



# THE GEOLOGICAL SOCIETY OF MINNESOTA

## News

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

### From the President's Desk...

The strange year called 2020 continues. I hope all of you remain healthy and active.

As you were informed by e-mail a few weeks ago, all of our fall lectures will be on-line webinars, not in person. The GSM Board had a special meeting July 9 to discuss that and related issues. You can find the minutes on our website.

In the "GSM Fall Webinar" article in this issue are specifics about these webinars and how you will connect. The fall lecture schedule is included too, and it is also posted on our website. In spite of uncertainties, Program Chair **Steve Erickson** has put together a compelling, varied program, although a few holes remain. If you have an idea for a lecture, or know of a possible presenter, contact Steve with the information, or submit it using the "contact us" form on our website. Steve always appreciates new leads.

No live lectures also means no Fall Banquet at U Garden Restaurant, one of our cherished traditions. This banquet has included our Annual Meeting, with election of new GSM Board members. This year, we will conduct that election by e-mail; active GSM members will receive the slate of candidates and voting instructions in September. We must elect at least two new members to our **Board of Directors** for 2021-2022. These openings occur as two current Board members, **Deborah Naffziger** and myself, have served the maximum of 4 consecutive years. (Our bylaws include this provision so we periodically get fresh perspectives from new members on the Board.) You can find our bylaws and the duties of Board members on our website. If you think Board membership is a way you could give back to GSM, please contact me at [dewilhelm53@msn.com](mailto:dewilhelm53@msn.com), preferably by September 1. (By the way, as I write this, U Garden has posted that they plan to re-open on August 3, in case you might want to dine there.)

September is the start of our new fiscal year, and many of your continuing memberships are up for renewal. Instructions for renewing are in this issue. Your membership fees keep GSM going fiscally; without that support we could not fund the fine speakers who share their research and experiences with us each year.

A few of us continue to meet socially via Zoom at 7 PM, Mondays. If you might like to join a session, drop me an e-mail, and I'll send you a link and instructions. We've had lots of fun meeting this way and would like to see more members there.

Unfortunately, COVID-19 has eliminated GSM field trip opportunities so far this summer. However, **Kate Clover** plans to lead a driving/hiking trip this September to explore Platteville limestone in the Twin Cities. See her article in this issue. Thank you, Kate!



GSM President, Dave Wilhelm

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*from the GSM archives:  
Buffalo-Susquehanna mine,  
Mesabi Iron Range, July 1939*



In lieu of field trips and other in-person activities, I have been sending occasional e-mails with interesting seminars and articles that can be accessed online. I hope you are finding these informative. If you learn of something that our members might like, let me know and I'll pass it on.

**Theresa Tweet, Mark Ryan,** and I also post articles related to earth sciences on the GSM Facebook page, so check that out occasionally; the link is on page 2.

Stay informed and healthy as we adjust to this new way of living and learning.

Dave Wilhelm

**GSM**

**Officers:**

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

**Board Members:** Wolf Bielefeld; Frank Janezich; Dave Kelso; Roxy Knuttila; Deborah Naffziger, Joe Newberg; Patrick Pfundstein; Theresa Tweet; John Westgaard; Dave Wilhelm

**Editors:** Kate Clover; Mark Ryan; Harvey Thorleifson; Rich Lively

**Programs/Lectures/Labs:** Steve Erickson  
**State Fair:** vacant

**Video Library:** David Wilhelm

**Webmaster:** Alan Smith

**Membership:** Joanie Furlong

**Field Trips:** David Wilhelm; Joe Newberg

**Outreach:** Joel Renner

**Geological Markers:** Rebecca Galkiewicz

**Lecture Recording:** Joe Wright

**Web Site:** [gsmn.org](http://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:**

<b>Student</b> (full time)	\$10
<b>Individual</b>	\$20
<b>Family</b>	\$30
<b>Sustaining</b>	\$50
<b>Supporting</b>	\$100
<b>Guarantor</b>	\$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](mailto:kclover@fastmail.fm) Thank you in advance.

**GSM Board Membership:**

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

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

Board meetings are open to all GSM members. If you are a new or long-time member and Board membership is of interest to you, please consider attending a meeting. If you have a topic you would like the Board to consider, please contact Dave Wilhelm, [dewilhelm53@msn.com](mailto:dewilhelm53@msn.com)

**New GSM Members:**

Craig L. Croone, Northfield, Mn

**GSM Member Spotlight**  
**Ed and Sandy Steffner**



*Ed and Sandy Steffner with their shiny new Estwing hammers*

Ed and Sandy Steffner have been members of GSM since 2004. They enjoy being members of this special group because they are always learning and enjoy science.

Ed has always been a science buff. After retiring from work, he took Geology 101 at Normandale College and an Earth Sciences class at the U of M in 2003. From a professor’s recommendation, he attended a GSM lecture and came home so pleased with the presentations and the people that he talked Sandy into joining too.

Both have served on the Board for two terms. Ed was treasurer. Also, in his tenure, he installed seven Geologic Markers with Doug Zbikowski’s help; and he led a field trip to Kentucky to visit Mammoth Cave and the Fluorite Museum, with help from Deb Preece. In addition, Ed served many years on the State Fair Committee and has fond memories of setting up and tearing down the booth. Sandy chaired the Membership Committee for two years, and she chaired the State Fair Committee for three years, plus she assisted with State Fair set up and take down.

For at least eight years, Ed and Sandy have hosted the Winter Potluck Social. After dinner, Ed has brilliantly played the piano and his accordion, and GSM members have sung geological holiday tunes.

Ed’s favorite geology book is *Rare Earth: Why Complex Life is Uncommon in the Universe*, by Peter Ward. He refers to it all the time.

They are both very proud to have been honored with the Rock Pick award in 2019.

**NOTES FROM THE PAST**

*From the Minnesota Geologist:*

*The Official Bulletin of the Geological Society of Minnesota*  
 January 1948

**DENVER TRIP – June 1948**

The time has come when we must know definitely how many plan to go on the Denver Field Trip. It has already been necessary to make an advance payment to assure us of accommodations in Denver, and it will soon be necessary to make other deposits and commitments.

