2020 Program

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](http://www.geosociety.org/edu-career)
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

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Vice Chair .............................................................. Harry Jol
Technical Program Chair ........................................ Chad Wittkop
Field Trips .......................................................... Carrie Jennings
Short Courses ................................................................. Josh Feinberg
Exhibits .......................................................... Erik Brown
Sponsorships ................................................................. Howard Mooers
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Student Program Representative ........................................ Collin Roland
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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, gsaeventscodel@gmail.com
You may also stop by the registration desk or the GSA Bookstore to have the named individuals directly contacted via phone.
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 these 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

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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.
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@uw.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 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


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.


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.


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


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.


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, 1–5 p.m. 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


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.


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.


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, porphyry 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.

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.


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.


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.


This ethics course is designed to meet the requirements of the ethics-related professional development hours (2 PDH) 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.


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

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

<table>
<thead>
<tr>
<th>Session</th>
<th>Time</th>
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<tbody>
<tr>
<td>19</td>
<td>1:30 PM</td>
<td>T2. Intrusive Rocks of the Midcontinent Rift</td>
<td>French River Room 1</td>
</tr>
<tr>
<td>20</td>
<td>1:30 PM</td>
<td>T18. It's a Small (Microbial) World</td>
<td>Lake Superior Ballroom O</td>
</tr>
</tbody>
</table>

### Tuesday, 19 May 2020

<table>
<thead>
<tr>
<th>Session</th>
<th>Time</th>
<th>Sponsor/Description</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>22</td>
<td>8:00 AM</td>
<td>D4. Novel and Classical Approaches to Deciphering Records of the Precambrian Earth</td>
<td>Saint Louis River Room</td>
</tr>
<tr>
<td>23</td>
<td>8:00 AM</td>
<td>T4. Petrology, Mineralogy, and High-Temperature Geochemistry</td>
<td>Lake Superior Ballroom L</td>
</tr>
<tr>
<td>24</td>
<td>8:00 AM</td>
<td>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)</td>
<td>Lake Superior Ballroom O</td>
</tr>
<tr>
<td>25</td>
<td>8:00 AM</td>
<td>T12. All Things Aeolian (GSA Quaternary Geology and Geomorphology Division)</td>
<td>French River Room 1</td>
</tr>
<tr>
<td>27</td>
<td>8:00 AM</td>
<td>T36. Teaching, Learning, and Research in Geoscience Education (National Association of Geoscience Teachers (NAGT); GSA Geoscience Education Division)</td>
<td>French River Room 2</td>
</tr>
<tr>
<td>28</td>
<td>8:30 AM</td>
<td>D4. Novel and Classical Approaches to Deciphering Records of the Precambrian Earth (Posters)</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>29</td>
<td>8:30 AM</td>
<td>T4. Petrology, Mineralogy, and High-Temperature Geochemistry (Posters)</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>30</td>
<td>8:30 AM</td>
<td>T9. Paleontology of the Upper Midwest: Glimpses into Five Seashores (Posters)</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>31</td>
<td>8:30 AM</td>
<td>T11. Glaciation and Deglaciation along the Southern Margin of the Laurentide Ice Sheet I: Bringing Multiple Tools to Bear (Posters) (GSA Quaternary Geology and Geomorphology Division)</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>32</td>
<td>8:30 AM</td>
<td>T24. Lakes as Sentinels of Environmental Change (Posters)</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>34</td>
<td>8:30 AM</td>
<td>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)</td>
<td>Lake Superior Ballroom KJ</td>
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<tr>
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<tr>
<td>35</td>
<td>8:30 AM</td>
<td>T31. Preventing, Responding to, and Understanding the Long-Term Behavior of Crude Oil and Petroleum in Terrestrial and Aquatic Environments (Posters)</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>36</td>
<td>1:30 PM</td>
<td>D6. Structural Geology, Tectonics, and Impact Structures</td>
<td>Lake Superior Ballroom L</td>
</tr>
<tr>
<td>37</td>
<td>1:30 PM</td>
<td>T9. Paleontology of the Upper Midwest: Glimpses into Five Seashores</td>
<td>French River Room 2</td>
</tr>
<tr>
<td>38</td>
<td>1:30 PM</td>
<td>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)</td>
<td>Lake Superior Ballroom O</td>
</tr>
<tr>
<td>39</td>
<td>1:30 PM</td>
<td>T24. Lakes as Sentinels of Environmental Change</td>
<td>Lake Superior Ballroom MN</td>
</tr>
<tr>
<td>40</td>
<td>1:30 PM</td>
<td>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)</td>
<td>French River Room 1</td>
</tr>
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</table>
## Schedule of Events

