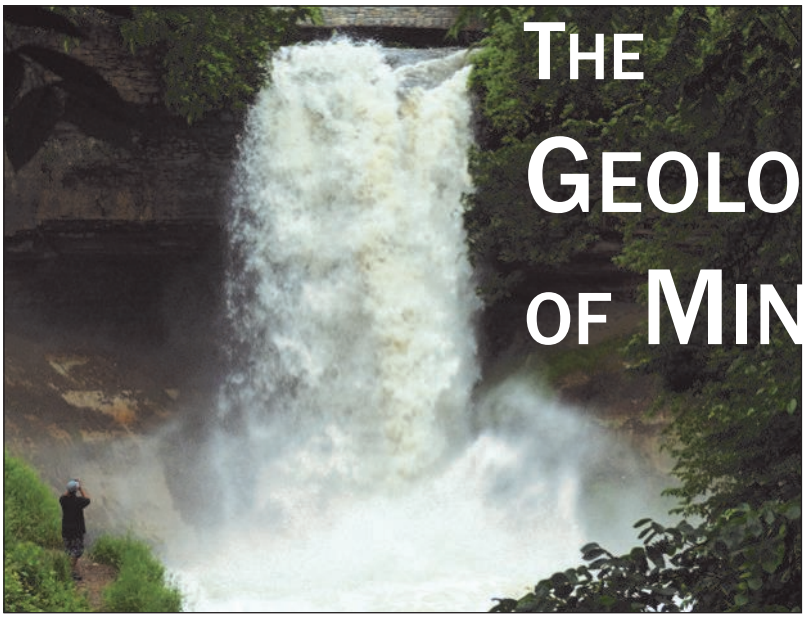
Summer 2016 *Promoting public interest and educational support in the geological sciences* Volume 70, No. 2



The Geological Society of Minnesota News

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

From the President's Desk…

It's summer again, so now's the time to get out and see Minnesota geology up close and personal!

To start off, our lecture series for 2015-2016 was a smashing success. The average attendance was 95 people per lecture, up from 73/71 the last two years! A few of the lectures were deemed by some of our members to be the best they have attended during their time with the GSM. Wow! Thanks to Steve Erickson and Bill Robbins for all your efforts.

Speaking of seeing Minnesota geology up close, Dave Wilhelm has scheduled a series of field trips to help us get out there. Next up is a trip to Eagle Lake Observatory in early June.

Summer is here and it is State Fair Booth time again. This is my favorite GSM activity! The State Fair will run from August 25 to September 5. Dan Japuntich and his team are gearing up to have the GSM booth ready for action. There are only a few slots left, so see Dan right away and sign up before it's too late.

Another way to get out into the field this summer is to help Becky Galkiewicz get the Geological Marker survey completed. We need GSM members to drive to remote places in the Gopher State to find existing markers, record their location, take photos and assess their material condition. Once we compile this information we will determine what needs to be done to maintain this valuable resource.

GSM President, Dick Bottenberg

Speaking of geologic markers, good progress is being made on replacement of the missing Minnehaha Falls markers. As you may recall, 13 descriptive markers were erected in the Minnehaha Falls Park in 1969. These markers provide visitors with basic geologic, historical, and environmental information. They are placed throughout the Park at various locations/places of interest. These markers are made of brass and 10 of the 13 have been removed by vandals. Of the 13, 5 are geological and were sponsored by the GSM. In addition, there is 1 large brass marker erected in 1953 that describes the overall geology of Minnehaha Falls. Carrie Jennings (Freshwater Society/UofM Geology/frequent GSM lecturer) and I met with Minneapolis Park Board representatives and developed a joint plan of action to resolve the Minnehaha Falls geologic marker situation. The Park Board representatives are very receptive to working with the GSM on this effort….more to follow.

Finally, all members are invited to attend our board meetings at MGS. The remaining meetings this year are 19 May, 11 August and 3 November. Have a safe and adventurous summer!!

Dick Bottenberg

Upper photograph: Mark Ryan, Summer 2014.

Inside this issue:

Visit us on Facebook!

from the GSM archives: Field trip stop at Dr. Birch's cabin, North Shore Lake Superior, circa 1944..

GSM News

Officers:
Dick Bottenberg, President
Theresa Tweet, Vice President
Mary Helen Inskeep, Treasurer
Rebecca Galkiewicz, Secretary

Board Members: Kate Clover, John Jensen; Ruth Jensen; Mark Ryan; and Dan Japuntich

Editors: Theresa Tweet; Mark Ryan; Harvey Thorleifson; Rich Lively

Web Site: *www.gsmn.org*

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

Send all GSM membership dues, change of address cards, and renewals to: Joanie Furlong, GSM Membership Chair, P.O. Box 390555, Edina, MN 55439 -0555; Membership dues are: $10 Full-time students; $20 Individuals; $30 Families

GSM News is published four times a year: **February 15, May 15, August 15, and November 15**. Deadline for article submission is the first of the month, before the date of publication.

Newsletter contributions welcomed

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

New GSM Members!

Kirky Otto, Minneapolis; Philip Friend, Minneapolis; Lydia Erickson, Rogers; Jim and Heidi Pipkin, Maple Grove; Mandy Jackson, Minneapolis

Please volunteer for the 2016 GSM State Fair Booth!

Our most important source of funding comes from new membership generated from our State Fair Booth! Please show your enthusiasm for GSM at the Great Minnesota Get Together! We are in our 78thYear and are very proud to be Supporting and Promoting Public Interest in the Geological Sciences since 1938!

State Fair Info:

-Volunteers hand out our 2016-2017 Lecture Series handouts and chat about our Lectures, our Field Trips and our "MN Rocks".

-You do not need to know geology to volunteer. Instructions will be provided!

-The State Fair dates are Thursday, August 25 to Labor Day, September 5.