The bus will leave Minneapolis, Saturday Morning, June 12<sup>th</sup>, stopping at Grand Island, Nebraska, the first night. We will arrive in Denver Sunday evening, June 13<sup>th</sup>, where reservations have been made in a modern Auto Court. Monday morning, we will leave for Colorado Springs, Garden of the Gods, Pikes Peak and vicinity, Cripple Creek area, and the Royal Gorge, stopping at Canon City, Monday night. We will return to Denver Tuesday evening, remaining there all day Wednesday and Wednesday night. Opportunity will be afforded the group to see the excellent Denver Museum and to attend some of the sessions of the First Annual Convention of the American Federation of Mineralogical Societies, including a noon luncheon arranged for members of the Midwest Federation, and the evening banquet. Thursday morning, we will leave for the Rocky Mountain National Park, stopping at Estes Park for the night and returning to our rooms in Denver Friday evening. Saturday morning, we will start for home, arriving there Sunday evening, June 20<sup>th</sup>.

The cost of the entire trip should be between \$65.00 and \$80.00, depending upon your budget, which is estimated as follows:

Bus Fare (Round Trip)	\$27.00 to \$30.00
(Depending upon the number going)	
Rooms (8 Nights)	\$16.00 to \$20.00
Meals	\$22.00 to \$30.00
Total Expense	\$65.00 to \$80.00

**GSM 2020 Fall Webinars**

Due to COVID-19, GSM will conduct the Fall 2020 lectures online, as webinars via Zoom. Lectures will still be held Monday nights at 7 PM. I think we are all disappointed that we cannot meet in person, but we are happy technology exists for us to participate in remote lectures. On the bright side, this has allowed Program Chair **Steve Erickson** to tap lecturers from University of Minnesota Duluth, who are otherwise too distant to justify driving to Minneapolis for a 1.5 hour lecture. It will also allow some of you to participate remotely who otherwise could not attend. We plan to record those webinars for which we have permission and post them online after they are presented.

As every year, this August issue of the Newsletter includes a schedule of upcoming lectures. However, this issue includes only the Fall schedule, due to uncertainty with the Spring schedule. We plan to include the Spring schedule in the November Newsletter, and the full, but tentative, schedule is on our web site. At this time, we cannot know if the Spring lectures will be live or via webinar.

As in the past, we will post an abstract and presenter biography on our website and our Facebook page about 2 weeks prior to each lecture. Also, active GSM members will receive an e-mail with that same information before each lecture. This e-mail will include explicit instructions for participating in the webinar, so that active members need not register beforehand. Since our lectures are free and open to the public, the website will include instructions by which non-members can register to attend and get the sign-on credentials.

The Zoom webinar facility allows over 100 participants per session, so attendance should not be limited. It appears that Zoom has all the webinar features we want, including the ability to see both the presenter and the presenter's visuals, to chat informally among participants, to ask pertinent questions during the presentation, and to post questions to be asked at the end. (Alas, it provides no facility for cookie break.:-)) A few of us did a trial webinar a few weeks ago to test drive all of these features and were pleased with how it worked. Note that questions will be monitored by **Randy Strobel** and myself. Questions during the lecture will be limited to those we feel are immediately pertinent.

In addition to our regular lecture schedule, Randy is planning a lecture on COVID-19 in August; you will get an e-mail with instructions when the date is decided. We strongly encourage all members to attend, as that will give you a chance to ensure you are set up to receive our webinars before the scheduled lectures begin. It will also give us a chance to monitor a webinar with many dozens of participants.

Dave Wilhelm

### FALL 2020 GSM LECTURE SERIES

Lectures are free and open to the public

Virtual Lectures 7:00 PM, CT. Mondays

Participation instructions and last-minute changes will be posted on our web site: [www.gsmn.org](http://www.gsmn.org)

2020:

**Sep 21 Title TBD (Topic: Banded Iron Formations)**

Latisha Brengman, Ph.D., Assistant Professor,

Earth and Environmental Sciences, UMD

**Oct 5 Minerals are the Future**

Brian Lentz, B.Sc., Vice-President, Big Rock Exploration

**Oct 19 Neotectonic Fault Reactivation and Landscape Rejuvenation on Norway's Post-glacial Margin**

Jeni McDermott, Ph.D. Associate Professor, Geology Dept., Univ. of St. Thomas

**Nov 2 Geological and Tectonic Evolution of the Transantarctic Mountains**

John Goodge, Ph.D., Professor, Earth and Environmental Sciences, UMD

**Nov 16 Minnesota's Geologist: The Life of Horace Winchell**

Sue Leaf, Ph.D., Author

**Nov 30 Title TBD**

Peter Makovicky, Ph.D., Professor, Earth and Environmental Sciences, U. of MN

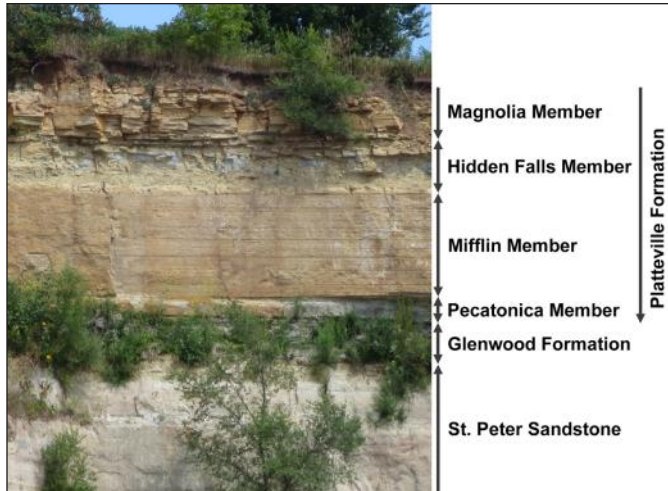
**Dec 14 Presenter & title TBD**

### The Platteville Formation as Building Stone in the Twin Cities

Being interested in geology, architecture and history, I often walk the streets of cities, always noticing stone. Wherever I go, I see stone inside and outside buildings, on the bluffs along rivers, on road cuts, as landscaping, on countertops and as gravestones, and sand-sized grains on beaches. I especially like to walk older towns and neighborhoods, to observe and to learn about relationships between people, place, and the built environment. This learning gives me a greater appreciation of how the city was built. Recently, I have focused on 19<sup>th</sup> century buildings around the Twin Cities that were constructed with locally quarried Platteville Limestone.