<table>
<thead>
<tr>
<th>EVENT</th>
<th>TIME</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>SATURDAY, 16 MAY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC7. Workshop: The Role of Geoscience in Environmental Health through Food Sovereignty (Short Course)</td>
<td>8 a.m.–7 p.m.</td>
<td>City Side Convention Center, Entrance B</td>
</tr>
<tr>
<td>FT1. Northern Minnesota Peatland and Soil Research Tour (Field Trip)</td>
<td>9 a.m.</td>
<td>City Side Convention Center, Entrance B</td>
</tr>
<tr>
<td><strong>SUNDAY, 17 MAY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FT4. The Sandstone Karst of Pine County, Minnesota (Field Trip)</td>
<td>7:30 a.m.–6 p.m.</td>
<td>City Side Convention Center, Entrance B</td>
</tr>
<tr>
<td>FT2. Geology Field Trip along the Mesabi Iron Range with Fossil Collecting (Field Trip)</td>
<td>7:45 a.m.–7 p.m.</td>
<td>City Side Convention Center, Entrance B</td>
</tr>
<tr>
<td>SC6. Workflow for Unmanned Aerial Systems UAS (Short Course)</td>
<td>8 a.m.–noon</td>
<td>Harbor Side Convention Center, Room 204</td>
</tr>
<tr>
<td>SC3. Programming IoT Monitoring Stations Built on the Arduino Framework with the EnviroDIY Modular Sensor Library (Short Course)</td>
<td>9 a.m.–4 p.m.</td>
<td>Harbor Side Convention Center, Room 202</td>
</tr>
<tr>
<td>SC2. 3D modeling using Structure from Motion and Terrestrial Laser Scanning (Short Course)</td>
<td>9 a.m.–5 p.m.</td>
<td>Harbor Side Convention Center, Room 205</td>
</tr>
<tr>
<td>SC1. Navigating the Path to Professional Licensure (Short Course)</td>
<td>1–4 p.m.</td>
<td>Harbor Side Convention Center, Room 203</td>
</tr>
<tr>
<td>Exhibitor Set up</td>
<td>3–7 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>Registration</td>
<td>3–7 p.m.</td>
<td>Reception/Registration Area</td>
</tr>
<tr>
<td>Speaker Ready Room</td>
<td>3–7 p.m.</td>
<td>Split Rock 2</td>
</tr>
<tr>
<td>First Time Attendees Workshop</td>
<td>5–5:30 p.m.</td>
<td>Harbor Side Convention Center, Room 202</td>
</tr>
<tr>
<td>Icebreaker Welcome Reception</td>
<td>5–7 p.m.</td>
<td>Harbor Side Convention Center Ballroom, 3rd Floor</td>
</tr>
<tr>
<td>Student Lightning Talks</td>
<td>5:30–7 p.m.</td>
<td>Harbor Side Convention Center Ballroom, 3rd Floor</td>
</tr>
<tr>
<td><strong>MONDAY, 18 MAY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speaker Ready Room</td>
<td>6:30 a.m.–6 p.m.</td>
<td>Split Rock 2</td>
</tr>
<tr>
<td>Session Chair Orientation</td>
<td>7–7:15 a.m.</td>
<td>French River Room 1</td>
</tr>
<tr>
<td>Registration</td>
<td>7 a.m.–5:30 p.m.</td>
<td>Reception/Registration Area</td>
</tr>
<tr>
<td>Exhibits Open</td>
<td>8 a.m.–6 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
</tbody>
</table>