-We need 2 people for each of the 3 four-hour shifts per day.

-Shift times are 9 AM- 1 PM, 1 PM- 5 PM and 5 PM- 9 PM in the Education Building.

-And, you get to eat cheese curds, milkshakes and foot-longs on your way to the booth!

Please email your date and time choice to me at: danjap7@yahoo.com, or leave a voicemail at 651-216-6678.

Dan Japuntich

Next year's Spring Banquet and Silent Auction

Over the past several years, I have had the opportunity to have some great fun pulling together the Silent Auction and Volunteer Appreciation event. However, I find that it is time to turn this opportunity over to someone new, with fresh ideas. At this point there is plenty of time for the planning and executing of the 2017 function, so if you have enjoyed the occasion in the past, and would like to see this tradition continued, please contact phoenix8185@gmail.com, and thank you in advance for your consideration!

Theresa Tweet

GSM Member Spotlight, featuring Diane Lentsch

How long have you been a GSM member?

I became a member in 1997 or 1998, but did not become active until 1999, when membership chair Gail Marshall took me under her wing and we went on a field trip together. I believe I was one of, if not THE youngest members at the time.

How did you get interested in geology?

Growing up on a glacial lake, I had always collected pretty rocks and agates. But it was while prepping for a back packing trip in Glacier National Park that I was wowed by the story of the Rockies. It got me thinking that I did not know anything about the geology of Minnesota. So I took a Complete Scholar class - 4 Billion Years in MN - taught by Jim Miller, who was then at the Geological Survey (MGS), and it captured my imagination. I was dazzled by the variety of geologic settings in MN - not to mention some

of the oldest rocks in the world as well as evidence of the most recent glaciation. It was Jim who suggested I contact the GSM to continue my hobby.

What do you dig about the GSM?

The other members in the group are such good company on the outstanding field trips. Also, I try not to miss a single lecture in the series...even if the topic does not grab me. I always come away with something new.

Diane Lentsch

NOTES FROM THE PAST, from *GSM News, Summer 1996*

BEWARE: PAINTED ROCKS AHEAD

Rock varnish just got a whole new meaning. It seems the U.S. Forest Service has been busy painting newly exposed rock surfaces along the scenic highways in Washington State whenever they have been laid bare by constructions or landslides. The idea is to stain them shades of gray and brown to simulate that weathered look we "expect" of rocks along our highways.

Were those nasty gashes of fresh rock so jolting that unsuspecting drivers were running off the road? Or perhaps it was another species of traveler they were after. This type has been known to car caravan, sometimes in large numbers, park precariously on narrow shoulders and gaze at fresh outcrops for minutes on end – causing passersby to gaze equally intently at them, and in at least one instance, do an impromptu impact test on the car in front of it. (I think it was Missouri in 1992).

Whatever the motivation, when Representative Jack Metcalf of Washington State got wind of these "rock colorization" projects, he was prompted to intervene – not to save "face" so much as to save money. The Forest Service in cahoots with the Washington State Department of Transportation were about to start dying rocks along a stretch of Highway 2 as it crosses the Cascade Mountains. Estimated cost was $18,000. The bid came in at $37,000.

Both agencies agreed to postpone the paint job for 12 to 18 months to see how the rocks could do on their own. Perhaps they can relieve some of that creative pressure by redoing the Painted Desert.

Commentary by Dwight Robinson, inspired by Reader's Digest, 1995

Coming This Summer – the GSM Marker Treasure Hunt!

As you travel in Minnesota this summer, you can participate in the GSM Marker Treasure Hunt. There are 60-something GSM markers scattered around the state. They will reward you with new knowledge about Minnesota geological treasures.

What you need is a Treasure Map! That's located on the GSM website (www.gsmn.org). Using your laptop, I-phone, or tablet computer, go to the GSM Home Page. Click on "GSM Road Markers" on the Navigation menu. This will take you to a Marker page and a map of the State of Minnesota. Choose a red flag near where you plan to travel, click on it, and go to a page describing the marker.

The description includes:

- the county in which the marker is located
- road directions to find it
- the text on the marker
- the GPS coordinates
- a Google map that shows you approximately where the marker is located

Once you have found a marker, please take a photo, take the GPS coordinates, inspect the marker, and report your findings to the Marker Team.

Why is this a treasure hunt? Because just like on treasure maps, the locations of our GSM markers are not exactly known. It will take ingenuity to find some of them! The Treasure Hunt will award prizes at the September banquet.

Who benefits? We all do! We will be improving our GSM marker database and making it available to other GSM members, to students and teachers interested in geology, to children and their parents who want to travel and learn at the same time. The GSM will become more widely known as a result.

The Marker Team has a goal of maintaining and expanding the network of markers and making them better known to everyone. We need your help! Please participate in the GSM Marker Treasure Hunt and help us improve the marker database on the web -site. The project rollout occurred at the May Banquet and concludes in September.

Becky Galkiewicz launches the GSM Marker Treasure Hunt

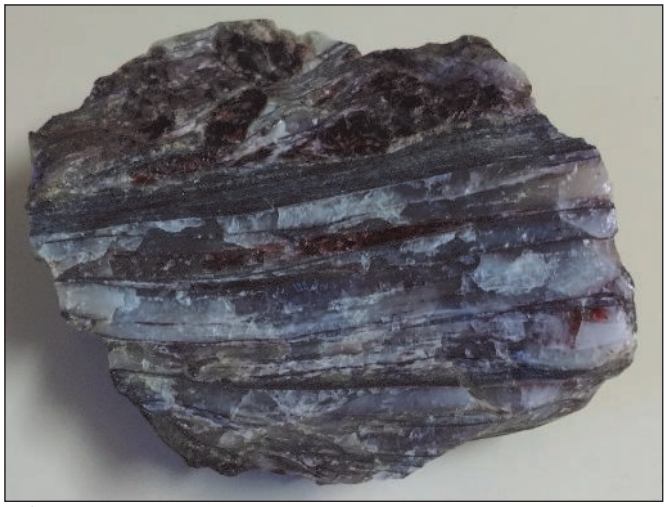
If you have any questions, please contact one of the Team members: Dick Bottenberg, Becky Galkiewicz (rebeccag@us.family.net), Dan Japuntich, Alan Smith, and Ed Steffner.