Throughout this article, I will describe Platteville Limestone and the quarries as they were documented in 1918. Back then, the stone was pretty much all referred to as Platteville Limestone. Today, the Platteville Formation is subdivided into Members, and the stone is recognized as either limestone or dolostone. My goal here is to give an historical overview of the old quarries and to highlight a few of the buildings that were constructed with this stone that are still standing. My research into this building stone started with locating information about the quarry sites. The book: *The Structural and Ornamental Stones of Minnesota*, written in 1918 by Oliver Bowles and published by the USGS in cooperation with the Minnesota Geological Survey, provided lots of information. However, the terminology used in 1918 to describe the Platteville Limestone is

outdated. Quarrymen in the early days identified the rock layers by their physical characteristics, color, and value for construction projects - for example: prime building stone, flinty and friable, porous with cavities, or stone with clay that readily disintegrates. Since 1918, geological mapping has greatly progressed, and geologists have more accurately described the Platteville Formation and its subdivisions.



The bluff below Mounds Park in Saint Paul illustrates the different subdivisions or members of the Platteville Formation. From Tweet, *Equatorial Minnesota: Divisions of the Platteville Formation*.

Geologists have subdivided the **Platteville Formation** into four distinctive members: Pecatonica, Mifflin, Hidden Falls and the Magnolia. The lowest is the **Pecatonica** member; it is yellowish-gray in color and a sandy dolostone. The **Mifflin** member is considered a dolomitic limestone that ranges from 8 to 12 feet thick in the Twin Cities; it breaks apart on right angle joints and along the flat bedding planes, often as massive chunks. Above the Mifflin, the **Hidden Falls Member** is described as pasty-gray in color, with abundant shale layers, and vulnerable to erosion. It ranges for 3.5 to 5.5 feet thick and is characterized as an argillaceous to silty dolostone that is massively bedded. The **Magnolia Member** tops the Platteville Formation; it is dolostone and about 8 feet thick, and resistant to erosion. Locally, the total Platteville Formation averages about 27 or 28 feet thick, and it lays on top of the St. Peter Sandstone. The thickness of the members varies.

The Platteville Formation was widely quarried, and the quarrymen of the mid-to-late 1800s noted that the stone varied in color from white to yellow to pinkish, both within a deposit and across the region. They considered the whitest stone as nearly pure calcite or dolomite, and the more yellow stone to contain minute particles of iron oxide, a common impurity. Reference was also made to "blue limestone" which appeared blue when first quarried, but weathered to a buff color upon exposure, probably from the oxidation of iron originally present in the stone. They noted that the hard "blue stone" layer supplied most of the structural stone that

was used for entire buildings around Saint Paul. Looking at the limestone on old buildings today, some stone appears solid, and elsewhere the stone has weathered, with conspicuous horizontal layers forming ridges and depressions. The weathered layers that stand out in relief and give the rock a wrinkled surface texture are thin bands of shale that over time have weathered out before the harder layers. This weakens the stone. The quarrymen referred to these argillaceous layers as "soaprock." In contrast, the stone quarried in Mendota that was used to construct **General Sibley's house** (1835) and **Saint Peter's Church** (1853) is still solid, showing minimal disintegration after 185 years.



The weathered argillaceous layers of the Platteville Formation stone

As rock quarried from the Platteville Formation initially was the only structural stone found in southeastern Minnesota and Southwestern Wisconsin in the mid-to-late 1800s, including Ramsey, Washington and Hennepin counties in Minnesota, it was used extensively. This distinctive-looking building stone was first used locally in 1820 to construct **Fort Snelling** at the confluence of the Mississippi and Minnesota Rivers. Work began to build the fort with stone quarried from the river bluffs. The soldiers found the rock easy to break into blocks, and built the fort's foundation and towers from it. The fort remains one of the largest structures ever built from the local limestone.



The stone on General Sibley's house in Mendota remains solid after 185 years

In downtown **Saint Paul**, the **German Catholic Assumption Church** (1874) and its school were built from the stone that was quarried on site. Nearby on St.



The Sibley house (1835) in Mendota, the first stone house erected in the state



*Assumption Church (1874) is the oldest existing church in Saint Paul.*

Peter Street, the **Original Coney Island** (1858) was built with local stone. It is the second-oldest commercial building in the city, and the oldest building in downtown St. Paul. (Today, the bar is only open for special events, such as Winter Carnival.) In addition, a side wall (circa 1885) of the **Barrel Theory Beer Company** on East Seventh and Wacouta Streets was built with the limestone. Basement walls of other buildings in Saint Paul's Lowertown District were also constructed with local stone. Many references note the stone was "quarried on site."

In downtown Saint Paul, from the mid-1800s through early 1900s, buildings constructed with the Platteville stone lined the streets and defined the look of the city. In 1882, Newton Horace Winchell, Minnesota's State Geologist, counted 384 buildings constructed entirely of the locally quarried limestone, plus hundreds more with stone sides, backs, basements and trim. Today, the weathered, gray buildings made entirely from the stone are a rarity, but many homes and buildings in the older areas of town have stone basement walls. Seeing these is a way to date the houses.

The first Platteville quarry in downtown **Saint Paul** was opened in 1856. Between 1858 and 1865, the largest quarries were located on Robert Street near Sixth, Ninth near Robert, and Tenth near Minnesota. The walls of the quarry on Tenth and Minnesota can be seen today in a parking lot on the southeast corner of this intersection. Observing this city block today, it is possible to imagine that the quarry extended all the way to Jackson Street. Looking at old plat maps and Sanborn Fire Insurance maps, it is sometimes possible to speculate where these

quarries were located as no buildings were present while the rest of the area was built up.

The locations of the quarries constantly shifted as the cities graded and leveled streets and laid gas and sewer lines. And as the thickness of the deposits ranged from 12 -15 feet, few quarries operated before the prime building stone was exhausted and another was opened nearby. Eventually, that became a problem as people were quarrying stone in the streets, and the city of Saint Paul passed an ordinance in 1884 forbidding this process. (The fine was between \$10 and \$100, plus \$10 per day for each day excavations remained.)

