

News

Volunteer opportunities, field trips, lectures, and public service, since 1938

From the President's Desk...

Summer 2022 is zipping by, and we are excited for in-person events in late summer and fall.

The State Fair is around the corner, we have the Fall Banquet to look forward to, and GSM will return to hosting lectures at the University.

Thanks to Randy Strobel and Joanie Furlong for leading a field trip to Southwestern Minnesota. It sounds like it was an incredibly interesting trip. The trip Stephen Wilging and I led to collect fossils in northern Iowa also was a great trip. Please read about these adventures, and see photos, in the pages of this newsletter.

If you have already signed up for a shift at the GSM Booth at the State Fair, thank you! If you haven't, please watch your emails for information about signing up for a shift or two. The State Fair is our most important outreach event where we "capture" new members. The shifts are four-hours long, and the time quickly zooms by as you talk about the Minnesota rock samples on the table and promote our lectures and opportunities to learn more about geology.

I send thanks to Steve Erickson for contacting local geologists and compiling an interesting Fall 2022 lecture schedule. It looks excellent! Thanks to Randy Strobel for hosting last season's Zoom lectures. Thanks to Dave Wilhelm for sending out emails about lectures, field trips, the state fair and more.

Dave Wilhelm is arranging a field trip to Cedar Creek Ecosystem Science Reserve on Saturday, Sept 10, 10 AM to 1 PM. That's about 45 minutes north of the Cities. Look for an email about signing up for this trip later in August.

Lastly, summer is not over. I hope you all get out to explore more geology. See you at the Fair! Then see you at the Banquet and at lectures.

Roger Benepe



GSM President, Roger Benepe

See you at the State Fair!

MINNESOTA STATE FAIR

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from the GSM archives: Buffalo Cliff, Sioux Quartzite, Mound Springs State Park, Luverne, MN, GSM Sioux Falls trip, 1941



GSM

2021 Board of Directors:

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The Geological Society of Minnesota is a 501(c)3 nonprofit organization.

GSM Mail Address: Send all GSM membership dues, change of address cards, and renewals to: Joanie Furlong, GSM Membership Chair, P.O. Box 141065, Minneapolis, MN 55414-6065

Membership categories and dues:

Student (full time)	\$10
Individual	\$20
Family	\$30
Sustaining	\$50
Supporting	\$100
Guarantor	\$250

Individual and Family memberships can be renewed for 1, 2, or 3 years. Members donating at the Sustaining, Supporting or Guarantor levels will have their names highlighted in the GSM membership directory.

GSM News: The purpose of this newsletter is to inform members and friends of activities of interest to the Geological Society of Minnesota. GSM News is published four times a year during the months of February, May, August and November.

Newsletter contributions welcome:

GSM enthusiasts: Have you seen

interesting geology while traveling? If so, please consider sharing your experiences with others through our GSM Newsletter. Write a short article, add a photo or two and send it in. Deadline for submission is the first of the month before the publication date. Send your story to newsletter editor: Kate Clover, kclover@fastmail.fm Thank you in advance.

GSM Board Membership:

The GSM Board consists of members who have a special interest in advancing the goals of the society, including lectures, field trips, and community outreach. The Board currently has ten members, and our bylaws limit terms to four years to encourage turnover, and a change of perspectives and ideas.

The Board meets quarterly, on the second Thursdays of February, May, August, and November, or on a different date if conflicts arise. In-person meetings are from 7-9 PM at the Minnesota Geological Survey at 2609 W. Territorial Rd, St. Paul, MN 55114.

Board meetings are open to all GSM members. If you are a new or long-time member and Board membership is of interest to you, please consider attending a meeting. If you have a topic you would like the Board to consider, please contact Roger Benepe, rbtrilobite@gmail.com

Welcome New Members!

- Anita Hall, Bloomington
- John Foley, Minneapolis
- Aaron Guemann, St. Paul
- Marilynn Hammond, Minneapolis
- John Olson, Lakeville
- Lowell Hill, St. Paul

GSM Members!!

It's membership renewal season. You can renew by giving Joanie Furlong, GSM's membership chair, your renewal form at the Fall Banquet or at a Fall Lectures. The Membership Renewal form can be found on the last page of this newsletter if you want to mail it in.

To members who have multi-year memberships, an email will be sent to inform you if your membership is due this year or not. If you have questions, contact Joanie at jfurlong12345@yahoo.com

GSM Member Profile

"Ernie" – John Ernst



Ernie in his 1935 Ford Convertible with his daughter Rosemary and her son Pierre Itschner in the rumble seat, around 1998/99.

Q. How long have you been a GSM member? What got you involved? Why do you stay involved?

A. Not sure how long, but I think about 20 years ago. I got involved through a member from another organization that I belonged to. His name was John Jordan. He had a motorcycle, and so did I. He had a major in mathematics, and so did I.

