November 2023 Volume 77, No. 4

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…

I'm writing this note on a cool, rainy late October evening. The leaves should all be down in the next few days, and that means winter is just around the corner.

The lectures so far have been outstanding, with more great topics still to come. We are in the smaller of the two rooms this fall, but it works well for our needs. The University is still locking the exterior doors at 6:30 and someone will be at the door to let you in. However, please try to arrive before 7 pm so nobody has to miss any of the lecture. If you do arrive after 7 pm, someone will check the door every five minutes till about 7:15.

At the Fall Banquet, we elected Dave Wilhelm and Lowell Hill to fill the board seats being vacated by Patrick Pfundstein and myself (Roger). Dave and Lowell's terms will begin in January 2024. Attendance at the Fall Banquet was 70. We all enjoyed Greg Brick's lecture: The Deep Caves of Minneapolis and the Shock of the Anthropocene.

The lectures in late November and early December will be on Zoom to avoid possible inclement weather and to bring in speakers from outside of our region. See details elsewhere in the newsletter.

A lab is planned for Saturday morning, February 17th with geology instructor and lab supervisor, Jeff Thole, at Macalester College. The topic will be fossils through time. It should be a great lab. Details to follow.

And great news: Ed and Sandy Steffner have offered to host the GSM holiday potluck party again this year. That's scheduled for Dec. 9th. Look for more information elsewhere in the newsletter. I look forward to seeing lots of you there. Ed is looking forward to playing the piano as we sing along to holiday tunes. We'll be sending out additional information via email too.

I want to send special thanks: Steve Erickson for putting together such a great line-up of lectures for us to enjoy. Randy Strobel for keeping the zoom meetings going and his work on developing such great field trips all over the country. Kate Clover, Mark Ryan, Harvey Thorleifson and Rich Lively for their work putting together this newsletter. Patrick Pfundstein for wrangling volunteers to staff our booth at the State Fair and the Minnesota Mineral Club Rock and Mineral Show. I would also like to thank all of the other society members that have helped in so many ways over the years. There are so many that I cannot list them all.

Before the ground freezes and is covered by snow, get out there, take a hike, and do some collecting.

Roger Benepe

GSM President, Roger Benepe

Upper photograph, Mark Ryan

Inside this issue:

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GSM Field Trip to Hudson, Wisconsin, June 1942. Examining rocks of the Ironton Formation.

GSM

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

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

Membership categories and dues:

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

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

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

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

GSM Board Membership:

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

The Board meets quarterly, on the second Thursdays of February, May, August, and November, or on a different date if conflicts arise. In-person meetings are from 7-9 PM at the Minnesota Geological Survey at 2609 W. Territorial Rd, St. Paul, MN 55114.
Board meetings are open to all GSM members. If you are a new or long-time member and Board membership is of interest to you, please consider attending a meeting. If you have a topic you would like the Board to consider, please contact Roger Benepe, rbtrilobite@gmail.com

Welcome New Members!

Erika Wilder, Mpls
Zenobia Evans, Mpls
Susan Grubb, Stillwater
Kim & Norm Olson, St Paul
John Bisgaard, Roseville

GSM Holiday Gathering: December 9, 2023

Ed and Sandy Steffner will again be opening their doors to the GSM clan for a festive holiday gathering. The Steffner's will welcome guests on **Saturday, December 9th from 4:00 - 5:00 pm for appetizers and 5 pm for dinner**. It's potluck. Ed's piano is tuned, and he's ready to play some holiday tunes, and you can sing or hmm along, or retreat to the kitchen. If you play an instrument, bring that along too — more fun! Please RSVP to Sandy where you can discuss food plans and get the address. Sandy Steffner: ssteffner41@gmail.com. All are welcome.

Fall/Winter Seminar Schedule

November 13, 2023: "Deciphering the Details of Dinosaur Worlds: Insights From 35 Years in the Cretaceous Rocks of Montana." *Ray Rogers/Kristy Rogers*, Macalester College.

November 27, 2023: (**Zoom** Lecture) 7 pm start time. "Tennessee's Mining Industry and Geology-Related Tourism." *Ronald Zurawski, State Geologist*, Tennessee Geological Survey.

December 11, 2023: (**Zoom** Lecture) **Note: 6 pm start time**. "T. rex, Triceratops, and MORE: The Dynamic Dinosaurs of Museum of the Rockies." *Ashley Hall, Outreach Program Manager*, Museum of the Rockies.

January 29, 2024: "Sediment Records of Extreme Earthquakes." *Chris Paola, CSE Distinguished Professor*, Department of Earth and Environmental Sciences, University of MN.

February 12, 2024: (**Zoom** Lecture) "Charting pathways to a more sustainable future in the Ogallala Aquifer of western Kansas." *James Butler, Senior Scientist, Geohydrology Section*, Kansas Geological Survey, The University of Kansas.

