, Emily; Wittkop, Chad: **THE ROLE OF SILICA IN IRON FORMATIONS: TEXTURAL, MINERALOGICAL, AND GEOCHEMICAL COMPARISONS FROM LOW METAMORPHIC GRADE NEOARCHEAN AND PALEOPROTEROZOIC EXAMPLES**
- 22-5 9:25 AM Duncanson, Samuel P.*; Brengman, Latisha Ashley; Fournelle, John H.; Moy, Aurélien: **RECONSTRUCTING FE-SILICATE PARAGENESIS USING PAIRED TEXTURAL AND COMPOSITIONAL DATA IN THE ~1.9 GA BIWABIK IRON FORMATION, MN**
- 9:45 AM **BREAK**
- 22-6 10:00 AM Niedzielski, Brian J.*; Wittkop, Chad; Swanner, Elizabeth; Fralick, Philip; Poulton, Simon W.: **EVALUATING MECHANISMS FOR MANGANESE ENRICHMENTS IN THE PROTEROZOIC ANIMIKIE BASIN**
- 22-7 10:20 AM Ledesma, Gabrielle*; Lanza, Nina; Wittkop, Chad; Swanner, Elizabeth: **CLASSIFICATION OF TERRESTRIAL MANGANESE ENRICHMENTS BY LASER-INDUCED BREAKDOWN SPECTROSCOPY WITH RELEVANCE FOR GALE CRATER, MARS**
- 22-8 10:40 AM Johnson, Benjamin*; Zawaski, Mike; Mojzsis, Stephen: **EARTH'S EARLIEST ICE AGES: NEW ZIRCON GEOCHRONOLOGY OF ARCHEAN GLACIAL DIAMICTITES FROM MONTANA**
- 22-9 11:00 AM Turenne, Nathalie N.*; Cloutis, Edward A.; Applin, Daniel M.; Connell, Stephanie A.; Parkinson, Alexis E.: **IDENTIFICATION AND CHARACTERIZATION OF STROMATOLITES FROM GRAND RAPIDS, MANITOBA, CANADA USING SPECTROSCOPIC TECHNIQUES**
- 22-10 11:20 AM Grengs, Ashley*; Wittkop, Chad; Lambrecht, Nicholas; Fahkrae, Moji; Katsev, Sergei; Swanner, Elizabeth: **CONSTRAINING IRON FORMATION PRIMARY MINERALOGY USING FERRUGINOUS LAKE SEDIMENTS**

SESSION NO. 23***T4. Petrology, Mineralogy, and High-Temperature Geochemistry***

8:00 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom L

Fred Davis, Presiding

- 23-1 8:00 AM Crabtree, Stephen*: **APPLICATION OF A NEW D_N (OLIVINE-MELT) GEOTHERMOMETER: A CASE STUDY OF BLUE ROCK SHIELD VOLCANO, JACKSON CO., OREGON**
- 23-2 8:20 AM Raia, Natalie H.*; Whitney, Donna L.; Teysier, Christian: **SUBDUCTION ZONE REDOX: EXTRACTING FO_2 FROM THE ROCK RECORD**
- 23-3 8:40 AM Wrage, Jackie*; Simon, Adam C.; Linsler, Stefan; Holtz, Francois; Behrens, Harald: **SULFIDE AND SULFATE SATURATION OF DACITIC SILICATE MELTS AS A FUNCTION OF OXYGEN FUGACITY**
- 23-4 9:00 AM Whitney, Donna L.*; Kang, Patricia: **WHY LAWSONITE IS ONE OF THE MOST IMPORTANT MINERALS IN THE PLANET AND WHY IT IS RARELY OCCURS IN THE GEOLOGIC RECORD**
- 23-5 9:20 AM White, John C.*: **MATRIX GLASS AND MELT INCLUSIONS RECORD EXTREME FRACTIONATION IN PANTELLERITIC MAGMAS BEYOND THE EXPERIMENTAL MINIMUM IN THE SYSTEM Q-OR-AB**
- 9:40 AM **BREAK**
- 23-6 9:55 AM Polk, Raven*; White, John C.: **MODELLING THE METALUMINOUS TRACHYTE TO PERALKALINE RHYOLITE TRANSITION USING THE RHYOLITE-MELTS ALGORITHM**
- 23-7 10:15 AM Marché, Jordan D.*: **FURTHER STUDIES OF PSEUDO-CUBIC TERMINATIONS OF QUARTZ CRYSTALS IN A KEOKUK GEODE**
- 23-8 10:35 AM Ruley, Alex*; McLeod, Claire; Lindeman, Carter; Oglesbee, Traister; Klein, Ethan; Patrick, Jessica; Fouch Mbindi, Mireille; Taylor, Mack; Blakemore, Daniel; Krekeler, Mark P.S.: **A REVIEW OF RECENT PROGRESS IN UNDERSTANDING GOLD MINERALIZATION AND PETROLOGY AT THE ROUND MOUNTAIN GOLD MINE, CENTRAL NEVADA**
- 23-9 10:55 AM Lindeman, Carter*; Flett, Lonnie; Ruley, Alex; McLeod, Claire; Krekeler, Mark P.S.: **INITIAL INVESTIGATION OF SAMPLES OF THE VIRTUE MINE, OREGON: A STUDY INTO THE TEXTURAL, MINERALOGICAL, AND GEOCHEMICAL PROPERTIES OF GOLD BEARING QUARTZ VEIN DEPOSITS**
- 23-10 11:15 AM Seaman, Kailey M.*; Rimmer, Susan M.: **SPECTRAL FLUORESCENCE OF LIPTINITE MACERALS IN THE LOWER KITTANNING COAL AND OTHER PENNSYLVANIAN-AGE COALS**

SESSION NO. 24***T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet I: Bringing Multiple Tools to Bear (GSA Quaternary Geology and Geomorphology Division)***

8:00 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom O

Jennifer McDonald, David J Ullman and Kenneth Lepper, Presiding

- 24-1 8:00 AM McDonald, Jennifer*; Wagner, Kaleb G.; Meyer, Gary N.: **CHRONOLOGY AND EXTENT OF THE LAURENTIDE ICE SHEET IN THE ARROWHEAD REGION, NORTHEASTERN MINNESOTA, USA**
- 24-2 8:20 AM Wagner, Kaleb G.*; McDonald, Jennifer; Meyer, Gary N.: **LOBATE INTERACTIONS AND GLACIAL LANDSYSTEM HETEROGENEITY ALONG THE SOUTHERN MARGIN OF THE LAURENTIDE ICE SHEET, NORTHEASTERN MINNESOTA**
- 24-3 8:40 AM Breckenridge, Andy J.*; Lowell, Thomas V.; Wattrus, Nigel; Peteet, Dorothy; Douglas, Peter; Moretto, Michael; Norris, Nathaniel: **A NEW GLACIAL VARVE CHRONOLOGY FROM NORTHERN MINNESOTA AND NORTHWESTERN ONTARIO**

