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Promoting public interest and educational support in the geological sciences

The Geological Society of Minnesota News

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

From the President's Desk…

As the summer waned, our ample rain switched to drought, and the first frost was mild. But no hurricanes (or earthquakes!) in Minnesota.

Fall means our lecture series has started; and as usual, Steve Erickson has put together a great schedule, which you can find on our website and in this newsletter. As is our custom, we started with our Fall Banquet and Annual Meeting at U Garden Restaurant, enjoyed this year by 74 members and guests. Randy Strobel's lecture "Geology of the Mississippi River Gorge" was outstanding, as we have come to expect from Randy. Although there are detailed reports in this issue, I want to point out one remarkable statistic: 12 of the banquet attendees were new to GSM; they found us through our State Fair presence, word-of-mouth, and our website. Most of those have since become members. Thanks to all of you who keep this organization growing.

Other recent activities include our presence at the State Fair and the Minnesota Mineral Club annual rock show. Thanks to all who volunteered for those; Patrick Pfundstein has a detailed report inside. In September, Steve Willging and Roger Benepe led a fossil hunting trip in northern Iowa; see Steve's report inside. In addition, I recently organized a tour of the St. Anthony Falls Lab (SAFL); this issue includes an illustrated report by John Foley. I hope to arrange another of these tours next year. Also, I want to thank Joe Newberg for arranging the sale of GSM swag (T-shirts, vests, & caps); most of you should have received your order by now.

I want to remind you that GSM has a large array of geological markers throughout this state. See our website for an interactive map with their locations, descriptions, and photos. Becky Galkiewicz has done a great job of establishing and maintaining that map and underlying database, with input supplied by many of you as you have visited these. Thank you! However, other commitments prevent Becky from continuing in this role, so we are looking for someone else to fill it. That could be you! Contact me if you might be interested. Becky will of course supply all the training you need.

Since we have formed online relationships with like-minded organizations, such as the Rochester Academy of Science (NY) and the Geological Society of Nebraska, I am getting notices of their online presentations. I continue forwarding these to you. Many are quite interesting, and I can see that many of you are attending virtually.

As always, I thank Kate Clover, Mark Ryan, Harvey Thorleifson, and Rich Lively for their great job of compiling, editing, and distributing the GSM News. But this publication is by GSM members for GSM members, so consider submitting an article for the next issue. And thanks to all who have contributed articles to this issue. Another important person who does not get thanked enough is Alan Smith, our webmaster. Our website is a primary means for the public to learn about us, and it includes a wealth of information; Alan manages all of it for us. Thank you!

GSM President, David Wilhelm

Upper photograph, Mark Ryan

Inside this issue:

Visit us on FaceBook

GSM Field Trip to Jordan, Mn, Sept. 1940. Glacial eratic,

As winter approaches, please enjoy activities both outdoors and indoors. Maybe I will read of them in the next issue.

David Wilhelm

GSM

2024 Board of Directors:
David Wilhelm, President
Deborah Naffziger, Vice President
Dave Kelso, Treasurer
Stephen Willging, Secretary

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Geological Markers: Rebecca Galkiewicz

GSM Outreach: Open

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Video Library: David Wilhelm

Webmaster: Alan Smith
Web Site: https://gsmn.org

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 and Zoom meetings are from 7 - 9 pm. Meeting location will be announced close to the meeting date. 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 David Wilhelm, dewilhelm53@msn.com

Welcome New Members!

Grant Eager, Minneapolis
Jerik Hahn, Saint Paul
Erik Haider, Mendota Heights
Max Herman, Saint Paul
Charlotte Herman, Minneapolis
Renee Kargleder, Saint Paul
Kathy A. McGillis, Minneapolis
Paul Monroe, Minneapolis
Thomas Ostertag, Saint Paul
Roger Sharpe, Bloomington
Barry Shillingford, Eagan
Patrick Steury, Afton
Jonathan Wold, Saint Cloud

Notes from the Past

From the Spring and Summer 1965 edition of The Minnesota Geologist, Official Bulletin of the Geological Society of Minnesota:

The 26th Annual Banquet

The 26th Annual Banquet of the Geological

Society of Minnesota was held on Monday, March 29, 1965, at the Mount Olivet Church Hall, with 80 members and guests attending.

Dr. Arthur Nash, Dean of Science at Augsburg College, who has been Ranger Naturalist at Yellowstone National Park for 26 years, gave a vivid account of the geologic and scenic wonders of the park. He showed pictures of the spectacular geysers and the changes made by the earthquake several years ago which caused great faulting and destroyed roadways.

Pupils of Mr. Nelson and Mr. Jasperson, Art teachers at Central High School in St. Paul, prepared the attractive free form modernistic sculptures in various colors which decorated the dinner tables. The many favors for guests were solicited by Martha M. Peterson. Chairman of the committee which made arrangements for the banquet was Grace V. Benz, assisted by Martha M. Peterson, Co - Chairman.

Fall / Winter 2024 - 25 GSM Seminar Schedule

All lectures are Mondays at 7 PM CT, except as noted.

Fall Banquet 2024, September 16, 2024: U Garden Restaurant, 2725 University Ave. SE. Minneapolis. Dinner at 5-7 pm. Annual Meeting at 6:30. Lecture at 7 pm. "Pearl Harbor." *Jared Trost*, M.Sc., Hydrologist, USGS Upper Midwest Water Science Center.

September 30, 2024: "Plan, Core, Scan, Store: Facilitating Core Research." *Kat Cantor*, M.Sc., Science and Outreach Coordinator for the Continental Scientific Drilling Facility at the University of Minnesota.

October 14, 2024 (Zoom Lecture): "Earthquake hazards in Oklahoma." *Jacob Walter*, Ph.D., State Seismologist, Oklahoma Geological Survey.

October 28, 2024: "Groundwater Governance in the Great Lakes States—from well-cobbled to equitable and sustainable?" *Carrie Jennings*, Ph.D., Research and Policy Director, Freshwater Society.

November 11, 2024: "Geological Mapping." *Harvey Thorleifson*, Professor, Department of Earth and Environmental Sciences, University of Minnesota.

November 25, 2024 (Zoom Lecture): "Shale in a Nutshell: An Overview of Shale, Oil and Gas in the U.S. and Texas." *Tim McMahon*, PhD. Project Manager and Principal Investigator for Tight Oil Resource Assessment (TORA) consortium.

December 9, 2024: "Beautiful Ohio: Sedimentary Dreams." *Deborah Naffziger*, GSM.

January 27, 2025: TBD

February 15, 2025: Saturday Lab, 10 am - noon. Macalester College. "The Crystallography of Common Rock Forming Minerals." *Jeff Thole*, Geology Laboratory Supervisor and Instructor at Macalester College.

NOTE: If you have rocks and minerals you would like Jeff to analyze, please bring them to the prior January lecture. We will pass them on to Jeff. With your specimen, include your name and the location where the specimen came from.

February 10, 2025: "Soils." *Holly Dolliver*, Ph.D., Department Chair of Plant and Earth Science, U. of Wisconsin, River Falls.

February 24, 2025 Zoom Lecture): "Greatest Mass Extinctions in Earth's History." *Rachel Phillips* (GEO GIRL), Postdoctoral Researcher and Instructor, University of South Carolina.

March 10, 2025 (Zoom Lecture): "Mining." *Joyashish Thakurta*, Ph.D. Research Manager, Natural Resources Research Institute.

March 24, 2025: "Earthquake Hazards." *Stephan Delong*, USGS, and Adjunct Prof, University of Minnesota.

April 7, 2025: "Ancient Seas, Modern Thrills!: Journey Through Minnesota's Paleozoic Geology." *Andrew Retzler*, M.Sc., Phanerozoic Geologist, Minnesota Geological Survey.

April 21, 2025: "Stromatolite Morphology and Diversity - How did (mostly) brainless pond scum build large, complex structures?" *Julie K. Bartley*, Gustavus Adolphus College.

May 5, 2025: Spring Banquet. U Garden, 2725 University Ave. SE. Minneapolis. Dinner 5 - 7pm. Lecture at 7 pm. "Bemidji and Bemidji West (Pearl Harbor)." *Jared Trost*, USGS.

Rock Hammer Awards 2024

Periodically, the GSM Board chooses members who have made exceptional contributions to GSM and awards them a rock hammer as a sign of appreciation. These are exceptionally nice Estwing hammers. This year, the Board elected to award three hammers, which have been presented in person to the honorees at recent GSM lectures.

