



THE GEOLOGICAL SOCIETY OF MINNESOTA

News

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



GSM President, Dave Wilhelm

From the President's Desk...

Déjà vu all over again – I'm back for my second term as GSM President, as of January 1, 2018. I look forward to serving our Society once again in this role. I want to thank **Dick Bottenberg**, who did a great job as President over the past two years. I also want to thank **Mary Helen Inskeep**, who served the past few years as our Treasurer, and **Ruth Jensen**, for their four years of service on the Board of Directors. GSM has a policy of Board members serving no longer than four consecutive years, to prevent an entrenched Board and to foster new points of view. In that regard, I commend **Cathy Wait** and **Dave Kelso** both for their election to the current Board, and for their immediately stepping into leadership roles as Treasurer and Secretary. I look forward to working with them, Vice President **Deborah Naffziger**, and the remainder of our Board and chairpersons, whose names are listed elsewhere in this issue. Always feel free to approach me or any other Board member or chairperson with your ideas for how to improve our Society and its offerings. We'll be wearing GSM name badges.

The Geological Society of Minnesota was formed in 1938, so 2018 marks our **80th anniversary**. I thank all members for being a part of this long tradition. As in 1938, the business of this Society is "to support and promote interest in the study of Geology with special reference to the Geology of Minnesota". We do that through lectures, labs, field trips, student and public outreach, geological markers, State Fair booth, web site, Facebook page, video library, and this Newsletter. (We are busy!)

We are well into the 2017-2018 lecture series, and so far it has been a great one. We are averaging around 94 persons per lecture, and had especially good turnouts of 130 on November 27 for *Minnesota: A History of Ice, Rivers, and Landscape Change* and 126 on October 16 for *Agate Hunting Made Easy*, including around 28 first-time attendees. The full schedule appears on our website (gsmn.org). Prior to each lecture **Alan Smith**, who maintains our web site, posts a summary of the upcoming lecture on our home page as soon after the previous lecture as we receive the summary. All lectures and labs are free and open to the general public, so feel free to invite family or friends when topics are presented that you feel might interest them. These lectures are eligible for continuing education credit, if you can take advantage of that. Forms are available at all lectures. If you have an idea for a lecture or lab, or know of a possible presenter, contact **Steve Erickson** with the information. Steve will soon start creating the 2018-2019 schedule, so now is the ideal time to approach him with your suggestions.

Our policy for lecture cancellation due to inclement weather is posted on the home page of our web site. As most of you know, it came in effect quite recently on January 22, when nasty weather forced a postponement of **Dr. Joshua Feinberg's** lecture until the following Monday. We thank Dr. Feinberg for accommodating us on the reschedule.

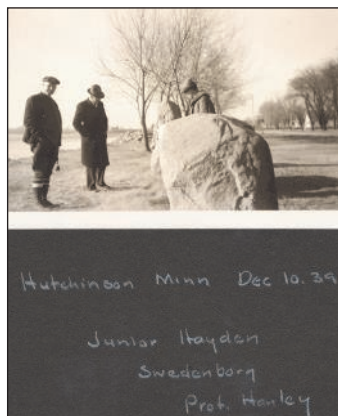
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from the GSM archives:
Hutchinson, Mn, 1939



You might have noticed that **Joe Wright** has been recording most of our lectures, and we have heard requests for these recordings. We are still working on how we can best make these available, but as soon they are, you will receive e-mail with the details.

Our membership year started in September, when everyone’s annual membership payment came due. Thanks to the great majority of you who have already renewed. For those who have not, the easiest way to renew is to pay Membership Chair **Joanie Furlong** or Treasurer **Cathy Wait** at one of the lectures. Or mail in your membership form and dues to the address listed in this Newsletter and on our web site. *Be sure we have your e-mail address exactly right.* The largest portion of your membership dues contribute toward our speakers’ honoraria, so all of us as members do our part in making the 2017-2018 lecture series possible, and in continuing our eight-decade history.

As every year, we are looking forward to an exciting season of field trips, which are outlined elsewhere in this issue.

Finally, thanks to our Newsletter editors, **Theresa Tweet, Mark Ryan, Harvey Thorleifson, and Rich Lively** for putting this issue together. I look forward to reading it. They are always looking for articles. If you have taken a trip (formally organized or not), read a book, or done an activity that you feel would interest others in GSM, consider writing a few words describing your experience and submitting it to Theresa or Mark. We’d love to hear from you. Our Newsletter is by GSM members for GSM members. The deadline for the next issue is **May 1**, with earlier submissions encouraged. See our web site for submission details.

I hope to see you on campus for lectures and in the field for trips.

Dave Wilhelm

GSM

Officers:

- Dave Wilhelm, President
- Deborah Naffziger, Vice President
- Cathy Wait, Treasurer
- Dave Kelso, Secretary

Board Members: Dick Bottenberg; Kate Clover, Dan Japuntich, John Jensen; Theresa Tweet

- Editors:** Theresa Tweet; Mark Ryan; Harvey Thorleifson; Rich Lively
- Programs/Lectures/Labs:** Steve Erickson
- State Fair:** Dan Japuntich
- Newsletter:** Theresa Tweet/Mark Ryan
- Video Library:** David Wilhelm
- Webmaster:** Alan Smith
- Membership:** Joanie Furlong
- Field Trip Coordinator:** David Wilhelm
- GSM Outreach:** Theresa Tweet
- Geological Markers:** Rebecca Galkiewicz
- Video Programming:** Joe Wright

Web Site: gsmn.org

The Geological Society of Minnesota is a 501(c)3 nonprofit organization. The purpose of this newsletter is to inform members and friends of activities of interest to the Geological Society of Minnesota.