I have had a longtime love for geology. When I was a child, between 1932-1940, our family went each summer for a month to Big Carnelian Lake, which is 7 miles north of Stillwater. While we were there, we collected agates, which was appropriate considering the name of the lake. Every time a heavy rain would go by, we would go looking for agates in the washout that flows into the lake. We added agates to our collection each summer. At the end of those years, we had collected half a bushel of agates. Later, as a student at Hamline University, I had a favorite teacher who taught geology. This teacher took our class on field trips to the North Shore, Lake Superior, and lots of stops between here and there. He gave me an understanding and interest in geology and fossils. I learned about glacial Lake Agassiz, moraines, spit dams, the formation of Lake St. Croix, and Lake Pepin, etc. He got me started, and I've been interested ever since. I continue to talk about these things with my children and grandson.

Q. Have you been involved in any GSM projects or initiatives?

A. Yes, I worked the geology booth at the fairgrounds for several years.

Q. What interests around the geosciences do you have today?

A. I'm interested in human evolution. I find it interesting to learn how tectonic plates affect topography with various geological formations and to learn how minerals are created and distributed. These

things in turn, create climates and soil that affect terrain and vegetation that have played a part in the migration and evolution of humans. It's all connected.

Q. What do you dig about the GSM?

A. I like the camaraderie and always learning something new. It's educational.

Q. What is your favorite geology-related travel destination? And why? What field trips have you taken with GSM?

A. I like to travel in Wisconsin and view glacial impact on the topography. I enjoyed collecting agates with my daughter when she was a child at Mille Lacs Lake. Taylors Falls area is a favorite for viewing glacial potholes that were formed 10,000 years ago by melting glaciers. I also have enjoyed going fossil hunting with my daughter and grandson along the Mississippi riverbanks.

I went on a field trip once north to Lake Superior where we found no agates. On one of the trips, Richard Ojakangas was our guide. He slipped on a rock (ironic) and injured his knee. I was a ski patroller, so I administered first aid until he was taken to the hospital.

Q. Do you have a favorite geology related book, movies, topics, website?

A. *Roadside Geology of Minnesota* by Richard W. Ojakangas. *Earth Structure* by Ben A. van der Pluijm and Stephen Marshak.

----- I was born in 1927, too early to know about websites.

Q. Anything else? Career? interests? hobbies? sports?

A. I was a science and mathematics high school teacher for 35 years. At the same time, I also worked extensively in real estate involving house & apartment rentals, a restaurant (Hopkins House), and a large scale housing unit with boarding. Once I ran a small ski area with a partner, and I also have had large tree farms up north. In my early 20's, I worked in a used car lot, and I never stopped buying and reselling cars. I am mechanical, and I am a collector of old cars. The first car I owned was a 1943 Model A Ford. In my youth, I was a stock car racer. I got my nickname "Ernie" because I used the name Ernie Johnson (which is my name backwards) to race so that my parents and my students wouldn't see my name in the sport column. I am an enthusiastic sportsman. I have been skiing every year for 10 decades, and I was a ski patroller for 55 years. I love golf and have had 4 holes-in-one. I like to distance bike and have played a lot of racquetball over the years. I have been fishing and hunting my whole life, and continue to do so.

2022 Fall Banquet and Annual Meeting

The GSM 2022 Fall Banquet and Annual Meeting will be held **Monday, September 19th** at U Garden Restaurant. Plan to arrive after 5 pm for dinner. The buffet will be available, as well as ordering from the menu. U Garden Restaurant (<http://www.ugardenrestaurant.com/>) is

located at 2725 University Ave. SE, Minneapolis. A map appears on our website.

Our Annual Meeting, during which we elect Board members for the upcoming calendar year, will start around 6:30. Names of nominees for the Board will be sent to GSM members by e-mail prior to the meeting. Following the meeting will be our first lecture of 2022-2023. Our presenter, Mark Jirsa, will speak about the Sioux Quartzite in the Pipestone Basin of Southwestern Minnesota. Mark is a retired geologist from the Minnesota Geological Survey, and has given many past presentations to GSM. His talk will begin around 7.

GSM Lecture Schedule for 2022-2023

Mondays, Fall 2022

September 19: Fall Banquet - Geologic Highlights of the Sioux Quartzite in the Pipestone Basin: Rock, Pipestone & Nobles Counties in Southwestern Minnesota; *Mark Jirsa, M.Sc.*, Minnesota Geological Survey (retired)

October 3: Minerals and Microbes and Mining...Oh My!; *Cara Santelli, Ph.D.*, Associate Professor, Dept. of Earth & Environmental Sciences, U of Minnesota

October 17: From Sparta to St. Paul, the Roles Earth Processes Played in Our Past; *Kent Kirkby, Ph.D.*, Teaching Professor, Dept. of Earth & Environmental Sciences, U of Minnesota

October 31: What's New with Plate Tectonics?; *Christian Teyssier, Ph.D.*, Professor, Gibson Chair in Geoscience, Dept. of Earth & Environmental Sciences, U of Minnesota