Dave Wilhelm and Dan Japuntich (Mark Ryan)

Dan Japuntich has been a Board Member (and will be again starting January 2025); served as State Fair Chairperson; helped with Dino Fest 19; and led the rewriting of our Operations Manual. While State Fair Chair, Dan helped update the State Fair booth by adding pictures, posters, and doing the logistics of the booth's layout. At times he has stored the State Fair booth and materials at his house, saving us the cost of a rental unit. Our rewrite of the Operations Manual updated it to current GSM policies & practices and clarified the duties of each role. During this process, Dan and his wife Dorthy hosted many meetings at their house (and provided tasty snacks).

Dave Wilhelm and Becky Galkiewicz (Mark Ryan)

Becky Galkiewicz has been a Board Member, including Secretary. Until quite recently, her focus over many years has been the GSM's Marker Project. These Markers are located all over the state, most dating back many decades, and are cited in the book "Minnesota History Along the Highways: A Guide to Historic Markers and Sites." Becky led the effort to develop a database of these markers, soliciting our members to supply descriptions, GPS coordinates, and photos of these markers. All this information is now available on the GSM website, so the marker information is readily available to the Minnesota public and its educational communities.

Dave Wilhelm and Mary Helen Inskeep (Dave Wilhelm)

Mary Helen Inskeep has been a Board Member, including Treasurer; written articles for our Newsletter; helped with our silent auctions; as well as working on the Marker Project. In 2014, Mary Helen was the chief editor as we revamped our by-laws to fit with current practices and to tighten up the language; Currently, Mary Helen is leading an effort to help GSM attract a younger and more diverse membership. To that end, she has created a "Meet Up" group online; you can find it by searching for 'Geological Society of Minnesota' on https://www.meetup.com/, check it out. Mary Helen is our "Go-To-Person," if we need something done, she will try to find a way to do it!

submitted by Dave Wilhelm

"THE RIVER RUNS THROUGH IT"

On 18 September, fourteen GSM members and guests toured the University of Minnesota (UMN) St. Anthony Falls Laboratory (SAFL). SAFL is just under 5,000 m² and home to laboratories for fluid mechanics, energy, the environment, and more. For many of the participants, this was their first time in the facility. The 90-minute tour was led by SAFL's Communications Director, Bridget Mendel.

One thing that makes this facility unique, is the interdisciplinary nature of the research. Teams include members from the College of Science and Engineering, the College of Food, Agricultural and Natural Resource Sciences, and the Department of Bioproducts and Biosystems Engineering among others. Over its 85+ years, the facility has performed more than 500 major research projects. The personnel consists of 15 faculty members, 39 staff and 46 students (please see links in references). Having participated in joint research programs in both academia and industry, I have seen the unique strength of cross-disciplinary teams translating basic science into practical engineering applications. According to the SAFL website, a high percentage of graduates move on to work in industry.

HISTORY: The power of the falls has drawn people here from the time of the area's earliest inhabitants. Native Americans in Minnesota and the Great Lakes region can be traced back ~10,000 years (that's more than twice as old as the pyramids in Egypt). A number of nations have inhabited the larger areas including the Ho-chunk, Ojibwe, Dakota, and Meswaki; and the entire length of the Mississippi River Valley extending from the Driftless area northward to the falls was full of villages. The Dakota called the falls "Owámniyomn," a name associated with the water sprit, Uŋktehi.

The Englishman Jonathan Carver (of St. Paul's Carver Cave fame) visited in 1776 and noted that the Dakota had painted a large effigy of the water spirit near the site of the falls. In the modern era, the power of the falls was initially used for the sawmills and grain mills – industries that helped establish Minneapolis as a major milling center.

SAFL is located on the East Bank of the Mississippi River in downtown Minneapolis (Figure 1). SAFL was among the structures built around the Twin Cities by the depression-era Works Progress Administration (WPA) in the late 1930s. The SAFL facilities were the vision of Lorenz Straub who earned the nickname, "The River Doctor," for his ability to understand and manage river engineering problems around the world. Straub designed not only the lab, but also all of the equipment needed for its research. The "Hydrologic Laboratories," as they were then called, were dedicated on 17 November 1938; and according to a history of SAFL by Barbara Heitkamp, Straub became the facility's Director in 1942.

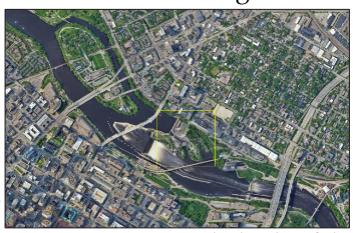

Figure 1. SAFL on the banks of the Mississippi River in Minneapolis. (Google Maps; downloaded 17 October 2024)

The facilities were overhauled between 2012 and 2014. Upgrades and additions included better control of water flow in the Main Channel, modern fluid and sediment controls, the EcoFluids Laboratory, and a Bioflume facility which allows researchers to view experiments in real time.

Wind energy has emerged as one of the most competitive renewable energy sources in recent decades. In addition to the Minneapolis site, SAFL has a 2.5 megawatt wind station in Rosemount. Together with the wind tunnel at the falls, these facilities enable researchers to tackle a broad range of wind energy problems. One important topic is to understand how turbulence affects power generation. For more details, please see the EOLOS website listed in the references.

ENGINEERING THE FALLS: The area around the facility is quite complex from an engineering perspective (Figure 1). The Army Corps of Engineers is responsible for maintaining the waterways of the Mississippi River. The immediate area around the falls contains the spillway, locks, dams, a hydroelectric plant, and SAFL.

Each needs its own flow to fulfill its purposes.

In order to reach to SAFL, one must pass the power structures of the Xcel Energy (Northern States Power) hydroelectric plant (Figure 2). The plant stands on a pier of the old Pillsbury A Mill. The first power plant was built in 1881, and it was the first commercial hydroelectric plant in America. For comparison, the world's first large electrical plant, Tesla's Niagara Falls N.Y. facility, was built in 1895. Today's plant, the third at the Minneapolis site, was built in 1908 by the architect, William de la Barre, who also was the inventor of steel roll oat milling at the Washburn-Crosby Mill.

Figure 2. Xcel's power plant structure is located on the pier of the old Pillsbury Mill next to SAFL. (John Foley)

The cataracts of St. Anthony Falls and Niagara Falls have much in common. About 10,000 years ago, outflow from Lake Agassiz formed River Warren Falls in St. Paul, similar to today's Niagara Falls in width and height. These falls were estimated to be 2,700 feet wide (vs. 2,200 feet for Niagara) and ~180 feet high (vs. ~170 feet; Parker and King, 1998). With the recession of those Minnesota River Falls to where they dissipated just beyond what is now the airport where the limit of the hard limestone was reached, St. Anthony Falls began their retreat from Fort Snelling.

The hard limestone of St. Anthony Falls and Niagara Falls is underlain by softer rock which erodes and undercuts the limestone above which eventually collapses. In this way, the rivers are both receding upstream. In the case of St. Anthony Falls, the Corps stabilized the falls with a concrete "apron" just about ¼ of a mile before reaching the end of the limestone around Nicollet Island. If this limestone cap had been compromised (and it may still happen one day), the St. Peter Sandstone would rapidly erode away, changing the fate of the river (Anfinson, 1995).

THE TOUR: Our group gathered outside on a walkway between the swirling waters of the Xcel Energy hydroelectric plant and the falls themselves. Before entering, we heard about the history of the facility dating back to the Great Depression era.

Figure 3a. The SAFL Outdoor Stream Lab as seen during the GSM visit. (John Foley)

Figure 3b. Outdoor Stream Lab showing how different water courses can be engineered with different configurations. (SAFL website)

Below us was a nondescript field that to the uninitiated looks like little more than an overgrown yard. It is however the facility's state-of-the-art Outdoor Stream Lab (OSL) where they study the processes of rivers and their environment (Figure 3).

At the OSL, researchers can test various plant communities, flow rates, etc. to study the reciprocal interactions of water and environment. This allows for a unique combination of laboratory and field research. Importantly, the OSL allows sunlight, weather, and water flows to drive natural processes allowing for more "real-world" data collection.