**The Seven Corners area of Saint Paul** (West Seventh, Eagle Street and the current Kellogg Blvd) is located atop a limestone shelf that was a quarrying hub from about 1850 through the early 1900s. The quarries in this area provided most of the structural stone for the Saint Paul area. The rock in the Seven Corners area had the shallowest depth-to-bedrock measure in any part of the city—in some areas, less than one foot.

Near the hub of quarrying in the **Seven Corners Neighborhood**, a residential neighborhood got its start in the 1840s when John Irvine built a riverboat landing near Chestnut Street (below the current Science Museum of Minnesota). The **Upper Landing** was the head of navigation and became an important point of arrival and a shipping area.

(Upriver towards Minneapolis, the Mississippi River was full of rock left from the retreat of glacial River Warren Falls.) This residential area, **Irvine Park**, and the nearby

neighborhood, referred to as **Uppertown**, had both upper class and modest houses and attracted skilled tradesmen, among them stone and brick masons. Here **Governor**

**Alexander Ramsey** had his house built in 1872 from Platteville stone quarried in the neighborhood. Today, other small stone, brick and wood frame houses dating to the 1850s still stand in this neighborhood. It is Saint Paul's oldest neighborhood, which became fully developed between



*The front door at the Alexander Ramsey house (1872) shows dressed stones and decorative stonework*



*Schillinger-Brings house (1859) in Saint Paul's West Seventh neighborhood, one of the few remaining solid stone buildings in Saint Paul*



Waldman house (1857) in Saint Paul's West Seventh neighborhood. Currently this is the Waldman Brewery, the oldest commercial building in Saint Paul

for building. For example, at the 60-acre Robbins Quarry, across the Mississippi River from Fort Snelling, stone was quarried, crushed, and used for street construction. There the deposit included 10 feet of thin-bedded, blue to yellowish limestone. Beneath that was blue shale which overlay the St. Peter Sandstone.

Limestone also was quarried in **South Saint Paul** in the Cherokee Heights area. The Bielenberg quarry (as it is currently designated) started operation in the middle 1880s. Bielenberg took over the operation in 1904. This



The Platteville Formation at the former Bielenberg Quarry in West Saint Paul, off George Street. Currently the site of the Cerenity Senior Care Center

limestone" was quarried, which was considered so abundant that the "blue limestone" was not quarried. In

1849 and 1900. Historic preservationists continue to restore and document the remaining Pioneer era homes. However, many have been lost to demolition and redevelopment. Stone was also abundant and quarried extensively along **Saint Paul's old Fort Road/West Seventh Street**, the corridor between downtown and Fort Snelling. However, the stone quality was not always suitable

for building. For example, at the 60-acre Robbins Quarry, across the Mississippi River from Fort Snelling, stone was quarried, crushed, and used for street construction. There the deposit included 10 feet of thin-bedded, blue to yellowish limestone. Beneath that was blue shale which overlay the St. Peter Sandstone.

Limestone also was quarried in **South Saint Paul** in the Cherokee Heights area. The Bielenberg quarry (as it is currently designated) started operation in the middle 1880s. Bielenberg took over the operation in 1904. This was off East George Street and is bounded by Robert and Humboldt Streets, and Dearborn (Stevens) and Robie Streets. Today the **Cerenity Senior Care Center** is located on this site, and remnants of the quarry can be seen all around the property. The quarry was around five acres in size, and produced stone for buildings, foundations and roads. From this quarry, the "high-grade yellow limestone" was quarried, which was considered so abundant that the "blue limestone" was not quarried. In

a nearby quarry, however the "blue limestone" was quarried where it reached thicknesses of 12-14 feet. In **Minneapolis, Platteville Formation** stone was first quarried in 1864 along the river bluffs near the foot of St. Anthony Falls. Later it was used to build the **Pillsbury A Mill** (1881). Beginning in the early 1900s, limestone was quarried at the **Johnson Street Quarry**. This was a 60-acre site between Johnson Street and Central Avenue, south of 18th Avenue (now the site of the Quarry Shopping Center that was built in 1997). At this site, ten feet of glacial sediment covered four feet of thin-bedded yellow limestone, six feet of blue-gray stone, and from 14 to 18 feet of the hard, blue limestone. Around 1918, three major companies operated crushing mills and annually produced 150,000 - 200,000 cubic yards of crushed rock. Most was used for concrete and road construction. The widespread availability of Platteville limestone was its drawing card in the Twin Cities and in the southeastern part of the state, but it had flaws as well. Much of it wasn't durable, and it easily crumbled, nor could it be polished or carved. Use of this stone waned as the railroads spread through the region in the 1870s, and stone from farther distances became available and more popular. For example, red sandstones from the Lake Superior region, and the more attractive and durable Kasota stone from the

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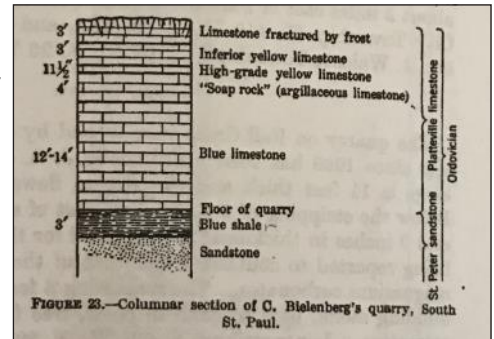


FIGURE 23.—Columnar section of C. Bielenberg's quarry, South St. Paul. The 1904 columnar section at the Bielenberg Quarry in West Saint Paul. Diagram from Bowles, Fig. 23.



The Pillsbury A Mill (1881) was constructed from stone quarried onsite and along the river banks.

companies operated crushing mills and annually produced 150,000 - 200,000 cubic yards of crushed rock. Most was used for concrete and road construction. The widespread availability of Platteville limestone was its drawing card in the Twin Cities and in the southeastern part of the state, but it had flaws as well. Much of it wasn't durable, and it easily crumbled, nor could it be polished or carved. Use of this stone waned as the railroads spread through the region in the 1870s, and stone from farther distances became available and more popular. For example, red sandstones from the Lake Superior region, and the more attractive and durable Kasota stone from the

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Limestone Arch Bridge in Mendota (circa 1884)



Three-foot thick (basement?) wall constructed with both outer and inner stone blocks and a core of smaller rubble stone. Cathedral Hill area of Saint Paul

Mankato area were used. After that, the Platteville limestone was relegated to basements, foundations and retaining walls.