November 14: Southern Spain: Tectonic Collision, Geoparks and Fabulous Vacation Spots; *Melissa Lamb, Ph.D.*, Professor, Earth, Environment, & Society, University of St. Thomas

November 28: Ice Age Extinctions in North America: Climate Change and Humans; *David Fox, Ph.D.*, Professor, Dept. of Earth & Environmental Sciences, U of Minnesota

December 12: Hunting for Dinosaurs: The Search for Ancient Giants; *Alex Hastings, Ph.D.*, Fitzpatrick Chair of Paleontology, Science Museum of Minnesota

Mondays, Early 2023: January 30, February 13, February 27, March 13, March 27, April 10, April 24; Spring Banquet: May 8

Rock and Gem Show at the State Fair Grounds

The Minnesota Mineral Club's annual Rock, Mineral & Gem Show is planned for Saturday and Sunday, September 24-25 in the Dairy Building on Underwood Avenue on the State Fair Grounds. Please make plans to see one of the largest local gathering of vendors, exhibits and demonstrations under one roof. Get the odd item identified, visit the Kid's Corner and dine in

food truck splendor. Parking is **FREE** on the streets and in the parking lot to the left of the Dairy Building.

If you'd like volunteer for GSM at the show, please stay tuned for a membership email linking to the online SignUpGenius volunteer schedule. Questions, contact Patrick Pfundstein, patrickpfundstein@icloud.com

Show details can be found at: minnesotamineralclub.org

GSM Fossil and Prairie Park Field Trip, Floyd County, Iowa

On Monday May 16, 2022, Roger Benepe and Stephen Willging led a GSM field trip to the Floyd County Fossil and Prairie Park located just west of Rockford, Iowa. That's about a 2.5 hour drive from the Twin Cities.

It was a nice sunny day but very windy. Seven participants (6 new visitors to the park) had an enjoyable time. Everyone found numerous fossils. On arrival, Steve gave a short introduction about the park's

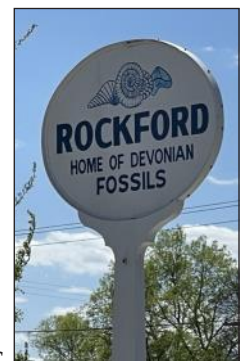


Stephen Willging discusses fossils from the park with Jane Hancock

history and showed examples of Devonian age fossils that can be found in the park.

The park (<https://fossilcenter.wordpress.com/fossils/>) was a clay quarry of the old Rockford Brick and Tile Company. The bedrock clay deposit lay near the surface and was recovered by open pit mining. The clay was manufactured into bricks and drain tiles. The company operated for 80 years.

In 1990, the Floyd County Conservation Board purchased the site, and in 1991, it opened as a park. In addition to fossil collecting, the park has a visitor center with fossil and wildlife/prairie displays, a picnic shelter and restrooms. The fossil collecting areas range from very steep slopes (in situ stratigraphic column) to gently rolling terrain (top of the stratigraphic column and overburden dump piles). Although collecting is allowed, the park asks that you take only for your personal collection. Reselling is prohibited. Check the park website for more



A sign on the edge of Rockford reminds people that fossils are Devonian in age



Kevin Miller, Jane Hancock and Gerald Stahl stand overlooking the clay pits. Their hats are tied under their chins to keep them from blowing away



The park includes trails over the prairie sections



Historic brick kilns remain on the site

and about 35 feet of the lower to middle Cerro Gordo member are exposed in the park. The Owens Member can be found a couple of miles to the west of the park. The Cerro Gordo member is the uppermost layer that can be seen at the quarry. It is made up of three intervals of shale with varying colors, quantities of limestone beds, and fossil content. The lower 25 feet of the Cerro Gordo is made up of shales with interbedded argillaceous (clay containing) limestones units. The top 10 feet of the Cerro Gordo layer is a pale-yellowish calcareous shale or marl and is extremely fossiliferous.



Lynne Grigor, Kevin Miller and Kate Clover explore in the bottom of the quarry

information. The strata exposed in the park are part of the Lime Creek Formation of the Late (Upper) Devonian Epoch, 381 – 373 million years ago (Wicander and Playford, 1985).

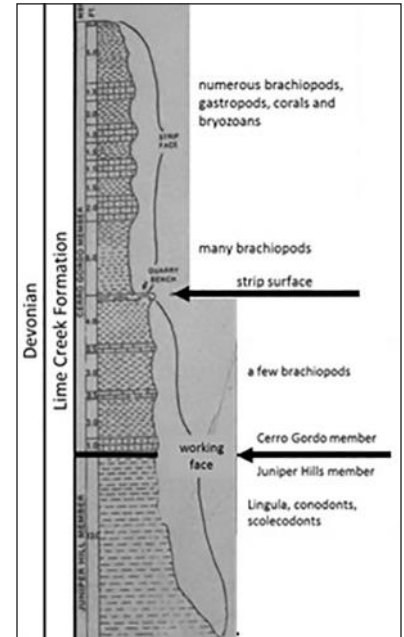
The Lime Creek Formation was deposited during the seventh and last Devonian age transgression-regression episode in what is now Iowa.