Please note the GSM change of 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 dues are: \$10 Full-time students; \$20 Individuals; \$30 Families GSM News is published four times a Year during the months of February, May, August and November. Deadline for article submission is the first of the month, before the date of publication. Newsletter contributions welcomed.

Newsletter contributions welcomed

Of interest to our GSM enthusiasts: While out and about enjoying your vacation time – when you visit a site that you find interesting, please consider sharing your experiences with us by writing up a few words and sending it to Theresa Tweet at phoenix8185@gmail.com. Thank you in advance!

New GSM Members!

- Patricia Siebert, Minneapolis
- Lisa Berndt, St Paul
- Gary Hartung, Prescott
- Michael Moe, Rogers
- Mary B Johnston, Woodbury
- Dick Westby, Minneapolis
- Vernon & Claire Bollesen, Bloomington
- Barb Divinski, St Louis Park
- Kevin Miller, Lauderdale
- Jay Maher, Minneapolis
- Neil Simonson, St Paul

GSM Board Membership

The GSM Board consists of members who have a special interest in advancing the goals of our society, including lectures, field trips, and

community outreach. The Board currently has nine members. Our bylaws limit the terms of Board members to four years, to encourage a turnover of perspectives and ideas. The Board typically meets quarterly, on the second Thursdays of February, May, August, and November, or a different date if conflicts arise. We typically meet from 7 to 9 PM at the Minnesota Geological Survey at 2609 W Territorial Rd, St. Paul MN 55114.

Board meetings are open to all members of GSM. So, whether you are a new member of GSM or have been a member for many years, if Board membership is something that might interest you, or you are just curious to see what our Board does and how it works, we encourage you to attend a meeting. And, if you have a topic you would like the Board to consider, please contact Theresa Tweet at phoenix8185@gmail.com.

**Member Spotlight;
Roxy Knuttla**



Frank Janezich and me on our trip to Utah

1. How long have you been a GSM member?

I have belonged to the Geological Society of Minnesota for about five years, having heard about it at the State Fair.

2. How did you get interested in geology?

I have always loved rocks and have come home from many trips or hikes with my pockets full of “favorite” rocks. As a child, I lived across the road from a county gravel pit and I spent many hours looking for shiny, sparkly rocks to bring home or put into one of many “rock caches” that I had made. I probably should have gone into geology, but I didn’t know that that was something that people did.

3. What do you dig about the GSM?

I enjoy the lectures a lot, but I really love to go on field trips where I get to look at more rocks (and bring home a few more.) And, I enjoy the many nice people I’ve met through the club. I also look forward

to going out to supper at the U Garden before the lectures where I know I will see many familiar faces.

**Notes from the Past
From the FALL 1980 edition
of GSM’s Newsletter**

First Field trip Worthwhile

At long last I was able to connect with a field trip. After many, many classes in geology, field trips are a must, as well as a good reason to join the Geological Society.

With some trepidation, I arrived at the Macalester parking lot at 8:00 a.m. on a bright Saturday in July. The group was friendly; helping people to get acquainted, and arranging rides with those who would drive in the caravan.

Dr. Webers had an excellent trip planned and I enjoyed his lectures along with nature’s wonders. Being in the field certainly makes it easy to commit the subject to memory.

I managed to resist the temptation of adding to the boxes of fossils already in my basement. The ride home through Minnesota’s beautiful farmland was another plus.

All in all, a delightful day.

Bertha Ames

The GSM Holiday Gathering 2017



So what is it that brings a person back to a gathering spot? Is it the good food, the wonderful conversations that takes place, the entertainment—or all of the above...?



For many years, Ed and Sandy Steffner have been opening their doors to the Geological Society of

Minnesota community, bringing them out of the cold and into their warm and wonderful home for a holiday celebration. To say that it is just one thing or another that causes a number of us to gather year after year for a bit of merrymaking would not do this couple justice, because in this instance it is all of these things and more.

The menu is simple: if you wish, bring hors d'oeuvre to share. The meal follows the same principle: bring a dish to share. The desserts are delicious; bring something sweet to share with the rest of the group. As a surprise, Ted Chura donated some pieces of magnetite to be used as door prizes. After the hors d'oeuvre, salads, main dishes and the magnetite disappeared, the tradition of singing holiday songs with geology lyrics rounded out our evening with Ed doing the accompaniment on the piano and accordion.

Thank you to Ed and Sandy Steffner for another lovely Holiday Gathering, from the folks of the GSM.

Theresa Tweet

GSM Spring Banquet

The GSM Spring Banquet on **Monday, April 30**, will begin with social time and banquet from 5 to 7 PM, followed by announcements and sign-ups for State Fair. Then, at 7 PM, Roger Benepe of the Geological Society of Minnesota will speak on "Trilobites"

Location: **U Garden Restaurant**, 2725 University Ave SE, Minneapolis, MN 55414, (612) 378-1255, near the east bank U of MN campus. The restaurant is on the north side of University Ave SE, east of 27th Ave SE. There is free parking behind the restaurant. (<http://www.ugardenrestaurant.com>)

No reservation or registration is needed. We recommend the buffet, which is priced at \$11.95 + tax and tip, with beverages extra. Ordering from the menu at the posted price is also an option. To make payment easy, we encourage everyone to pay using cash. The restaurant does not accept checks. You may come for just the lecture, skipping the meal if you wish; however we encourage you to enjoy the meal also, as the restaurant appreciates our business in return for hosting this event.

As with all GSM lectures, this lecture is free and open to the public.