Becky Galkiewicz

CSI Mineralogy: Using Technology to Investigate Geologic Unknowns

Although this year's lab at Macalester on February 20 could have been considered somewhat similar to last year's lab, the specimens that were brought in were anything but similar!

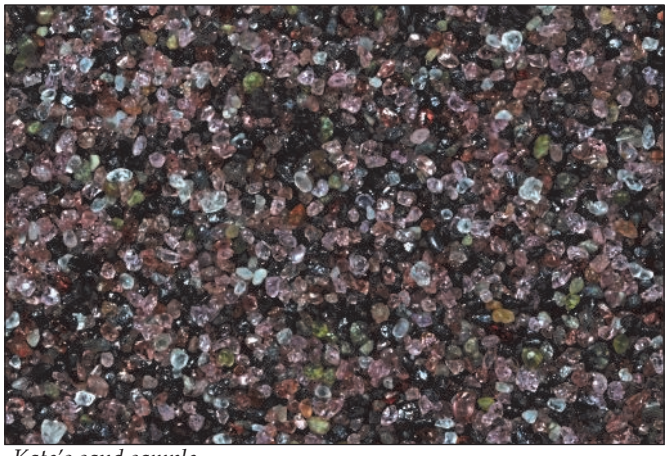
For an example, I brought in a well banded piece of stone. I



Theresa's quartz specimen

could tell that there was some quartz in it, but I had no idea as to the composition of the banding. After the processing, it was determined to be quartz – all quartz – and nothing but colored bands of quartz.

Another of the samples that was brought in for identification was a sand sample from Kate Clover. As if sunlight was being projected through a prism onto a white wall, the colors were



Kate's sand sample

varied, with shades of bright green, rust red and beautiful lavender. These sand grains were later identified as garnets. This sample was intriguing to say the least. In Dr. Thorleifson' recent talk, he mentioned that purple garnets tend to be a guide in finding diamonds.

Kate's example of silicate minerals was a possible indicator to a cache of diamonds. My silicate example was found to be garden variety quartz!

Minerals, you've got to love them. Thank you Jeff for another excellent lab.

For information on the procedures that were used during this lab, check out "Using Electrons and X-rays to Investigate Geologic Unknowns" which can be found in our GSM Summer 2015 edition of the Newsletter.

Theresa Tweet

Tour of Washington County Environmental Center

On a cold, sunny, windy day in early April, nine intrepid souls gathered at the Washington County Environmental Center for a tour. We met in a conference room filled with many interesting recycled items: a 1947 TV, a 1965 'laptop', a giant capacitor from a vintage telephone system, a transparent TV from Stillwater Prison. There was even a circuit board from a Cray laptop with gold circuit paths—they built their stuff to last.

We watched a video explaining the center and some of what they do. Then our tour guide, Adam Fredericks, answered a whole slew of questions—he called us an 'inquisitive group'. We learned most everything can be recycled for later use. They can't recycle mercury—it goes to a storage facility in Canada; radioactive materials go to radioactive storage; latex driveway sealant goes to a landfill after processing; asbestos goes to a landfill after incineration. Lead glass is a big problem—they are still waiting for someone to invent a system to extract the lead from the glass. Otherwise most everything else can be recycled or recovered. That's quite impressive. They even take used needles—sharps. One thing that they can't accept is old prescription medicine; it's too much of a security issue.

Washington County also operates a 'free' room at the facility—they take good paint, varnish, and household products and make sure they are still useable and in sound,

WCEC Free room

closed containers—and people can come and take what they need. This saves recycling costs for the facility, and people get useful products. It's a win-win strategy.

This is a Class II facility, in operation since September 2009, and it's designed for safety. The sprinkler system is especially engineered for the various items beneath. They have retention areas below the floor for 20 minutes of sprinkler output, so a fire won't result in contaminated water spilling out into the environment. There's a cage for empty propane tanks, so if they explode the shrapnel won't injure anyone. But they are

very careful to ensure there are no fires in the first place—all lithium battery terminals are taped before being packed for recycling. The workers are very conscientious; they all wear good safety gear and are careful to never mix incompatible liquids.

WCEC Recycled electronics

The recycled items are shipped elsewhere in the U.S. for breaking down, recovery, processing or safe destruction. Used motor oil powers burners to keep asphalt warm. They reclaim many metals, send pesticides to incinerators, and send electronics and old TVs to sites for disassembly, and recovery. In 2014 they took in 1.3 million pounds of electronics.

They receive money for some items they recycle, but with world metal prices down, that income is also down. Still, it's a good facility and they are keeping a lot of toxic and dangerous material out of our local landfills.

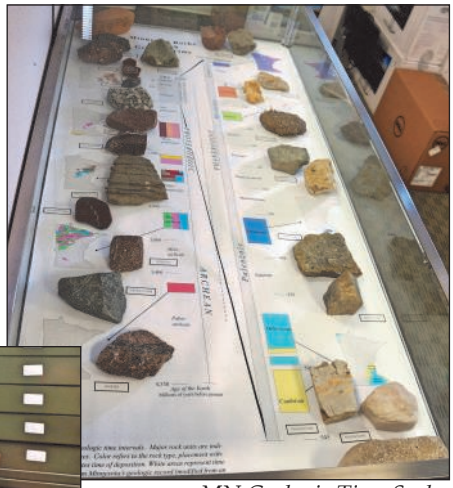
We learned a lot at the WC Environmental Center, and I certainly feel better about recycling efforts in Washington County, and Minnesota in general. The supposedly 45 minute tour last over 90 minutes, but that was just value added to our outing.