Back in the early 1900s, the streets of downtown Saint Paul were lined with these drab, gray weathered limestone buildings.

Today, these structures are mostly gone. However, we can thank community members and the historical preservation society for their foresight to preserve the remaining structures built from

the local stone. Stonemasons and woodworkers are also to be thanked for their efforts to restore the homes to their original beauty. The buildings represent a chapter of local history that includes geology, architecture and



An abandoned quarry on Ravenna Trail in Hastings, near the Hastings Scientific and Natural Area

skilled stonemasons. As you travel the region, look for these old structures. Notice the variations in the stone and how it has weathered, consider what the stone and the buildings mean for history. Maybe you can speculate on which member

of the Platteville Formation the stone came from or figure out if the stone is limestone or dolostone. Oh yea,



Brachiopods on a building stone

you might discover fossils too. Also, you might imagine where the stone quarries were located; likely—they were not far away.

**Fall Field Trip:** If you would like to see some of these structures and the stone up-close, I'll be leading

a field trip with driving and some hiking in September. We will send out an email with details once they firm up.

**For Further Information:**

Bowles, Oliver. *The Structural and Ornamental Stones of Minnesota*, U.S. Geological Survey, Bulletin 663, 1918

City of Saint Paul Heritage Preservation Commission. *Neighborhoods on the Edge of the Walking City*. 2011.

[https://www.historicsaintpaul.org/sites/default/files/2011%20Context%20Study%20%20Neighborhoods%20at%20the%20Edge%20of%20the%20Walking%20City\\_0.pdf](https://www.historicsaintpaul.org/sites/default/files/2011%20Context%20Study%20%20Neighborhoods%20at%20the%20Edge%20of%20the%20Walking%20City_0.pdf)

City of Saint Paul Heritage Preservation Commission.

*Limestone Properties of Saint Paul's West Seventh Neighborhood*. <https://www.stpaul.gov/DocumentCenter/View/2/80219.pdf>

Mossler, John. *Bedrock Geology Map of the Twin Cities Ten-County Metropolitan Area, Minnesota, M-194*. 2013.

<https://conservancy.umn.edu/handle/11299/154925>

Tweet, Justin. Equatorial Minnesota: Divisions of the Platteville Limestone. <https://equatorialminnesota.blogspot.com/2014/01/divisions-of-platteville-formation.html>

Williams, J. Fletcher. *History of the City of Saint Paul to 1875*. First published 1876. Reprinted Minnesota Historical Society Press, 1983.

Kate Clover

**Cottage Grove Ravine Regional Park:  
the green rocks of home**

I come from Cottage Grove, Minnesota, and in the southeast part of town, there's Cottage Grove Ravine Regional Park. Up until late 2016, I had no idea that there was actually exposed bedrock in the park. The only outcrops I knew of in town were a couple of pockets around the compost site, a couple of spots in Old Cottage Grove, and some outcrops of the St. Peter Sandstone up high on Camel's Hump overlooking Highway 61

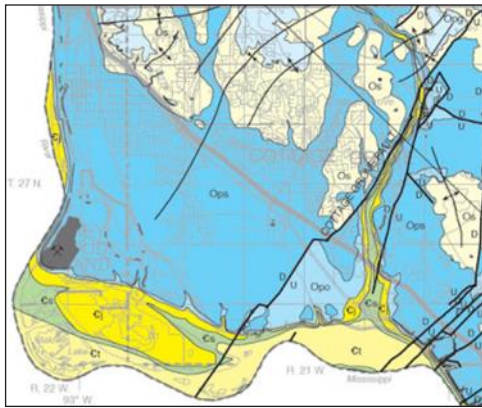
(there's a little park up on the crest of the hill now, with a good view across the valley, by the way). Obviously, I had to have a look around.

Here's a geologic bedrock map of Cottage Grove, clipped from Bauer (2016). The medium gray lines are the streets, with the thick line going northwest-southeast being Highway 61. That big area of blue with the Ops on it is the Shakopee Formation of the Prairie du Chien Group, the stern and sometimes stromatolitic Lower Ordovician dolomite



The rocks, counterintuitively, are the green things in this photo.





A geologic bedrock map of Cottage Grove, clipped from Bauer (2016)

lurking beneath much of southeastern Minnesota. The column is as follows, starting at the base (which happens to coincide with the south part of this map, where the Mississippi drainage system has

deeply eroded): Ct = Tunnel City Group, the former Franconia Formation; Cs = St. Lawrence Formation; Cj = Jordan Sandstone; Opo = Oneota Dolomite; Ops = Shakopee Formation; Os = St. Peter Sandstone; and Opg = Glenwood Formation and overlying Platteville Formation. This is a bedrock map with the surficial deposits omitted, so almost none of these rocks can be seen at the surface. The exceptions are in areas denoted by dark gray, the most obvious being the blob in Grey Cloud Island representing a major quarry in the Shakopee Formation. You'll notice there aren't a whole lot of dark gray areas on the map.

You also get Grey Cloud Island and St. Paul Park for no extra charge. The faults are pretty much decorative these days. Thanks to the Minnesota Geological Survey for allowing reuse of this image!

I would like to draw your attention to the colorful strip heading north in the eastern part of the map. This represents the "ravine" of Cottage Grove Ravine Park, where erosion from flowing water cut down through several formations. Clearly, at one time flowing water was a much bigger concern in this area to cause this much erosion (although we can guess that the presence of the Cottage Grove Fault didn't hurt for determining where the water flowed). The exposures, though, are not where the bedrock has been deeply eroded, but just to the east: see the D and U on the fault east of the deeply eroded part of the ravine and north of Highway 61. There's a little worm of outcrop represented below the D, in a secondary channel. If you're hiking in the park, these areas are just



With flowing water, this would be a human-sized waterfall

west of the unpaved path going north from the parking lot, and generally parallel the path in that area. The channel is deep-set in many places and plant growth usually does a good job of obscuring it. Today the flow in the channel is only sporadic, but there are plenty of rounded cobbles and boulders to be seen in the bed, and there are erosional features from flowing water along the banks, and even a dry waterfall.