February 17, 2024: Saturday,10 am - noon. "Fossils Through Time: Fossil Diversity and the 'Big Five' Mass Extinctions." *Jeff Thole, Geology Laboratory Supervisor and Instructor at Macalester College*.

February 26, 2024: (**Tenative**) "PFAS: Contaminant hydrogeology of the East Metro." *Christopher Formby, Hydrologist*, Minnesota Pollution Control Agency.

March 11, 2024: (**Zoom** Lecture) "Tales Told by Trilobites." *Thomas Hegna, Associate Professor*, SUNY, Fredonia, Research Associate at the Buffalo Museum of Natural History.

March 25, 2024: "From Formations to Foundations: The Geology of Bridge Construction." *Jill Mickelson, Senior Engineer*, Braun Intertec.

April 8, 2024: "Important Events In Precambrian Earth History As Seen Through Minnesota's Bedrock." *Erik Nowariak, Precambrian Geologist*, Minnesota Geological Survey.

April 22, 2024: Speaker and title TBD

May 6, 2024: Spring Banquet. U Garden, 2725 University Avenue SE, Minneapolis. Dinner at 5 - 7 pm. Lecture at 7 pm. Speaker and title TBD.

GSM at the State Fair and Minnesota Mineral Club Rock and Mineral Show

GSM returned to the 2023 Great Minnesota Get Together and the MN Rock and Mineral Club Annual Show (MMC) in an atmosphere that was blessedly "normal" for the first time in several years. No concerns of cancellation, no new protocols, and solid attendance.

The last Minnesota State Fair statistic was tracking solidly toward being the highest since the pandemic, but the scalding hot temperatures on Labor Day Weekend caused the last days to run about 130K short of the '22's final weekend, so both ended at 1.8 million. MMC also saw a strong turnout for its two-day run (Sept 23-24).

Steve Fox and Carol Nankivel talking to a visitor at the State Fair. Photo by Kate Clover


Dan Japuntich and Lowell Hill at the State Fair. Photo by Jan Japuntich

Forty GSM volunteers worked over 306 hours enthusiastically representing our organization talking about the state's minerals, and our programs including the Geological Markers and the upcoming lecture season. Visitors took nearly 1400 lecture brochures and 900 Marker maps at the State Fair, while another 400 brochures and 300 maps were picked up at MMC.


Glenn Lee, Patrick Pfundstein and Kate Clover at the Minnesota Mineral Club Rock and Mineral Show. Photo by Lowell Hill

At the MMC shows, lots of people brought us rocks to identify, and we did our best to ID the agates, porphyries, granites, unakite, amygdaloidal basalts, and more. One volunteer, Glenn Lee noted, "one college

Randy Strobel and Joanie Furlong at the Minnesota Mineral Club Rock and Mineral Show. Photo by Suresh Sreenivasan

young woman hung around for nearly an hour asking all kinds of thoughtful questions. I gave her a rundown on magmatic differentiation, which I don't recall ever having had to explain to anyone before. A future scientist in the making?" It was really fun to talk to people with an interest in rocks, minerals and geology.

Both of these shows represent major outreach efforts to the public; efforts vital to GSM's long term sustainability, and this author and the Board extend a deep and hearty "Thanks!" to all of you who made the shows a great success!

Specifically, a serious hat tip to the following members and friends who stepped up to represent our organization so well (* indicates volunteers for both the Fair and MMC): Mark Anderson, Dick Bottenberg, Kate Clover*, Denise Cumming, Myron Kasch, Jean Doyle, Steve Erickson, Steve Fox, Joanie Furlong*, Rebecca and Robert Galkiewicz, Elaine Handelman, Elaine Heisterkamp, Pete Hesse*, Lowell Hill, Janet Hopper, Mary Helen Inskeep*, Frank Janezich, Dan Japuntich, Marilyn Johnson, Alfred Kauth, Sherry Keesey, Roxy Knuttila, Glenn Lee*, Jay Maher, Vanessa May, David McGill, Jim Mirick, Carol Nankivel, Mark Nupen, Rosie O'Donovan, Patrick Pfundstein*, Steven Pinta, John Renwick, Mark Ryan, Pat Ryan, Vernon Schaaf, Cindy Schneider, Alan Smith, Randy Strobel*, Dave Wilhelm, and Harry Wernecke.

Patrick Pfundstein

Notes from the Past

From the Winter 1960 Minnesota Geologist, Official Bulletin of the Geological Society of Minnesota

Fears and Hopes about our Changing Climate, by Lucien Neret, UNESCO Features Writer

Speaking before the American Chemical Society in December 1957, the famous physicist Edward Teller gave a solemn warning about the increase in the rate or carbon dioxide gas in the air. According to Dr. Teller, the carbon dioxide content of the air has gone up by 2% since the beginning of the Industrial Revolution. He said that if the rate of increase reached 10% the melting of Arctic ice would be speeded, causing the level of the oceans to rise quite considerably.