Deborah Naffziger

Tour of the Minnesota Geological Survey (MGS)

Harvey Thorleifson calls himself the "politician in the corner office", but he is so much more. Recently, Harvey was our tour guide of the new Minnesota Geological Survey (MGS) facility where he serves as the Director and the Minnesota State Geologist. A person of endless enthusiasm, Harvey is an engaging speaker on whatever topic he tackles. On Saturday, April 9th, he led two GSM groups with almost 50 GSM members participating, on a tour of the Survey at their address on Territorial Road. The office moved to this new location in January 2015, and it was a chore to make the move - they discarded a lot of old papers and other items, but nothing of importance - just the usual detritus that collects over the years.

The Minnesota Geological Survey is a state mandated service housed at the University since its founding in 1872. Originally mandated to find what was 'out there' in the new state, over time the scope and duties of the Survey has changed. Nowadays its mission centers on groundwater and all the activities that support that. Mapping is an important part of the agency's duties, and it's in the process of creating a new Quaternary map of the state. The science and technology have advanced since the first Quaternary map, so it's time for a new one.



MN Geologic Time Scale

Harvey Thorleifson, Director

Touring the office, Harvey said several times that he was there for us - the people of Minnesota - and emphasized that the MGS is open to the public. Funded by the legislature, the agency is also held to deadlines and the timely completion of projects, but the budget is tight. Most projects are co-funded by whoever wants the information. The MGS is re-mapping the state county by county, and the counties that share expenses - or fund a survey outright, get done first. Money is not wasted here at all, and you get the impression that we will never suffer a water crisis like that which hit Flint because of the diligence of agencies like MGS.

The building contains a lot of information, many core samples for research (though the big DNR drill core library is up in Hibbing), a small slabbing area, two soil probe trucks, and many geologists amd staff who work for the agency. Plus there are many displays to see, such as commercial granites quarried in the state; a case of Minnesota rocks spanning across geologic time; several cases of minerals from the Walker (of Walker Art Center) collection, as well as the numerous geological samples that adorn the

Rotasonic core storage

Map in progress

cubicles of the MGS staff. I especially liked the almost-100-pound copper nugget on top of the mica sheets. Other displays include stromatolites, a hand-made canoe, and a mammoth tusk. There's always something interesting to see at the MGS.

The Survey sells maps, but that income is way down because the organization has made all of its output available for free on the web. The maps, their journals - whatever can be uploaded - are made available online. Google "Minnesota Geological Survey" to find them. Still, a pretty, colorful map is always nice to hang on your wall - so there likely will always be paper maps available for sale. Then there's the quilt - created by Aileen and Rich Lively, it is a colorful quilt of the bedrock of Minnesota - for now it hangs at Wilson Library. It was also displayed last year at the State Fair.

It was a fun and informative tour. This is one state agency that works hard and gives a good return for our tax dollars. And Harvey is a dedicated and hard-working director who never forgets where that tax money comes from—the citizens of Minnesota.

Thanks to Harvey Thorleifson and Dave Wilhelm for arranging the tour for us.

Deborah Naffziger

GSM Annual Banquet

On May 2nd, 2016 the GSM Annual Banquet at the U-Garden on University Avenue in Minneapolis attracted over 100 people. The Annual Banquet is usually held in a restaurant, giving members plenty of time for a leisurely meal and a chance to mingle with other interested guests as well as the opportunity to hear an excellent lecture. This evening's lecture was given by the well-known geologist Mark Jirsa, M.Sc., an expert in the area of Precambrian geology from the Minnesota Geological Survey – his title was 'Have Canoe, Will Travel: Geology of the Boundary Waters Canoe Area Wilderness'.

Mark described the state of mapping in northeastern Minnesota, and how a forest fire had presented new opportunities to see the rocks. Mark also talked about Timiskaming-type extensional basin sequences in the Superior Province. Timiskaming type basins form in granite-greenstone belts under extensional conditions. There is a major unconformity with the overlying rocks of the Duluth Complex, which is part of the Midcontinent Rift - a separation in the earth's crust that formed over a billion years ago, and that caused the Lake Superior basin. Magma continued to flow for roughly 15-22 million years. Some sediment was deposited later, but much of the sediment has been removed by glacial events, leaving the basalt flows exposed. The surface bedrock that remains represents the continual weathering, supplemented by fresh rock and filled in by local sediments. So, although we think of the rift as being very old, it is not as old as its host rocks. Mark did a superb presentation on this beautiful wilderness area.

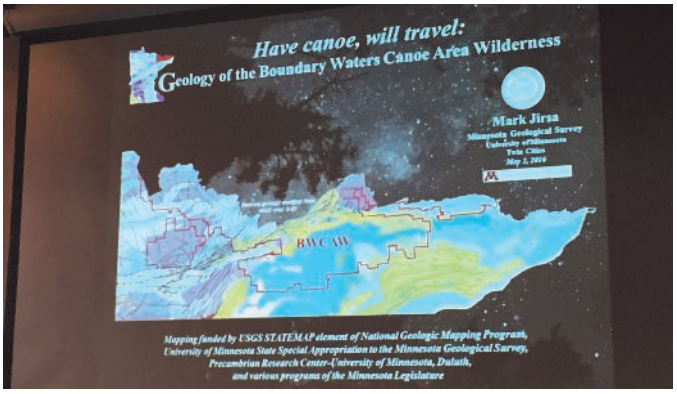
While reading through previous Banquet articles, it occurred to me how the GSM has grown through the years. We just finished up another great lecture season, and Steve Erickson announced that he already has much of the 2016-2017 lecture season put into place. According to Dan Japuntich, his Minnesota State Fair Volunteer calendar sheet has 72% of the dates filled. Also, we have upcoming Field Trips being updated and posted regularly by Dave Wilhelm, as well as a "Treasure Hunt" project to find existing markers and record their location sponsored by the Marker Committee. The GSM membership has expanded over the years, and its offerings and format has evolved to reflect this – meaning that the Geological Society of Minnesota truly does "rock"!