Tuesday, 19 May 2020

- 24-4 9:00 AM Ullman, David J.*; Morency, Michelle; Prince, Karlee K.; Fitz, Tom; Barth, Aaron M.; Breckenridge, Andy J.; Ceperley, Elizabeth G.; Marcott, Shaun A.; Caffee, Marc W.: **A NEW SURFACE EXPOSURE CHRONOLOGY FOR THE MOST RECENT DEGLACIATION OF SOUTHERN LAKE SUPERIOR AND THE IMPLICATIONS FOR PROGLACIAL LAKE EVOLUTION AND CONTINENTAL-SCALE MELT-WATER ROUTING**
- 24-5 9:20 AM Lepper, Kenneth*: **WHAT BEACH IS IT? GEOMORPHOLOGICAL OR GEOCHRONOLOGICAL CORRELATION OF LAKE AGASSIZ SHORELINES IN NORTHWESTERN MINNESOTA, USA**
- 9:40 AM **BREAK**
- 24-6 9:55 AM Lowell, Thomas V.*; Heath, Stephanie L.; Hall, Brenda L.; Kelly, Meredith A.; Diefendorf, Aaron F.: **SOUTHERN LAURENTIDE ICE SHEET FLUCTUATIONS DURING TERMINATION 1**
- 24-7 10:15 AM Berthold, Angela J.*; Mooers, Howard D.: **EVOLUTION OF THE TWIN CITIES MEMBER TILL: IMPLICATIONS FOR LITHOLOGIC VARIATION IN THE NEW ULM FORMATION**
- 24-8 10:35 AM Hill, Christopher L.*; Feathers, James K.: **STRATIGRAPHY AND GEOCHRONOLOGY OF THE SOUTHWEST MARGIN OF THE LAURENTIDE ICE SHEET: QUATERNARY SEDIMENTARY SEQUENCES ON THE NORTHERN PLAINS, MONTANA**
- 24-9 10:55 AM Tassier-Surine, Stephanie A.*; Kerr, Phillip J.: **DETERMINING A GLACIAL BOUNDARY WITHOUT TRADITIONAL STRATIGRAPHIC AND GEOMORPHIC EVIDENCE: MAPPING THE MIDDLE WISCONSINAN SHELDON CREEK FORMATION IN NORTH-CENTRAL IOWA**

SESSION NO. 25

T12. All Things Aeolian (GSA Quaternary Geology and Geomorphology Division)

8:00 AM, Duluth Entertainment Convention Center, French River Room 1

Phillip Herman Larson, Randall J. Schaetzl and Garry Leonard Running IV, Presiding

- 25-1 8:00 AM Schaetzl, Randall J.*; Running, Garry L.; Larson, Phillip H.; Rittenour, Tammy: **SAND WEDGES POINT TO PERMAFROST AND AEOLIAN ACTIVITY IN THE CHIPPEWA VALLEY CA. 18-13 KA**
- 25-2 8:20 AM Shandonay, Kenzie L.*; Mataitis, Richard J.; Burds, Luke; Larson, Phillip H.; Bowen, Mark W.; Running, Garry L.; Schaetzl, Randall J.; Rittenour, Tammy: **GEOMORPHOLOGY OF AEOLIAN SAND STRINGERS IN WESTERN WISCONSIN AND SOUTHEASTERN MINNESOTA**
- 25-3 8:40 AM Burds, Luke*; Larson, Phillip H.; Schirmer, Ronald C.; Running, Garry L.; Faulkner, Douglas J.; Rittenour, Tammy; Mataitis, Richard J.: **AEOLIAN GEOMORPHOLOGY AND GEOARCHAEOLOGY OF THE KIWANIS SITE, CHIPPEWA RIVER VALLEY, WISCONSIN**
- 25-4 9:00 AM Kerr, Phillip J.*; Tassier-Surine, Stephanie A.: **VALLEY ORIENTATION AS A FACTOR FOR LOCAL SAND SOURCES ON THE IOWAN EROSION SURFACE**
- 25-5 9:20 AM Loope, Henry M.*; Antinao, José Luis; Jacobs, Peter M.; Lowell, Thomas V.; Booth, Robert K.: **CHRONOLOGY OF PEORIA LOESS DEPOSITION RELATED TO HURON-ERIE LOBE ADVANCE AND RETREAT, CENTRAL INDIANA**
- 9:40 AM **BREAK**
- 25-6 9:55 AM Bowen, Mark W.*; Johnson, William C.: **LATE QUATERNARY ENVIRONMENTAL CHANGE AND LUNETTE DUNE FORMATION AND EVOLUTION**
- 25-7 10:15 AM Mason, Joseph*: **WHAT IS THE AEOLIAN RECORD REALLY TELLING US ABOUT THE LATE HOLOCENE OF THE CENTRAL GREAT PLAINS?**

- 25-8 10:35 AM DeVries-zimmerman, Suzanne*; Aerts, Rene; Kay, Katherine; Donaldson, Alexandra; Fast, Kathleen M.; Hansen, Edward C.: **WAXING AND WANING INTERDUNAL WETLANDS/SLACKS IN AN EVOLVING AEOLIAN LANDSCAPE ON LAKE MICHIGAN'S EASTERN COAST**
- 25-9 10:55 AM McKeehan, Kevin*; Arbogast, Alan F.: **REPEAT PHOTOGRAPHY OF LAKE MICHIGAN COASTAL DUNES: EXPANSION OF VEGETATION AND HUMAN IMPACTS SINCE 1900**

SESSION NO. 26

T26. Groundwater Quality Degradation and Protection: Water Quality Assessment, Modeling and Uncertainty Analysis, and Water Supply Management

8:00 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom MN

Melinda L. Erickson, Kate S. Pound and William W. Simpkins, Presiding

- 8:00 AM **INTRODUCTORY REMARKS**
- 26-1 8:05 AM Schilling, Keith E.*: **DISSOLVED PHOSPHATE CONCENTRATIONS IN IOWA SHALLOW GROUNDWATER**
- 26-2 8:25 AM McCormick, Matthew*; Kolapkar, Amar; Martin-Hayden, James M.: **EVALUATING THE ADVECTIVE CAPACITY OF REGIONAL FLOW REGIMES TO TRANSPORT LEGACY PHOSPHORUS ON A TILED FARM FIELD, NORTHWEST OHIO**
- 26-3 8:45 AM McDaris, John R.*; Feinberg, Joshua: **USING REAL-TIME ELECTRICAL CONDUCTIVITY MEASUREMENTS TO UNDERSTAND CHLORIDE IN GROUNDWATER**
- 26-4 9:05 AM Erickson, Melinda L.*; Reeves, Howard W.; Hoard, Christopher J.: **GROUNDWATER QUALITY INDICATORS IN THE GREAT LAKES BASIN**
- 26-5 9:25 AM Jones, Matthew M.*; Devlin, J.F.: **PRELIMINARY ASSESSMENT OF GROUNDWATER VELOCITIES IN THE LAKEBED OF UNNAMED LAKE, NEAR BEMIDJI, MN**
- 9:45 AM **BREAK**
- 26-6 10:00 AM Schmidt, Adam; Meurer, Cullen; Sulikowski, Gabrielle; Hatami, Jiyan L.; Paradis, Charles J.*: **THE MILWAUKEE COLUMN: A SIMPLE, AFFORDABLE, AND EFFECTIVE APPARATUS FOR TEACHING AND RESEARCH OF ONE-DIMENSIONAL FLOW AND TRANSPORT IN POROUS MEDIA**
- 26-7 10:20 AM Anurag, Harsh*; Ng, G.-H. Crystal; Tokos, Kathy; Tipping, Robert G.: **MODELING THE IMPACT OF SPATIOTEMPORALLY VARIABLE VEGETATION ON GROUNDWATER RECHARGE**
- 26-8 10:40 AM Kang, Peter*; Runkel, Anthony C.; Jennings, Carrie: **ESTIMATING INJECTION CAPACITY OF WELL-BASED MANAGED AQUIFER RECHARGE SITES**
- 26-9 11:00 AM Li, Xiang*; Nieber, John; Runkel, Anthony; Magner, Joe; Wilson, Bruce; Mulla, David J.; Kuehner, Kevin J.; Holmberg, Kerry; Cowdery, Tim: **MODELING TRAVEL TIME DISTRIBUTIONS WITHIN KARST AND BEDROCK AQUIFERS SYSTEMS OF SOUTHEASTERN MINNESOTA**
- 26-10 11:20 AM Cowdery, Tim*; Baker, Anna; Haserodt, Megan; Feinstein, Daniel T.; Hunt, Randall J.: **MODELING THE IMPACTS OF MINING ON HYDROLOGY IN THE ST. LOUIS RIVER BASIN**
- 11:40 AM **CONCLUDING REMARKS**