We entered the facility on the 3rd floor. To the left of us, behind a large glass wall, was the enclosed Main Tunnel carrying a portion of the river flow through the building. Our guide pointed out that most people are disappointed upon entering at not being able to see the flow directly. I was reminded of watching salmon through a glass wall as they migrated up fish ladders along the Columbia River; you will not see the water flowing by on its way to the research areas, but it is there.

Next, we passed through the office area with its research posters on the walls and into the original auditorium. Our guide, Bridget Mendel, shared that most of the facilities have been upgraded over the years. However, the Straub Memorial Library, where members of GSM can attend the monthly SAFL lectures, has been kept original, right down to using chalk for the blackboards. This preservation is out of respect for the SAFL founder, Lorenz Straub, who is still highly regarded to this day (Figure 4).

Figure 4. Lorenz Straub with a model of his design for the laboratory in 1937 during construction. (SAFL website)

We next moved to the research areas of the building. There was no research taking place during the tour on any of the floors during our visit. However, just seeing the physical scale of the inside facilities in person was impressive. This felt like a deceptively large building to me. The remainder of the floor was dedicated to wind research. In addition to hydrology, a range of other environmental flows are studied at the lab. The wind tunnel allows researchers to study the impact of wind on the environment as well as other practical engineering solutions such as wind turbine efficiencies, noise abatement, and impact on wildlife (Figure 5). One interesting application is to develop small-scale industrial wind power generation in addition to large scale farms that require energy transport to the point of use.

Figure 5. SAFL Communications director, Bridget Mendel discusses the wind facility. The wind chamber is the large white chamber behind the club members. (Dave Wilhelm)

We then toured the area where researchers study the impact of differing water flow and substrate conditions to better understand how rivers interact with their beds (Figure 6). During our tour, it was being refitted for a new experiment, but you could still see the debris patterns left behind from the previous experiment.

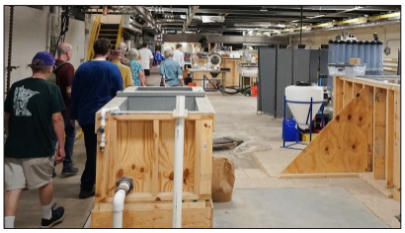

Figure 6: A partial view of the very long experimentation floor. (Dave Wilhelm)

The lowest floor of the facility (Level 1) once served as a quarry for the dolomitic limestone used in the building masonry. When the floor floods at high river levels, fish and people can swim or kayak in from the river (Figure 7).

Figure 6b: A large channel simulation device with dyes and other materials. (Dave Wilhelm)

What is the future for the lab? The EPA has announced that it is partnering with UMN and the University of New Hampshire to support the nation's water infrastructure and to protect water quality. The Centers of Excellence for Stormwater Control Infrastructure Technologies will be one of the first national stormwater centers. The new center will conduct cold climate stormwater research and provide technical assistance to governments. Cold environments present unique challenges for the environment.

Figure 6c: A cross section of sediments from a previous experiment. (Dave Wilhelm)

"Stormwater causes flooding in our streets and ditches, and contributes pollution to our lakes and rivers," said Andy Erickson, research manager. "In cold climates, like Minnesota, this problem is exacerbated by spring snowmelt, freeze/thaw cycles, and road salt. We are building a team of national stormwater experts who experience these challenges with the rest of us." Please see website for more information.

Figure 6d: An ode to Joan Miro. (Dave Wilhelm).

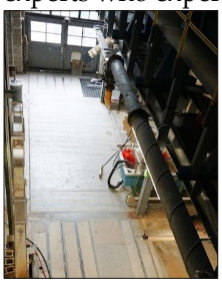

Figure 7a: The bottom floor of SAFL that has been known to flood during high water. (John Foley)

CONCLUSIONS: The tour was very popular with the attendees. A common feeling among members was that one cannot really get a sense of the scale of the facility without seeing it on the inside. Overall, I was left with a sense of how forward-looking Straub was when he designed the building over 86 years ago; it still serves as a state-of-the-art facility in today's more technologically advanced world.

Bridget explained that outreach is one of the core missions of SAFL, and they encourage people to learn more about its history. Public tours take place regularly. Groups are welcome and are asked to schedule their visit as the number of participants is limited. Please see the website or contact Bridget for more tour information.

For more of Dave's & John's photos of this tour, see: https://t.ly/hgOSc

Figure 7b: Dolomitic limestone bedrock forms the lower walls of SAFL. This stone was mined on site to build the laboratory. (John Foley)

Figure 7c: The WPA plaque is mounted at the entrance to SAFL. Below is a 1989 award from the American Water Resources Association for Outstanding Water Achievement. (John Foley)

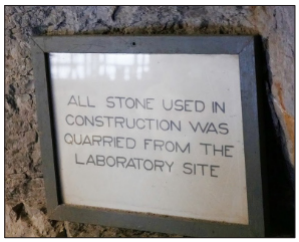

Figure 7d: The sign reads: All stone used in construction was quarried from the laboratory site. (Dave Wilhelm)

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Anfinson, John O., 1995. The Secret History of the Mississippi's Earliest Locks and Dams. Minnesota History, Summer, 1995. Pp. 254-267. A great introduction to the Army Corps' projects in the region from St. Paul District historian for the Corps.

Heitkamp, Barbara, 2017. "The Lab on the River: The St. Anthony Falls Laboratory at the University of Minnesota." Open Rivers: Rethinking The Mississippi, no. 6. DOI: https://doi.org/10.24926/2471190X.2753.

Parker and King. 1998. Engineering the Falls: The Corps of Engineers' Role at St. Anthony Falls. Very interesting review of the natural history of the river and Army Corps engineering efforts. A description on the recession of the falls from the junction of the Minnesota and Mississippi Rivers 12,000 years ago to their present location gives a real sense of the dynamic nature of the falls.

Newton H. Winchell, 1872. Geological and Natural History Survey of Minnesota. Vol 1. University of Minnesota.

WEBSITES:

- SAFL staff and faculty: https://cse.umn.edu/safl/safl-affiliated-faculty
- EOLOS Wind Energy Research Consortium: https://eolos.umn.edu/about
- Cold Climate Center of Excellence for Stormwater Infrastructure Technology: https://wrc.umn.edu/news/stormwater-centers-excellence

OTHER READING THAT MAY BE OF INTEREST:

•. Leaf, Sue, 2020. Minnesota's Geologist: The Life of Newton Horace Winchell. University of Minnesota

Press.

•. Huber, Molly 2014. Electric Pioneer: Harnessing the Mississippi for Power in Minneapolis. One page review of the Minnesota Brush Electric Company and the main players in building the first hydroelectric plant. MNopedia 4 Sept. 2014.

• Carver, Jonathan. Travels Through the Interior Parts of North America, In the Years 1766, 1767 and 1768. Ross and Haines, Inc. 3rd edition (1956). First-hand account of the region from an exploration of the region. A good description of the falls and the indigenous peoples of the region. pp.59-74.

• Cofer, Dawn. Pilot Knob/Oȟéyawahe: A new spelling for an old name. Pilot Knob Preservation Association. Posted on September 21, 2017.

• White, Bruce, 2016. "Minnesota's Disappearing Mounds." Bruce White. MinnesotaHistory.net posted 22 Sept 2016.

• Birmingham and Rosebrough, 2017 Indian Mounds of Wisconsin (2nd ed.). University of Wisconsin Press, Madison, WI, USA.

John Foley
Photos by John Foley and David Wilhelm

GSM Annual Meeting

GSM's 2024 Annual Meeting was held September 16 at U Garden Restaurant in conjunction with the Fall Banquet and the first lecture of 2024-2025. The main business of the Annual meeting is elections for the GSM Board, which consists of nine Directors who have a special interest in advancing the goals of our society, which include lectures, field trips, and community outreach. Our bylaws limit the terms of Board members to four consecutive years. We do that to encourage a turnover of perspectives and ideas.

Of the nine current members, Pete Hesse will be leaving the Board at the end of 2024, as he has served the maximum of 2 consecutive 2-year terms. I want to thank Pete for his service to GSM. Prior to the meeting, Dan Japuntich expressed his willingness to again serve on the Board. Three other Board members, Dick Bottenberg, Kate Clover, and Steve Willging), are completing one 2-year term and all are willing to serve a second term. They all explained their background and why they were willing to again serve on the Board. Since there were no other nominations, we voted by acclamation to elect these members to our Board. Their terms start January 1, 2025.