Further reading: https://pubs.er.usgs.gov/publication/70023220

Theresa Tweet

Spring Banquet Room and attendees

Banquet speaker—Mark Jirsa



Banquet talk

Lecture Attendance Summary

In my role as Video Librarian, I am in a good position to "count the room" during lectures, which I have done the past few years. This past year (2015-2016), total attendance for 15 lectures (including 2 banquets) was 1428, which averages ~95 persons per lecture. This compares very favorably to 2014-2015, which averaged 73 per lecture, and 2013-2014 with 71 per lecture. We had 6 lectures with over 100; prior to this there had been only a single lecture since 2012 with over 100. The best attendance of 133 was for "A Tour of the Solar System" in early December, followed very closely by "Volcanoes and Our Past" at 129 in March. Around 104 persons identified themselves as first-time attendees throughout the year, although I suspect the true number is above that. The most common reasons given for new attendees are: referral by friend or relative, State Fair, and website (either ours or a U of MN calendar). Kudos to Steve Erickson for putting together an outstanding, diverse, and broadly interesting schedule this past year.

Dave Wilhelm

Video Library Summary

Since September, 2015, the GSM Video Library has had the following activity:

84 rentals

7 new Video Library memberships

263 unique titles in library

17 new DVDs purchased

2 DVDs donated

16 member reviews of DVDs written and entered into the online directory

You can view the Video Library online directory at http://gsmvl.gsmn.org/, or link to it from the GSM home page. I encourage members to write reviews of videos they have seen, to help others decide what might interest them.

I plan to purchase more new videos by September. If you have any suggestions, please e-mail me at dewilhelm53@msn.com by August 1. Also, consider donating DVDs on geology or other scientific subjects if you are have some that are just collecting dust.

Rentals will start again at the Fall Banquet, but if you specifically request a DVD for rental 24 hours before a GSM tour or field trip, I will bring it.

Dave Wilhelm

GSM Field Trips and Tours

The St. Anthony Falls lab hosted 23 GSM members on March 23 and April 7. Both were very informative tours of this important facility. For Mary Kay Arthur's report on an earlier tour of this lab, see the Spring 2015 Newsletter (Vol. 69, No. 1). Going forward, I plan to arrange one or more of these tours each semester as your interest dictates.

Joanie Furlong arranged a tour of the Washington County Environmental Center on April 2, while Harvey Thorleifson conducted two tours of the Minnesota Geological Survey on April 9. Deborah Naffziger has generously contributed articles on both these tours, which you will find elsewhere in this issue.

Upcoming, we have an excursion to **Eagle Lake Observatory in Norwood-Young America on June 10 at 7 PM.** This Friday evening event will include a lecture on Mars given by NASA Ambassador David Falkner, tours of the telescopes and other equipment at Eagle Lake, and opportunities to view Mars and other celestial objects through the Eagle Lake telescopes. GSM members have expressed overwhelming interest in this event, such that we are at the classroom capacity of 80 persons, with a handful on a waiting list. If you have signed up for this event and cannot attend, please let me know so that someone else can utilize your spot. If you have signed up, you will receive an e-mail reminder a week or two before the event.

Two weeks later on **Saturday, June 25** at 2 PM, GSM member Greg Brick will lead interested members and guests on a tour of the Bruce Vento Nature Sanctuary, where we'll learn about the North Star Cave, Carver's Cave, and Dayton's Bluff Cave. Following, we'll walk over to the Trout Brook Tunnel for the story of St. Paul's buried rivers, and from there reconvene for social hour at the taproom of Flat Earth Brewery, from whose panoramic windows overlooking Swede Hollow, we will speculate on how that valley formed. We'll wrap up with the story of the deep cellars underneath the building, converted to a Cold War fallout shelter during the Cuban Missile Crisis. You can show up for this event without signing up, but if you plan to participate and have not already let me know, I would appreciate your doing that so we know about how many to expect. Around 40 have so far responded. Information on this event will be posted on our web site a few weeks beforehand, and there will be at least one further e-mail to members.

Some time ago, I sent a survey of interest for a weekend field trip to the **Hill Annex Mine State Park** in Calumet, MN, and other sites of interest in that area. GSM member and Science Museum of Minnesota Volunteer Project Lead John Westgaard and his research partner Doug Hanks will share their current research on Cretaceous deposits on the Mesabi Iron Range. Around 50 of you have expressed interest. This trip is scheduled for the weekend of **July 23-24**. It will likely be a 2 or 3 day trip, and we will not rent a bus for it. (Carpooling is encouraged.) You will be free to participate in just selected days if you wish. By the time you read this, you will already have received an e-mail with further information on this trip.

For each of the above trips, I and the Newsletter editors will be looking for someone to contribute a report. It would be great to have someone volunteer before we need to ask. Our web site has guidelines on article

submission. We have a tradition of great contributions; consider being a part of that tradition.

As of May 1, the trips above are those actively being planned. Beyond these, following are a few of the field trip ideas I have received but as of yet have no "champion" (organizer): local glacial history; a trip led by Jim Miller; Mark Jirsa on the effect of the Sudbury impact on Minnesota; the Canadian North Shore of Lake Superior; trip to Chicago to visit museums; trip to intercept the 2017 total solar eclipse. E-mail any other suggestions you might have to me at dewilhelm53@msn.com.