### Morning Oral Technical Sessions

<table>
<thead>
<tr>
<th>Session</th>
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<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>D3. Indigenous-Centered Research, Education, and Strategies to Facilitate Learning in Geosciences</td>
<td>8 a.m.–noon</td>
<td>French River Room 2</td>
</tr>
<tr>
<td>T1. Insights into Processes of Proterozoic Crustal Growth, Modification, and Stabilization in the North-Central U.S. Continental Interior</td>
<td>8 a.m.–noon</td>
<td>French River Room 1</td>
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</tr>
<tr>
<td>T17. Geochemical Cycling of Environmentally Relevant Elements</td>
<td>8 a.m.–noon</td>
<td>Lake Superior Ballroom O</td>
</tr>
<tr>
<td>T21. Flash Floods, Landslides, and Debris Flows in the Midcontinent</td>
<td>8 a.m.–noon</td>
<td>Lake Superior Ballroom L</td>
</tr>
<tr>
<td>T23. Cores to Drones: Understanding Shoreline Behavior, Processes, and Coastal Landscape Changes in the Great Lakes</td>
<td>8 a.m.–noon</td>
<td>Lake Superior Ballroom MN</td>
</tr>
<tr>
<td>T32. Unique Geology and Geoheritage of the Lake Superior Region</td>
<td>8 a.m.–noon</td>
<td>Saint Louis River Room</td>
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</tbody>
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**Poster Sessions:** Authors will be present from 3:30 to 5:30 p.m.

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<td>D1. Caves, Karst, and the Hydrogeology of Fractured Bedrock Aquifers (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>D2. Geophysics, Magnetism, and Remote Sensing (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
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<td>D3. Indigenous-Centered Research, Education, and Strategies to Facilitate Learning in Geosciences (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>D5. Paleoclimate, Paleontology, and Sedimentology (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>T13. Geoarchaeology: Exploring the Connections Between Humanity and Geology (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>T17. Geochemical Cycling of Environmentally Relevant Elements (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>T18. It's a Small (Microbial) World (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>T21. Flash Floods, Landslides, and Debris Flows in the Midcontinent (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
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<tr>
<td>T23. Cores to Drones: Understanding Shoreline Behavior, Processes, and Coastal Landscape Changes in the Great Lakes (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>T37. Undergraduate Research (Posters)</td>
<td>8:30 a.m.–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
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<tr>
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<tbody>
<tr>
<td>Geoscience Career Workshop Part 1: Career Planning and Networking</td>
<td>9–10 a.m.</td>
<td>Gooseberry Falls Room</td>
</tr>
<tr>
<td>Coffee/Tea Break</td>
<td>9:30–10 a.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>Geoscience Career Workshop Part 2: Geoscience Career Exploration</td>
<td>10–11 a.m.</td>
<td>Gooseberry Falls Room</td>
</tr>
<tr>
<td>Roy J. Shlemon Mentor Program in Applied Geoscience</td>
<td>noon–1:30 p.m.</td>
<td>Gooseberry Falls Room</td>
</tr>
<tr>
<td>Duluth Lakewalk for Students</td>
<td>12:50–1:30 p.m.</td>
<td>City Side Convention Center, Entrance B</td>
</tr>
</tbody>
</table>

**Afternoon Oral Technical Sessions**

<table>
<thead>
<tr>
<th>Event</th>
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</tr>
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<tbody>
<tr>
<td>D1. Caves, Karst, and the Hydrogeology of Fractured Bedrock Aquifers</td>
<td>1:30–5:30 p.m.</td>
<td>Lake Superior Ballroom MN</td>
</tr>
<tr>
<td>D2. Geophysics, Magnetism, and Remote Sensing</td>
<td>1:30–5:30 p.m.</td>
<td>French River Room 2</td>
</tr>
<tr>
<td>T2. Intrusive Rocks of the Midcontinent Rift</td>
<td>1:30–5:30 p.m.</td>
<td>French River Room 1</td>
</tr>
<tr>
<td>T18. It's a Small (Microbial) World</td>
<td>1:30–5:30 p.m.</td>
<td>Lake Superior Ballroom O</td>
</tr>
<tr>
<td>T22. Drainage Basin Evolution, Fluvial Geomorphology, and Fluvial Processes of the Great Plains, Great Lakes, and Upper Mississippi River Basin</td>
<td>1:30–5:30 p.m.</td>
<td>Lake Superior Ballroom L</td>
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<tbody>
<tr>
<td>Posters/Exhibits Reception</td>
<td>4–6 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>Monday Student Social Hour</td>
<td>5:30–7 p.m.</td>
<td>Hoops Brewing located in Canal Park</td>
</tr>
<tr>
<td>FT5. Walking Tour of Minnesota Point (Field Trip)</td>
<td>4–6 p.m.</td>
<td>City Side Convention Center, Entrance B</td>
</tr>
<tr>
<td>EVENT</td>
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<td>LOCATION</td>
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<td>---------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Speaker Ready Room</td>
<td>6:30 a.m.–3 p.m.</td>
<td>Split Rock 2</td>
</tr>
<tr>
<td>Session Chair Orientation</td>
<td>7–7:15 a.m.</td>
<td>French River Room 1</td>
</tr>
<tr>
<td>GSA Campus Representatives Recognition and Technical Advisory Board Meeting</td>
<td>7–8 a.m.</td>
<td>Board Room</td>
</tr>
<tr>
<td>Registration</td>
<td>7 a.m.–3 p.m</td>
<td>Reception/Registration Area</td>
</tr>
<tr>
<td>Exhibits Open</td>
<td>8 a.m.–3 p.m</td>
<td>Lake Superior Ballroom KJ</td>
</tr>
<tr>
<td>FT6. Geology under the Surface: Lake Superior and the Research Vessel Blue Heron—Morning Trip (Field Trip)</td>
<td>8 a.m.–noon</td>
<td>City Side Convention Center, Entrance B</td>
</tr>
</tbody>
</table>