ILSG 2018



The **64th Institute on Lake Superior Geology** will be held from Tuesday, May 15 to Friday, May 18, 2018 in Iron Mountain, Michigan. All activities will be held at Pine Mountain Golf and Ski Resort. The meeting consists of two days of technical session on Wednesday,

May 16 and Thursday, May 17. Four field trips will be offered, with two before the technical session on May 15 and two following the technical sessions on May 18. Descriptions of the field trips are available on the [ILSG](#) web site. If you are interested, please indicate so on the web site.

Travel through Minnesota and Find GSM Markers

Summer is a wonderful time to travel and the State of Minnesota is a beautiful place to do your traveling. Located in some of the most scenic areas of the state, GSM markers show you where geological processes have occurred here over billions of years. You don't need to wait for a GSM-sponsored field trip – you can "do it yourself" using the Do-It-Yourself (DIY) Geology Field Trips page, under GSM Road Markers on the GSM web site, to find a map of the entire state that conveniently groups markers into 12 different regions, making it easy to find the ones close to you.

Here's how to do it:

1. Go to the GSM Web Site (gsmn.org).
2. Click on GSM Road Markers link on the GSM home page to access the Marker Home Page.
3. Click on DIY Geology Field Trips link to see a spreadsheet of all of the markers.
4. Click Road Marker Map, select a county or region, input pertinent information, and then click on "Apply".
5. On the map, place the cursor over any red dot to identify each marker. Click on a red dot and information about the marker will pop up, including the following:

- Where the marker is located.
- Driving directions to get you there.
- The text of the marker.
- The GPS coordinates – click here to go to a Google map that will show you how to find the marker.

Get the hang of using the GSM Road Markers link by visiting a marker close to your home. For example,

- Indian Mounds Park in St. Paul, in the Metro Area DIY Field Trip
- Geology of Frontenac State Park, in the Mississippi River Valley DIY Field Trip
- Glacial Potholes at Interstate State Park in the St. Croix Valley DIY Field Trip
- Geology of Lake Minnetonka in Excelsior in the Metro Area DIY Field Trip

The GSM Marker Committee believes you will have fun and get to know Minnesota better – past and present – when you take a DIY Geology Field Trip!

Rebecca Galkiewicz

GSM Field Trips and Tours

On Wednesday, November 15, 2017, 12 GSM members participated in a one-hour tour of the **St. Anthony Falls Laboratory**, organized by Dave Wilhelm and conducted by Lab personnel. See Deborah Naffziger's report in this issue. Dave will organize future tours of this unique lab each semester as member interest dictates.

So what's in store for 2018?

GSM is planning a field trip to **Isle Royale National Park** during **June 18 through 24**. This trip will leave on the Ranger III from Houghton, MI, spend 3 full days on Isle Royale, returning on the Ranger III on the fifth day. The sixth day will be an overview of Keweenaw geology. While on Isle Royale, the Michigan Tech research vessel Agassiz will take us to many scenic and geologically interesting sites, allowing us to see the beauty of Isle Royale from both land and water. We have been actively planning this trip; members are being notified by e-mail. Eight GSM members participated in a similar trip during June, 2017, and had an excellent time. Look for Dave Wilhelm's report of the 2017 trip in the August, 2017 Newsletter. Specific information on the 2017 trip is here: <https://tinyurl.com/IRtrip2017>; we'll send a link for the 2018 trip when it is ready. Photos of the 2017 trip taken by Dave and other participants are here: <https://tinyurl.com/IRphotos2017>. Look for Dave Wilhelm's report of the 2017 trip in the August, 2017 Newsletter.

GSM is planning a field trip in the **Thunder Bay, Ontario** area during **Summer, 2018**, led by members of the Ontario Geological Survey. OGS personnel are very eager to show us the highlights of geology in that area, and there is quite a bit to see. We will start actively planning this in February. Most likely duration is 2.5 to 3.5 days.

In April and/or May, we'll schedule one or more walking tours of the **St. Paul Water Treatment Plant**, which we last did about 6 years ago. These tours are free, last about 1.5 hours, and will start at 3 PM on a work day, although we might be able to schedule an evening tour during their open house tentatively on Thursday, May 10. The tours are limited to 20 persons each; we'll schedule as many as interest dictates.

We'll do one or more 90-minute walking tours of the building stones and architecture of downtown **St. Paul**, using the book "Rocky Roots" as the primary source book. We will cover a 1½-mile course from the [Science Museum of Minnesota](#) to [Rice Park, Landmark Center](#) and several other interesting buildings along St. Peter Street and Wabasha. We will discuss the geology of the building stones, architecture of the buildings, and history of St. Paul and the state of Minnesota. Our leaders will show many interesting features found in rocks and discuss how these are formed in geology. Highlights will include some of the most spectacular examples of the [Morton Gneiss](#), cleanly cut

and polished. We will see examples of the products from the [Twin Cities Brick Company](#) that went into many of the buildings in St. Paul.

To see other trips GSM is considering, select the "GSM Field Trips" link on the web site home page and click 2018. Members will receive e-mail on these possibilities and any others that arise when there is sufficient detail. As always, contact Dave Wilhelm with ideas for other field trips that would interest you. Our past field trips are also described on the web site, sorted by year. These summaries provide a good way to learn more about GSM

GSM Field Trip Coordinator Dave Wilhelm

St. Anthony Falls Laboratory Tour

Nov 15th 2017



St. Anthony Falls, Minneapolis, Mn.

It was a raw and windy afternoon when 12 hardy souls gathered for a tour of the St. Anthony Falls Laboratory, Barbara Heitkamp, Communications Specialist was our historian and guide.