SESSION NO. 27**T36. Teaching, Learning, and Research in Geoscience Education (National Association of Geoscience Teachers (NAGT); GSA Geoscience Education Division)**

8:00 AM, Duluth Entertainment Convention Center, French River Room 2

Kyle Gray and Beth A. Johnson, Presiding

- 27-1 8:00 AM Winkelstern, Ian Z.*: **MOTIVATING UNDERSTANDING IN SEDIMENTOLOGY WITH STUDENT-DRIVEN ISOTOPIC RESEARCH**
- 27-2 8:20 AM Rice-Snow, Scott*: **SUPPORTING BROAD-FORMAT STORYTELLING WITH LANDFORM DOCUMENTATION**
- 27-3 8:40 AM Polifka, Jack D.*; Holme, Thomas A.: **MEASURING STUDENTS' UNDERSTANDING OF PLATE TECTONICS AS A FACTOR OF THEIR USE OF MULTIPLE REPRESENTATIONS AND SPATIAL ABILITY**
- 27-4 9:00 AM Wolf, Michael B.*; Arkle, Kelsey M.; Arkle, Jeanette C.: **USING RESEARCH PROJECTS TO ENGAGE STUDENTS IN A COMBINED INTRODUCTORY AND ADVANCED GEOLOGY FIELD PROGRAM**
- 27-5 9:20 AM Shmagin, B.*: **NOTES ON A PHILOSOPHY IN THE GEOSCIENCE EDUCATION**
- 27-6 9:40 AM Ackerman, Jessica R.*; LaDue, Nicole; Shipley, Thomas F.; Dolphin, Glenn R.: **UNDERGRADUATE CONCEPTUAL UNDERSTANDING OF SURFACE PROCESSES**
- 27-7 10:00 AM Arkle, Kelsey M.*; Wolf, Michael B.; Arkle, Jeanette C.: **RECONSTRUCTING THE PALEOGEOGRAPHY OF A MOCK WORLD: A PROGRESSIVE LAB SERIES DESIGNED TO ENGAGE GEOLOGY 101 STUDENTS**
- 27-8 10:20 AM Rempe, Norbert T.*: **MISSING NUCLEAR LINKS IN GEOSCIENCE EDUCATION**
- 27-9 10:40 AM Branlund, Joy M.*; Sachtelaben, Traci: **MATH SUCCESS AS A PREDICTOR OF PERSISTENCE IN STEM**
- 27-10 11:00 AM Zoher, Erika*; LaDue, Nicole; Dugas, Daryl: **QUALITATIVE PERSPECTIVES ON THE STRANGE TRAILS OF PERSISTENCE IN STEM**
- 27-11 11:20 AM Syverson, Kent M.*; Mahoney, J. Brian: **USING THE RESPONSIBLE MINING INITIATIVE AT UW-EAU CLAIRE TO PREPARE MORE GRADUATES FOR JOBS IN MINING, ENVIRONMENTAL CONSULTING, AND REGULATORY AGENCIES**
- 27-12 11:40 AM Cull-Hearth, Selby*: **TEACHING THE HISTORY OF GEOLOGY: RECOGNIZING AND ADDRESSING GEOLOGY'S TIES TO COLONIALISM AND IMPERIALISM**

POSTER TECHNICAL SESSIONS

SESSION NO. 28**D4. Novel and Classical Approaches to Deciphering Records of the Precambrian Earth (Posters)**

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

Booth #

- 28-1 1 Eyster, Athena*; Brengman, Latisha Ashley; Nichols, Claire; Levitt, Zoe; Bergmann, Kristin D.: **THE TECTONIC CONTEXT FOR THE GOGEBIC RANGE IRON FORMATIONS**
- 28-2 2 Tozaki, Naoto*; Smythe, Wendy F.: **CHARACTERIZATION OF MN-OXIDIZING PROTEINS FROM HYPERTHERMOPHILLIC ARCHAEA**
- 28-3 3 Connell, Stephanie A.*; Cloutis, Edward A.; Applin, Daniel M.; Parkinson, Alexis E.; Turenne, Nathalie N.; Kubanek, Krista: **CHARACTERIZING PALEOSOLS BY REFLECTANCE SPECTROSCOPY, RAMAN SPECTROSCOPY, AND X-RAY DIFFRACTION**

- 28-4 4 Hinz, Isaac L.*; Nims, Christine; Theuer, Samantha; Templeton, Alexis S.; Johnson, Jena E.: **FERRIC IRON CATALYZES THE FORMATION OF IRON-RICH SILICATES UNDER ARCHEAN OCEAN-LIKE CONDITIONS**

SESSION NO. 29**T4. Petrology, Mineralogy, and High-Temperature Geochemistry (Posters)**