Looking ahead, three Board members will have reached their term limits next year, so we will be looking for their replacements. Please think about joining the Board next September. Non-officer positions on the Board do not involve a great time commitment – just four two-hour meetings per year, plus a bit of prep time before each meeting. We typically meet at 6:30 PM on the second Thursday of February, May, August, and November, recently at U Garden Restaurant. However, the Board can change the date and location to accommodate Director's availability. These meetings are open to all GSM members. See our website for specifics. Consider sitting in on a Board meeting to see how they work and if joining might be for you.

Dave Wilhelm

GSM Floyd County Iowa Fossil and Prairie Park Field Trip

On Saturday September 8, 2024, Stephen Willging and Roger Benepe led a group of 14 GSM members on a field trip to the Floyd County Fossil and Prairie Park located just west of Rockford, Iowa, about a 2.5-hour drive from the Twin Cities.

Floyd County Fossils and Prairie Park Entrance marker about 1 mile west of Rockford, Iowa on Floyd County highway B47. (Stephen Willging)

It was a nice sunny day. On arrival, Stephen gave everyone a short introduction to the park's history and showed examples of Devonian fossils that can be found in the park. Then everyone started looking, and we all found numerous fossils. Even a friendly toad was caught in the act of looking for fossils.

Stephen Willging giving some of the GSM field trip participants an introduction to the fossils that can be found in the park. (Lowell Hill)

The Floyd County Fossil and Prairie Park www.fossilcenter.wordpress.com is located about 1 mile west of Rockford, Iowa on Floyd County highway B47. The park encompasses the site of the old Rockford Brick and Tile Company clay quarry which was purchased by the Floyd County Conservation board in 1990 and opened as a park in 1991. The Rockford Brick and Tile Company manufactured bricks and drain tiles for 80 years at this site. The bedrock clay deposit in this area was near the surface and was recovered by open pit mining. The park allows fossil collecting but asks that you take only for a personal collection. Fossil reselling is prohibited. In addition to fossil collecting, the park has numerous walking trails through restored prairie and wetlands where one can find numerous prairie flowers in bloom. A couple of the kilns remain on site. The park has a visitor center with fossil and wildlife/prairie displays, picnic shelter and restrooms (modern and rustic). 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).

A toad joined the GSM field trip. (Stephen Willging)

At least three types of Brachiopods occurring in the park near the parking lot. (Stephen Willging)

Geology of the Floyd County Fossil and Prairie Park

The bedrock exposure in the park is part of the Lime Creek Formation of the late (upper) Devonian Epoch,

One of the walking paths in the prairie section of the Floyd County Fossil and Prairie Park. (Stephen Willging)

Canada Goldenrod (Solidago canadensis) in bloom in the prairie. (Lowell Hill)

Coreopsis (Coreopsis palmata) is one of several wild flowers blooming in the prairie portion of the Floyd County Fossil and Prairie Park. (Lowell Hill)

Prairie Ragwort (Senecio plattensis) yellow flowers and Rough Blazing Star (Liatris aspera) purple/pink flowers were also blooming in the prairie. (Lowell Hill)

Historic Kilns used to fire bricks and drain tiles at the old Rockford Brick and Tile Company at the present-day Floyd County Fossil and Prairie Park. (Lowell Hill)

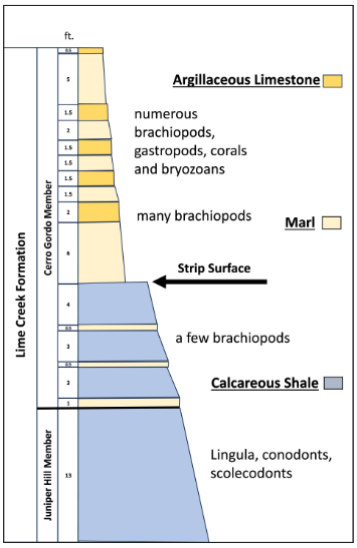
381 – 373 million years ago (Wicander and Playford, 1985). This formation was deposited during the seventh and last Devonian age transgression-regression episode in what is now Iowa. The Lime Creek formation is divided into three members: Juniper Hill, Cerro Gordo, and Owens members. About 13 feet of the Juniper Hills member and about 35 feet of the lower to middle Cerro Gordo member are exposed in the park. The Rockford Brick and Tile Company mined both the Juniper Hill and the lower third of the Cerro Gordo members.

The layer that is uppermost at the quarry today, the Cerro Gordo member, is made up of three intervals of shale with different colors, quantities of limestone beds, and fossil content. The lower 25 ft of the Cerro Gordo is made up of shale with interbedded argillaceous (clay containing) limestone units. The top 10 ft layer of the Cerro Gordo in the park is a pale yellowish calcareous shale or marl which is extremely fossiliferous. The uppermost two thirds of the Cerro Gordo member was removed as overburden, and placed in dump piles.

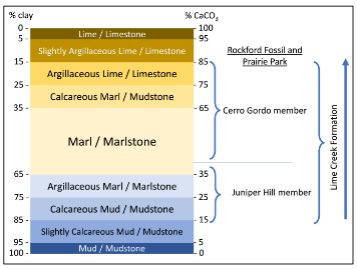
The Cerro Gordo member is one of Iowa's most fossiliferous deposits. It is notable for the preservation and diversity of its fossil fauna. Nearly 200 species of macro and micro fossils have been collected and described from this formation (Anderson, 1998; Bunker, 1995; and Groves, 2008). Invertebrate macrofossils are abundant. There are numerous well-preserved shelly invertebrates such as brachiopods (most common), gastropods and bivalves. Colonial and solitary corals, bryozoans, and fragments of crinoids can be found. Less common are nautiloid and ammonoid cephalopods. Many of the macrofossils show evidence of epibionts, which are animals such as worms, bryozoans, corals, and sponges anchored and growing on brachiopods, corals and gastropods (Briggs, ed. 1987).

The Juniper Hill member is a medium gray calcareous shale and mudstone containing less abundant and diverse fossil fauna. Fossils in the Juniper Hill member primarily consists of brachiopods and pyritized plant remains. Devonian shark or ray teeth have been reported.

Roger and I want to thank Lowell Hill for his photography documenting the trip.



Stratigraphic column of the exposure in the Floyd County Fossil and Prairie Park. Adapted from J.N. Rose 1967 (see references) (Stephen Willging)



This diagram shows the nomenclature as one moves from a mudstone (100% silt and clay) on the bottom to a limestone (100% calcium carbonate) on the top.

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Stephen Willging

2024 State Fair Setup and Teardown

Tuesday August 20th dawned slightly cloudy and cool, as four people gathered at our storage unit at 10 am - Extra Space Storage at University and Transfer in St. Paul. Patrick Pfundstein is the State Fair coordinator, and he came by bike. Kate Clover, Dick Bottenberg and I each arrived by car. Each of us had cleared out our cars to take the various materials to the Fair Grounds.

State Fair 2024 Set up Crew. (l to r) Patrick Pfundstein, Deb Naffziger, Dick Bottenberg and Kate Clover. (Patrick Pfundstein)

The Fair has streamlined many things this year. No car tag was needed to enter the fairgrounds. That made things a lot easier.

We removed the middle seats from my van, to make room for the frame for the rear of the booth and carpet - the longest things that are most difficult to transport. After futzing a bit, they were wedged into my van, and the rest went easily and quickly. We took the tables, boxes of rocks, and supplies, chairs, fans (necessary for those hot days), and banners.

Two cars left for the fair, my van with most of the 'stuff,' and Dick Bottenberg's with the rest and the other people. Actually, we could have gotten all the 'stuff' in my van, but we used 2 cars because with all the 'stuff,' there is no room for another person in my van. There was barely room for me.

Once at the fairgrounds, we drove to the Education Building, and with my handicapped tag and luck we got two spaces right in front. We started with the frame and carpet. Patrick and Dick put down the carpet, as Kate and I unloaded the rest. We were placed next to the Minnesota Genealogical Society. Both concerned with old stuff, but ours is older by far.

The carpet is getting old, so maybe we should replace it, or clean it. It was okay for this year, though. The frame went up, and I brought more material in. We managed to borrow a hand truck (through miscommunication we left Patrick's at the storage site), for the heavy boxes of rocks. Unloading was done, and we set the booth up quickly. Four people make it go really fast. We were done by 12:30, which might be some sort of a record. Patrick had a list of extra things we needed: extension cord, tape, name badges, another book etc. He returned on Wednesday to finish it all.