In 1930, Dr. Lorenz Straub came to the University of Minnesota, observed the flow of water over St. Anthony Falls and conceived of a lab to be used for hydrological research. Dr. Straub's vision was realized during 1936-38 with WPA funds. At first the Lab was used as a model to research river infrastructure; in dams, spillways, and fish access. As time went by, the Lab branched out and broadened its focus into the environmental needs of society, fluid flow in general (air and water), water quality, delta formation, stream restoration, and climate change. The finished building was dedicated in 1938, which makes 2018 the lab's 80th anniversary. There are many events being planned for the celebration this year.

Currently, the Lab is staffed by 16 University of Minnesota (U of M) faculty members in the fields of civil, bio- and geo- engineering. There are also 20 permanent employees in applied engineering who design and help create the experimental models for the U of M and other, independent clients. Furthermore, there is a staff of permanent builders who create what the engineers design. Additionally, because of the new administration, money for SAFL (pronounced saff'l by

our tour guide Dr. Heitkamp) projects have changed with both the National Science Foundation (NSF) and National Aeronautics and Space Administration (NASA) scaling back on their funding. However, the Department of Defense and the Navy are still good funding sources. Currently, SAFL is looking at private funding as well as state and local projects to help make-up the financial difference.

One of the newer installations at SAFL is the wind tunnel. This was created in the 1980's and is currently used to help model turbulence of wind farm turbines. The St. Anthony Falls Labs owns a single turbine in Rosemount along highway 52. It is called a Clipper Liberty 2.5 MW, 425 feet high and is plugged into Xcel's grid that helps to make money for the lab. With a video camera and a light snowfall, the Lab was able to map vortices and wind patterns as the turbine rotated. They also measured low frequency subsonic pressure wave generation that can make people feel nauseated. In a collaborative effort with the Raptor Center, they are currently researching audible deterrents as a way to help birds avoid the turbines.

In water projects, the Metropolitan Council is designing a new sanitary sewer using a long throated U flume. Usually these are utilized in agricultural settings, but they may be adapted for city use. Hydrokinetic power is another area of research the lab investigates. Hydropower without dams is done using underwater turbines that are placed in water flow sources. The turbines move so slowly that fish are able to swim through them without injury. An example of this is the East River in New York City. Also tidal power is another form of converting water flow into free electricity – this is a renewable resource.

The storm water group investigates how pollutants and other matter tend to settle in water. They also research ways to use less salt on roadways in winter which, in turn, will reduce the total amount of salt running off into waterways and thus mitigating changes to the water's natural chemistry. They are testing a manhole design that helps filter out storm water at the base of the manhole.

Fish passage through culverts is another project. They are hoping to make fish and aquatic passing easier in existing culverts by simulating ordinary stream conditions, rather than having to build larger culverts. New Zealand rope is a plastic rope with tendrils that changes the water turbulence so fish can pass through culverts more easily without expanding the culvert.

The St. Anthony Falls Lab has an outdoor stream laboratory that models between the lab and nature. They use native freshwater mussels and varying turbidity, currents, and nutrients, and then measure what conditions are best for the mussels. They research stream bank stabilization, and nutrient dynamics; denitrification of water in fertilizer runoff situations.

They have 'hot tubs' where they see how algae fatten themselves up in turbid or still conditions. This is part of biofuels research.

As you can see, the St. Anthony Falls Laboratory is a lively and dynamic place. Each time I take a tour I see different projects, which shows that fluid research is a vital and important area for our ever changing and evolving world.

Deborah Naffziger

The Great American Eclipse Trip; Part 2: The Rest of the Week

Tuesday, August 22nd: Today began the portion of our trip in which we learned about the geology of Nebraska. There were 26 GSM members on the trip. People dropped out for various reasons and headed back home throughout the week, but the activities continued for those of us who stayed. We congregated at Econolodge, and the caravan took off for interesting geological sights around Kearney. We visited several sites on old river beds and cuts to see how the loess was deposited and moved around. We stopped for an impromptu in-field lecture about the loess and sand that were blown off the



Borrow pit where loess is quarried

Rockies. In Nebraska, what they think of as a hill is like a shallow rise for Minnesota, so sometimes it was difficult to see the features, but our guides helped us.

Basic History of Nebraska farming: Only a small part of the eastern edge of Nebraska was glaciated, so the geology talks concentrated on what drifted east from erosion of the Rocky Mountains, both ancestral and present. Paul Hanson and Jeremy Dillon, both Nebraska geologists, were our guides. One thing that impressed me was that everything about geology in the parts of Nebraska we visited was about supporting and improving agriculture. The loess that blankets 3/4 of the state is exceptionally fertile, and with enough water, it is very productive. You see corn, soybeans, wheat and many, many cattle. When I vacationed there in the 1990's everything was wheat, period. Combining the older

system of irrigation canals with the more modern giant sprinklers pumping from the aquifer, the types of crops that are now being planted are varied.

Minnesota is the most water-rich state in the country, but it seems Nebraska is the second most water-rich. The Ogallala aquifer underlies the majority of the state and



Center-point irrigation

except for a small area in the southeast corner; water from the aquifer is used and replenished continually. This all comes down to the geology of Nebraska. In the north central 1/4 of the state are the sand hills, large widespread sand dunes covered and anchored with scrubby brush. These dunes are leftovers from windblown erosion of the Rockies, and with the brush they are good for cattle ranching. In the early 1900's, ranchers discovered the ideal number of cattle per acre to sustain the brush and not overgraze. This is not recent 'green' farming, but old-time practical knowledge about being able to farm year after year and keep your land as nutrient-rich as possible.