**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                                |
| 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
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<th>EVENT</th>
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<tr>
<td><strong>Afternoon Oral Technical Sessions</strong></td>
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<tr>
<td>D6. Structural Geology, Tectonics, and Impact Structures</td>
<td>1:30–5:30 p.m.</td>
<td>Lake Superior Ballroom L</td>
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<tr>
<td>T9. Paleontology of the Upper Midwest: Glimpses into Five Seashores</td>
<td>1:30–5:30 p.m.</td>
<td>French River Room 2</td>
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<td>T11. Glaciation and Deglaciation along the Southern Margin of the</td>
<td>1:30–5:30 p.m.</td>
<td>Lake Superior Ballroom O</td>
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<tr>
<td>Laurentide Ice Sheet II: Bringing Multiple Tools to Bear</td>
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<td>T24. Lakes as Sentinels of Environmental Change</td>
<td>1:30–5:30 p.m.</td>
<td>Lake Superior Ballroom MN</td>
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<tr>
<td>T29. Addressing Habitat, Water, Ecosystem, and Sustainability Issues</td>
<td>1:30–5:30 p.m.</td>
<td>French River Room 1</td>
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<td>through Interdisciplinary Work</td>
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<tr>
<td>Geology Club Officer Meetup</td>
<td>2–3 p.m.</td>
<td>Gooseberry Falls Room</td>
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<tr>
<td>Exhibitor Teardown</td>
<td>3–7 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
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<tr>
<td>Posters/Exhibits Reception</td>
<td>4–5:30 p.m.</td>
<td>Lake Superior Ballroom KJ</td>
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| **WEDNESDAY, 20 MAY**                                                 |               |                                                        |
| FT11. Sediments, Landforms, and Proglacial Lake History in Western   | 7:30 a.m.–5:30 p.m. | City Side Convention Center, Entrance B                |
| St. Louis County, Minnesota (Field Trip)                             |               |                                                        |
| FT12. Geologic Setting of the 1850 Ma Sudbury Meteorite Impact Layer | 7:30 a.m.      | City Side Convention Center, Entrance B               |
| on the Gunflint Trail, Northeastern Minnesota (Field Trip)           |               |                                                        |
| FT10. Duluth to Two Harbors—Transect through the Duluth Complex and  | 8 a.m.–6 p.m.  | City Side Convention Center, Entrance B               |
| Base of the North Shore Volcanic Group (Field Trip)                  |               |                                                        |
| FT9. Slope Stability, Extreme Floods, and Implications for Restoration| 8:45 a.m.–5 p.m.| City Side Convention Center, Entrance B               |
| in the Duluth Area (Field Trip)                                      |               |                                                        |
# 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

## 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

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<tr>
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<tr>
<td>8:00 AM</td>
<td>INTRODUCTORY REMARKS</td>
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<tr>
<td>8:05 AM</td>
<td>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</td>
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<tr>
<td>8:25 AM</td>
<td>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, Brenna; Ng, G.-H. Crystal; O'Hara, Patrick; Santelli, Cara; Schmitter, Riley; Schultd, 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</td>
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<tr>
<td>8:45 AM</td>
<td>Neville, Melinda*; Mooers, Howard D.; Breckenridge, Rachel B.; Dalbotten, Diana: INDIGENIZING GEOSCIENCE CURRICULA AT LEECH LAKE TRIBAL COLLEGE</td>
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<tr>
<td>9:05 AM</td>
<td>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</td>
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### BREAK