The Lime Creek Formation is divided into 3 members: Juniper Hill, Cerro Gordo and the Owens Members. About 13 feet of the Juniper Hills Member

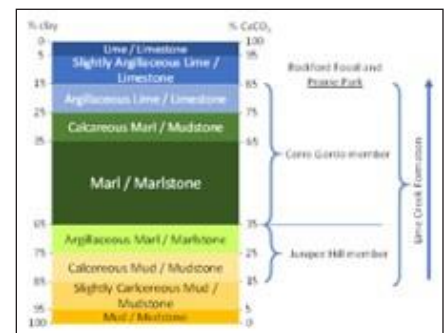
Brick and Tile Company. The uppermost two-thirds of the Cerro Gordo Member was removed as overburden, and left as dump piles in the park. The Juniper Hill Member is a medium-gray calcareous shale and mudstone. Fossils in this member primarily consists of brachiopods and pyritized plant remains. Devonian shark or ray teeth have been reported. Fossils in the Juniper Hill member are less abundant than in the Cerro Gordo member.

The Cerro Gordo member, one of Iowa’s most fossiliferous deposits, is notable for the preservation and diversity of its fossil fauna. Nearly 200 species of macro and micro fossils have been collected and described from this formation (Anderson 1998, Bunker 1995, and Groves, 2008).

Macrofossils are abundant and well-preserved. These include shelly invertebrates such as brachiopods (most common), gastropods and bivalves. Colonial and solitary corals, bryozoans and fragments of crinoids can also be found. Less common are nautiloid and ammonoid cephalopods. Many of the macrofossils show evidence of epibionts, animals such as worms, bryozoans, corals and sponges anchored and growing on brachiopods, corals



Stratigraphic column of Fossil and Prairie Park, Floyd County, Iowa. Illustration by S. Willging



Stratigraphic column of Fossil and Prairie Park, Floyd County, Iowa. Illustration by S. Willging



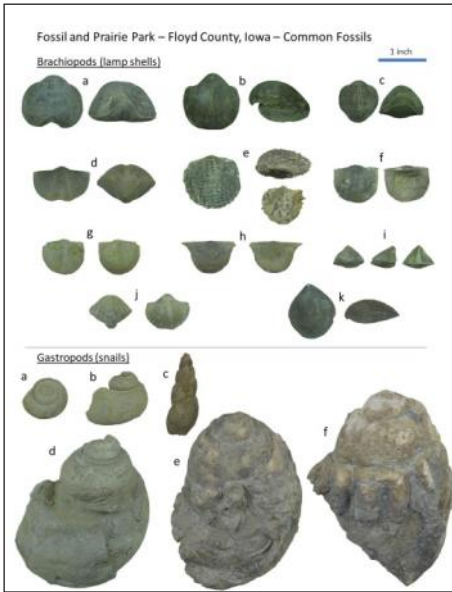
Microfossils are abundant. Kate Clover collected scoopfuls of the mud from around the park and spent hours sifting and cleaning the samples; she recovered numerous microfossils including crinoids, bryozoans, sponge spicules, sea urchin spines, gastropods and charophyte algae balls. Photo by Leo Kenney

and gastropods. (Briggs, ed, 1987).

To the northeast of the park, the bedrock is the older Shell Rock Formation which is composed of mostly carbonate rocks. There is a good exposure of the Shell Rock formation by the dam on the Shell Rock River at Nora Springs city park, about 5 miles north of Rockford. Several corals and stromatoporoids (sponges) can be seen in this exposure. No collecting is allowed in this park.

Fossils Picture Legends

Brachiopods (lamp shells)



- a.) *Schizophoria iowensis*. b.) *Theodossia hungerfordi* c.) *Atrypa devoniana* (*Pseudoatrypa*), d.) *Cyrtospirifer whitneyi*, e.) *Atrypa rockfordensis* (*Spinatrypa*), f.) *Douvillina maxima*, g.) *Douvilliana delicata*, h.) *Strophonella reversa*, i.) *Tenticospirifer cyriniformis*, j.) *Spirifer* sp., k.) *Cranaena iowensis*

Gastropods (snails)

- a.) *Straparollus* sp., b.) *Holopea* sp., c.) *Westernia pulchra*, d.) *Floydia concentrica* (internal cast), e.) *Floydia concentrica*, f.) *Floydia gigantea*



Corals

- a.) *Heliophyllum solidum*, b.) *Heliophyllum halli*, c.) *Pachyphyllum woodmani*, d-1.) *Aulopora* sp. on gastropod d-2.) *Aulopora* sp. on brachiopod, d-3.) *Aulopora* sp. on *Heliophyllum* coral

Pelecypods (clams and mussels)

- a.) *Paracyclas parvula*, b.) *Paracyclas sabini*, c.) *Paracyclas validalinea*

validalinea

Bryozoan – *Lioclema* sp.