We took several pictures, of us volunteers, of the booth all set up, and the booth covered up for reference for those who will work the booth. We congratulated ourselves for doing a good job.

We returned to the storage unit to get Patrick's bike and my car seats. Everything was put back together, and we went on our separate ways. The cool day was a blessing that made it lots easier.

State Fair Teardown

Tuesday September 3rd was sunny and temperate at 10 am as I met Patrick Pfundstein at the storage place. We went in and put my middle seats and his bike in the empty storage bay, took his hand truck, and headed out to the Fair. Getting in was a bit of a maze, as trucks were parked in the middle of the street and we had to go around Robin Hood's barn to get to the Education Building. But we made it.

The handicapped spot was taken, and they said it didn't count on teardown. I said – yes, it does, because I have a tag and need the space. We parked next to it. I disapprove of people who use handicap spaces without a permit. (End of rant.)

Teardown is always quicker because there is nothing to set up, just tote the stuff back to the storage unit. I had been worried, but Patrick was Superman and did all the heavy lifting (literally), and I managed the lighter stuff.

Patrick had already packed the booth up and all was ready for transport. We put the frame and carpet in first, and the rest went quickly. We managed to get it all into my Sienna, and I was happy—so was Patrick. He squished and made it into my front passenger seat (see photo) and we made our way back to the storage unit. I guess I can get a person in if they are willing to be a contortionist, which is appropriate for the fair, I guess.

Unloading was pretty quick and less than 2 hours after we started, it was done! Boy that was good. We put the middle seats back in, and off I went. Another state fair done by the group! Back again next year…

Deborah Naffziger

GSM at the 2024 State Fair and Minnesota Mineral Club Show

First at the State Fair, Minnesotans got together and then dispersed, the last aromas of donuts and pronto pups were gone with the summer breezes, and the table rocks were packed away for the winter. Then, the Minnesota Mineral Club (MMC) Annual Mineral, Rock, and Gem Show came and went. With all of this, GSM volunteers pulled off the two largest public outreach events of our year!

The GSM booth at the State Fair is a large undertaking involving space rental, brochure composition and printing, dozens of GSM volunteers to staff the booth, and set-up/teardown before and after the Fair. The State Fair Committee thanks Steve Erickson and Dave Wilhelm for the essential prep work for the lecture brochure. Deborah Naffziger, Kate Clover, Dick Bottenberg and your intrepid reporter set up the booth; and Deborah and I managed (with the assistance of some human origami) to fit everything back into her van after the Fair was over.

We were a bit lighter on shift volunteers than last year, but fortunately several members stepped up with multiple shifts to fill critical gaps (and thus avoid cancelling the booth). Possibly the star in that regard was Jim Mirick who covered three solo shifts by himself, but thanks to all of you who came out made this happen. We handed out thousands of brochures, talked to thousands of people, and the success was immediately reflected with several first time attendees at the Fall Banquet Lecture.

Roger Benepe (l) and Lowell Hill (r). (Patrick Pfundstein)

The Mineral Club show at the end of September is different in many ways: shorter (2 days and only 13 hours in total), and more focused on our specialty. Given the space/infrastructure/support supplied gratis by MMC, set-up and teardown was done with a backpack and bike trailer instead of motor vehicle. The show was held in the Dairy Building on the Fair grounds, and with easy, on-street parking, the event was well attended.


Jim Mirick (l) and Gene Ollila (r). (Kate Clover)

All MMC volunteer shifts were covered, which given the geo-centrically interested crowds meant lots of great conversations about lectures, markers, and rock identification. Included on the MMC roster is new GSM Member and retired geologist, Roger Sharpe. Thanks for jumping right into the action, Roger, and welcome to the group! GSM has shared members with both of our Show Neighbors (MMC and the Science Museum), and it was fun to see some folks multi-tasking their time and expertise.


Dan Japuntich (sitting) and Terry Mackin (standing). (Patrick Pfundstein)

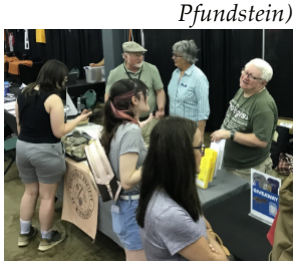
To sum up, I send a deeply grateful GSM thank you to the following volunteers for making these critical public appearances a success. It literally would not be possible without you, and GSM might possibly not be sustainable without these public recruiting efforts. Major hat tip to all, my friends! To decode the list, underlined means folks who worked both State Fair and Mineral Club, and bold is multiple shifts within one or both of the events.


Stacy Schulz and Dan Dee. (Patrick Pfundstein)


With two loads using Salty (Patrick's bike) and the trusty Burley Travoy trailer, everything was on site. (Patrick Pfundstein)

Roger Benepe, Dick Bottenberg, Denise Cumming, Kate Clover, Jean Doyle, Steve Erickson, Joan Furlong, Robert Galkiewicz, Lynne Grigor, Elaine Handelman, Elaine Heisterkamp, Peter Hesse, Lowell Hill, Ken Holmbeck, Janet Hopper, Mary Helen Inskeep, Frank Janezich, Dan Japuntich, Myron Kasch, Alfred Kauth, Roxy Knuttila, Terry Mackin, Jim Mirick, Deborah Naffziger, Mark Nupen, Eugene Ollila, Thomas Ostertag, Patrick Pfundstein, John Renwick, Mark Ryan, Cindy Schneider, Stacy Schultz, Roger Sharpe, Alan Smith, Kay Smith, Randy Strobel, David Wilhelm, Stephen Willging.


GSM Table set up at the MMC show. (Patrick Pfundstein)


(l to r) Steve Willging, Kate Clover and Roger Sharpe engage with MMC visitors. (Patrick Pfundstein)

My Trip to Winona

Monday August 5th was overcast and rainy. I set out to Winona to pick up many copies of a book from Dr. Sally Sloan, the widow of Dr. Robert Sloan, Professor of Paleontology at the University of Minnesota from 1953 to 1997. Dr. Sloan taught me geology at the U long ago, and I was happy to get his books for donation to GSM as a labor of love.

The rain stopped before Red Wing and it was just cloudy after that. I stopped for cheap gas in Red Wing—somehow the gas there is always cheaper.

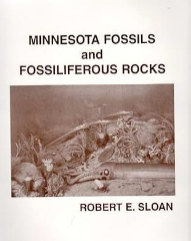
Highway 61 is a wonderful drive along the winding and tree-lined Mississippi River. I love driving it, and had a wonderful time down and back. Going down, I stopped at the Lake Pepin geological marker. It is not dated, but there was a plaque below it dating to 1939, so this was one of the first things GSM did after our founding. This made me feel proud. I looked at the lake and thought about what the marker said.

A few miles past the roundabout at Highway 43 in Winona, I turned in and found the house easily. I arrived a little after noon, and Dr. Sally was there to greet me. She opened the garage, and I saw the book boxes. I tried to lift one, and it was way too heavy for me. So we went back inside and she called a neighbor to help us load them into the car. The house is 70 feet wide and has full length windows looking out over the river. We saw a cruise ship go by. It is a lovely place, and there are good rocks by the front door.

As we waited, we chatted. Dr. Sally started at the University of Chicago at the age of 15. She had to take a course to conform with Illinois High School graduation requirements, but otherwise she had no problems with the University curriculum. She met the love of her life and her future husband in a shooting club at the University. She and Bob did competition target shooting all their lives, and both were crack shots. They eventually married, and she had their first daughter at the age of 19. She encountered a lot of resistance to her gender in academia, but persevered and got her doctorate in Mathematics while raising a family, and Bob got his in paleontology. They eventually moved to Minnesota, and they lived here for the rest of their lives.

The book is Minnesota Fossils and Fossiliferous Rocks by

Robert E. Sloan, 2005, self-published, a compilation of 52 years of hunting fossils all over Minnesota, some for the Minnesota Geological Survey. It is copiously illustrated with maps, charts, and graphs, and there is a lot more here than 'just' fossils. He was up-to-date with geological information. The Introduction covers fossils, geologic time, stratigraphy, plate tectonics, evolution, classification (with a nifty graph of the various families of animals of the planet), and how to prepare fossils. There are pictures of Precambrian fossils found in Minnesota. The rest of the book deals with fossils of various episodes in Minnesota, with detailed descriptions of the environment they lived in, where Minnesota was on the planet at that time, and pictures. The eras covered are Late Cambrian, Early Ordovician, Late Ordovician, Devonian, Cretaceous, and Pleistocene. Most of those times, Minnesota was under an intercontinental sea. Episodes of seashore emergence due to sea level drops meant there were no fossils preserved during those times. So Minnesota's geological record is intermittent, but still leaving plenty to explore.