9:45 AM

### 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

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<tr>
<td>8:00 AM</td>
<td>INTRODUCTORY REMARKS</td>
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<tr>
<td>8:05 AM</td>
<td>Craddock, John P.*; Malone, David: A PALEOMAGNETIC AND STRUCTURAL STUDY OF THE PROTEROZOIC (1688 MA) GABBROIC XENOLITH, MARSHFIELD TERRANE, WISCONSIS, WISCONSIN</td>
</tr>
<tr>
<td>8:45 AM</td>
<td>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-PENOEAN MAFIC DIKES FOR GROWTH AND OVERPRINTING OF PROTEROZOIC PROVINCES IN CENTRAL WISCONSIN, SOUTHERN LAKE SUPERIOR REGION</td>
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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.: MICROBIALLY-MEDIATED PYRITE OXIDATION IN THE TUNNEL CITY GROUP AND WONEWOC FORMATION STONESTONES OF TREMPEALEAU 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

3-6 9:45 AM BREAK

3-7 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

3-8 10:20 AM Ritchey, Robyn*: ANALYSIS OF BIOGEOCHEMICAL CONDITIONS RESPONSIBLE FOR MERCURY METHYLATION IN THE SNAKE RIVER

3-9 10:40 AM Erickson, Melissa L.*; Malenda, Helen F.; Berquist, Emily C.: GEOCHEMICAL EVOLUTION OF GROUNDWATER AFTER DRINKING WATER WELL INSTALLATION: EFFECTS ON GEOGENIC ARSENIC

3-10 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, ZAMIBIA: NEW CONSTRAINTS ON THE NATURE OF METALS OF ENVIRONMENTAL CONCERN IN A MAJOR LEAD IMPACTED REGION

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, Maximillian*: 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.; Dahl, Derek T.; Day, Stephanie S.; Engle, Zachary; Hammer, Morena; Kurak, Ethan; Larson, Phillip H.; McDermott, Jeni A.; Richard, Emilie M.; Swanson, Melissa; Trippelt, 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

4-6 9:40 AM BREAK

4-7 10:00 AM DeLong, Stephen B.*; Engle, Zachary; Hammer, Morena; Richard, Emilie M.; Gran, Karen B.; Breckenridge, Andy J.; Jabloone, 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 Mihndukulasooriya, Lorrta*: 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
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

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

Booth #

SESSION NO. 6
T32. Unique Geology and Geohistory of the Lake Superior Region (Geochronological 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

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

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

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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

9-1 11 Peele, Sarah*; Smyte, Wendy F.: INDIGENOUS KNOWLEDGE COUPLED WITH GEOSCIENCE TO EXAMINE INDIGENOUS FOOD SOVEREIGNTY
9-2 12 Dalbotten, Dianna*; 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, Clémente: 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

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 Malinis, Paula; Martinez, Ricardo; Drovandi, Juan Martin; 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 CHONDRICTHYAN TOOTH NICHE SPACE ACROSS THE PERMIAN-TRIASSIC BOUNDARY
10-6 20 Peterman, David J.*; Inoue, Shinya; 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 CERCIDYPHYLLUM JAPONICUM LEAVES
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 DIGGAPAN 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. 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

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 Schaeetzl, 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, M.; Pajovic, Goran; Borovnic, Nikoloz; Tostevin, Gilbert; Monnier, Gilliane*: APPLYING HIGH-THROUGHPUT RNA GENE SEQUENCING TO ASSESS MICROBIAL CONTAMINATION OF A 40-YEAR OLD EXPOSED ARCHAEOLOGICAL 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. 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

12-1 30 Erickson, Melinda L.*; Yager, Richard M.; Kaufman, Leon J.; Wilson, John T.: DRINKING WATER QUALITY IN THE GLACIAL AQUIFER SYSTEM, NORTHERN USA: GEOCHEMICAL PROCESSES INFLUENCE GROUNDWATER CONTAMINANT PATTERNS
12-2 31 Wedel, 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*; Oiu, Xiaomin: GEOCHEMICAL CHARACTERIZATION OF STREAM SEDIMENTS FROM A HISTORICALLY CONTAMINATED SITE
Tuesday, 18 May 2020

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

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13-1 34 Tashjian, Allegra*; Noyce, Genevieve; Megenigal, J. Patrick: EXAMINING THE EFFECTS OF ELEVATED ATMOSPHERIC CO2 AND WARMING ON SOIL REDOX POTENTIAL