Cephalopods

a.) *Gomphoceras* sp., b.) cephalopod - unidentified

Crinoids (sea lilies)

a.& b.) Crinoid stem segments, c.) Crinoid calyx - unidentified

Roger and I want to thank Kate Clover and Lowell Hill for their photography documenting the trip.

References and additional readings:

Anderson, Wayne I. *Iowa's Geological Past: Three Billion Years of Earth History*. University of Iowa Press, Iowa City, 1998.

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Groves, John R. et al, *Carbonate Platform Facies and Faunas of the Middle and Upper Devonian Cedar Valley group and Lime Creek Formation*, Northern Iowa, Iowa Dept. of Natural Resources, 2008. Online access <<http://s-iihr34.iihr.uiowa.edu/publications/uploads/GB-28.pdf>>

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Fenton, C.L and Fenton M. A, "The Stratigraphy and Fauna of the Hackberry Stage of the Upper Devonian", Vol. 1, University of Michigan Press (1924).

Stephen Willging

Photos by Kate Clover and Lowell Hill

June 2022 trip to SW Minnesota—the Morton Gneiss and Sioux Uprising Tour

After a hiatus of two years, GSM had an overnight field trip to southwest Minnesota to explore the wonders of ancient rocks. Twenty-seven intrepid souls trekked to Morton, Minnesota, epicenter of Morton Gneiss, a 3.6 billion year-old basement rock that outcrops along the Minnesota River valley. Everyone was in high spirits, and it was wonderful to meet in person, hang out and do geeky rock stuff. Many were hungry for personal interaction after the two years of confinement during the pandemic. Zoom meetings are helpful, but nothing replaces face-to-face interaction. Meetings with this group are always happy but being together again added to the fun and camaraderie.

Randy Strobel and Joanie Furlong were the trip leaders, and they found a whole bunch of interesting places to stop.

The trip was planned for two days, June 25 and 26. Day

one was focused around Morton Gneiss, and day 2 added Sacred Heart Granite and then Sioux Quartzite. We also visited sites of the 1862 Sioux uprising. And there was an unexpected extra site that was of great interest though of much more recent geological vintage. The weather was perfect - low 80's the first day and mid 70's the second, with blue skies and wind.

Day 1—Morton Gneiss and the Sioux Uprising

We all met in Saint Peter, at the **Nicollet County Museum, The Treaty Site History Center**. Most arrived at 10 am to enjoy the museum before things officially started. The museum is dedicated to the July 23, 1851 Treaty of Traverse des Sioux which ceded much of southern Minnesota to the US government and allowed for white settlement. There are also artifacts and other exhibits of life in Nicollet County from the time of the treaty until present. There was a good balance of Native American and settler exhibits.

At 11 am, we gathered in a meeting room, and Randy outlined the weekend and discussed the rocks we would see. Morton Gneiss is 3.6 billion years old, originally emplaced as a proto-continent. Then 2.7 to 2.5 billion years ago, the Algomian Orogeny occurred, and along what is now the Minnesota River Valley terrane—the Morton Granite collided and accreted to more landmass and helped assemble what is now North America. This process altered and changed the Morton Granite to Morton Gneiss. Also the Sacred Heart Granite was emplaced during that event. During the Penokean Orogeny 1.86-1.83 billion years ago, the St. Cloud Granite was emplaced. We did not see any of this, but it is a good time marker.

Then the Penokean Mountains eroded, and the Sioux Quartzite was deposited as a fine-graded beach sandstone. The Midcontinent rift started 1.1 billion years ago, and the sandstone was altered to Sioux Quartzite - pure quartz and highly resistant to erosion. During the Cretaceous 145-65 million years ago, in some areas, the Morton Gneiss weathered to clay. And in the Quaternary, 2.6 million years ago, the Minnesota River Valley formed with glacial River Warren 10,000 years ago being a big influence in that. It drained Lake Agassiz in a series of outflows, cutting a channel five miles wide in many places. (This outflow was similar to what you see in the channeled scablands in Idaho and Oregon.) It ripped through everything down to the bedrock, including the Morton Gneiss and other ancient crystalline rocks. Glacial River Warren drained along the Minnesota River valley to the Mississippi, just as the Minnesota River does today, but with a great deal more water.