One caveat: the places Sloan describes may or may not be accessible at present. Also, property rights have changed a lot, and so if you go to find fossils from the book you MUST obtain prior permission to collect before you go out. Roadcuts may be on private property, and collecting in some counties requires a permit. So read the book, and enjoy the pictures and the rest, but if you go out, you have to do research and plan beforehand.

There is a graph on page 183 that details a lot of interesting things, such as O2 saturation, oceanic crust production, global temperature, and magnetic reversals. This diagram dovetails so much stuff, it's amazing. I was reading another book, and turned to this graph to help me understand.

This is an invaluable reference book for all those who are interested in fossils in Minnesota. GSM now has eight big boxes of the books, and we are distributing them for a donation to GSM. Enjoy.

Driving back, I stopped at Lock and Dam 5 just north of Winona. I know a lot about this lock because a colleague grew up there—his father managed the dam. I heard a lot of stories about the place from him. I looked at the Geological Marker there, dated 1960. Again I was happy I belonged to an organization that had worked to put all these markers up. (Check the website for a list and directions to them all.)

On the way home, I got more cheap gas in Red Wing, and by Hastings it was raining again. Not really hard, just a steady light rain. I left shortly after 9 am and got back home after 4 pm, and that included stops and dawdling. A good day indeed, and I got the books.

Deborah Naffziger

DinoFest at the Science Museum

On Saturday August 3, 2024, Dave Wilhelm, Alfred Kauth and I were at the Science Museum of Minnesota (SMM) to showcase GSM, and the wonderful rocks we have, as part of the SMM DinoFest.

The Science Museum is an awesome institution, and the newest location is along the river bluffs in downtown Saint Paul. The entrance is on the 5th floor, and the floors go down to the ground below. Levels 5, 4, and 3 are the main exhibition floors, and level 2 is classroom space. The 5th floor has the Collectors' Corner, fabulous views of the Mississippi River, the Omnitheater entrance and the gift shop. I recommend the gift shop because they have interesting things you don't see elsewhere, and you might even find a bargain—as I did.

We set up at a table on the 3rd floor, where most of the activities were happening. There was a Mosasaur 'swimming' above us and a rock wall of plants on the way to becoming coal behind us. Our table was beside the people of the Science Museum who went out and collected the dinosaurs. They had bones and a replica of a skull. But despite that distraction, we garnered many people at our table and talked about GSM and the amazing rocks and fossils we brought.

Steve Willging showing museum visitors Minnesota and Iowa fossils. (Mark Ryan)

Of course, we brought the standard State Fair Rocks, and they were a hit, especially the magnets and magnetic ores. The kids really loved trying out the magnets on the rocks and seeing which were magnetic. We had the oldest (Morton Gneiss 3.5 billion years old) and the youngest (Glacial conglomerate, about 10,000 years old) next to each other. There was a piece of mica that's shiny and somewhat golden, and most thought it was fool's gold—pyrite, which it wasn't and they said, oh yes, after they picked it up and found it too light to be pyrite. The cephalopod piece was also well received, especially with the picture that accompanied it. And the stromatolites were also a big hit. Theresa Tweet had sent a box of samples which were also well received - Ordovician fossils from Ohio, and a claw and horn from dinosaurs.

Deb Naffziger and Alfred Kauth staffed the GSM table at SMM's Dino Fest. (Mark Ryan)

One thing we could offer was hands-on exploration. Many people young and old came and petted our rocks. Some youngsters also tried to taste some, and that shows true geological interest. I mean, who among us hasn't licked a rock? (Admit it, you have!) We had marker brochures and handed out about 60 lecture schedules. Many seemed interested in our lectures, and we hoped

we would see some new people come fall.

There were many other exhibitors including our own Steve Willging with some of his magnificent fossils. He was on Level 4 looking down on our exhibit. Macalester, the University of Minnesota and other institutions were present as well as many others. The Science Museum had many presentations which were a hit, if somewhat loud. They opened a cast from a recent dig out on the terrace, but it was not as exciting as they expected as they started at the end, and found lots of dirt. Still the "How to train your dinosaur" demonstration was lots of fun with an actor in a dino suit. It was a fun day and a good time was had by all.

Deborah Naffziger

Dramatic Events in Minnesota's Rocks

Editor's note: The following question came to GSM from member Patrick Branigan. Justin Tweet kindly answered his question.

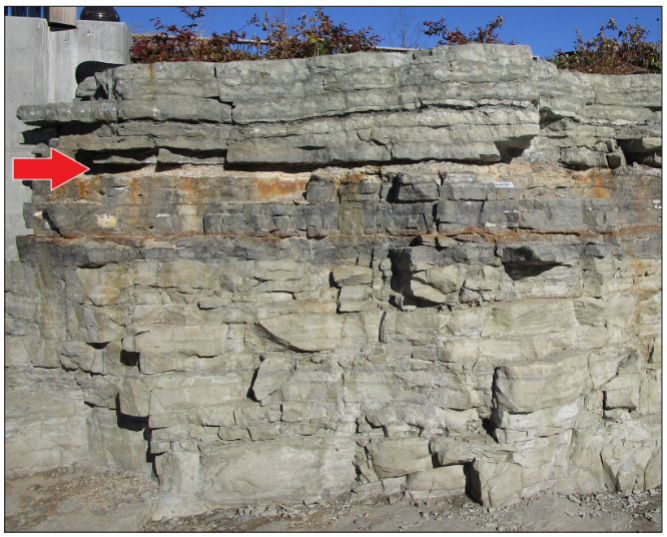
Patrick asked: I joined GSM last winter for one primary reason. I'm curious, is there anywhere in Minnesota that you can view a section of the KT boundary marking the dividing line between the Cretaceous period and the Tertiary period?

Justin Tweet answered: I think I can answer your question about the presence or absence of the KT boundary in Minnesota. Although we do have a fair amount of Cretaceous rocks in the state, they predate the boundary by about 25 million years at least, so we have no locations in-state where the boundary can be found. A little bit of explanation: During the middle of the Cretaceous, shallow continental seas inundated the interior of North America due to various factors (high global sea level plus plate tectonic activity in the western part of the continent producing a downwarp in the midsection, to give the quick explanation). When the sea was at its maximum extent, Minnesota was the coast on the eastern side, so when the sea retreated, Minnesota was one of the first places it left. We have marine rocks from that sea level highstand and some younger rocks from the coastal terrestrial setting that followed, but anything younger has been eroded in the following 90 or so million years. Minnesota just hasn't been much of a depositional basin for hundreds of millions of years, and much of what it may have caught has been eroded away.

Having said that, it's not quite the same as the KT, but if you want to put your finger on a dramatic and "instantaneous" geologic event in the Twin Cities, I can recommend bentonite beds from enormous volcanic eruptions that took place 453 million years ago. At Shadow Falls Park at the end of Summit Avenue, and at Uŋčí Makhá Park, within the Highland Bridge development in Saint Paul, just north of Hidden Falls Park, there is a "cut-in" in the limestone that represents the Deicke K-bentonite. The bentonite was formerly a bed of volcanic ash, maybe a foot or so thick before it was compressed and altered. The volcanic eruption that produced it took place somewhere off the southeast coast of North America, and the layer can be traced over about a quarter of the US, so this was a big-time eruption.

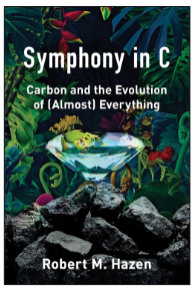
There are pictures that show the layer in a post on my blog: https://equatorialminnesota.blogspot.com/2022/11/quick-guide-to-fossils-at-unci-makha-park.html.