We are always looking for new field trip ideas. Is there some place of geological interest that you would like to visit, or have visited and would like to share with other members? Local field trips can be as short as a few hours, others might encompass a weekend, and still others might take most or all of a week. Often we can recruit a professional geologist as the technical leader. But a field trip also requires an organizer to handling planning, communication, and logistics. For short, local field trips, this does not involve a great deal of work. Trips that span more than one day and involve significant travel obviously require more planning. Having organized last year's Keweenaw trip, and having worked with Randy and Joanie on some of their trips, I have a good deal of experience, and will give you the assistance you need. So, consider organizing a field trip as a way to give back to GSM.

Finally, for those who missed 2015's outstanding field trip to the Keweenaw Peninsula in Michigan, there is this opportunity: Erika Vye and Bill Rose are planning to lead a geotour of the same areas July 25-28, 2016. You can find very detailed information here, along with a link to registration:

http://www.geo.mtu.edu/KeweenawGeoheritage/KeweenawGeoheritage/Geotours.html.

See you in the field!

Dave Wilhelm

Chautauqua Contrasting Crater Lake and Lassen Peak, Part II

In the previous Newsletter (Vol 70, No. 1), I described a Chautauqua that contrasted Mount Shasta and Medicine Lake volcanoes. During the following four days, most of the same participants, including Randy Strobel, Joanie Furlong, and myself, embarked on a second Chautauqua, which studied Crater Lake and Lassen Peak.

Following a day of classroom instruction, we left Weed, CA the morning of August 8 on the 2.5 hour drive to Crater Lake. When I decided to participate in these Chautauqua, the destination that especially sold me was Crater Lake. I'd been within 100 miles twice before, but had never seen it, and particularly wanted to. So I was concerned as we drove north through another day of haze from the forest fires. At the welcome center on the Oregon border, the receptionist had heard that Crater Lake was high enough to be clear of the haze, so that was hopeful. Still, I kept my fingers crossed. But sure enough,

First View of Crater Lake

well before we reached the south shore of the lake, the haze had cleared, and my first view of Crater Lake was as stunning as I had hoped. The lake is famous for its deep blue color and water clarity, and with clear skies that day, it was spectacular.

Both Dr. Bill Hirt, instructor of the Chautauqua, as well as the displays in the park, explained how Crater Lake formed: Prior to 7,700 years ago, Mount Mazama was a broad stratovolcano whose glacier-clad slopes rose to about 12,000 feet. Very suddenly, over a period of perhaps only hours to days, a massive eruption drained

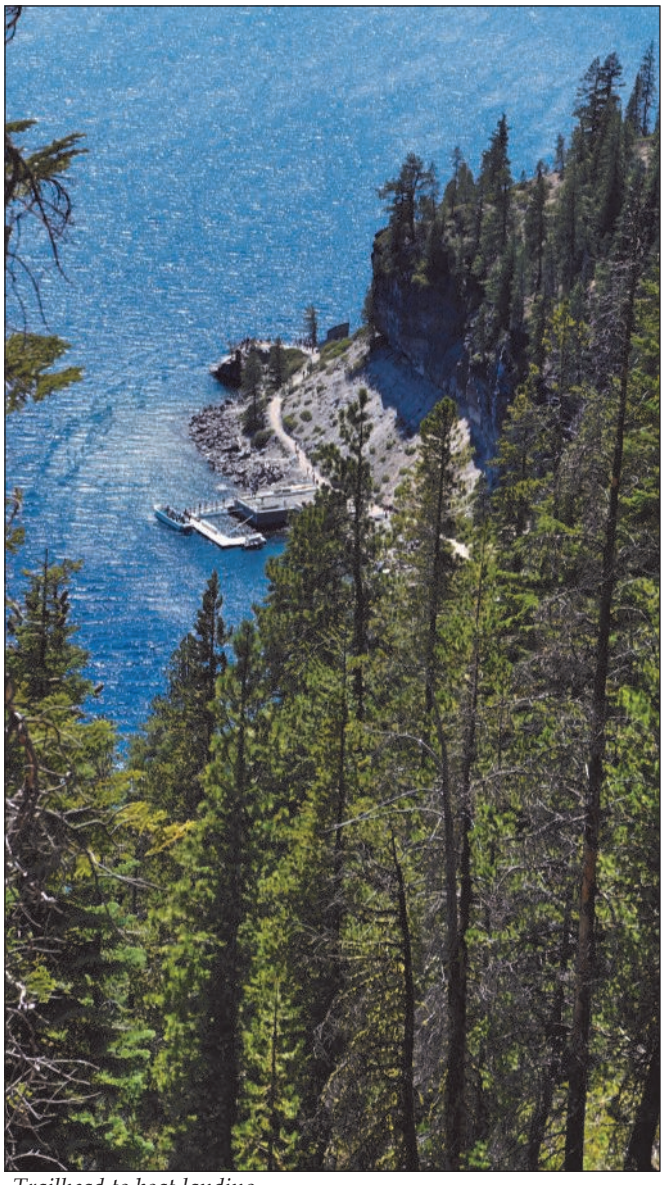
Steep caldera walls

nearly 12 cubic miles of magma from a shallow reservoir that had grown beneath the mountain. Mount Mazama's summit collapsed as the reservoir emptied, which created a steep-walled caldera 5 to 6 miles across and about 1 mile deep. Most volcanic activity on the caldera floor ended within a few hundred years after the climactic eruption, and rain and snow have since accumulated to form the lake. It is estimated that about 720 years was required to fill the lake to its present depth.

Forest fires west of Crater Lake

We circled the lake clockwise from the south. The caldera walls are very steep and the rim varies between 600 and 2000 feet above lake level, so we were treated to many spectacular views as we made various stops during our circumnavigation. But during our lunch break, we could also see a few small forest fires to the west; we were so glad that the smoke did not drift toward the lake.