Nebraska farming is big farming: The small holdings of a few hundred acres aren't sustainable anymore with irrigation and machinery requirements. You need thousands of acres and big investments to make a go of it. But except for planting and harvest, few people are needed to maintain a farm. Everything is computerized and monitored--sometimes to the square yard level--and water and other resources are highly calibrated to get the most out of each acre of land. In the southeast, Nebraska gets 32 inches of rainfall a year. In the northwest they get 10 inches a year, so you lose 2 inches a year every 50 miles you go northwest. Knowing how much rainfall your area gets, and what can be sustained there with and without irrigation is vital to being a successful farmer. Ecology and being green isn't something new to the farmers of Nebraska, but is the result of how they operate and have operated since they began farming.

In Europe, the prevailing knowledge was that loess was undifferentiated, that is, not layered. In Nebraska, we saw several examples of differentiated loess, and loess that cascaded down 'dune' faces and then was 'cemented' in place by overlying layers. There were three main episodes of loess deposition. Loess comes off the detritus sand and outwash from the Rockies, and the lightest and most fertile stuff is the loess that travels farthest. The sand is next, and the sand dunes also

provided loess for downwind areas.

There was a 'cut' in a hill that illustrated about 30 feet of loess, emplaced in 3 glaciation episodes. We saw that the surface plants, prairie and scrub, can send down roots 10 to 20 feet or more, and small calcium (calcite) deposits can result from water flowing down and leaching the calcium out at the bottom of the roots.

After a fast-food lunch, we caravanned and stopped at a few sites to see road cuts and loess. Paul and Jeremy were our guides, and we saw a lot. We stayed overnight in and near North Platte.

On Wednesday, August 23rd, 20 GSM members started out at University of Nebraska West Central Research and Extension Center, in North Platte. Doug Hallum was our host, and the staff made us very welcome and treated us like VIP's, giving us a comprehensive tour of their facilities and the wide variety of their research, as well as nifty maps and handouts. The facility sits on something over 2000 acres. Here, they study livestock, crops and most everything else related to farming in the



Jeremy and dog Maggie at loess roadcut



Plant pathology lab

state.

The first talk was by Tony Adesemoye, Asst. Professor of Plant Pathology. He outlined his research on bacteria and viruses found naturally in the soil, and how they can help or hurt various plants. He wants to be able to cultivate and then add the good bacteria to the soil and thereby help the crops thrive.

Then we got onto the people mover, a giant trailer with seats pulled by a pickup around the facility. At various stops, we received some insights about pest management from Julie Peterson, the Assistant Professor

from the Department of Entomology, and we learned from Greg Kruger, Associate Professor, about pesticides



Campus people mover (Jean Gorman, photographer)



Entomology lab



Wind tunnel in Weed Science and Pesticide lab

and ways they can be used to help manage the weeds in crops.

After the station, the caravan took off, and we ended up



Discharge from power plant in Sutherland Reservoir

downstream (actually down the irrigation ditch) from Nebraska's largest power plant which is coal powered. The water comes out of the plant at 92+ degrees, and the irrigation ditch and spillway are there to get the water down to a temperature that is compatible with the rivers and the trout therein. These were WPA projects, and are still operational. Much of Nebraska is threaded by many irrigation channels, distributing the water from the various rivers to areas that have no rivers. These ditches were started early in the 20th century, and still are maintained and used. There are many varieties of irrigation used across the state, and we saw most of them.

We visited Paulman Farms, and Roric Paulman, a third generation farmer, is a man who embraces the latest technology in his farming. Sometimes the innovations work; sometimes they don't. But Roric is very successful, and he hosts farmers from all over the world to teach them about the methods he has used. There was a group from South America attending, and he broke from that meeting to talk to us and answer our questions. He has tried organic and direct-to-market selling on his farm, as well as the more conventional selling to the commodities exchanges. If you buy quinoa, you are probably buying his quinoa. The majority of his crops go to producers — such as beans that go to Mexican restaurant chains and so forth.

Lunch was at Ole's Big Game Steakhouse in Paxton. The



Lunch at Ole's

food was good so many also purchased box lunches for their supper that evening.

There were stops at more canals and surface monitoring stations, as well as Alkali Lake to learn more about hydrology used in support of agriculture.

Next we toured the Kingsley Dam and hydro station.



Sutherland Canal

The dam was built from 1935-1941, and the hydrologic power station built later in the 1960's. This power station is used to augment the power from the giant coal-fired station we saw earlier. A coal fired plant is slow to start and stop, so is used for the base power needs of the state, with the various hydro stations generating as needed for peak load times. Hydro power is much more versatile in ramping up and down throughout a day. Nebraska's power is a state-owned utility and they enjoy some of the most economical electrical power in the U.S.