At times of the year when plant growth is dead or dormant, the green of the moss/algae/et cetera covering the rocks stands out brilliantly, and can look almost neon-like on a grey day. The extent of the



The creek bed is a maze of eroded bedrock, cobbles and boulders, and branches,

green invasion is remarkable. If you've ever gone snorkeling and seen rocks underwater with thick coverings of algae and other encrusters, it's kind of as if you're back in the ocean and someone has taken all the water away. It's a little hard to tell you're looking at the Prairie du Chien with so much green, but if you look closely you can see some characteristic features. Broken and uncovered faces have that typical oatmeal-like color, and beds with sand grains floating in the carbonate matrix are apparent.



Not bad in terms of fine stromatolite-like layering, but this is kind of an odd cobble, with some good-sized chert nodules like the one near the top of the photo

Because this is the Prairie du Chien, I was on the lookout for stromatolites, but again the modern greenery was making it hard to see traces. There were occasional pieces with suggestive features, but not great preservation.

Scattered throughout the dry creek bed are various cobbles and boulders, most of which are also green and reasonably rounded. The population of cobbles is a mix, which is typical of



The numerous rounded pocks could be from small eroded dome-like stromatolites, or just erosion. Note the greenery as well



The objects in the lower center, right of the foreground finger, are chunks of crinoids. There is also a shell fragment near dead center, and, not visible, a piece of bryozoan

an area with hundreds of thousands of years of glacial activity under its belt. The generous greening of everything makes it difficult to tell what is what, but some of the cobbles are clearly igneous in origin. One interesting ringer,

clearly not Prairie du Chien, included weathered crinoid stem fragments and other fossils representing a more recent sea with a more favorable environment.

**References**

Bauer, E. J. 2016. Geological atlas of Washington County. Minnesota Geological Survey, St. Paul, Minnesota. County Atlas 39.

Justin Tweet

adapted from Equatorial Minnesota blog post of the same name, November 26, 2016

(<https://equatorialminnesota.blogspot.com/2016/11/cottage-grove-ravine-regional-park.html>)

**Seminole Canyon, Texas**

With the pandemic curtailing everyone’s travel, I have had time to review and edit photos from past trips. In March 2018, I spent 2.5 weeks driving through Texas, a state I had not been to before, visiting relatives and viewing sites. In the [May 2018 Newsletter](#), I reported on the remote national park of Big Bend. Now that I’ve reviewed my photos from Seminole Canyon State Park, I’ll share that travel experience.

Seminole Canyon, near the Rio Grande River northeast of Big Bend, provides camping and hiking opportunities, both of which I enjoyed. But its big claim to fame is world-class prehistoric rock art which can only be seen on tours guided by local archaeologists. (Be sure to reserve a tour before you arrive.) Since this is southern Texas, tours are less frequent in summer due to the heat. (Mid-March was ideal.)

Outside the Seminole Canyon Visitor Center, where tours start, stands The Maker of Peace, a 17-foot bronze statue created by Texas artist Bill Worrell in 1994. From there, I took the 90-minute Fate Bell Shelter tour, which is described as “a fairly rugged hike to the Fate Bell and Fate Bell Annex rock shelters. Protected by a huge cliff overhang, the shelters hold some of Texas’s most spectacular rock art.” (Don’t worry, it was not that rugged.) There were two guest archaeologists on the tour, so we were privileged to have four experts in our group. We appreciated hearing their inside discussions of the various pictographs.

Seminole Canyon is composed of Devils River limestone (100 million-years-old). This geologic formation preserves fossils dating back to the Cretaceous period. In some places, it has weathered into a honeycomb pattern.

Archaeologists estimate that human habitation of the Lower Pecos Canyonlands of southwest Texas area began over 10,000 years ago, almost during the onset of Holocene time

but still when mammoth animals would have inhabited the area. Vegetation is believed to have been a denser and richer variety to support the life of the area. The erosion that happened over the ages can be seen in some rock walls. Indigenous peoples began to leave evidence of their presence in caves some 2,000–8,000 years ago.

Fate Bell Shelter is a deeply stratified rock shelter containing evidence of over 8,000 years of occupation, from the Archaic Period to the Late Prehistoric Period

(ca. 7000 B.C. to A.D. 1500). It is named after Mrs. Fayette Bell, who owned the land the shelter occupies. Fate Bell is one of the largest rock shelter sites in the Lower Pecos

Canyonlands of southwest Texas and contains extensive pictograph panels in a variety of styles. Styles include the Pecos River Style, Red Linear Style, and many other unclassified styles. The Pecos River style, which may date to between 3000 and 4000 years ago, is generally

considered the oldest type found in the Lower Pecos area. This would place the art in the middle Archaic period. The Pecos River style is polychrome and images are considered



The Maker of Peace



Approaching Fate Bell Shelter



Fate Bell Shelter



*Eroded Devils River limestone*

manifestations of a shamanic cult. The pictographs at Fate Bell Shelter are among the best documented and best preserved of the Pecos River style. The central characters depicted are faceless

anthropomorphic figures, elaborately dressed and often holding a variety of accessories such as atlatls (spear-throwing tools), darts, and fending sticks. The figures are often depicted with their arms outstretched, and in some

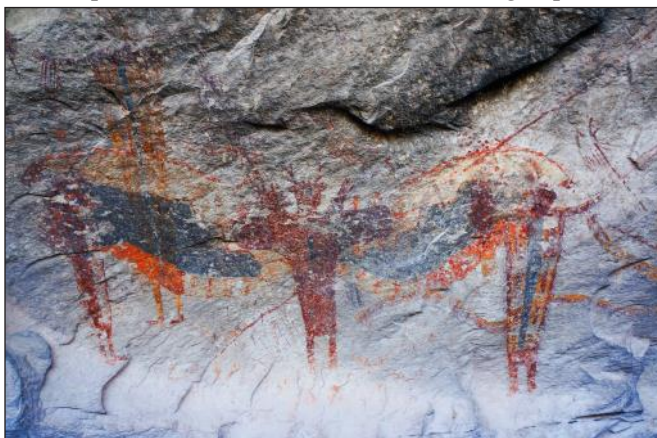


*Wall pictographs*

pictographs the anthropomorphs' arms are stylized and seem to be more akin to wings than arms. While archaeologists believe they have

deciphered many of the images, I found it fun to just guess what the figures represent.