Justin Tweet



The Deicke K-bentonite is found in the notch indicated by the red arrow. It is a former volcanic ash erupted about 453 million years ago during the Late Ordovician, and can be seen in several places in the Mississippi River gorge in the Twin Cities, such as here at Uŋčí Makhá Park in St. Paul. (Stratigraphic details: The bentonite bed is within the Carimona Member of the Decorah Shale, the bluish-gray rocks above the off-gray Magnolia Member of the Platteville Formation in this photo.) (Justin Tweet)

Book Reviews



Symphony in C, Carbon and the Evolution of (Almost) Everything by Robert M. Hazen, 2019 W. W. Norton and Co. New York

The Deep Carbon Observatory (DCO) is a multi-disciplinary group that explores most everything about carbon on Earth. The book details many of the interesting things they have found, and are still working on. DCO started in 2008 and is still ongoing. Hazen was an administrator and guiding light, and his book shows how many useful and interesting things you can discover if you mix and match scientists of different fields and have them work together. This is a somewhat radical idea, as most scientists work in their chosen field, and do not venture outside that. Hazen believes in having scientists working together and letting them cross-pollinate ideas. And in this instance it has certainly worked well.

Why he called it ***Symphony in C*** is interesting. Hazen is a musician, and he uses music as a theme in organizing the book. The title is a musical and geological (elemental) pun, which I appreciated. He views the cooperation among scientists as a symphony, each person 'playing' their specialty but also contributing to a greater whole. I found the musical analogies interesting but sometimes tiresome, not being a musician myself.

But that is a minor quibble. Otherwise the book is a real treat.

Carbon is a unique element. It has four spaces to share electrons, which allows it to make many different molecules that can play many roles. It is the backbone of life, period. The versatility of carbon has led to muscles and tendons and DNA and skin and cell membranes and all sorts of building blocks of life. It is what makes us, us. Carbon can also make diamonds and graphite and with other elements, other minerals as well.

The book is divided into four sections, Earth, Air, Fire, and Water – after the four classical elements. He starts with the Big Bang, then when carbon came into existence, and ends with the origins of life, which are better understood but still not fully defined. There is a lot of history but also cutting-edge modern science. What happens in the deep earth, the molten mantle, molten core, and how much carbon is there was the part I found most interesting. It is frustrating because we cannot go down there (The ***Core*** movie notwithstanding), and so we must infer what happens down there. There are a few places where mantle rocks appear at the surface, and they are studied; but it is a dynamic system, and frozen rocks can tell only so much. What happens at subduction zones, the deep-sea ooze that gets carried down, how much stays down, and how much comes back up? All this is interestingly illustrated in a plate of the deep carbon cycle, and how much is not known is shown. Those plates are really interesting and illustrate concepts well.

He also discusses how the earth has changed over time, with the beginnings of life and how life has altered the planet, and the planet has altered life. If this sounds like the Gaia Hypothesis, it certainly is borrowing ideas therefrom. He even mentions Gaia. But this is less metaphysical and more scientific than Lovelock's work. Not that Lovelock was not scientific. But Hazen has taken those ideas to another plane and made them mostly acceptable to all. Just the evolution of our present atmosphere (those stromatolites ruined it for everyone!), shows how earth is unique in our solar system. It seems that earth may be unique in the universe, but then maybe not. There is an air of optimism throughout the book. Hazen thinks we can work through global warming and help things stabilize, making life better for all.

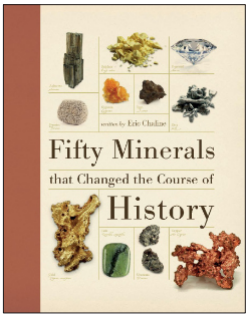
Hazen is my favorite geological author, and this book is another reason. This is the next step after his ***The Story of Earth***, reviewed earlier. Some of his books are not as compelling. ***The Diamond Makers*** and ***The New Alchemists: Breaking Through the Barriers of High Pressure Research*** are solid works detailing those topics, but not as compelling to my mind. Read the ***Story of Earth*** and ***Symphony in C*** and you will have a real solid geological education.

Stuff Matters: Exploring the Marvelous Materials that Shape Our Man-Made World by Mark Miodownik, 2014, Houghton Mifflin Harcourt, Boston, New York.

This book looks at everyday things in a materials engineering way. Miodownik is a PhD materials scientist

who has worked in a variety of places including Sandia National Laboratories, University College Dublin, Kings College London, and University College London. Each chapter explores something that can be seen from his rooftop in London, where he enjoys tea. He weaves in chemistry and physics, but everything is pretty easily understood. My favorite chapter was the one on chocolate, and how it was engineered from a bitter bean to the wonderful sweetness we all know and love. It traveled through several countries and processes to make up the many varieties and uses we have for it today, from the somewhat bitter cocoa of colonial times to the fabulous flavors and varieties we enjoy today. One does not usually think of a food as being engineered, but that's exactly what happened and it's a fun ride following all the innovations.

Another chapter tackles glass, and its many varieties and uses, from natural fulgurites to modern skyscrapers. And lest you think he is prejudiced; he also tackles cement in another chapter. There are ten materials he explores, and then has a chapter on how it all works together. One quibble, he has 'handwritten' illustrations showing various atomic stuff (atoms etc.), and I would rather that he had used proper diagrams, as some are a bit sparse and tough to decipher. But that was the only problem, and otherwise it is a fun and entertaining book that is well written and easy to read. You learn a lot without realizing it, and you get the viewpoint of a materials scientist, which is different from everyday people.



Fifty Minerals That Changed the Course of History by Eric Chaline (2012 Quid Publishing, Hove, England)

If you like anecdotes and some selective history, and not much mineralogy, this is the book for you. You should also be a fan of calcite, $CaCO_3$, because the author has entries for alabaster, chalk, coral, marble, and nacre (pearls). Quartz, SiO_2, only plays a role in four entries: slate, quartz, sand, and flint. There are many entries for elements: carbon (diamond and graphite), gold, silver, uranium, arsenic and so on. But there are also entries for kaolin (the clay which makes porcelain possible), asbestos, pumice, petroleum, and others. He also includes the natural materials amber and ivory, which are not minerals. The blurb says he weaves economic, cultural, political, and industrial history. That he does, but telling interesting stories is what he really does, whatever the subject.

The main thrust of the book is interesting stories about the material he is talking about. But he misses a lot. Diamonds are only for decoration, and he ignores their abrasive and scientific uses such as high-pressure

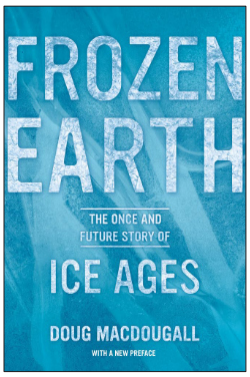
research. The stories he tells are amusing, but there's more to diamonds than Cullinan, Koh-I-Noor, and the affair of the Queen's Diamonds.

Each entry has two, four, six or eight pages with many illustrations and sidebars of quotes and factoids. Read those because you get more good information. You get an idea of the progression of civilization by the materials it produces—or doesn't. You hear frequently how China never produced a lot of glass beyond small beads. That seems to be a great strike against China. And their late use of steel.

There are histories about the 'discovery' of iron and steel, bronze (which has its own entry), porcelain (kaolin), and other useful things humans have created over time and place. He mentions the Americas and China as well as Europe, but little about Africa or South Asia. Like I said, this is selective history.

He tells a good tale, and I found no scientific mistakes, but he leaves a lot out, and that is what makes this book just OK. Not bad, but not great either. For example, the entry on jade is wholly about Meso-America. Jade was important for them, but China used it earlier (Neolithic) and more comprehensively; jade hand axes and such. It is a good book to give someone who is just learning about minerals and science, but make sure to let them know there's a whole lot he left out and steer your young person to more complete works, and also more complete histories.

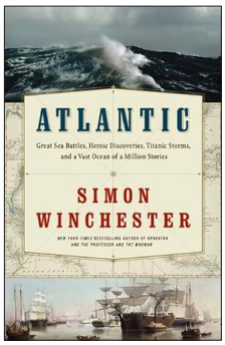
He did books on plants and animals (Fifty ___ That Changed the Course of History) as well, and I expect those are similar to this one - selective history and amusing anecdotes.



Frozen Earth; The Once and Future Story of Ice Ages by Doug Macdougall, 2004, University of California Press, Berkeley and Los Angeles.

This not a new book, but there's lots of good stuff here, and it's worth reading. The first half is a story of people: Louis Agassiz, Jean de Charpentier, Ignatz Venetz, William Buckland, James Croll, J. Harlan Bretz, Milutin Milankovitch, Alfred Wegener. He traces the history of 'discovering' Ice Ages with the people who made those discoveries, and the way theories are proposed, argued, accepted, dismissed, and then resurrected. How Croll discovered the Earth's orbital cycles and then later Milankovitch built upon Croll's work and added new ideas is a good story told over several chapters. And Louis Agassiz was a colorful character and had a varied life for sure.