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

Booth #

- 29-1 5 Lindeman, Carter*; Flett, Lonnie; Ruley, Alex; Oglesbee, Traister; Krekeler, Mark P.S.: **PRELIMINARY MINERALOGICAL INVESTIGATION OF BREATHITT GROUP SANDSTONES FROM BREATHITT COUNTY, KENTUCKY REVEALS UNEXPECTED MINERALOGICAL COMPLEXITY**
- 29-2 6 Oglesbee, Traister*; Brum, Jared; McLeod, Claire; Krekeler, Mark P.S.: **AN SEM INVESTIGATION OF A NATIVE PLATINUM CRYSTAL FROM RUSSIA: INSIGHT INTO VARIATION, SOURCING AND COMPOSITIONAL PROBLEMS OF A HIGHLY COLLECTIBLE MINERAL AND IMPORTANT GEOLOGIC RESOURCE**
- 29-3 7 Pieratt, Connor J.*; Ricci, Samantha; Unger, Derick; Brake, Sandra: **TRACE ELEMENT GEOCHEMISTRY OF SPHALERITE: IMPLICATIONS ON MINERALIZING EVENTS AT THE CUMBERLAND MINE, CENTRAL TENNESSEE, USA**
- 29-4 8 Kershaw, Charles Thomas*; Hummer, Daniel R.; Denny, F. Brett: **MINERALOGY OF IGNEOUS INTRUSIVES AT HICK'S DOME AND THEIR ECONOMIC VIABILITY**
- 29-5 9 Draxler, Elliot F.*; Ihinger, Phillip D.: **ORIGIN AND EVOLUTION OF THE SULFIDE-RICH, MAFIC IGNEOUS INTRUSION AT EAGLE MINE, UPPER PENINSULA, MI**
- 29-6 10 Piispa, Elisa J.; Smirnov, Aleksey V.*; Pesonen, Lauri J.: **PALEOMAGNETISM OF THE MIDCONTINENT RIFT SYSTEM INTRUSIVES IN THE THUNDER BAY AREA (ONTARIO, CANADA): A REVIEW**
- 29-7 11 Kass, Salvatore P.*; Lodge, Robert W.D.; McFarland, Nathaniel J.: **ORIGIN OF PRECAMBRIAN GARNETIFEROUS GNEISSES FROM THE SOUTH BOULDER RIVER VALLEY, TOBACCO ROOT MOUNTAINS, MONTANA**
- 29-8 12 Hamelin, Clémentine*; Whitney, Donna L.; von der Handt, Anette: **SYMPLECTITES IN ECLOGITE AS RECORDERS OF DEEP CRUST EXHUMATION IN A MIGMATITE DOME**
- 29-9 13 Krauss, Heidi N.*; Davis, Fred A.: **EXPERIMENTAL INVESTIGATION OF MANTLE HETEROGENEITY USING PARTITIONING OF FIRST-ROW TRANSITION ELEMENTS BETWEEN CLINOPYROXENE AND MELT WITH VARYING JADEITE COMPONENTS**
- 29-10 14 BC, Aakash*; Sharma, Tripti; Grosz, Bridgett; Kosugi, Yoko; Colson, Russell O.; Colson, Fenner E.: **USE OF PT-MELT EQUILIBRATION AND ELECTROCHEMICAL EXPERIMENTS TO CONSTRAIN THE EFFECT OF CL ON NIO ACTIVITY IN SILICATE MELTS**
- 29-11 15 Crabtree, Stephen*: **A MAPPING, PETROGRAPHY, AND GEOCHEMISTRY-BASED STUDY OF VOLCANIC UNITS IN THE SOUTHERN OREGON CASCADES**
- 29-12 16 Anae, Madison*; Cassady, Victoria; Ukstins, Ingrid; Brenna, Marco; Cronin, Shane J.; Smith, Ian: **UNDERSTANDING MAGMA RISE AND STORAGE USING MAJOR ELEMENTAL DIFFUSION IN OLIVINE; PUPUKE MAAR, AUCKLAND FIELD, NEW ZEALAND**
- 29-13 17 Algbory, Raghad*; Velazquez Santana, Liannie C.; McLeod, Claire; Shaulis, Barry: **TRACKING AMPHIBOLE CRYSTAL POPULATIONS IN CONTINENTAL ARC MAGMAS THROUGH STUDY OF ANDESITES AND HORNBLENDITE CUMULATES IN THE CENTRAL ANDES, BOLIVIA**
- 29-14 18 Wallington, David W.*; Davis, Fred A.: **AN EXPERIMENTAL STUDY OF THE EFFECT OF AL CONCENTRATION IN CLINOPYROXENE ON PARTITION COEFFICIENTS OF THE FIRST-ROW TRANSITION ELEMENTS**

Tuesday, 19 May 2020

- 29-15 19 Dykstra, Brooke A.*; Seitzinger, Zenja; Knesel, Kurt: **MICROLITE ORIENTATIONS AND STRAIN LOCALIZATION WITHIN THE BASAL SHEAR ZONE OF A LARGE RHYOLITE LAVA DOME, MINYON FALLS, AUSTRALIA**
- 29-16 20 Seitzinger, Zenja*; Knesel, Kurt: **FLOW BANDS AND MICROLITE TEXTURES IN OBSIDIAN, MINYON FALLS RHYOLITE, AUSTRALIA**
- 29-17 21 Flint, Juliana M.*; Knesel, Kurt: **BUBBLE SHAPES AND ORIENTATIONS IN OBSIDIAN LAVAS, PYROCLASTS, AND VENTS OF THE TWEED SHIELD VOLCANO, EASTERN AUSTRALIA**

SESSION NO. 30

T9. Paleontology of the Upper Midwest: Glimpses into Five Seashores (Posters)

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

- Booth #
- 30-1 22 Pearson, Logan*; Liles, Preston; Barnett, Samantha; Simpson, Dakota G.; Fitzpatrick, David B.; Larson, Erik B.; Testa, Maurice P.: **BIOSTRATIGRAPHIC ANALYSIS OF A MCKAY BAY MEMBER (BUSH BAY FORMATION) MID-SILURIAN KNOLL REEF IN MICHIGAN'S UPPER PENINSULA**
- 30-2 23 Renner, Dalton John*; Day, Jed: **UPPER DEVONIAN (LATE FRASNIAN) BRACHIOPOD FAUNA OF THE TWIN FALLS FORMATION (GRUMBLER GROUP), NORTHERN TERRITORIES, WESTERN CANADA**
- 30-3 24 Shell, Ryan*; Peterman, David J.; Ciampaglio, Charles N.: **ADDITIONAL VERTEBRATES FROM THE WRETFORD LIMESTONE (PERMIAN: CISURALIAN, SAKMARIAN) OF SOUTHERN KANSAS**
- 30-4 25 Hoffman, Jon J.*; Jones, Matthew M.; Petersen, Sierra V.; Curley, Allison N.: **MULTI-PROXY INVESTIGATION OF THE CENOMANIAN WESTERN INTERIOR SEAWAY USING OYSTER MACROFOSSILS (~94.5 MA)**
- 30-5 26 Haire, Scott A.*; Hanks, H. Douglas; Westgaard, John: **THE ENIGMATIC LATE CRETACEOUS (CENOMANIAN) WINDROW FORMATION IN MINNESOTA**
- 30-6 27 Bachman, Rylan*; Powell, Lisa LaGoo; Hastings, Alexander; Hanks, H. Douglas; Westgaard, John: **FOSSIL FISH SCALES FROM THE CENOMANIAN (UPPER CRETACEOUS) COLERAINE FORMATION OF NORTHERN MINNESOTA: INSIGHTS FROM INDUSTRIAL MICROSCOPY**
- 30-7 28 Willging, Stephen*; Westgaard, John; Hanks, H. Douglas; Hastings, Alexander: **A LOOK AT POSSIBLE UPDATES TO THE GASTROPOD FAUNA OF THE LATE CRETACEOUS COLERAINE FORMATION OF MINNESOTA (HILL ANNEX MINE STATE PARK)**
- 30-8 29 Whiting, Evan*; Hastings, Alex: **SYSTEMATICS AND PALEOECOLOGY OF FOSSIL LIZARDS FROM THE MIDDLE-LATE PALEOCENE WANNAGAN CREEK FOSSIL SITE IN WESTERN NORTH DAKOTA**

SESSION NO. 31

T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet: Bringing Multiple Tools to Bear (Posters) (GSA Quaternary Geology and Geomorphology Division)