The earthen Kingsley Dam

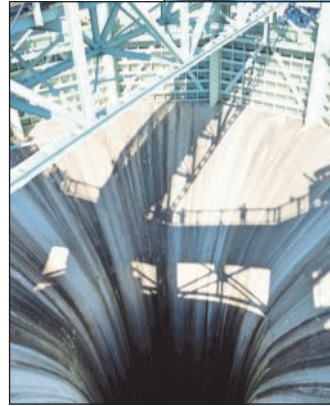
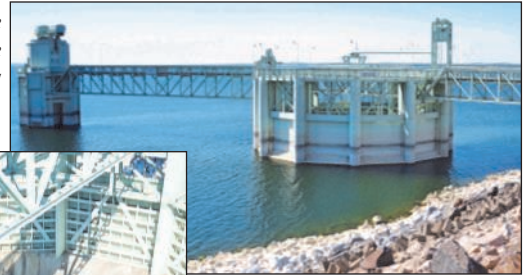
The coal comes from neighboring Wyoming, so there is little cost in getting it to the plant. The hydro station was clean and well maintained. We saw the actual turbines that turn the brushes generating power. It was a bit scary, but cool as well. Again, the station is mostly operated remotely by computers. Not that the station is



Discharge from Lake McConaughy through power plant into Lake Ogallala

Nate Nielsen and Doug Hallum by the discharge left unstaffed, because there is staff on site, and Nate Nielsen was the man in charge who was proud to show us the dam and power plant. Afterward we went down the road to the Cedar Point

Discharge tower on Lake McConaughy



Overflow discharge for Lake McConaughy

Biological Station (formerly a Girl Scout camp), for supper and to bed down for the night, on the shores downstream of the dam's spillway. It was a nice place, and Doug took us on a sunset geology hike to see the bedrock. This is one of the few places in



Deb and Sherry by oversized power plant tools

the state that you can see bedrock underlying the loess and sand hills.

On Thursday, August 24: Going north and east out of Ogallala,

a caravan of 17 people drove to several local sites where



Cedar Point Biological Station, Lake Ogallala

we could see road cuts and some sand-dune formations in a cow pasture. We studied the sand dunes and saw how the sand was laid down in layers. Again we saw evidence of the three periods of deposition from the northwest, which provided the sand for these dunes.



Cavities filled in by more resistant material

Some 20+ years ago, the University of Nebraska did an experiment to see how quickly a sand dune would recover after being stripped of vegetation. To their dismay, it is still is bare. So the present estimates are

In Nebraska, spades replace rock hammers for geologists!



about 100 years or so to fully recover a sand dune to prairie plants. This has proved a big incentive to keep the



Paul explains sand dune structure

vegetation in place.

We stopped at a high outcrop over the Dismal River, which cuts through the water table. The drop is several hundred feet, all through the sand and detritus. There are a few small lakes (water table) here and there around the river. Again, the individual farms are immense. Mostly ranching, and maybe fodder, but few crops are grown in this area, except in the river lowlands.

We stopped for lunch in Mullen, and had 'the best hamburgers in Nebraska' at the Chuckwagon 'n Jug. Nebraska is a big beef state, so all the beef you eat here is exceptional. The hamburgers were very good, and we all had a fine lunch. We said goodbye to Paul and continued onward without a guide, but with a good itinerary and maps. Paul said if his first year university



Sandhills where Hwy 83 crosses Dismal River

students were as enthusiastic and interested as we were, teaching would be much easier.

Our last stop that day was Carhenge, north of Alliance. This is not at all geological, but it is an American Icon. Check it out at carhenge.com, and on Wikipedia. Built by Jim Reinders, it was dedicated at the June 1987

summer solstice. He took a number of old cars, and constructed a replica of Stonehenge on a corner of his land. These cars are spray-painted gray, to simulate stone. Since the original erection, he (and others) added many more vehicles in various configurations, and in 2006 a gift shop, bathrooms and a nice parking lot were built. We spent a fun hour wandering, exploring and buying souvenirs in the gift shop. The field next door still bore marks of the eclipse watchers from Monday. Then we made our way to Scottsbluff and rest.

Friday, August 26: Early in the morning, the remaining 11 GSM members gathered at the museum of Scotts Bluff National Monument and watched a video before proceeding to the top of the bluff. It was the National Parks' Birthday with free admission all weekend. The view was spectacular and we hiked both trails at the top, took many pictures, and generally had fun. The bluff was an important landmark for people traveling west on the various trails, Oregon, Mormon and others. It is the remnant of a 31-22 million year old marine reef, along with the other bluffs and buttes visible in the area.

Then the caravan took off to Agate Fossil Beds, which had no agates, but did have many interesting fossils



Carhenge

(and traces of ancient animal behavior) along the trail. The corkscrew holes (*Daemonelix*) seen there were finally determined to be burrows of ancient beavers after many 'interesting' speculations as 'Devil's corkscrews'. Then we drove (and drove and drove) through local back roads with great clouds of dust--like a blizzard of dust--and we had to use wipers and lights to follow the lead car. Finally we made it to Toadstool Geological Park, a 'badland' cut into volcanic beds and other geological layers. This is definitely a hidden gem of the Forest Service. There were fossils as well, and everyone was impressed by the rocks. The hike was challenging, and not everyone made it all the way through, but it was a fun stop nonetheless. There was also a "soddie", a replica sod house we all went into and got our pictures taken. It must have been pretty desolate living in a sod house on the Nebraska prairie in the 1800's.



Field trip participants atop Scotts Bluff



View from Scotts Bluff

local geologists who led our field trips through central Nebraska. It was a trip of a lifetime, and the eclipse was just the amazing start to a fun and educational week. All photos courtesy of Dave Wilhelm except as noted. For more photos, visit the [GSM web site](#).

Deborah Naffziger

Saturday was the end of the planned events. I left the group and drove north to the Black Hills for an extra day of fun, while the rest of the group headed home through the South Dakota Badlands. It was the official end of the trip, after a good time was had by all.