Member Profile: Zenobia (Zee) Evans
Geology and Antarctica


Zee with Mt. Williams in the background.

I'm brand new to GSM. I got a brochure at the 2023 Minnesota State Fair, and three days later I joined. I was able to attend the Fall Banquet in-person presentation on the Deep Caves of Minneapolis, and I've watched two lectures on-line in the short span of time. They are meaningful; I learn something at every lecture.

My love of geology began in high school when my family moved from the Iowa farmlands to North St. Paul. Our St. Paul apartment overlooked a huge vacant lot with fieldstones, and those fascinated me. I must have had 200 pounds of vacant-lot rocks 'collected' in my closet when I left home to join the U.S. Navy right out of high school.

I served for six years as a jet engine mechanic and flight crew and moved back to Minnesota in 1982. Though I was working in building maintenance, my real love was the North Shore, and I visited whenever I could, collecting rocks, admiring the bedrock, and taking photographs.

In 1997, I saw a job posting in the Star Tribune want ads: "Antarctica, Maintenance Wanted, Fax us your resume." I faxed my resume on Monday, the interview was Wednesday, and they hired me on Friday. Within a few months, I flew to New Zealand, then Antarctica. I spent the next year at McMurdo Station, the U.S. National Science Foundation facility on the volcanic Ross Island. I was immediately blown away by the geology that surrounded me. The plethora of volcanic rock types was amazing: pumice to volcanic bombs, to this crazy red rock that the station would crush and use on the roadways. The dust from the crushed rock infiltrated the buildings and created havoc with the air handlers and motors. Nasty stuff, but job security for me. I got my first academic introduction to geology that year. A scientist from the University of Colorado, Boulder taught a geology class to our small Antarctician community. It was that class that fueled my interest in rock identification.

I returned to McMurdo for five seasons, and then was offered a job at the U.S. National Science Foundation's Palmer Station on Anvers Island right off the Antarctic Peninsula. I was foreman of a small maintenance crew supporting the station's infrastructure. Palmer Station looks out onto what we call the Backyard, a glacial moraine with scoured bedrock from an actively

retreating glacier. I explored the Backyard thoroughly during my 13 seasons at Palmer Station and found many unique cobble and boulder glacial erratic rocks. I kept returning to Antarctica most seasons, including some long stints during the pandemic, returning to the U.S. for the last time in October 2022. I worked full-time from home until April 2023 when I retired.

Remarkable Memories in Antarctica

- Wintering in Antarctica at McMurdo station with the sound of the dry snow crunching underfoot in the isolated quietness.
- Flying by helicopter to service a furnace in a science hut in the famous Dry Valleys. We flew over grounded icebergs and penguins on their way to their breeding grounds.
- Taking a tracked vehicle 30 miles in the dead of the Antarctic winter over the frozen ice to do maintenance on the furnaces at a communication hub. From the top of that island, I could see the silhouette of Ross Island and its four volcanoes.
- Traveling across the infamous Drake Passage nearly 30 times. Sometimes it was "the Drake Lake" and other times we had to stay in our bunks to keep from getting thrown to the ground.
- Walking over ice-encrusted snow and sliding down a hill only to realize my Will Steger Mukluks didn't have much traction going back up.
- Going out on zodiacs to help scientists when they needed an extra hand. I got to explore tiny islands. I felt as though I was making a difference in the world by helping these smart minds get the information they needed for their research.

Antarctica in general is an amazing geological wonder. Every view, every breath of wind, every snowflake, and every new geologic wonder is awe inspiring.

Zee Evans at the top of the glacier in the "backyard" of Palmer Station heeding the warning: DANGER, CREVASSES, STOP. But stopping to take a photo.

My hobbies:

Working in Antarctica for most of us meant contract work: six months on (in Antarctica) and six months off (at home). I'd go south during the Minnesota winter (Austral summer) when the temperature at Palmer Station was a balmy +30 to 45F. Often warmer than Minneapolis!

Art and Photography


Onlookers. The only way to get to Palmer is by boat. The views are stunning.

I was lucky to be able to work on my two hobbies – art and photography – both at home in Minnesota and in my Antarctic home. I've enjoyed printing my own photos, hand coloring photos and watercolor painting. In Palmer Station, I sponsored 'art in the bar' every Sunday. We had so many creative souls at Palmer Station, and it was so much fun to watch them work on their projects.