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

- Booth #
- 31-1 30 Gehringer, Holden M.*; Granger, Darryl E.: **GLACIAL AND POSTGLACIAL GEOMORPHOLOGY OF TIPPECANOE COUNTY, INDIANA**
- 31-2 31 Grote, Todd*; Griggs, Carol B.; Lorentzen, Brita; Peteet, Dorothy: **FLUVIAL SYSTEM EVOLUTION AND PALEOENVIRONMENTS UNDER A CHANGING CLIMATE FROM THE YOUNGER DRYAS INTO THE HOLOCENE, LAKE ONTARIO LOWLANDS, NEW YORK**
- 31-3 32 Boulding, Russell*: **EVIDENCE FOR EARLY PRE-ILLINOIAN GLACIATION IN SOUTHCENTRAL INDIANA**
- 31-4 33 Kerr, Phillip J.*: **DECIPHERING PRE-ILLINOIAN FLOW PATHS IN THE WESTERN CENTRAL LOWLANDS**
- 31-5 34 Arneson, Laura J.*; Zoet, Lucas K.: **USING RATE-AND-STATE FRICTION TO ESTIMATE SLIDING STABILITY OF GLACIERS**
- 31-6 35 Rogers, Emma R.*; Granger, Darryl E.: **A NEW RECONSTRUCTION OF PLEISTOCENE LAKE TIGHT SHOWING GLACIAL ISOSTATIC FLEXURE AT 1.3 MA**
- 31-7 36 Antinao, José Luis*; Loope, Henry M.; Jacobs, Peter M.: **EXPLORATORY QUARTZ AND FELDSPAR LUMINESCENCE GEOCHRONOLOGY OF PRE-WISCONSIN SEDIMENTS, SOUTH-CENTRAL INDIANA**
- 31-8 37 Laabs, Benjamin J.; Brugger, Keith A.*: **COSMOGENIC EXPOSURE DATING OF LATE PLEISTOCENE TERMINAL MORAINES OF THE SOUTHWESTERN LAURENTIDE ICE SHEET**
- 31-9 38 Jacobs, Peter M.*; Loope, Henry M.; Luis Antinao Rojas, Jose; Dennis, Hannah: **MAGNITUDE AND VARIABILITY OF LAST INTERGLACIAL PEDOGENESIS: EVIDENCE FROM SANGAMON GEOSOL MORPHOLOGY, MINERAL WEATHERING, AND GEOCHEMISTRY IN SOUTHERN INDIANA**
- 31-10 39 Layton, Parker John*; Adams, Townes Matthew; Jol, Harry M.; Hanson, Paul: **AEOLIAN DUNE STRATIGRAPHY REVEALED WITHIN NIOBRARA RIVER VALLEY, NEBRASKA SAND HILLS, USA**
- 31-11 40 Wittkop, Chad*; Bartley, Julie K.; Krueger, Russell; Bouvier, Audrey; Georg, R. Bastian; Knaeble, Alan R.; Piper, Christian; St. Clair, Katherine; Breckenridge, Andy J.: **GEOCHEMICAL AND ISOTOPIC TOOLS FOR PLEISTOCENE SEDIMENT PROVENANCE IN THE NORTH AMERICAN MIDCONTINENT**
- 31-12 41 Conrad, Daniel R.*; Thorleifson, L. Harvey: **UTILIZING TILL GEOCHEMISTRY TO CORRELATE AND DISTINGUISH TILLS IN MINNESOTA, USA**
- 31-13 42 Blankenship, Jayson D.*; Trexler, Charles C.: **STRUCTURAL ANALYSIS SUGGESTS BEDROCK JOINTS IN OHIO ARE TECTONIC RATHER THAN GLACIAL IN ORIGIN**
- 31-14 43 Gardner, Daniel*; Penprase, Shanti; Larson, Phillip H.; Wickert, Andrew D.; Faulkner, Douglas J.; Blumentritt, Dylan; Schirmer, Ronald C.: **LANDSCAPE EVOLUTION AND STREAM TERRACES OF THE WHITEWATER RIVER VALLEY, MINNESOTA: PRELIMINARY RESULTS**
- 31-15 44 Combs, Sarah*; Kilgore, Susan; Clayton, William; Diallo, Thierno: **CHARACTERIZATION AND MAPPING OF PALEOLAKE ALGOMA SHORELINE SEDIMENTS IN GRAND PORTAGE NATIONAL MONUMENT, MINNESOTA**
- 31-16 45 Samsen, Brian*; McDonald, Jennifer; Lepper, Kenneth; Fisher, Timothy G.: **WATER PLANE HISTORY DERIVED FROM LAKE AGASSIZ SHORELINES, CENTRAL POLK COUNTY, MINNESOTA**
- 31-17 46 Sodeman, Alexander D.*: **REVISITING THE HURON-ERIE LOBE: GEOMORPHOLOGIC INSIGHTS FROM LIDAR AND THEIR IMPLICATIONS FOR THE DYNAMICS OF THE ICE SHEET**
- 31-18 47 Ives, Libby R.W.*; Rawling, J. Elmo; Stolzman, Kacie C.: **LANDFORM ASSEMBLAGES, QUATERNARY STRATIGRAPHY, AND PRELIMINARY QUATERNARY GEOLOGIC MAP, JEFFERSON COUNTY, WISCONSIN**
- 31-19 48 Rawling, J. Elmo*; Breckenridge, Andy J.: **1:100,000 SCALE PRELIMINARY QUATERNARY MAPPING IN NORTHERN BAYFIELD COUNTY, WISCONSIN**
- 31-20 49 Nguyen, Maurice K.*; Knaeble, Alan R.: **THE LATE WISCONSINAN GLACIATION AND DEGLACIATION IN THE AITKIN AND UPHAM BASINS: AITKIN COUNTY, MINNESOTA**
- 31-21 50 Brick, Greg*: **GEOLOGIC CONTEXTS OF MINNESOTA'S SAND AND GRAVEL PITS**

SESSION NO. 32**T24. Lakes as Sentinels of Environmental Change (Posters)**

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

- | | Booth # | |
|------|---------|--|
| 32-1 | 51 | Lepe, Luis*; Bowen, Mark W.; Johnson, William C.: EXAMINING PATTERNS AND DRIVERS OF SPATIAL AND TEMPORAL VARIABILITY IN PLAYA HYDROPERIOD ON THE KANSAS HIGH PLAINS |
| 32-2 | 52 | Finkenbinder, Matthew S.*; Adamson, Kathryn; Lane, Timothy; Fortune, Angus; Delpais, Michael; Baratta, Daniel D.; Monteath, Alistair: DEGLACIATION OF THE SOUTHEAST MARGIN OF THE LAURENTIDE ICE SHEET IN NORTHEAST PENNSYLVANIA |
| 32-3 | 53 | Bishop, Grace*; Larson, Chloe; Schreiner, Kathryn; Grode, Noah; Sieber, Jessica: FINDING HIGHLY-BRANCHED ISOPRENOID LIPID PRODUCING DIATOMS IN LAKE SUPERIOR AND THE ENVIRONMENTAL CONDITIONS THAT INFLUENCE THEIR PRODUCTION |
| 32-4 | 54 | Fernandez, Alejandro*; Steinman, Byron A.; Stansell, Nathan D.; Abbott, Mark B.: QUANTITATIVE RECONSTRUCTION OF LACUSTRINE SEDIMENT OXYGEN ISOTOPE RECORDS OF HYDROCLIMATE CHANGE IN THE PACIFIC NORTHWEST THROUGH THE APPLICATION OF A HYDROLOGIC AND ISOTOPE MASS-BALANCE MODEL |
| 32-5 | 55 | Callaghan, Kerry L.*; Wickert, Andrew D.; Barnes, Richard: COUPLED GROUNDWATER-SURFACE WATER LEVEL MODELLING ON A CONTINENTAL TO GLOBAL SCALE |
| 32-6 | 56 | Kaplan, Samantha W.*; Sims, Alyssa; Peacock, Alexandra; Huckbody, Chelsea; Koch, Keith: RAILROAD FLY ASH AS A RELATIVE DATING TOOL IN CENTRAL WISCONSIN LAKES |
| 32-7 | 57 | Wallick, Joseph P.*; Theissen, Kevin M.; Edlund, Mark B.: HISTORY OF THE COMPOSITION AND SEDIMENTATION OF TWO LAKES IN THE COMFORT LAKE FOREST LAKE WATERSHED DISTRICT IN THE LAST 200 YEARS |
| 32-8 | 58 | Murphy, Collin*; Steinman, Byron A.; Schreiner, Kathryn; Pompeani, David P.; Depasqual, Seth; Bain, Daniel J.; Hanson, Bennett: RECONSTRUCTION OF ARCHAIC COPPER MINING AND HOLOCENE ENVIRONMENTAL CONDITIONS ON ISLE ROYALE, MICHIGAN USING LAKE SEDIMENT BIOGEOCHEMISTRY |