According to artist-turned-archaeologist Dr. Carolyn Boyd of Shumula: "Using vibrant earth colors of black, red, yellow, and white, hunter-gatherer artists painted enormous murals stretching expansive



*Anthropomorphic ceiling pictograph*

distances along the canyon walls. In some locations, the paintings once towered 30 feet tall and spanned hundreds of feet in length. Repeated scouring by violent flash floods and exposure to sun and rain through the millennia have degraded these murals, but within the protection of hundreds of dry rock shelters, some remain vivid. They help us appreciate how stunning and awe-inspiring the painted canyons once were and challenge our preconceptions of the art and its makers."

After our trip, one of our guides sent me the following: "If you're interested in learning more about rock art and rock art preservation, visit our website (<http://www.shumla.org>) or the American Rock Art Research Association (ARARA) (<https://arara.wildapricot.org/>). ARARA is a fantastic group that combines professionals with avocational folks interested and passionate about rock art." [I especially recommend watching the Shumula video.]

To see all my photos for Seminole Canyon, see "Day 12 PM" at <https://tinyurl.com/DEW2018TX>. You can also find further info from our guide Vicky there.

Dave Wilhelm

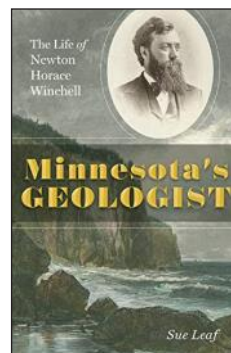
### BOOK REVIEW

#### Minnesota's Geologist

*The Life of Newton Horace Winchell*

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Review by Glenn Lee



The story of Newton Horace Winchell, his remarkable family, and their accomplishments, has been brought to life by authoress Sue Leaf in a straightforward and perceptive account. Winchell, a New York native educated in Michigan, came to Minnesota in 1872 to perform a comprehensive survey of Minnesota's geology. His long career took him to every corner of the state, often in primitive conditions, to examine in detail rocks and physiographic features. Along the way, he mentored many in the discipline of geology, including members of his own family.

Science aside, Winchell's story is a rich and varied one, much of it drawn from his own words in a diary kept throughout his life. Minnesota in the late nineteenth century was a land newly opened to energetic pioneering in areas of industry, education and social change. Winchell's wife, Lottie, became an early activist for women's rights and suffrage. Their children were actively engaged in studying language, science and music. Their stories are all integral to the narrative of a pioneering society emerging into a new century and dramatic change.

Many of the locales in the book will be familiar to those who have travelled throughout the state. For those interested in Minnesota history, various notable figures appear and their roles in creating institutions like the University of Minnesota and the Minnesota Geological Survey are explained. The Winchell family also had large parts to play in the publication of the scientific literature and journals of the day. The book includes detailed footnotes, appendices, and short biographies of many of the leaders and contributors to the Minnesota Geological Survey.

Winchell's legacy is a broad one, encompassing not only geology, but also in the fields of Minnesota natural history and archaeology. At the end of his life, he was fully engrossed in the discovery and delineation of the people of Minnesota's prehistory. Sue Leaf has done a superb job of capturing Winchell and his times.

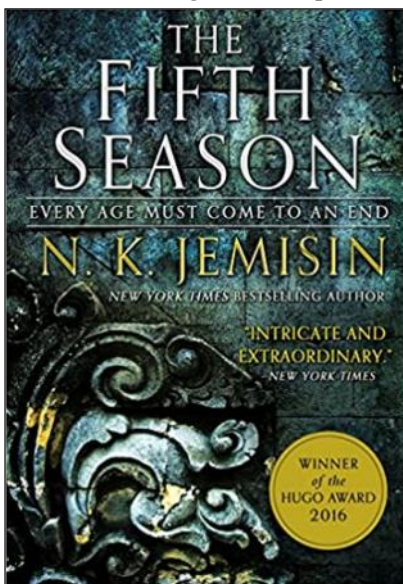
## BOOK REVIEW

### The Broken Earth Trilogy, by N.K. Jemisin

Review by Barb Heideman

Living on the north shore of Lake Superior, in the cradle of the midcontinent rift, affords me ample opportunity to ponder what the actual on-the-ground conditions might have been during the period of rifting. Clearly, N. K. Jemisin was also thinking about such things when she wrote *The Broken Earth Trilogy*, a dystopian sci-fi/fantasy novel set in a far-distant future earth where tectonic events shape human history. She won consecutive Hugo awards for each book in the trilogy (2016, 2017, 2018).

As the series begins, a great rift, initiated by human sabotage, is ravaging the equatorial regions of The Stillness, a Pangea-like supercontinent. Destruction and



*The Fifth Season, the first book in The Broken Earth Trilogy*

death are immediate for the large wealthy cities, while outlying communities are forced into survival mode for weeks, months, centuries—nobody knows. Unlike our own Precambrian rift story where no higher life forms existed to chronicle the process, Jemisin created a history where a progression of human civilizations, both advanced and primitive, were born, thrived, and subsequently perished

in a Fifth Season, the term used to signify mass extinction events that periodically ravage the earth.

The protagonist is a female "Orogene," a human variant with the ability to sense and manipulate the thermal and kinetic energy of seismic earth forces. Exceptionally skilled Orogens can also harness the life forces, known as "magic," to amplify their orogenic abilities. Orogens are both despised and feared by the general population, and children exhibiting orogenic aptitude are routinely abandoned or murdered by their families. The lucky ones survive undetected, but most are turned over to the Fulcrum, a kind of paramilitary training academy for Orogens. The Fulcrum, an institution of an imperial government, controls wealth and power on the continent. Remnants of extinct civilizations (deadcivs) are everywhere in the outer regions, and peculiar structures, giant crystal obelisks created by an advanced prehistoric civilization, exist in their original form floating above the Stillness like beautiful dirigibles. Stone Eaters, immortal human-mineral hybrids with curious phase changing abilities, live both inside the earth and among humans on the surface.

The consequences of climate change and the cascading natural disasters that unravel within a Fifth Season are brought vividly into our consciousness as readers. Slavery, racism, revolution, hubris, mother/daughter conflict, and LGBT threads round out the human themes in this story. It is a creative and complicated tale that requires patience to understand the terminology and characters since much of it is revealed only through the context provided in the narration.