In the Twin Cities, Paleozoic sedimentary rocks occur, but not in Western Minnesota. The Twin Cities area was part of a giant embayment, where the sediments accumulated. Western Minnesota was higher land and not part of the embayment, because it had harder bedrock. Under the Twin Cities was the midcontinent rift; in the west, Cretaceous rocks altered to clays in the

Western interior seaways above a crystalline bedrock. At the museum, we watched a 12 minute movie about the Dakota Conflict from TPT. In a nutshell, the 1851 treaty ceded 24 million acres of land from the Sioux to the US. They were supposed to receive payments and goods, but traders ended up with most of the money and goods, and the Native people were first moved to a reservation five miles on either side of the Minnesota River, then after the conflict, out to South Dakota. In the ten years after the treaty, 160,000 settlers came to Minnesota.

We then drove to the **Korner Bar** in Morton, MN. As we drove, we noticed the corn looked quite puny and sad, a legacy of our cold, wet, late spring. All along the trip, the corn was small. In many places, it was unlikely to reach knee high by the 4th of July.

Coming into Morton on CR19 from the East, we saw a gigantic tailings pile of Morton Gneiss, from the working quarry at the east end of town.

The Korner Bar was faced with Morton Gneiss. The curbs along the street were also Morton Gneiss, though not polished. It is a swirly gneiss, called Rainbow Stone in the trade. Pink is orthoclase feldspar, white is plagioclase feldspar, grey is quartz, and black is biotite mica. As the granite partially melted to gneiss, similar minerals tended to line up.

The next stop was behind the BP gas station next to the Morton Inn, at the junction of CR19 and US71. Here we saw the classic outcrop of Morton Gneiss, celebrated in Ojakangas' book, *Roadside Geology of Minnesota*, Mountain Press, 2009. We observed many amphibolite xenoliths in the gneiss. We hung out and collected samples, and ate some mulberries growing alongside. I was familiar with the area, and the vegetation has grown massively in the past 10+ years. It used to be mostly bare, but now it is mostly vegetated.

The area behind the gas station is the **Morton Gneiss SNA** (Scientific Natural Area), where we clambered onto the outcrop, being careful to avoid the poison ivy which abounds up there. You cannot collect rocks in a SNA, but the rock was everywhere, so we all got good



Randy Strobel discusses the Morton Gneiss in front of the Korner Bar in Morton. The building is faced with gneiss



Abandoned quarry in the Morton SNA

dimension stone. It was abandoned in the 1930's, and locals told me in the past that they couldn't quarry enough big stone out as the rock had too many cracks, so they opened a quarry on the east side of town which is still in operation. There is another quarry west of Morton down CR15, but that is aggregate mining, not dimension stone.

Then we stopped at **Zion Evangelical Lutheran Church** in Morton, the only building in the world made totally of



Field trip attendees on the steps of the Zion Evangelical Lutheran Church



Crossing the suspension bridge at Alexander Ramsey Park

Morton Gneiss. Okay, the church steps are St. Cloud granite, but the building itself is all gneiss. It is at the corner of N. Valley and 5th Street. We took a group picture for Elaine and John's 6th anniversary. Then we broke for a late lunch. After lunch, we went to **Alexander Ramsey Park** in Redwood Falls, the largest city park in Minnesota. There we found the geological marker placed by GSM in 1998. We observed an

outcrop of gneiss and part of it was weathered to clay. Why one part was weathered and the other not is a mystery. We drove up to the falls, which comes off the gneiss and again there is another massively eroded cliff. The river makes a sharp left before going over the falls.

Next, we drove to the **River Warren Outcrops SNA** and hiked a mile or so through tall grass and muddy bottoms along tire tracks to a lake with many Morton Gneiss outcrops and many potholes with ridges scoured by River Warren. We stopped at a monument by the SNA dedicated to people who were killed in the Dakota Uprising. Two children survived because they were out when the natives came to massacre the settlers.

As we caravanned, we stopped at an intersection where Morton Gneiss was used as roadside fill, and people gathered samples to bring home. The rock is used widely in this part of the state, so finding some you can legally collect is not at all hard.

The last stop of the day was the **Birch Coulee Battle Monument**, the site of the bloodiest battle of the 1862 Sioux Uprising.

We all adjourned to our respective lodgings and later met at Plaza Garibaldi for a fine Mexican dinner and lots of chat. Yes, there is delicious Mexican food in Redwood Falls.

The SNAs are interesting places and well worth checking out. They are located around the state and were set aside to protect and preserve natural features and rare resources of educational and scientific value. They are managed by the DNR. They have been around for a while, but are not at all well known. You can probably count on being alone while you explore. Check them out <https://www.dnr.state.mn.us/snas/index.html>

Day 2— Sacred Heart Granite, Sioux Quartzite and more Sioux uprising sites

Our first stop on day two was the **Joseph R. Brown**



Alexander Ramsey Park, across the Redwood River, a bank of residual clay 23 meters high is all that remains of some gneiss that completely decomposed



Hiking back to the car through the tall grass



The remains of the Joseph R. Brown house with views across the Minnesota River Valley

House Wayside rest. The structure here is the skeleton remnants of a very grand house that was burned during the Sioux Uprising in 1862. Brown was the Indian Agent from

1857-1861, and built a massive three-story ostentatious stone house for his family along the Minnesota River Valley. It had a marvelous view. He started it in 1861, and it was finished in April 1862 when the family moved in. In August 1862, it was burned by Natives during the uprising. (It was never rebuilt.) The furnishings were the best available with chandeliers and everything. I thought about how much labor and transportation it took to build and furnish this place in the middle of nowhere. It was certainly a poke in the eye of all the common settlers living in log houses. It also illustrates how much money there was in trading and being an Indian Agent. Brown's family survived, and he lived to prosper elsewhere, his wife surviving him until 1902.