SESSION NO. 33**T26. Groundwater Quality Degradation and Protection: Water Quality Assessment, Modeling and Uncertainty Analysis, and Water Supply Management (Posters)**

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

- | | Booth # | |
|------|---------|---|
| 33-1 | 59 | Meurer, Cullen*; Tigar, Aaron D.; Bradley, Michael S.; Tafoya, Kara; Telfeyan, Katherine; Johnson, Raymond H.; Paradis, Charles J.: ENHANCED MASS REDUCTION OF URANIUM VIA ALKALINITY-DRIVEN DESORPTION AND GROUNDWATER FLUSHING |
| 33-2 | 60 | Phillips, Ethan*; Lenczewski, Melissa: EVALUATING GEOCHEMISTRY FIELD TEST KITS |
| 33-3 | 61 | Hatami, Jiyan L.*; Sulikowski, Gabrielle; Schmidt, Adam; Meurer, Cullen; Benko, Anna M.; Grundl, Tim; Reimus, Paul W.; Johnson, Raymond H.; Paradis, Charles J.: SORPTION OF 2-NAPHTHALENE SULFONATE TO ORGANIC-RICH SEDIMENTS IN BATCH AND COLUMN EXPERIMENTS |

SESSION NO. 34**T29. Addressing Habitat, Water, Ecosystem, and Sustainability Issues through Interdisciplinary Work (Posters) (GSA Geobiology and Geomicrobiology Division; GSA Hydrogeology Division; GSA Environmental and Engineering Geology Division; GSA Soils and Soil Processes Division)**

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

- | | Booth # | |
|-------|---------|--|
| 34-1 | 62 | Hennen, Sadie*; Malzone, Jonathan M.: HYDROSTRATIGRAPHY OF NATURAL AND CONSTRUCTED WETLANDS, DANIEL BOONE NATIONAL FOREST, KENTUCKY |
| 34-2 | 63 | Gallant, Jake*; Duffy, Bruce; Larson, Martha; Frankl, Aaron; Byrne, Lorraine; Le, Nhan; Savina, Mary E.: ANALYZING GROUNDWATER DYNAMICS BELOW A CARLETON COLLEGE GEOTHERMAL WELL FIELD USING DISTRIBUTED TEMPERATURE SENSING (DTS) |
| 34-3 | 64 | Teh, Zhi Yee*; Kawak, Katrina Evete; Kieffer, Gwen; Lee, Josiah Zheng Hong; Manislovich, Jasmine Michelle; Strehlow, Lillian Jean; Theodore, Keith Ashley; Clark, Scott K.: TEMPORAL ANALYSIS OF WASTE-SORTING BEHAVIORS OF UNIVERSITY STUDENTS: MEASURING THE IMPACT OF INTERVENTION EFFORTS |
| 34-4 | 65 | Strehlow, Lillian Jean*; Clark, Scott K.: ZERO-WASTE PHILOSOPHY IMPLEMENTATION AT A UNIVERSITY: INITIAL STEPS IN ADDRESSING STUDENT PERCEPTIONS AND TACKLING INSTITUTIONAL BARRIERS |
| 34-5 | 66 | Schwartz, Megan*: DESCRIBING MICROPLASTICS IN THE SEAGRASS BEDS OF SOUTH FLORIDA |
| 34-6 | 67 | Fernandes, Miguel V.; Abdullahi, Xavier*; Clark, John: MICROPLASTIC: A COMPARISON OF SOIL SAMPLES IN MINNESOTA BY POPULATION |
| 34-7 | 68 | Fernandes, Miguel V.; Abdullahi, Xavier; Clark, John*: MICROPLASTIC: A CONSISTENT COMPARISON OF GLOBAL SAND AND SOIL SAMPLES |
| 34-8 | 69 | Baker, Anna*; Fitzpatrick, Faith: TRACKING SEDIMENT FROM SOURCE TO SINK: SEDIMENT FINGERPRINTING AS A TOOL TO GUIDE WATERSHED MANAGEMENT IN THE LITTLE FORK RIVER |
| 34-9 | 70 | Moore, Peter L.*; Williams, Forrest F.; Dodson, Colton; Schilling, Keith E.; Isenhardt, Tom: HOW DO SEDIMENT AND NUTRIENT LOADING FROM BANK EROSION VARY WITHIN A WATERSHED? |
| 34-10 | 71 | Iqbal, Mohammad*; Tuladhar, Sushil: COMPARING LOSS OF PHOSPHORUS FROM FARM FIELDS WITH TRANSPORTING SUSPENDED SOLIDS IN STREAM WATER |
| 34-11 | 72 | Bauer, Sara*; Yoo, Kyungsoo; Wackett, Adrian; Frelich, Lee; Feng, Xue; Klaminder, Jonatan: IMPACT OF EARTHWORM INVASION ON SOIL TEMPERATURE REGIME IN THE FENNOSCANDIAN ARCTIC |
| 34-12 | 73 | Schroeder, Hannah*; Capron, Shauna; Triplett, Laura; Bartley, Julie K.: MONITORING WATER QUALITY IN THE SEVEN MILE CREEK WATERSHED |
| 34-13 | 74 | Hammerschmidt, Shelby R.*; Dymond, Salli F.: MEASURING INSTANTANEOUS EVAPOTRANSPIRATION RATES OF A FOREST UNDERSTORY POST-DISTURBANCE USING A PORTABLE CHAMBER |
| 34-14 | 75 | Burgeson, Emma*; Behar, Hannah; Dymond, Salli F.; Gran, Karen B.; Teasley, Rebecca; Dumke, Josh: BEAVER DAM IMPACTS TO LOW FLOW HYDROLOGY IN NORTHERN MINNESOTA STREAMS |
| 34-15 | 76 | Behar, Hannah*; Burgeson, Emma; Gran, Karen; Dymond, Salli F.; Teasley, Rebecca; Swenson, John: STREAM THERMAL DYNAMICS: THE INFLUENCE OF BEAVER DAMS IN A NORTHERN MINNESOTA WATERSHED |

SESSION NO. 35

T31. Preventing, Responding to, and Understanding the Long-Term Behavior of Crude Oil and Petroleum in Terrestrial and Aquatic Environments (Posters)