I read this as an e-book, but would recommend hard-copy format to make it easier to flip back and forth, use the glossary, re-read key sections, and study the history of previous Fifth Seasons.

Months after reading this story (I did so during the early stage of the COVID quarantine) it has stayed on my mind. I draw parallels with our world today and understand even more clearly that in the face of earth events that cause famine, plague, and conflict over limited resources, survival depends mostly on luck. And in the end, humanity is nothing compared to the inexorable action of geological processes and the awesome staying power of the physical earth.

## WEIRD MOVIES

Reviews by Deborah Naffzinger

We're all shut in due to the pandemic, and are watching things we may never have considered before. Here is a collection of movies with somewhat geological or at least scientific themes, from the totally absurd to almost plausible. Some are turkeys, some are tedious, some are actually watchable. They are listed from worst to best (comparatively) by my estimation. You may or may not agree. Get the popcorn, fire up the DVD and watch. At least it can kill an evening.

NOTE: These movies are all DVDs in the GSM Video Library. You can find the full collection of video titles on our GSM web site, along with many more reviews. Unfortunately, the Video Library is on hiatus while we don't have live lectures, as the Video Librarian, Dave Wilhelm, is not able to send DVDs by mail. However, you might be able to find these videos on an on-line movie channel.

#### **Megalodon: 60 Feet of Prehistoric Terror**

This 2002 production stars a bunch of people I have never heard of. It looks like it was shot on a bunch of indoor sets with cheap approximations of reality. And it also has some almost real looking miniatures and models - a tiny clue this might not be an A list movie. An oil company has built the largest, deepest drilling rig off the coast of Greenland. But there are worries about going so deep ... yeah you get the idea. The oil executive, a TV crew, all the drilling rig crew, etc., gather and eventually experience Megalodon. The rig is ultra-modern with a crew of 22 and many robotic systems. There are more human characterization moments than the usual disaster flick. A 70 million-year-old fish bites the hand of a worker. Then the drill head falls down into a big hole (why is it always a big hole?). They discover a giant underground cavern, and guess what eventually comes out? It is slower and more tedious than the usual disaster movie. This does not mean it is any better.

#### **Just Add Water**

This 2008 movie takes place in Trona, California, a dead-end town in the desert on the edge of Death Valley. It is a nice little movie, and there is an interesting geological formation out of town, but what it has to do with the movie, I do not know. The town was destroyed by the water being annexed by LA, the chemical plants moved in and the rest is pollution, desert and waste. It gets better, really. Anyhow watch it for the movie if this is the stuff you like. Otherwise it is not really a science-oriented movie.

#### **2012**

This 2009 Movie is the usual disaster trope. Weird stuff is happening in a hard rock copper mine, the deepest in the world. Massive solar eruptions are making neutrinos cause a physical reaction, mutating into a new nuclear particle, heating up the earth's core, acting like microwaves. The world as we know it, will soon come to an end. Two years later, in 2011, they are packing up artworks for safekeeping. Come 2012, people are doing mass suicides as they are heading for the greatest solar climax and a planetary alignment. The crust of the earth is destabilizing. Though where you can go on the planet to be safe? I do not know. Woody Harrrelson explains it is crustal displacement, and the crust will just slip around loose on the planet. They are building arks to evacuate 400,000 people. And the rest is disasters. Really unbelievable disasters. We watch California fall into the ocean and Yellowstone explode. They really went all out for this one. It is exhausting and way too long, but somewhat relevant with Covid-19.

gsmn.org

#### **The Day After Tomorrow**

This is a 2004 blockbuster about climate gone wild. It starts in Antarctica, drilling cores in the ice, and suddenly the ice shelf starts breaking up. Uh oh. A giant crack opens in the ice and everything falls into the giant pit (what pit is below an ice shelf?). Global warming can trigger an ice age (um, yeah really?), and it is snowing in Delhi. So, I guess the Ice Age is coming faster than they thought. And the rest is weather gone wild, and the usual disaster tropes. Chunks of ice falling from the sky in Tokyo, huge hurricanes, buoys showing abnormally cool ocean water, giant hail in California, then tornadoes, and a mega-storm is about to hit New York. Oh, the horror of it all. There are big effects, a chopper flying right next to a tornado, with multiple tornadoes destroying LA. The north Atlantic current has changed because of too much cold fresh water from a month or so of melting ice. Then comes the sudden severe instantaneous freezing. This was filmed before *Absolute Zero*, so this is where they got that stupid idea. 'The superstorm is pulling cold air all the way from the upper troposphere.' It is wildly unreal, as is the rest of the movie. Just sit back and suspend disbelief, OR howl at the screen. Your choice.

#### **Absolute Zero**

This 2006 production starts with a giant crack in the ice of Antarctica (with people falling in, of course) then moves to Miami. When the polarity of the Earth switches, it gets cold instantly. Really cold. Absolute zero. They did it in a special chamber in a scientific facility, so that proves it. Then weird weather anomalies in Antarctica wreck the base camp and research rover. Then the archaeologist discovers petroglyphs in Antarctica. "Science is a series of educated risks, and every scientist knows it." "What if the ice age started in a sudden moment?" "The poles are melting so fast that it changes the shape of the Earth. If the Earth changes shape it can cause the poles to shift." Then an iceberg floats into the Miami marina. Undetected.

The ruthless head of the scientific facility wants to make money from it all. The courageous scientist keeps forging ahead. Then they discover the poles are shifting, like right now. "Everything within 30 degrees north and south of the equator will freeze and go dark, and become absolute zero." More weird and extremely isolated weather anomalies occur. With snow and ice and blizzards. Then an eclipse happens, all over the earth. And all the lights go out. This is totally unbelievable, and I cannot fathom how somebody could make all this up. It is certainly something different, and could be worse.

#### **GSM Membership Renewal**

**It is membership renewal time, and as we will not be meeting in person this fall, please mail in your renewal. An email will be sent to all members reminding you if your membership is up for renewal as some members renewed for 2 or 3 years. You can call membership chair, Joanie at 651-731-0458 with any questions.**

## GSM Membership Application/Renewal 2020-2021

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