13-2 35 Kuster, 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 CONSTRAINT 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*; Matt, 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 MELTWFATER 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 #

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 MID-CLAYTON LOWLANDS, ENGLAND

16-2 51 Walton, Christina*: Elder, Katie; Wermesichik, Jeremy M.; Grote, Todd: AN INVESTIGATION OF EPIKARST IN THE MUSCATATUCK GROUP (MIDDLE DEVONIAN)

16-3 52 Ahumada, David*: Beerie Pavek, Karissa; Mugavero, Dominic; Eichers, Celestie; Othloff, Kaeden; Paige Owens, Christinas; 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


16-8 57 Nelson, Emily P.*; Laabs, Benjamin J.; Munroe, Jeffrey S.: NUMERICAL MODELING OF VALLEY GLACIERS TO INFERENCE PLEISTOCENE CLIMATE IN THE BIGHORN RANGE OF WYOMING


16-10 59 Goldade, Bria*; 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 RADARGS AND HIGH-RESOLUTION DIGITAL TERRAIN MODELS
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. *; Bhattacharya, 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.; Retzl, 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

1:30 PM

INTRODUCTORY REMARKS

18-1 1:30 PM

Delong, Ashley; Mickus, Kevin L.: MAGNETOTELLURIC STUDY OF THE LITHOSPHERE IN THE NORTH CENTRAL USA

1:50 PM

Frederksen, Andrew; Pokar, Parth; Barrow, Eddie; Revenaugh, Justin; van der Lee, Suzan: SEISMIC ANISOTROPY ACROSS AND ALONG THE MID-CONTINENT RIFT

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

2:30 PM

Moskal, Rebecca; White, John C.; Matzone, 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

2:50 PM

Sadeghimarjehdehi, Mohammadhossein; Vitton, Stanley; Oomen, Thomas: ANALYSIS OF HIGH HORIZONTAL STRESSES IN PRECAMBRIAN ROCKS OF NORTHERN MINNESOTA AND MICHIGAN AND THEIR EFFECT ON FOUNDATION CONSTRUCTION

2020 GSA North-Central Section Meeting 25
**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 Eufrasio de Oliveira, Igor; van der Lee, Suzan*: **TOWARDS A UNIFYING LITHOSPHERIC MODEL FOR THE MIDCONTINENT 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)**

**SESSION NO. 21**


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 Sioren, 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**

21-5 2:50 PM Break

21-6 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?**

21-7 3:25 PM Meghani, Nooreen A.*; Anders, Alison: **LONG PROFILES OF MIDWESTERN RIVERS CAN REVEAL NUANCES OF POST-GLACIAL FLUVIAL NETWORK DEVELOPMENT**

21-8 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**

21-9 4:05 PM Morrison, Sean*: Kantack, Keith M.: **UTILIZING TABLET-BASED DATA COLLECTION FORMS IN GEOMORPHIC ASSESSMENTS: BEST PRACTICES IN DATABASE MANAGEMENT**
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. Guibranson, 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; Fralic, Philip; Pouillon, 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; Mojtis, Stephen: EARTH’S EARLIEST ICE AGES: NEW ZIRCON GEOCHRONOLOGY OF ARCHEAN GLACIAL DIAMICTITES FROM MONTANA

22-9 11:00 AM Turrene, 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; Fahkraee, Moji; Katsev, Sergei; Swanner, Elizabeth: CONSTRAINING IRON FORMATION PRIMARY MINERALOGY USING FERRUGINOUS LAKE SEDIMENTS
Tuesday, 19 May 2020

24-4  9:00 AM  Ullman, David J.*; Morency, Michelle; Prince, Karlee K.; Fitz, Tom; Barth, Aaron M.; Breckenneidge, Andy J.; Ceperley, Elizabeth G.; Marcott, Shaun A.; Coffey, 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 MELTWATER ROUTING

24-5  9:20 AM  Lepper, Kenneth*: WHAT BEACH IS IT? GEOMORPHOLOGICAL OR GEOCHRONOLOGICAL CORRELATION OF LAKE AGASSIZ SHORELINES IN NORTHWESTERN MINNESOTA, USA

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 SOUTHWA VEN COMPAGNIE 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 GEMORPHIC EVIDENCE: MAPPING THE MIDDLE WISCONSINAN SHERDON 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