Travel

My partner was an adjunct professor at the U of MN, so we both had summers free and were able to travel. Sometimes, she'd meet me in Chile, and we'd explore Chile and Argentina. Over several years we...

- traveled to the Atacama Desert, took a coast road, and watched the geology change as we drove south.
- visited the Chilean lakes and volcano districts.
- drove the Carretera Austral (Southern Highway) into Chilean Patagonia. We crossed the Andes into Argentina and headed to the east coast of Argentina. We saw forests of petrified wood sticking out of clay mounds, a species of penguin fossils that weren't found in Antarctica, hillsides oozing of ancient shell fossils that caused our feet to crunch as we walked.


Forests of petrified wood embedded in clay, Sarmiento Petrified Forest, Argentina.

- We also enjoyed traveling to South Africa and used 50 Must-see Geological Sites of South Africa as our guide. Over several trips we:
- saw the amazingly deep Kimberley Big Hole diamond mine, the largest hand dug hole in the world.
- explored Vredefort Dome, one of the oldest and largest (90 km wide) impact craters on earth.
- visited the Cradle of Mankind and walked through an amazing geological time frame exhibit showing the

distinct different extinction events.

But the best of all, during this time we also explored Minnesota, visiting the geology and other wonders in each of our 75 State Parks.

I'm excited to be a member of the Geological Society of Minnesota. I can tell fun adventures will be coming in our monthly meetings and Zoom events from all over the U.S.

Story and photos by Zee Evans

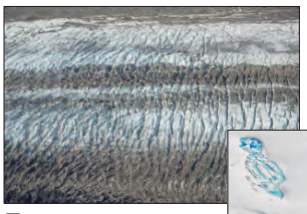
Glaciers I (Dave Wilhelm) Saw in Alaska

After a three-year delay due to COVID, this past July my friend and fellow Illini alum Suresh made our first trip to the Last Frontier, Alaska. Suresh had only 10 days available for this trip, so we had to decide which parts of this vast state to see. We opted to fly into Anchorage, rent a car, then travel north to Denali, southwest to Homer, and southeast to Seward. Although we were warned beforehand that the weather might prevent us from actually seeing Denali during the four days we were in that vicinity, we handily beat the odds and saw it very well each day we were there. In fact, we had excellent warm weather for all but one of our days in Alaska, and even on that one day in Seward, it rained only in the morning.

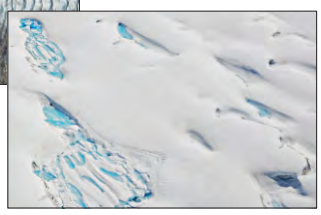
Our first encounter with glaciers was on Denali itself. As Gregory Beckstrom reported in the previous Newsletter, flightseeing tours leave Talkeetna airport, south of Denali. On our first full day in Alaska, we opted for a flight that flew around Denali and landed on a glacier. From the air, we could readily see that glaciers truly are rivers of ice. It was especially interesting to see a confluence of glaciers. Unlike rivers of water, the ice from the glaciers does not mix, so the two glaciers retain their separate characteristics after they merge, leading to bands of fairly clean white ice interspersed with sediment-laden brown ice. Many glaciers were crossed by vast crevasses, although they look small from the air. On the glacier surfaces, we could see many brilliant turquoise melt pools, the color due to suspended glacial flour.

Merging glaciers

Of course, the highlight was our landing and 30-minute stay on Ruth Glacier. In 1903, this glacier was explored by physician and explorer (and likely con artist) Frederick Cook, who named it after his youngest daughter. The glacier's upper reaches are approximately 3 vertical miles below the summit of Denali. Above the surface on both sides are 4,900-foot granite cliffs. Ruth Glacier moves at a rate of three feet per day and was measured to be 4,000 feet thick in 1983.



Transverse crevasses in a glacier



Turquoise pools on Ruth Glacier

Our De Havilland Otter had special landing gear combining both wheels and skis, to allow landing on ice. The sky was brilliant blue, the perfect backdrop for the white of the glacier and the browns and grays of the granite outcrops. From the glacier, we had great views of the main ice-covered peak of Denali, although it seemed dwarfed by nearby outcrops. Unexpectedly, we saw a building on a rock outcrop (nunatak) beside the glacier. This is the Sheldon Mountain House - more than a place to stay, it's an exclusive experience of grand proportion. How much does a stay here cost? As of 2023, the price is $75,000 for up to four people, for a 3-night minimum. This does include the 45-minute helicopter ride to get to the hotel, as well as all food, drinks, and activities.