Macdougall then goes into the past and talks about Snowball Earth and other Ice Age cycles, with emphasis on solar and earth orbit cycles. How various cores (marine, lake, ice) illustrate climate changes and cemented theories into accepted facts. The tables and graphs explain things well, and they made me think. He explores the climate changes in the nearer past, the Younger Dryas, and medieval climate changes as well, and how all this tied into the ice-age cycles and what they bring. This book thoroughly explores Ice Ages, how they affect Earth and those who live on it, and what might be coming in the future. I recommend it for those who like such things.



Atlantic: Great Sea Battles, Heroic Discoveries, Titanic Storms and a Vast Ocean of a Million Stories by Simon Winchester 2010, Harper Perennial, New York.

Winchester is a great author and has written a number of books; ***A Crack in the World*** (1906 San Francisco earthquake), ***Krakatoa, The Map that Changed the World*** (William Smith who made the first geological map), and many others that are not as directly geologic. ***Atlantic*** is as much history as anything, but he weaves in geological and scientific perspectives that makes it more interesting—at least for me. And he has a map at the end of the book from Scotese, a paleogeographer, of Pangea Ultima. What's not to like?

In ***Atlantic***, he starts with the first European explorations of the Atlantic – the Vikings and Basques finding North America and the cod banks off Nova Scotia. Then he discusses the age of exploration with Columbus and that crowd. He details the cross-oceanic trade and has many maps that illustrate what goods went where. Sea battles, trade wars, the cross Atlantic slave trade and more. The great currents that carry sea water around the globe and how the Atlantic has some of the most important ones. Then come undersea cables and plate tectonics. He talks about the fishing crises and where fish aren't dying out. The man is well-versed in many disciplines, and he weaves them all into this book.

How Lake Agassiz changed climate over the Northern Hemisphere is explained. So there's much here to read and digest. There's a lot of plain history but woven in with the science that drove the history, the science of the day and the science of now that affected what happened then. It's a good general science book that is fun to read.

Winchester weaves a good tale and adds a lot of science to explain it all. I recommend this book for those who are interested in the Atlantic and why it is arguably the most important ocean.

Lightning Often Strikes Twice, The 50 Biggest Misconceptions in Science by Brian Clegg, 2022 Michael O'Mara Books, London.

Lightning Often Strikes Twice is one of those compilation books that are a staple in popular science writing. An author does a column and eventually has enough articles to collect them in an anthology and publish them as a book. Asimov did a number of these and though now somewhat dated, they are still

good and fun reads. (I still remember his piece on anti-poisons. Think about it.) Brian Clegg studied Physics at Cambridge University and he may be a scientist, but I found this book disappointing, in places misleading, and other places just wrong.

It is British so be prepared for many Britishisms and weird spellings. But he really needed a good scientific proofreader. The sentence that exemplifies this is in the chapter on the Amazon Rainforest. "The amount of oxygen on the Earth has been roughly constant for around 2 billion years." Sigh. OK, let's break this down. As he is talking about oxygen in the atmosphere, we can assume he means the amount of free oxygen (O2), in the atmosphere. Now my idea of 'roughly constant' does not range from 2% to 35%. At present it is 21%. In Professor Robert Sloan's book, ***Minnesota Fossils and Fossiliferous Rock,*** there is a wonderful graph (p.187) that illustrates many things, one of which is the amount of free oxygen in the atmosphere through time. So this sentence alone makes the whole book suspect.

Many of the articles are good and very interesting, but they seem to end too quickly. Another sentence wrapping it up would have been appreciated. And he bounces around a lot within the articles. In the one on 'bumblebee's ability to fly defies physics,' he quickly moves to kangaroos and finishes with electric vehicles.

'Plastic waste contributes to climate change,' actually seems to promote the use of plastics and calls biodegradable packaging a contributor to climate change and greenwashing. He actually seems to champion plastic use as it sequesters carbon like a tree. Really.

And some things are just weird. 'The phases of the moon are caused by the Earth's shadow.' Huh? People actually believe that? Where did that come from anyhow?

Like I said, some are good and some are just weird. If you want an example of a book that proves everyone needs a good editor/proofreader, this is it. Otherwise, I would pass this one by. There are just too many flaws and problems to make it worth your money, even at Half Price (where I got it).

Deborah Naffziger

New Director and Minnesota State Geologist

Minnesota Geological Survey

We are delighted to announce the appointment of Dr. Robert (Bob) Tipping as our new MGS Director and State Geologist of Minnesota.Bob returns to the MGS from the Minnesota Department of Health (MDH), where he was a

Hydrologist Supervisor in the Source Water Protection group for the past 5 years. In that capacity, he worked closely with state agencies with overlapping regional interests in drinking water quality, including: land use and land management (Minnesota Department of Agriculture and the Board of Water and Soil Resources); groundwater contamination (Minnesota Pollution Control Agency); and the impact of high-capacity pumping and climate change on water quantity (Minnesota Department of Natural Resources). MDH work focused on the development of watershed-scale groundwater flow models, and the compilation of regional groundwater quality datasets, including unregulated contaminants of emerging concern and PFAS.

Prior to that, Bob was a hydrogeologist for nearly 30 years at MGS, where his work with IT, GIS, and geologic mapping and hydrogeologic research was instrumental in advancing databases and electronic mapping procedures that in the 1990s led to the transition from largely 2D paper maps to electronic 3D maps. Bob's hydrogeologic research targeted applied value with direct links to MGS maps and databases, leading to products suitable for the modeling necessary for groundwater and surface water management. These products are widely used by partner agencies (Federal, Tribal, State, County, and Local), consultants, and water planning organizations. In addition to his work at MGS, Bob served the broader University of Minnesota community as an adjunct faculty member within the Department of Water Resources Science and the Dept. of Earth and Environmental Sciences. He was also a visiting instructor at both Macalester and Carleton College.

Bob brings a clear understanding of both day-to-day and historical operations within the Survey, as well as how staff, skill sets, and equipment can best be maintained and augmented to serve natural resource management and protection. He was also a user of MGS maps, datasets and reports when he worked for the state government. This unique perspective will allow him to tailor MGS projects and products so they can be readily used by a wide audience, including students, professionals, legislators, and citizens.

https://cse.umn.edu/mgs/news/new-director-and-minnesota-state-geologist

USGS Invests Bipartisan Infrastructure Law Funding to map critical mineral potential along south Dakota, Iowa, and Minnesota borders

RESTON, Va. – The U.S. Geological Survey has announced it will invest approximately $1.5 million in Bipartisan Infrastructure Law funding to collect high-resolution geophysical data focused on areas with potential for critical mineral resources in the tri-state region of South Dakota, Iowa, and Minnesota. The data collection will be conducted through the USGS Earth Mapping Resources Initiative (Earth MRI), a partnership between the USGS and state geological surveys that is revolutionizing our understanding of the nation's geology and critical mineral resources, which are vital to the U.S. economy, national security, and energy technologies.

"This airborne survey will help us gain a much better understanding of the Precambrian geology in the region, which is entirely concealed by younger rocks and sediments, and advance our knowledge of potential resources as well as the geologic context that creates them," said Ben Drenth, lead USGS geophysicist for this survey. The rocks in this specific region are believed to contain nickel, chromium, and cobalt, all typically used to create stainless steel and rechargeable batteries, as well as platinum-group elements. These elements, called PGEs, tend to occur together in nature, and are indispensable to many industrial applications.

The survey footprint was designed in collaboration with the state geological surveys to best capture much needed data in the area and leverage state-level expertise to inform decision makers and land managers.

These airborne geophysical surveys will collect a combination of magnetic and radiometric data. These data can be used to map rocks from just beneath trees, grass, and shallow sediment cover down to several miles underground. Magnetic data can be used to identify ancient faults, different rock types, and other geologic features, as well as potentially the signatures of mineral deposits, while radiometric data indicate the relative amounts of potassium, uranium and thorium in shallow rocks and soil.

The initial airborne geophysical survey may be followed by additional investments, including new geologic maps, geochemical sampling, and other techniques to better understand the region's geologic framework and mineral potential.

Earth Mapping Resources Initiative (Earth MRI) November 19, 2024

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