8:30 AM, Duluth Entertainment Convention Center, Lake Superior Ballroom KJ

Authors will be present from 3:30 to 5:30 PM

Booth #

- 35-1 77 Nieber, John*; Haus, Kirsten: **WATER RETENTION CHARACTERISTIC AND UNSATURATED HYDRAULIC PROPERTIES OF CONTAMINATED SOILS AT THE NATIONAL CRUDE OIL SPILL FATE AND NATURAL ATTENUATION RESEARCH SITE**
- 35-2 78 Gohmann, Alicia; Maresh, Grayson*; Rios-Sanchez, Miriam; Isaacson, Carl; Cozzarelli, Isabelle M.; Bekins, Barbara A.; Slater, Lee; Ntarlagiannis, Dimitrios; Yokuş, Selcen; Atekwana, Estella A.; Kilde, Steve: **INVESTIGATING IRON MINERAL TRANSFORMATIONS AT A HYDROCARBON CONTAMINATED SITE FROM TEMPORAL MEASUREMENTS OF MAGNETIC SUSCEPTIBILITY OF MINERAL PACKETS SUSPENDED IN WELLS**
- 35-3 79 Trost, Jared J.*; Bekins, Barbara A.; Delin, Geoffrey N.: **LONG-TERM TRENDS IN VADOSE ZONE GAS CONCENTRATIONS AND FLUXES AS INDICATORS OF CHANGING SOURCE ZONE CRUDE OIL COMPOSITION AND DEGRADATION RATES**
- 35-4 80 Beaver, Carol Lynn*; Atekwana, Estella A.; Ntarlagiannis, Dimitrios; Slater, Lee; Rossbach, Silvia: **MICROBIAL COMMUNITY STRUCTURE AND MAGNETIC SUSCEPTIBILITY AT THE NATIONAL CRUDE OIL SPILL FATE AND NATURAL ATTENUATION RESEARCH SITE NEAR BEMIDJI, MINNESOTA**

**AFTERNOON
ORAL TECHNICAL SESSIONS**

SESSION NO. 36

D6. Structural Geology, Tectonics, and Impact Structures

1:30 PM, Duluth Entertainment Convention Center, Lake Superior Ballroom L

Ryan J. Clark and Kevin Ray Evans, Presiding

- 36-1 1:30 PM DeSilva, Cameron*; Kaempfer, Jenna M.; Guenther, William R.: **DECIPHERING ZIRCON (U-TH)/HE THERMOCHRONOLOGY DATA SCATTER IN ARCHEAN GRAINS FROM THE BEARTOOTH RANGE, MONTANA**
- 36-2 1:50 PM Teyssier, Christian*; Whitney, Donna L.; Rey, Patrice F.: **A REVIEW OF MIGMATITE DYNAMICS: POSSIBLE IMPLICATIONS FOR ARCHEAN AND PROTEROZOIC CRATONIC REGIONS**
- 36-3 2:10 PM McKay, Robert M.*; Liu, Huaibao P.: **INJECTED BRECCIA AT THE DECORAH IMPACT STRUCTURE**
- 36-4 2:30 PM Evans, Kevin Ray*: **"ROUND ROCKS" AND OTHER ENIGMATIC FEATURES OF WEAUBLEAU STRUCTURE, ST. CLAIR COUNTY, MISSOURI, USA**
- 36-5 2:50 PM Anderson, Raymond*; Clark, Ryan J.: **NEW INSIGHTS INTO THE DEVELOPMENT OF THE MANSON IMPACT STRUCTURE CENTRAL PEAK**
- 36-6 3:10 PM Clark, Ryan J.*; Anderson, Raymond: **THE SEARCH FOR WATER IN THE MANSON IMPACT STRUCTURE**
- 36-7 3:30 PM Evans, Kevin Ray*; Pavlowsky, Robert T.: **RAISED SHORE PLATFORMS AND AN EARLY JAMAICAN POTSDAM IN SOUTHWESTERN ST. ELIZABETH PARISH: NEOTECTONIC IMPLICATIONS FOR AN ARCHAEOLOGICAL HYPOTHESIS**

SESSION NO. 37

T9. Paleontology of the Upper Midwest: Glimpses into Five Seashores

1:30 PM, Duluth Entertainment Convention Center, French River Room 2

John Westgaard Jr., Kenneth C. Gass, Alex Hastings and Douglas Hanks, Presiding

- 1:30 PM **INTRODUCTORY REMARKS**
- 37-1 1:35 PM Mikulic, Donald G.*; Kluessendorf, Joanne: **SILURIAN DEPOSITIONAL SEQUENCES OF THE CENTRAL UNITED STATES**
- 37-2 1:55 PM Gass, Kenneth C.*; Kluessendorf, Joanne; Mikulic, Donald G.; Brett, Carlton E.: **THE DIVERSE BIOTA OF THE MILWAUKEE FORMATION (LATE GIVETIAN, MIDDLE DEVONIAN, WISCONSIN) AND ITS NEED FOR MODERN ANALYSIS**
- 37-3 2:15 PM Westgaard, John*; Hanks, H. Douglas; Gibson, Sarah Z.: **A RE-EXAMINATION OF THE FOSSIL EVIDENCE FOR THE PRESENCE OF FISH SPECIES WITHIN THE LATE CRETACEOUS COLERAINE FORMATION OF MINNESOTA'S MESABI IRON RANGE**
- 37-4 2:35 PM Hastings, Alexander*; Westgaard, John; Hanks, H. Douglas: **MARINE REPTILE FOSSILS FROM THE LATE CRETACEOUS (CENOMANIAN) COLERAINE FORMATION OF NORTHERN MINNESOTA (USA)**
- 2:55 PM **BREAK**
- 37-5 3:10 PM Hanks, H. Douglas*; Westgaard, John; Hastings, Alexander; Haire, Scott A.: **UPDATES TO THE DINOSAUR FAUNA FROM THE LATE CRETACEOUS COLERAINE FORMATION (CENOMANIAN) OF NORTHERN AND CENTRAL MINNESOTA**
- 37-6 3:30 PM Korf, Jason J.*; Westgaard, John; Hanks, H. Douglas; Hastings, Alexander; Willging, Steve: **TRACE FOSSILS IN THE LATE CRETACEOUS COLERAINE FORMATION; HILL ANNEX MINE STATE PARK, CALUMET, MINNESOTA**
- 37-7 3:50 PM Stivers-Biscuso, Autumn*; Thole, Jeffrey T.; Westgaard, John: **A PRELIMINARY ANALYSIS OF THE WOOD PRESERVATION RECOVERED FROM THE LATE CRETACEOUS COLERAINE FORMATION OF NORTHERN MINNESOTA**

SESSION NO. 38

T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet II: Bringing Multiple Tools to Bear (GSA Quaternary Geology and Geomorphology Division)