Combination ski-wheel landing gear

While alpine Ruth Glacier is high on the flanks of Denali, two other glaciers we saw extend to bodies of water. Portage Glacier, southeast of Anchorage, is on freshwater Portage Lake, so called because it is on a portage route between Prince William Sound and Turnagain Arm. Hundreds of years ago this glacier filled the entire Portage Valley, a distance of 14 miles, and was connected to what are now five separate glaciers. Portage Lake has only become visible since 1914, with the rapid retreat of Portage Glacier. We enjoyed a 90-minute excursion on the Ptarmigan to cross Portage Lake and see the face of the glacier, which has a distinct bluish

On Ruth Glacier with Denali rising behind us

Sheldon Mountain House on a nunatak

Portage Glacier

hue interrupted by brown streaks of sediment. The ice appears mottled blue because the red part of white light is absorbed by ice and the blue light is transmitted and scattered. The longer the path light travels in ice, the bluer the ice appears. The crew retrieved chunks of Portage Glacier ice from the lake; these appear completely clear since light travels through a small chunk for a very short distance.

On the Ptarmigan, backed by Portage Glacier

Glacial ice, shed from Portage Glacier

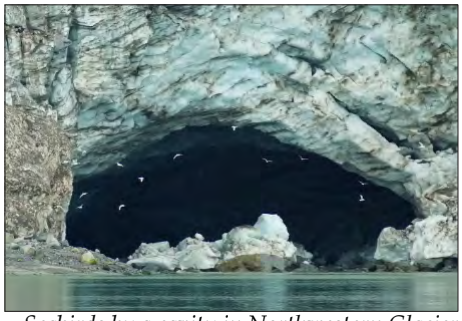
Another glacier we experienced close by is Northwestern Glacier in Kenai Fjords National Park, on an arm of the Gulf of Alaska. Major Marine Tours out of Seward offers various cruises; we opted for their longest (8.5 hours), which took us to the face of this glacier. It takes about half that time to travel to the glacier and back; the rest of the time we viewed wildlife in and near the water, including humpbacks, orcas, sea lions, eagles, gulls, puffins, murres, and other sea birds. The captains of the various excursion boats radio each other, so you are virtually certain to see both species of whales; we saw multiple pods of each and watched their feeding behaviors, including bubble-net feeding. To bubble-net feed, humpbacks dive deep below schools of fish and use bubbles blown from their blowholes to stun and trap fish closer to the surface. One whale generally leads the effort followed by the rest of the group. The leader is usually responsible for blowing the bubbles and the other members surround the fish, following them to the surface by swimming in spiral patterns to keep the fish trapped. During bubble net feeding, the whales swimming toward the surface will have their mouths open and gulp fish from the school they have corralled.

Steller sea lions

Murres on a cliff face

Prior to this excursion, Suresh complained that we had unnecessarily brought lots of cold-weather clothing, since temperatures reached the 60s and 70s each day. On this excursion, partially over the Gulf of Alaska, we were very happy to have many layers of warm clothing! Northwestern Glacier is at the end of a very long, deep fjord. Miles before we reached the glacier, our captain informed us that we were passing over relatively shallow water (a few hundred feet deep). This was the terminal moraine of Northwestern Glacier, from its farthest extent many millennia ago. We reached the glacier by early afternoon; its face loomed white, blue, and brown above us; its upper extent shrouded in fog. The water was filled with ice chunks shed by the glacier, some large enough for lounging seals. Although we could hear the glacier calving large chunks far above, we were not lucky enough to see any plop into the sea. As on Portage Lake a few days earlier, the crew retrieved ice from the sea; I later enjoyed a margarita made with this ice.

Northwestern Glacier



Seabirds by a cavity in Northwestern Glacier

As you can imagine, we saw many more wonders on our ten-day Alaska adventure (especially the grizzlies fishing for salmon at Brooks Falls in Katmai National Park), but I decided to emphasize glaciers in this article. Should you want to see more of the many hundreds of photos I took on this trip, look here: https://tinyurl.com/DaveAlaskaPhotos2023

Story and Photos by Dave Wilhelm

Antarctica: Sand from Cape Evans, Early Explorers, and their Legacy.

This article started as a story about the sediments from Cape Evans on Antarctica and the early explorers whose names are on capes, seas, and mountains. Then at the GSM Fall 2023 Banquet, I introduced myself to Zenobia (Zee) Evans; it was the first GSM meeting she'd attended, and I welcomed her. We talked of her interests in geology, then about her years working on Antarctica. From than meeting, she agreed to be the GSM member for the November newsletter. I also mentioned the story I was writing about the Ross Island sand, and she graciously offered additional photos. Thus the story expanded to include photos of the early explorers' historic huts. Her photos are phenomenal.

(Find Zee Evans' profile starting on page 4 of this newsletter.)