Nebraska is a lot more interesting geologically than I had previously thought, and important for water resources for the entire mid-continent. Dave Wilhelm organized the trip and we learned a lot about Nebraska's geology, history and farming communities with excellent guides throughout the tour. Also, a special "thanks" is in order to Jake Bruihler, son of GSM members Carl and Mary Kay, for connecting us with the



Daemonelix (Devils's corkscrew)

One of the many formations at Toadstool Park



Having fun at Toadstool Park



Field trip participants by the 'soddie'



Dave in the Badlands (Cathy Wait, photographer)

MINNESOTA CAVES: History & Lore

(2017) by Greg Brick. The History Press. Charleston, SC. Paperback, 143 pages, 6" x 9" format, ISBN 978-1-4671-3592-4. Available for \$21.99.

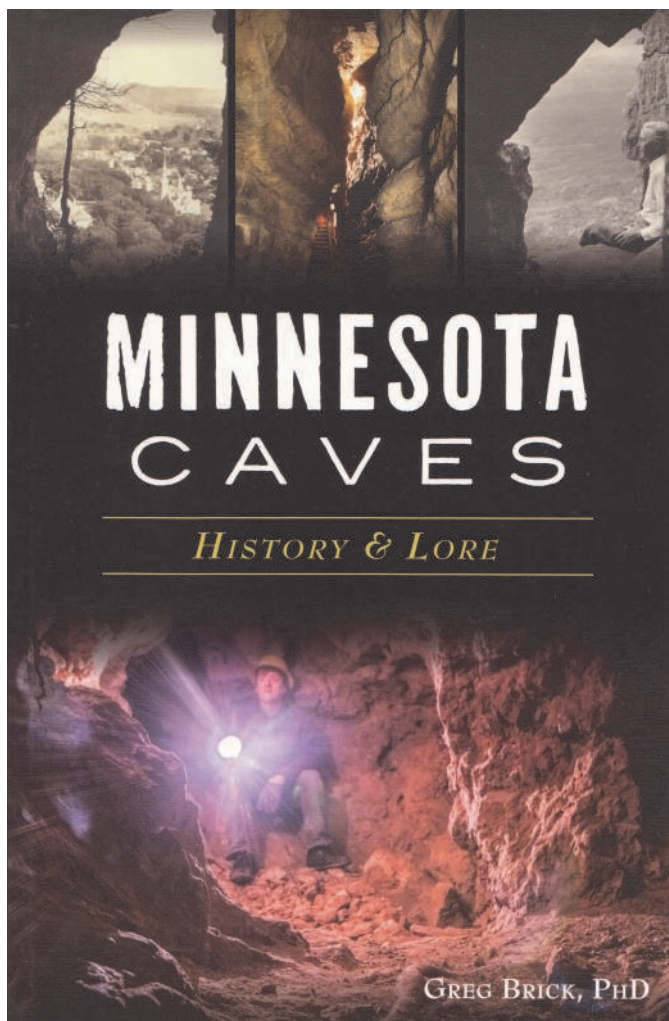
According to author Greg Brick, geologist and cave historian, Minnesota is home to more than 300 caves. These are primarily located in the southeast portion of the state (especially Fillmore County) and the Twin Cities region (Minneapolis/St. Paul). In addition to natural caves, many are artificial in nature, hewn into the local bedrock for a variety of reasons.

Following a brief description of the "layer-cake geology" of the state, Brick provides an overview of select sites, principally those of significant historical interest and those which he has personally visited. In doing so, he

defines several categories of caves, including sites of archaeological interest (primarily those used by Native Americans and from which a host of artefacts have been unearthed), those of historical interest (primarily those explored by early pioneers and settlers), artificial caves that were largely utilized by an assortment of innovative entrepreneurs, and show caves aimed at the tourist dollar. Discussion also features aspects of a number of imaginary or hybridized caves (i.e., those created in the mind when historical descriptions of two or more caves had been blended together, either accidentally or deliberately).

Beginning with late 17th-century descriptions of well-known local caves, Brick delves into the rich and storied history of underground Minnesota. In addition to the creation of various show caves (including those outlandishly decorated for Halloween fright nights), Minnesota caves were utilized for such diverse functions as root cellars for storing vegetables during winter months, lairs for horse thieves and other outlaws, places for college students to host wild parties in, locations of ritzy night clubs, and sites of mushroom gardening or cheese ripening. A number of brewery caves for the fermentation of lager-style beer were also developed by intrepid investors.¹ Of course, a book by urban cave historian, Greg Brick, wouldn't be complete without at least some mention of sewer caves, and some information in this regard is included, as well.²

Brick sheds light on some of the bizarre and interesting facets of Minnesota caves and caving, especially as they relate to many historical associations that are now an integral part of Minnesota folklore. The book is well written and easily accessible to general readers. It will be



of most interest to urban historians as well as to local cavers curious about various myths and legends or the early years of cave exploration in the state.

Reviewed by Danny A. Brass.

¹An interesting discussion of the brewery caves of St. Louis can be found in Hubert and Charlotte Rother's *Lost Caves of St. Louis: A History of the City's Forgotten Caves* (2004), Virginia Publishing Company.

²Interested readers may also enjoy Greg Brick's 2009 publication, *Subterranean Twin Cities*, University of Minnesota Press.

Critical mineral resources of the United States – An introduction

Professional Paper 1802-A

Since 1973, the United States has continued to become increasingly dependent on imports to meet its demands for an increasing number of mineral commodities. The global demand for mineral commodities is at an all time high and is expected to continue to increase, and the development of new technologies and products has led to the use of a greater number of mineral commodities in increasing quantities to the point that, today, essentially all naturally occurring elements have several significant industrial uses. Although most mineral commodities are present in sufficient amounts in the earth to provide adequate supplies for many years to come, their

availability can be affected by such factors as social constraints, politics, laws, environmental regulations, land-use restrictions, economics, and infrastructure.