1:30 PM, Duluth Entertainment Convention Center, Lake Superior Ballroom O

Jennifer McDonald, David J Ullman and Kenneth Lepper, Presiding

- 38-1 1:30 PM Schaeztl, Randall J.*; Colgan, Patrick M.; Baish, Christopher: **THE INTERLOBATE ZONE BETWEEN THE SAGINAW AND LAKE MICHIGAN LOBES OF THE SOUTHERN LAURENTIDE ICE SHEET (MICHIGAN, U.S.A.)**
- 38-2 1:50 PM Sodeman, Alexander D.*; Fisher, Timothy G.; Becker, Richard; Martin-Hayden, James M.; Loope, Henry M.: **PAIRED TUNNEL CHANNELS: ON THE ORIGIN OF A NEW VARIETY OF TUNNEL CHANNEL IN INDIANA**
- 38-3 2:10 PM Larson, Phillip*; Mooers, Howard D.; Berthold, Angela J.; Kotrapu, Kristi M.: **SEDIMENT TRANSPORT CYCLES OF THE LAURENTIDE ICE SHEET I: SOFT TO HARD BED TRANSITION DURING WISCONSIN MARINE ISOTOPE STAGE 5D-2**
- 38-4 2:30 PM Mooers, Howard D.*; Larson, Phillip; Berthold, Angela J.; Kotrapu, Kristi M.; Meyer, Margretta S.; Kryzer, Robert: **SEDIMENT TRANSPORT CYCLES OF THE LAURENTIDE ICE SHEET II: LODGEMENT TILL AND GLACIAL BEDFORMS**
- 38-5 2:50 PM Zoet, Lucas K.*; Hansen, Dougal; Rawling, J. Elmo: **A MECHANISTIC UNDERSTANDING OF GREEN BAY LOBE TILL DEFORMATION THROUGH EXPERIMENTAL ANALYSIS**

SESSION NO. 39

T24. Lakes as Sentinels of Environmental Change

1:30 PM, Duluth Entertainment Convention Center, Lake Superior Ballroom MN

Byron A. Steinman, Kathryn Schreiner and Matthew S. Finkenbinder, Presiding

- 1:30 PM **INTRODUCTORY REMARKS**
- 39-1 1:35 PM Vall, Kathryn G.*; Steinman, Byron A.; Pompeani, David P.; Schreiner, Kathryn; Depasqual, Seth: **RECONSTRUCTION OF PALEOENVIRONMENTAL CONDITIONS AND TEMPORAL PATTERNS OF ANCIENT MINING ON ISLE ROYALE USING BIOGEOCHEMICAL ANALYSES OF LAKE SEDIMENT**
- 39-2 1:55 PM Wagner, Zachary C.*; Steinman, Byron A.; Wiemer, Ali M.; Woods, Arielle; Abbott, Mark: **A 10,000-YEAR LAKE-SEDIMENT BASED RECONSTRUCTION OF PRECIPITATION ISOTOPE VALUES IN THE CANADIAN ROCKY MOUNTAINS**
- 39-3 2:15 PM Petersen, Madelyn*; Quick, Janna; Schreiner, Kathryn; Hyde, Emily; Sheik, Cody; Katsev, Sergei: **CHARACTERIZING THE SULFUR BUDGET WITHIN LAKE SUPERIOR: SIGNIFICANT ROLE OF ORGANIC SULFUR IN CARBON SEQUESTRATION**
- 39-4 2:35 PM Shea, Christopher J.*; Steinman, Byron A.; Abbott, Mark B.: **HYDROCLIMATE CHANGE IN SOUTHWESTERN BRITISH COLUMBIA, CANADA REVEALED BY A 7000 YEAR LAKE SEDIMENT OXYGEN ISOTOPE RECORD**
- 2:55 PM **BREAK**
- 39-5 3:10 PM Corcoran, Megan C.*; Diefendorf, Aaron F.; Lowell, Thomas V.; Bird, Broxton W.; Freimuth, Erika J.: **HYDROGEN ISOTOPES OF DIATOM-DERIVED C₂₀ HIGHLY BRANCHED ISOPRENOIDS FROM LAKE SEDIMENTS TRACK LAKE WATER HYDROGEN ISOTOPES**
- 39-6 3:30 PM Brown, Erik T.*; Caballero-Miranda, Margarita; Fawcett, Peter J.; Lozano-Garcia, Socorro; Ortega, Beatriz; Steinman, Byron A.; Stockhecke, Mona; Valero-Garcés, Blas; Werne, Josef P.: **MEXIDRILL, THE BASIN OF MEXICO DRILLING PROJECT: OVERVIEW AND INITIAL GEOCHEMICAL RESULTS**
- 39-7 3:50 PM Swanner, Elizabeth*: **LINKING POST-GLACIAL (HYDRO) GEOLOGY TO REDOX GEOCHEMISTRY AND ECOLOGY OF MIDWESTERN LAKES**

- 39-8 4:10 PM Wiemer, Ali M.*; Steinman, Byron A.; Abbott, Mark B.; Wagner, Zachary C.; Shea, Christopher J.; Woods, Arielle: **A HOLOCENE LENGTH OXYGEN ISOTOPE RECORD OF ROCKY MOUNTAIN HYDROCLIMATE VARIABILITY FROM SOUTH HOGARTH LAKE, ALBERTA, CANADA**

SESSION NO. 40

T29. Addressing Habitat, Water, Ecosystem, and Sustainability Issues through Interdisciplinary Work (GSA Geobiology and Geomicrobiology Division; GSA Hydrogeology Division; GSA Environmental and Engineering Geology Division; GSA Soils and Soil Processes Division)

1:30 PM, Duluth Entertainment Convention Center, French River Room 1

Anna Baker, Richard Kiesling and Scott K. Clark, Presiding

- 1:30 PM **INTRODUCTORY REMARKS**
- 40-1 1:35 PM Saad, David A.*: **SIMULATION OF LONG-TERM AVERAGE STREAMFLOW AND NITROGEN, PHOSPHORUS AND SUSPENDED SEDIMENT LOAD IN THE CONTERMINOUS UNITED STATES USING REGIONAL SPARROW MODELS**
- 40-2 1:55 PM Kuehner, Kevin J.*; Rassmussen, Katie; Ribikawskis, Matthew; Fett, James; Mathison, Aaren: **FROM FIELD TO STREAM: EXAMINATION OF NITROGEN TRANSPORT AND THE PERFORMANCE OF BMPS IN GLACIAL TILL AND KARST LANDSCAPES OF SOUTHEAST MINNESOTA**
- 40-3 2:15 PM Edge, Devin R.*; Minor, Elizabeth C.: **PHOTODEGRADATION OF NATURAL ORGANIC MATTER FROM TERRESTRIALLY-IMPACTED VERSUS OPEN WATERS IN LAKE SUPERIOR**
- 40-4 2:35 PM Budde, Nicholas R.*; Mooers, Howard D.; Cowdery, Tim: **HYDROLOGY OF CALCAREOUS FENS WITHIN THE LAKE AGASSIZ BEACH RIDGE COMPLEX, NORTHWESTERN MINNESOTA**
- 40-5 2:55 PM Illig, Jennifer McGuire*; Cozzarelli, Isabelle M.; Bekins, Barbara A.; Ziegler, Brady A.; Martinovic-Weigelt, Dalma: **ASSESSING THE LONG-TERM TOXICITY OF CRUDE-OIL IMPACTED WATERS; THE ROLE OF SECONDARY CONTAMINANTS AND THE BIOLOGICAL EFFECTS OF HYDROCARBON DEGRADATION PRODUCTS**
- 40-6 3:15 PM Johnson, Samuel M.*: **REMEDICATION AT THE FLINT HILLS RESOURCES PINE BEND REFINERY: THREE DECADES OF REMEDIAL RESPONSE AND SUCCESS**

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