The Brown house was mostly built from Morton Gneiss quarried nearby. The memorial at the site was constructed using Sioux Quartzite. This most resistant rock makes up a lot of the SW Minnesota basement and is the main reason SW Minnesota is higher in elevation than the Twin Cities area.

Swede's Forest SNA was the next stop. It is a stretch of land of alternating hillocks, outcrops of Sacred Heart Granite and swampy lowlands plus a small lake. We clambered onto the Sacred Heart Granite (named for the town of Sacred Heart where it outcrops), and observed elliptical potholes and rills of weathering. This granite is a pink and fine grained and weathers differently than Morton Gneiss. On the rocks exist many unique biomes of plants and animals which are some of what make SNAs special, not just the rocks. Tailings from an old abandoned quarry were visible in the distance.

Next, we caravanned and detoured around closed roads



Elliptical potholes in the Sacred Heart Granite

to the **Upper Sioux Agency State Park**, adjacent to Upper Sioux Community/ Yellow Medicine Agency, a prosperous group of houses,

community buildings plus a nifty water tower. The State Park was nicely maintained, and seeing a bunch of cars arrive, the Park Ranger came by to see who was coming to visit. We introduced ourselves, and Emily Albin, Ranger and Assistant Manager of the site told us a whole lot about the place and an extra, surprise geological site. The Employee Duplex #1 is the main building in the park today. It was built in 1859-60 and lived in by five families of workers, bakers and farmers who helped maintain the place. The building was burned down in a conflict with the Dakota Indians in 1862. It was bought in 1866 and rebuilt as a home for a local farmer. In 1974, it was reconstructed to its original appearance by the Minnesota Historical Society. The building is not open to tourists, but the ranger had the key in her wallet, and allowed us to see the inside of the place, as long as we didn't go down into the basement. It was pretty small for five families, but well-built for the time. Originally there were many buildings at the site: two employee duplexes, a bakery, outbuildings, a warehouse and other necessary edifices. All were burned and only the one employee duplex was reconstructed, although foundations of the other buildings exist and are marked.

Brown (whose destroyed house we saw earlier) was the Indian Agent from 1857-1861, and was replaced by Thomas Galbraith. The Agencies, run by Agents, were created to distribute the monies and commodities promised by the 1851 treaty. The Indians got little of the money and goods promised by the treaty; and when it did come, it went mostly to the traders and Indian agents, most of whom were guilty of corruption. Unfortunately, Galbraith was not a good agent and antagonized the Natives who resented the aggressive acculturation initiatives including taking up farming, adopting Christianity, and lots more. By 1862, that experiment was not going well. Many farms failed and people were starving. Andrew Myrick, storekeeper at the agency, refused to give food to the Indians and told Galbraith, "If they are hungry, let them eat grass." In the uprising on August 18, 1862, Myrick was killed. His body was found with grass stuffed in his mouth. It is surmised if Galbraith had been replaced, the uprising may have never happened. Or maybe only delayed.

After we picnicked in the park, we walked over the prairie to a wonderful overlook to see the five-mile wide Minnesota River Valley and the confluence of the Yellow Medicine and Minnesota Rivers way at the bottom in the distance.



View of the confluence of the Yellow Medicine and Minnesota Rivers at the Upper Sioux Agency State Park

Then we toured the **Highway 67 slump**, an additional unexpected geological feature, adjacent to the park. Highway 67 just beyond the park entrance was officially closed in 2019, except to a few farmers and others living down the road. The road, built in the 1940s, was cut into a steep bluff near a bend in the Yellow Medicine River. MnDOT first noted cracks in the pavement in 1998 which they filled with asphalt. Cracks continued to appear in the roadbed, and in 2010 monitors were first installed. The three wet years, 2017, 2018 and 2019 saturated the ground and movement well below the road surface caused the pavement to crack, first inches at a time and eventually two to three feet of grade separation appeared. Geologist Dr. Carrie Jennings examined the site in 2019 and said, "the movement is essentially a slow-motion landslide on the face of the river bluff down to the river which itself is meandering and could be cutting into the bluff." The hillside is still moving and monitors have been emplaced to alert MnDOT and the rangers if/



*The steep bluff along the Yellow Medicine River is eroding.
Photo by Brett Whaley*

when it slips again. We parked along the road and walked down to the slumped areas. First was a small dip of about four inches. Then a big slump three to four feet down along a ridge sideways to the road. Then another 15 inch slump. There were trees growing in a slanted way and also sideways, one was twisted into a loop. This was scary for sure. Gravel was placed so local vehicles could navigate the road, but I would not want to drive it day after day.