Reviews of 23 mineral commodities and commodity groups viewed as critical to a broad range of existing and emerging technologies, renewable energy, and national security include antimony, barite, beryllium, cobalt, fluorine, gallium, germanium, graphite, hafnium, indium, lithium, manganese, niobium, platinum-group elements, rare-earth elements, rhenium, selenium, tantalum, tellurium, tin, titanium, vanadium, and zirconium. All these commodities have been listed as critical and (or) strategic in one or more of the recent studies based on assessed likelihood of supply interruption and the possible cost of such a disruption to the assessor. For some of the minerals, current production is limited to only one or a few countries. For many, the United States currently has no mine production or any significant identified resources and is largely dependent on imports to meet its needs. The environmental issues related to production of each mineral commodity, including current mitigation and remediation approaches to deal with these challenges, are also addressed.

The modern approach to mining using best practices involves the following: (a) establishment of a pre-mining baseline from which to monitor environmental effects during mining and help establish geologically reasonable closure goals; (b) identification of environmental risks related to mining through standardized approaches; and (c) formulation of an environmental closure plan before the start of mining. A key aspect of identifying the environmental risks and mitigating those risks is understanding how the risks vary from one deposit type to another—a concept that forms the basis for geoenvironmental mineral-deposit models.

Accompanying the quest for best practices is the goal of making mining sustainable into the future. Sustainable mine development is generally considered to be development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The concept extends beyond the availability of nonrenewable mineral commodities and includes the environmental and social effects of mine development.

SUMMARY

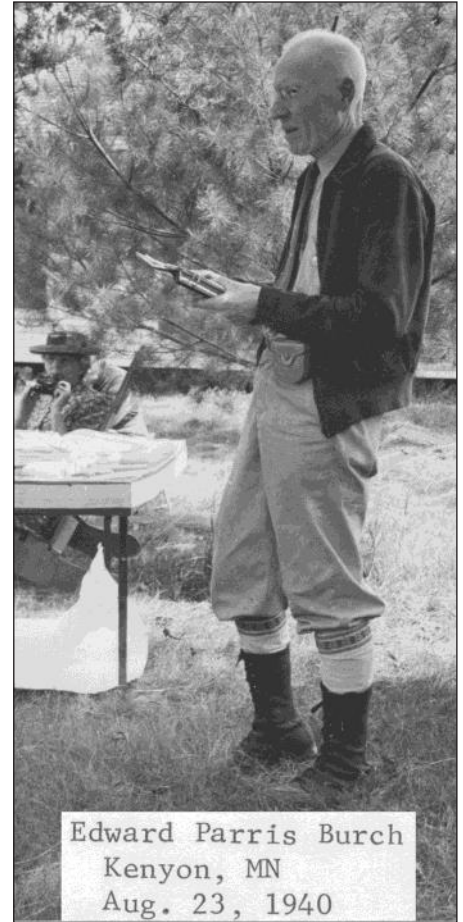
Mineral commodities are vital for economic growth, improving the quality of life, providing for national defense, and the overall functioning of modern society. With the increasing demand for a considerably more diverse suite of mineral commodities has come renewed recognition that competition and conflict over mineral resources can pose significant risks to the manufacturing industries that depend on them. In addition, production of many mineral commodities has become concentrated in relatively few countries (for example, tungsten, rare-earth elements, and antimony in China; niobium in Brazil; and platinum-group elements in South Africa and Russia), thus increasing the risk for supply disruption owing to political, social, or other factors. A increasing awareness of and sensitivity to potential environmental and health issues caused by the mining and processing of mineral commodities may place additional restrictions on mineral supplies. These factors have led a number of Governments, including the Government of the United States, to attempt to identify those mineral commodities that are viewed as most “critical” to the national economy and (or) security if supplies should be curtailed.

For more information about minerals mentioned in this article, go to: <http://minerals.usgs.gov>

80th Anniversary of the Geological Society of Minnesota

The Geological Society of Minnesota was started in 1938, when two separate but similar educational groups merged. One was an earth science club that had met regularly at the Minneapolis Public Library. The other was a group led by Edward P. Burch, from Minneapolis, who was a consulting engineer that had taken up an avid study of the geology of the Twin Cities area. During the years when Minneapolis was endeavoring, without success, to have the Milwaukee Railroad depress its main line tracks through south Minneapolis, Mr. Burch undertook an independent study of the problem. The proposed construction involved extensive excavation and required accurate knowledge of the rock formations under the city. This led to a study of deep well records of the Twin City artesian basin and to field inspection of rock exposures in the Twin Cities area. Mr. Burch invited others to join in the project, with the result that regular weekly field trips were conducted to study the geology of the area. In 1938, the combined groups organized the Geological Society of Minnesota for the purpose of stimulating public interest in geology, and the Society began a year-round program of lectures and field trips to which the public was invited free of charge. In 1939, GSM was incorporated as a Minnesota nonprofit educational organization. In 1949, an extensive geological markers project was started which aimed, in a limited way, to describe the geology of Minnesota in such a manner that it would develop interest by residents as well as visitors to the state. This was accomplished by the installation of bronze tablets at carefully chosen locations on state highway property and in city and state parks. Since about 1950, the winter lectures have been held at the University of Minnesota. Over the years, many outstanding geologic professionals have given the lectures. Lecturers are from the University of Minnesota and other academic institutions, government agencies, engineering firms, and industry. In about 1960, an educational exhibit was started at the Minnesota State Fair, which spreads interest to a broad spectrum of fair attendees, who also receive a program of the upcoming year's lecture series.

From the GSM web site



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