Cape Evans is a rocky, triangular-shaped area on the southwest coast of Ross Island on the Ross Sea. It may be ice-free in the summers, but not always. For early expeditions seeking to land and explore Antarctica's interior, the Ross Sea was often their entry point as it had the least ice among seas around Antarctica. Thus, Ross Island was one of the principal sites of the historic age of exploration. Until the ice shelf collapsed in 1995, the island was connected to the Antarctic mainland. Today, Ross Island lies 70 miles off the coast and is within the boundaries of Ross Dependency, an area claimed by New Zealand. The McMurdo research station is also on Ross Island.

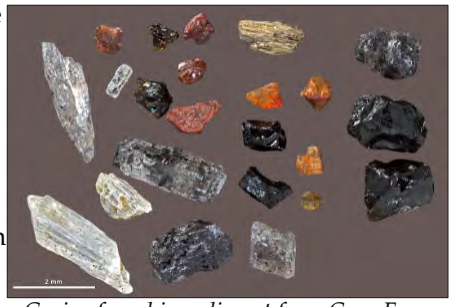
Scott's Terra Nova Hut at Cape Evans, Antarctica. Mt. Erebus is in the background. Photo by Zee Evans

The cape lies west of and on the flanks of Mt. Erebus, Antarctica's best-known volcano. Additionally, Mt. Erebus is the southernmost active volcano in the world and has been active for about 1.3 million years. It is a stratovolcano with a lava lake in its summit crater, and its frequent eruptions (up to six per day) are small and strombolian in character, some of which toss lava bombs onto the crater rim. The lava within the lake is alkalic in composition; and chemically, the lava equates to an anorthoclase phonolite. (Anorthoclase is a feldspar mineral. Phonolites contain alkali feldspar and nepheline.)

Two lava bombs from Mt. Erebus bookend the "Erebus crystals" or anorthoclase. Some anorthoclase crystals from Mt. Erebus are large. The pendant is a polished "Erebus crystal." Ruler is 6" long. Photo by Zee Evans

Volcanic soil found around Cape Evans is rock eroded from Mt. Erebus and entrained by the glaciers to lower elevations. Sample contains gray anorthoclase and glassy black matrix. Ross Island, Antarctica

The sand sample from Cape Evans shows sand and gravel size fragments. Many are tabular, grayish rhombohedrons of anorthoclase; the glassy, black fragments are volcanic glass; the red are breccia. This sample was part of a classroom collection that was deaccessioned at some point; both its exact source and the donor/collector are unknown. But we suspect, these sediments were entrained in glacial ice off the flanks of Mt. Erebus and are the "volcanic soil" found today around Cape Evans.



Grains found in sediment from Cape Evans, Ross Island, Antarctica includes gray to black rhombohedral anorthoclase grains plus glassy black grains and red breccia

Many locations on Antarctica are named after early explorers

Sir James Ross: In 1840, Ross, a British naval officer and scientist took two ships, the HMS Erebus and HMS Terror to within 80 miles of the Antarctic coast until a massive ice barrier (now called the Ross Ice Shelf) stopped their progress. On his second trip to Antarctica, he witnessed Mt. Erebus's eruption on January 27, 1841 then named the volcano after his ship, the HMS Erebus; he also named a nearby volcano after his second ship, HMS Terror. The purpose of Ross's second expedition was to locate the magnetic South Pole. Ross's attempt was unsuccessful, but he did infer its location.

Captain Robert Falcon Scott: From the UK, Scott and his party were the first to explore the area and attempted to be the first to reach the South Pole during the British National Exploration Expedition in 1901- 1904. They weren't able to complete the task. Scott is credited for discovering Cape Evans. He had to sail past it to get to McMurdo point where he'd build his first hut. Scott's first hut, built in 1901-04, is called the Discovery Hut, and it is on Hut Point, near McMurdo Station and 20km south of Cape Evans. The structure served as his headquarters and still stands today.

The kitchen at Scott's Discovery Hut, Ross Island. Photo by Zee Evans

Scott's Discovery Hut on Ross Island. The ice runway in the background services McMurdo Station. Photo by Zee Evans

Scott established a second hut at Cape Evans between 1910 and 1913 on his second expedition. This is the Terra Nova Hut. It was from here that Scott and his team took off from on their ill-fated trek to the South Pole. Unfortunately, Scott was beaten to the South Pole by Amundsen; and he and his team all died on their return journey. Both huts have benefited from ongoing conservation work.

Royal Academy Lieutenant Edward Evans was second in command on Scott's expedition in 1910 - 13. Scott discovered the cape on his 1901 - 04 expedition and renamed the cape for Evans on his second expedition.