25-4  9:00 AM  Kerr, Phillip J.*; Tassier-Surine, Stephanie A.: VALLEY ORIENTATION AS A FACTOR FOR LOCAL SAND SOURCES ON THE EROSION SURFACE

25-5  9:20 AM  Loope, Henry M.*; Antinao, Josué 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

25-6  9:40 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/LAKES IN AN EVOLVING AEOLIAN LANDSCAPE ON LAKE MICHIGAN'S EASTERN COAST


SESSION NO. 26


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

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

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 ADVOLUTE CAPACITY OF REGIONAL FLOW REGIMES TO TRANSPORT LEGACY PHOSPHORUS ON A TILED FARM FIELD, NORTHWEST OHIO

26-3  8:45 AM  McDaniel, 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

26-6  10:00 AM  Schmidt, Adam; Meurer, Cullen; Sullivan, Gabrielle; Hatami, Jivan 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; Mulia, David J.; Kuehner, Kevin J.; Holmberg, Ken; Cowdery, Tim: MODELING TRAVEL TIME DISTRIBUTIONS WITHIN KARST AND BEDROCK AQUIFERS SYSTEMS OF SOUTHEASTERN MINNESOTA


CONCLUDING REMARKS

28  2020 Program Book
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 Winkielstern, 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


27-4 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.; Sachteleben, Traci: MATH SUCCESS AS A PREDICTOR OF PERSISTENCE IN STEM

27-10 11:00 AM Zocher, 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-Heathr, Selby*: TEACHING THE HISTORY OF GEOLOGY: Recognizing and Addressing Geology’s Ties to Colonialism and Imperialism

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 8:30 AM Eyster, Athena*: Brengman, Latisha Ashley; Nichols, Claire; Levitt, Zoe; Bergmann, Kristin D.: THE TECTONIC CONTEXT FOR THE GOGEIC RANG/S IRON FORMATIONS

28-2 8:50 AM Tozaki, Naoto*: Smythe, Wendy F.: CHARACTERIZATION OF MN-OXIDIZING PROTEINS FROM HYPERTHERMOPHILIC ARCHAEA

28-3 9:10 AM 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 9:30 AM Hinz, Isaac L.; Nims, Christine; Theuer, Samantha; Templeton, Alexis S.; Johnson, Jena E.: FERRIC IRON CATALyzES THE FORMATION OF IRON-RICH SILICATES UNDER ARCEHAN 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 8:30 AM 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 8:50 AM 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 GEOLOCIC RESOURCE

29-3 9:10 AM 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 9:30 AM Kershaw, Charles Thomas*: Hummer, Daniel R.; Denny, F. Brett: MINERALOGY OF IGNEOUS INTRUSIVES AT HICK’S DOME AND THEIR ECONOMIC VIABILITY

29-5 9:50 AM Draxler, Elliot F.*; Ihinger, Phillip D.: ORIGIN AND EVOLUTION OF THE SULFIDE-RICH, MAFIC IGNEOUS INTRUSION AT EAGLE MINE, UPPER PENINSULA, MI

29-6 10:10 AM 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 10:30 AM 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 10:50 AM Hamelin, Clémentine*: Whitney, Donna L.; von der Handt, Anette: SYMPLICITIES IN ECOLOGIE AS RECORDERS OF DEEP CRUST EXHUMATION IN A MIGMATITE DOME

29-9 11:10 AM 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 11:30 AM 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 11:50 AM Crabtree, Stephen*: A MAPPING, PETROGRAPHY, AND GEOCHEMISTRY-BASED STUDY OF VOLCANIC UNITS IN THE SOUTHERN OREGON CASCADES

29-12 12:10 AM Ana, Madison*: Cassady, Victoria; Uktins, Ingrid; Brenna, Marco; Cronin, Shane J.; Smith, Ian: UNDERSTANDING MAGMA RISE AND STORAGE USING MAJOR ELEMENTAL DIFFUSION IN OLIVINE; PUPUKIE MAAR, AUCKLAND FIELD, NEW ZEALAND

29-13 12:30 PM Algory, Raghad*: Velazquez Santana, Lianne C.; McLeod, Claire; Shaulis, Barry: TRACKING AMPHIBOILE CRYSTAL POPULATIONS IN CONTINENTAL ARC MAGMAS THROUGH STUDY OF ANDESITES AND HORNBLENDEITE CUMULATES IN THE CENTRAL ANDES, BOLIVIA