The highlight of our visit was a boat tour on the lake. There are no roads and only one footpath from the rim to the lake surface, so the excursion started with a hike down Cleetwood Cove Trail, a strenuous 1.1 mile switchback trail with a steep 11% grade and 650-foot vertical descent, and the only legal access to the shore. It was a beautiful day to be on the lake, with pleasantly cool temperatures, a bright warm sun above, and deep clear blue waters below.



Trailhead to boat landing

Excursion boat

During the excursion, we learned that there are no rivers flowing into or out of the lake; the evaporation is compensated for by rain and snowfall at a rate such that the total amount of water is replaced every 250 years. With a depth of 1,949 feet, the lake is the deepest in the United States. Because of the nearly constant lake depth, even though there are no perceived outlets, it is presumed that there is outward seepage just below the lake surface, although many studies through the years have not been able to determine where this occurs. While having no indigenous fish population, the lake was

Wizard Island

stocked from 1888 to 1941 with a variety of fish. Several of the stocked species have since formed self-sustaining populations.

Crater Lake includes two islands: Wizard Island and Phantom Ship. Wizard Island, with an area of 316 acres, formed from a cinder cone that erupted after the lake began to fill with water. The top of the island reaches 755 feet above the lake surface. The cone is capped by a volcanic crater about 500 feet wide and 100 deep. The crater was named the "Witches Cauldron" by Will G. Steel in 1885, who named Wizard Island at the same time. The smaller Phantom Ship is a natural rock formation pillar whose name derives from its

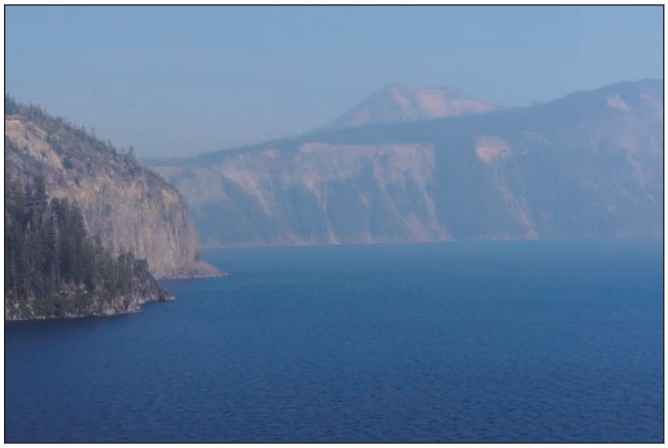
Phantom Ship

resemblance to a ghost ship, especially in foggy and low-light conditions. The rock composing this island dates from about 400,000 years ago, long before the Mount Mazama eruption. This island is about 500 by 200 feet in size and projects more than 656 feet out from the wall of the caldera. Our excursion traveled completely around Phantom Ship, giving us close views from all sides.

One especially striking feature just beyond Phantom Ship is Pumice Castle, which stands out due to its bright orange color and ribbed structure. It is composed of welded and unwelded ash-flow tuff layers that were erupted 50,000 to 60,000 years ago during the growth of Mount Mazama.

Pumice Castle

Shortly after passing Pumice Castle, about 15 minutes before our excursion ended, we noticed lots of haze pouring into the caldera from the west – the winds had shifted, directing the smoke of the forest fires toward Crater Lake. Soon the caldera was filled with a palpable haze. We were so glad that the wind shift occurred late in



Smoke haze after boat trip

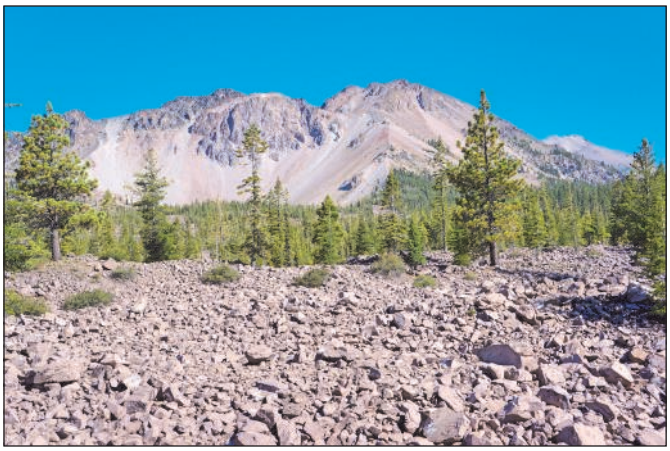
the day so that our excursion was nearly complete while the skies remained clear.

The following day we made our final field trip, to Lassen Volcanic National Park, home of Lassen Peak. Prior to the eruption of Mount St. Helens in 1980, Lassen Peak was the most recently active volcano in the High Cascades. Between 1914 and 1917 its eruptions focused public attention on the volcanic character of northeastern California and led to the designation of this area as a

Northeast side of Lassen Peak

national park. Lassen Peak is a prominent part of the 600,000-year old Lassen Volcanic Center where ongoing thermal and seismic activity indicated the presence of a modern magmatic system. Because another eruption is possible at any time and is likely to produce fast-moving pyroclastic flows and volcanic debris flows that could devastate low-lying areas tens of miles from the volcano, this area continues to be closely monitored by geologists.

The photo shows the northeast side of Lassen Peak, where an area devastated by mudflows and a lateral blast in 1915 is visible.