When the road was built, engineers had no way to determine slope stability, but now we have LIDAR and such. To repair the road they would have to go down 100 feet and pin the ground, and it is just too expensive and may not last anyhow, as it could slump elsewhere. And because the road crosses Indian lands, tribal approval would need to be granted for any work to be done.

A local farmer who spoke to us while we were looking at the site told us the bridge over the Yellow Medicine, also compromised by moving ground, had gone off its pilings in the past, and had been rerouted and replaced. They recreated it with less dip and rerouted the river etc.

The geology of the slump was mostly Quaternary and associated with tens of meters of sediments deposited by Glacial River Warren. This was an unplanned but interesting stop that the ranger kindly told us about.

We then caravanned to **Red Rock Falls County Park** (near Jeffers Petroglyphs). This was a gash in the Sioux Quartzite where a small stream went

over a waterfall. The stream found its way along cracks in the quartzite, and eventually wore it down to make the falls, thus proving water is the strongest element,

wearing everything else away eventually. The stream above the falls wound around and over several small rills and waterfalls before it plunged down the main falls, making a turn as it fell. Again, watch out for the poison ivy.

Lastly, we caravanned to **Jeffers Petroglyphs**. This has been a sacred site for over 7,000 years. Resistant Sioux Quartzite outcrops along a 23 mile-long ridge across Cottonwood County, and people have used the outcrop as their communal graffiti site for all that time. The actual carvings are not deep and are best viewed early or late in the day. As an experiment, an experienced stone knapper took 45 minutes to carve a hand design in otherwise unmarked quartzite, demonstrating that it was not a hardship for others in the past. This carved hand is displayed in the visitor center.

The thousands of carvings at Jeffers are subtle, but can be seen. Guides were there pouring water on them to make them more visible, and explaining what they might have been. There are also glacial striations in the rocks, and



The road is unstable due to slow motion movement of the earth under the roadway



Crack in the road



The road here has shifted vertically 4 feet



Monitors were installed in 2010



A petroglyph at Jeffers

ripple marks from the formation of the sandstone proto-quartzite.

This is a beautiful and haunting site, and well worth visiting. The visitor center closed at 5 pm, but we wandered well after that, enjoying the site.

That was the last stop on our tour, and we then decamped to go our various ways home. The corn was still small and puny. The gas was expensive. Dirt roads were dusty. But we all had a very good weekend crisscrossing the Minnesota River umpteen times. It was nice vacation from the cares and drudgery of post-Covid life. Thank you Joanie and Randy for leading us on a fascinating field trip.

Deborah Naffziger,

Photos by David Wilhelm and Kate Clover

Notes from the Past

ANTARCTIC SUMMER RESEARCH

Antarctica seems to be a favorite wintering spot of some U.S. researchers; those months that bring snow and ice to the United States are the only months of relative warmth in the southernmost continent. This year, about 300 U.S. researchers will take advantage of the austral summer to conduct a variety of projects during the 25th year of the National Science Foundation-funded U. S. Antarctic Program.

The largest of the 80-odd investigations scheduled for the season is the first leg of a four-year study of the Ellsworth Mountains, a 220-mile long, 50 -mile-wide north-south range located between the West Antarctica plateau and the Ronne Ice Shelf. The mountains mark a tectonic boundary between geologically younger West Antarctica and older East Antarctica, Under the direction of geologist Gerand F. Webers of Macalester College in

St. Paul, Minn., the researchers will try to determine what role the mountains may have had in the break-up of the super- continent Gondwanaland and the formation of America. To that end the project will include a search for fossil plants and animals (which may furnish reliable dates for the geologic history of Antarctica and its relationship to other continents) and a survey for radioactive elements (part of an ongoing study by University of Kansas geologists, which may reveal something of the geologic structure).

Other projects include: A study of the sediments near Taylor Valley - one of the ice-free regions, located at the boundary of McMurdo Sound and the Transantarctic Mountains - in order to determine if those mountains are an active or inactive plate boundary between East and West Antarctica.

A continuing study of the movements and behavior of marine animals, especially Weddell seals and the Antarctic cod.

An experiment in which researchers will generate very low frequency signals in order to study the relationship between such electromagnetic waves and the precipitation of charged particles from the earth's radiation belts.

A study of Antarctic sea ice by buoy and by ice thickness measurements in order to examine the interaction of sea ice, ocean circulation and atmospheric circulation.

A commemorative flight of an LC-130 airplane using the same route taken by Admiral Richard E. Byrd and colleagues to mark the 50th anniversary of that first flight over the South Pole.

T. Tweet, "Science News" - Oct. 13, 1979;
(from the GSM News - Spring, 1980)

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