29-14 12:50 PM 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

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 TERRITIES, WESTERN CANADA

30-3  24 Shell, Ryan*; Peterman, David J.; Ciampaglio, Charles N.: ADDITIONAL VERTEBRATES FROM THE WREDFORD 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) WINNOW FORMATION IN MINNESOTA

30-6  27 Bachman, Ryan*; 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 PALEOEKOLOGY 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) (GSQuaternary 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 Gehring, Holden M.*; Granger, Darryl E.: GLACIAL AND POSTGLACIAL GEOMORPHOLOGY OF TIPPECANOE COUNTY, INDIANA

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| 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 |

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

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

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| 33-2 | 60 | Phillips, Ethan*; Lenczewski, Melissa: EVALUATING GEOCHEMISTRY FIELD TEST KITS |
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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

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| 34-5 | 66 | Schwartz, Megan*: DESCRIBING MICROPLASTICS IN THE SEAGRASS BEDS OF SOUTH FLORIDA |
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| 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 |
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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

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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; Maresch, Grayson*; Rios-Sanchez, Miriam; Isaacson, Carl; Cozzarelli, Isabelle M.; Bekins, Barbara A.; Slater, Lee; Ntarlagiannis, Dimitrios; Yokuş, Selcettin; 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

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.; Guenthner, William R.: DECIPHERING ZIRCON (U-TH)/HE THERMOCRONOLOGY DATA SCATTER IN ARCHEAN GRAINS FROM THE BEARTOOTH RANGE, MONTANA

36-2 1:50 PM Tesfaier, 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, Huabao P.: INJECTED BRECCIA AT THE DECORAH IMPACT STRUCTURE

36-4 2:30 PM Evans, Kevin Ray*: "ROUND ROCKS" AND OTHER ENIGMATIC FEATURES OF WEAUBELEAU 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 POTSHerd IN SOUTHWESTERN ST. ELIZABETH PARISH: NEOTECTONIC IMPLICATIONS FOR AN ARCHAEOLOGICAL HYPOTHESIS

SESSION NO. 37

T39. 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 Hankes, 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


37-4 2:35 PM Hastings, Alexander*; Westgaard, John; Hanks, H. Douglas: MARINE REPTILE FOSSILS FROM THE LATE CRETACEOUS (CENOMANIAN) COLELAINE FORMATION OF NORTHERN MINNESOTA (USA)

37-5 2:55 PM Korf, Jason J.*; Westgaard, John; Hanks, H. Douglas; Hastings, Alexander; Willing, Steve: TRACE FOSSILS IN THE LATE CRETACEOUS COLELAINE FORMATION; HILL ANNEX MINE STATE PARK, CALUMET, MINNESOTA

37-6 3:30 PM Honik, John*; Westgaard, John; Hanks, H. Douglas: MINERAL REPTILE FOSSILS FROM THE LATE CRETACEOUS (CENOMANIAN) COLELAINE FORMATION OF NORTHERN AND CENTRAL 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 Schaetzl, 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.)


38-3 2:10 PM Larson, Phillip*; Soder, Howard D.; Berthold, Angela J.; Koliuapu, Kristi M.: SEDIMENT TRANSPORT CYCLES OF THE LAURENTIDE ICE SHEET I: TO HARD BED TRANSITION DURING WISCONSIN MARINE ISOTOPIC STAGE 5D-2

38-4 2:30 PM Mooers, Howard D.*; Larson, Phillip; Berthold, Angela J.; Koliuapu, 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, Doug; 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 ISOTOPIES OF DIATOM-DERIVED C_34H_60 ISOPRENOIDS FROM LAKE SEDIMENTS TRACK LAKE WATER HYDROGEN ISOTOPE

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 ECOSYSTEM OF MIDWESTERN LAKES


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.*; Rasmussen, Katie; Ribakawiskis, Matthew; Fett, James; Mathison, Aaron: FROM FIELD TO STREAM: EXAMINATION OF NITROGEN TRANSPORT AND THE PERFORMANCE OF BMPS IN GLACIAL TILL AND KARSTLANDSCAPES 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


40-6 3:15 PM Johnson, Samuel M.*: REMEDIATION AT THE FLINT HILLS RESOURCES PINE BEND REFINERY: THREE DECADES OF REMEDIAL RESPONSE AND SUCCESS
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The first number (preceding the dash) represents the session number in which the paper will be presented. The second number (following the dash) indicates the presentation order of the paper within its session.

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*denotes presenter
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