The lab at Scott's Terra Nova Hut. The expedition's goal was to collect scientific data. Photo by Zee Evans

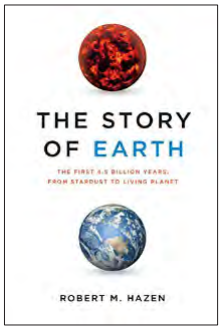
Sir Ernest Shackleton: Shackleton led an expedition to reach the South Pole in 1907-1909 and during his 1914 - 1917 expedition, his team used "Scott's Hut." The hut was locked when they left in 1917 and was untouched for decades; today, it is a designated historic monument. If with a guide, you can visit the hut to see objects from the past on shelves, literally frozen in place. The site contains historic structures and artifacts pertaining to the earliest studies in Antarctica: chairs, tables, beds, canned foods, and dried seal meat. The cold dry climate preserved the artifacts remarkably well.

The kitchen at Terra Nova, Cape Evans, was stocked with provisions, dishes and cookware. Photo by Zee Evans

Story by Kate Clover, sand photos by Leo Kenney, and Antarctica photos by Zenobia (Zee) Evans

Book Reviews

The Story of Earth: The first 4.5 billion years, from stardust to living planet. by Robert Hazen (2012, Penguin)



Most geology books start with the beginning of the solar system, the accretion disk and all that. They mention the early earth, the late heavy bombardment, maybe Theia if it's newer, the great oxidation event, maybe snowball/slushball earth, and then the last 90% of the book deals with the last 600 million years or so, talking about fossils, dinosaurs, trilobites, ammonites, and the rest. The earth is 4.567 billion years old, and ignoring 8/9 of the earth's lifetime seems negligent. Being a person who enjoys the early earth and deep time, this is very frustrating for me. They gloss over all the best parts. Well, if you're like me, there is a geology book for you, The Story of Earth by Robert Hazen. He is a prolific writer and even did a DVD series about all of this as well (The Origin & Evolution of Earth: From the Big Bang to the Future of Human Existence which is in the video library available for rental). His later book, Symphony in C (2019, W. W. Norton and Co.) is also good—C being Carbon, detailing some of the stuff that came out of the deep carbon research group, which he co-headed.

Hazen is a mineralogist, so his story of Earth is told through its minerals and how and when they formed. He starts with minerals in the proto-solar cloud, and progresses through the Ur minerals—those first minerals that existed as earth formed: diamond, graphite, corundum, peridot and others. His take is that earth, life, and minerals co-evolved. 90% of this book takes place before the Cambrian, and that's just fine with me. The boring billion isn't, and how oxygen totally changed the earth and its biosphere is something to behold. So that's why the Iron Range exists.

If you are familiar with James Lovelock's Gaia Hypothesis, that life and the Earth co-evolved, well this is more of that. Lovelock is not mentioned, but his ideas are all over this, though in a different way. Hazen was one of the geologists that discovered that clays were necessary for the formation of life, helping consolidate RNA and making DNA. Nova had a program on the various 'colors' of Earth and how clays helped life along (Life's Rocky Start in the video library).

There is lots of chemistry, but it is not difficult. He explains about atoms and how they bond and how they are distributed in the cosmos and also earth.

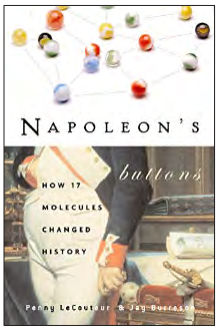
There are fossils, but they are mostly stromatolites. That's good because those stromatolites ruined it for everyone, and I like to read how and why. The increasing oxygen and what minerals it caused and changes it made is well told. He interjects anecdotes about people here and there. The man is engaging and knows how to write. There are few diagrams but they

are well done and descriptive. Some nice photos grace the middle.

He is thorough in his discussion of snowball Earth, the various ideas about just how much of Earth was covered in ice, and how long and how many times. It may seem he wanders at times, but he always goes back to the original idea, and ties it all together.

This is a modern geology book, covering all of earth's history, and leaving the last 600 million years or so as an interesting aftermath to all that went on before. That stuff you can get anywhere, the good stuff is hard to find, but it is all here for you to read and enjoy.

Napoleon's Buttons: 17 Molecules that Changed History by Penny Le Couteur and Jay Burreson (2004, Jeremy P. Tascher/Penguin)



I like history and science, so books about the history of science are naturals for me. But I much prefer books that detail the way science has impacted history. There are several books, Coal, Salt, or Cod and the like which focus on one commodity. Napoleon's Buttons has 17 different substances that have impacted history in a meaningful way, and also detail the chemistry of those molecules. It is not particularly chemistry heavy, but as a person who wonders why ozone smells different than regular oxygen, I like to see the molecules and how a small difference can make a very big effect.

One really good chapter is about vitamin C, Ascorbic Acid. The age of discovery in Europe was a time of sailing ships embarking on long globe-spanning voyages. Columbus, Vasco de Gama and the rest were the 'stars' of this migration. However they all suffered from the same debilitating disease—scurvy. Scurvy results from a lack of vitamin C, and leads to bleeding gums, loss of teeth (which was disastrous for people eating hard tack), lassitude and eventually death. This caused many voyages to falter and even fail. They had to carry more sailors because they expected many would die, and led to press gangs basically kidnapping young men to serve on ships because they could not recruit any other way.

Captain James Cook was the first ship's captain to make sure his crews did not suffer from scurvy. And he was very successful in his voyages because of it. He insisted on a high level of cleanliness on the ship, especially among the tight quarters of the sailors. He also stocked up on fresh fruits and vegetables, and when those were not available, he had his men eat sauerkraut. This was in the 1760's, which shows how late these improvements were made. He had his men eat sea grasses high in vitamin C and also decoctions of pine needles. The limes of the British navy came later.

The chapter wanders far and wide (pun intended) about sailing and discovery and how people managed to adapt and survive, and later thrive. Of course that exploration led to colonization and all the consequences of that. But with the discovery and use of vitamin C, the process became safer and more enjoyable.

The other 16 molecules are equally interesting and creatively told. They include the history of the molecule, how it was discovered or created, and how it was used. One chapter, the molecules of witchcraft, ranges from country herbalism to LSD. It's a wild ride (again pun intended, but you have to read the book).

So find this book and enjoy history, chemistry. and other interesting things.

Deb Naffziger

NATIONAL NEWS RELEASE

USGS partners with Minnesota to map critical mineral potential with cutting-edge data

Mapping effort will identify areas in the state with critical mineral resource potential that could strenthen the national economy

RESTON, Va. — The U.S. Geological Survey (USGS) will invest more than $2 million to map critical mineral resources in central Minnesota in partnership with several Minnesota state partners.

The funding comes in part from an investment by the President's Bipartisan Infrastructure Law in the USGS Mineral Resources Program's Earth Mapping Resources Initiative (Earth MRI), which provides $320 million over five years through the USGS to advance scientific innovation and map critical minerals vital to the Nation's supply chains, economy and national defense.

The work will modernize our understanding of the Nation's fundamental geologic framework and improve knowledge of domestic mineral resources both in the ground and in mine waste, a key step in securing a reliable and sustainable supply of the critical minerals that power everything from household appliances and electronics to clean energy technologies like batteries and wind turbines.

The USGS, the Minnesota Geological Survey, the University of Minnesota Natural Resources Research Institute and the Minnesota Department of Natural Resources will collaborate on an airborne geophysical survey of the Cuyuna Iron Range, a region known for past production of iron and unusually high concentrations of manganese.

"The critical mineral potential for this region is broad and important, including some of the largest identified manganese resources in the United States," said Anahita Tikku, a USGS scientist involved with the project. "As such, it is exciting to be able to better characterize and study this area with new high-resolution airborne magnetic and radiometric data."

"This USGS program offers the Minnesota Geological Survey an opportunity to improve our understanding of geologic resources in the state, including materials needed for cleaner sources of energy. It accelerates our ongoing mission to provide the geologic information necessary to protect and manage mineral- and water

resources across the state," said Anthony Runkel, Interim Director and Lead Geologist, Minnesota Geological Survey.

The critical mineral commodities that are the focus of these surveys are:

Cobalt, used in rechargeable batteries and superalloys

Manganese, used in steelmaking and batteries

Nickel, used to make stainless steel, superalloys and rechargeable batteries

Platinum group elements, used in catalytic converters

The airborne surveys will include the collection of magnetic and radiometric data. These different methods can be used to map rocks at the surface beneath trees and vegetation, and in some cases, several miles underground. Magnetic data, which image the deepest rocks, can be used to identify ancient faults, magma bodies and other geologic features, while radiometric data indicate relative amounts of potassium, uranium and thorium in shallow rocks and soil and can also be used to characterize mine waste.

The new geophysical data will be processed to develop high-resolution three-dimensional representations of bedrock composition and structure to depths more than 3,280 feet (1 kilometer) below the surface.

The 3D models and maps are important for improving our understanding of critical mineral resource potential, water resources, groundwater pathways near legacy mining areas, parameters for infrastructure and land use planning, and potential risks of naturally occurring radon.

More information can be found here. To learn more about how the USGS is investing the resources from the Bipartisan Infrastructure Law, visit our website. To learn more about USGS mineral-resource and commodity information, please visit our website and follow us on Twitter.

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Minnesota Geological Survey
Natural Resources Research Institute, University of Minnesota

Extra Photos Courtesy of Mark Ryan:

GSM Field Trip-Duluth

GSM Lecture-Mark Jirsa: The Sudbury Impact

Trilobite fossil, Lilydale, St. Paul

Field Trip-Spirit Mountain

Image courtesy of NASA

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