Lassen Peak, devastated area in foreground

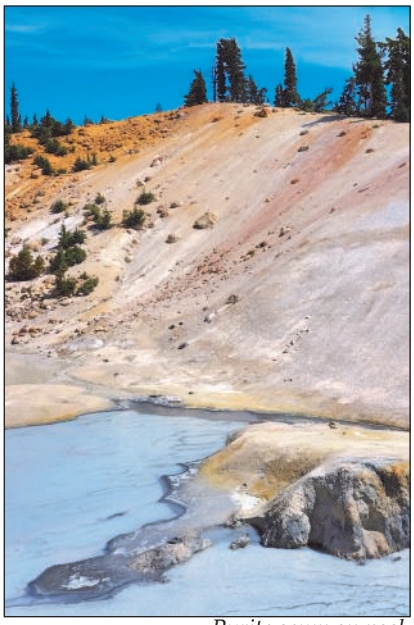
We saw close-up evidence of the destruction that can occur from a Lassen Peak eruption, the aptly named "Devastated Area". This is a swath of land that was swept by repeated debris avalanches, mudflows, and pyroclastic flows during Lassen Peak's 1915 eruptions. Beginning on the peak's northeastern slope, this area extends across the park road and at least a half mile into the forest beyond. In Mid-May of 1915, a small dome of glassy dacite rose into a summit crater that had been opened by earlier steam explosions. This dome was blown apart by an explosion on the night of May 19-20th, and its hot fragments melted snow on the peak and produced a large debris flow that travelled 8 miles down the canyon of Lost Creek. This eruption spread volcanic ash as far as 200 miles to the east.

The highlight of this day was our visit to Bumpass Hell, a hydrothermally altered geothermal area that spans 16

Dave in Bumpass Hell

Boiling mud

acres and has hot springs, fumaroles, and boiling mud pots (but no geysers). Bumpass Hell is the result of fissures that tap the volcanic heat (which is thought to be a cooling mass of andesite, perhaps three miles below the surface). It is named after miner Kendall Bumpass, who in 1865 broke through the surface of a scalding hot mud bank, and consequently lost a leg by amputation. Today, there is a boardwalk through here with signs clearly warning of the danger. Temperatures in the vapor-dominated part of the geothermal reservoir that underlies Bumpass Hell are 235°C, and the water discharged by the springs and fumaroles is rich in sulfates and quite acidic. Intense alteration of the host rocks is apparent in the development of the clay minerals seen in the boiling mud pots and the white outcrops near the boardwalk entrance. As the thermal waters reach the surface and cool, they deposit pyrite (iron sulfide) as a black "mud" in the streams that drain from several of the thermal pools.



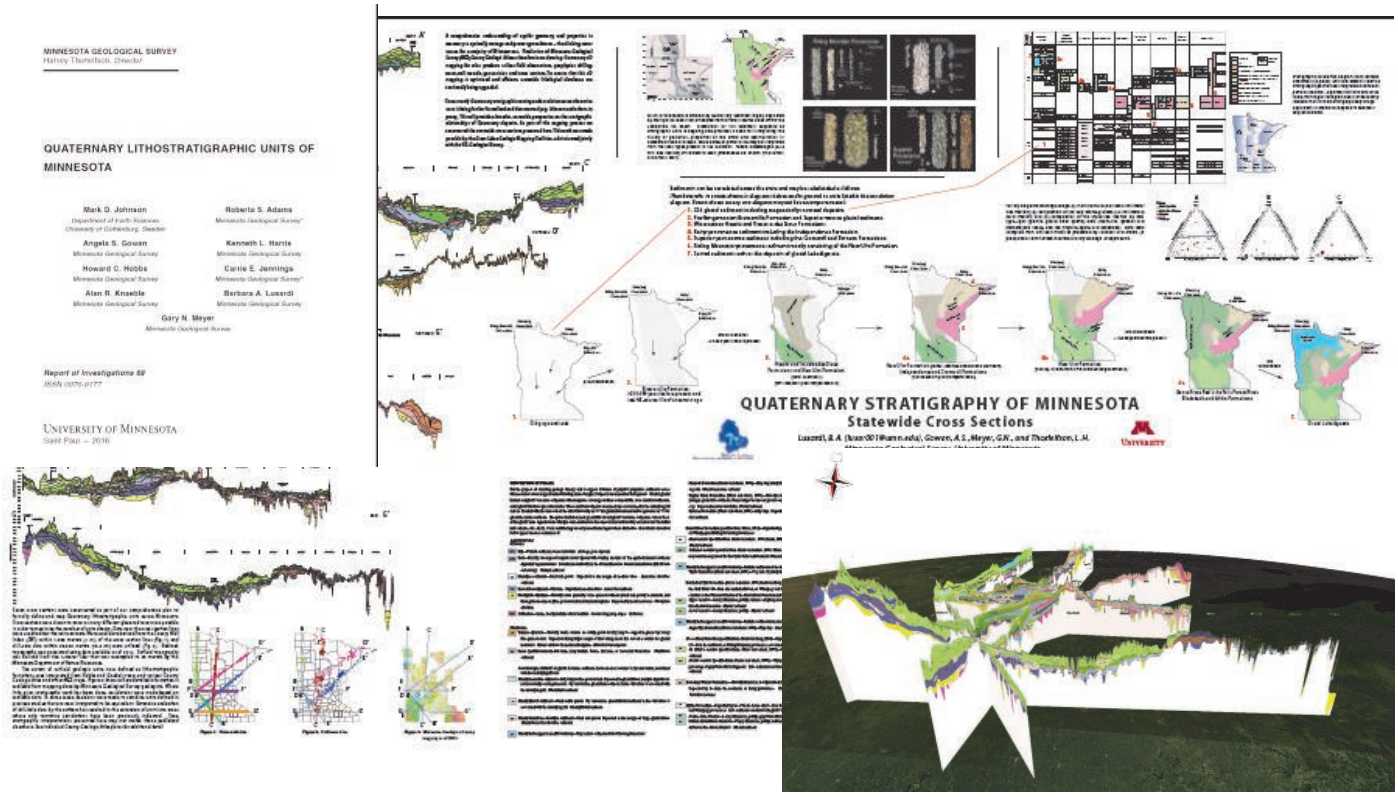
Pyrite scum on pool

I hope you enjoyed reading of the second Chautauqua of Cascade volcanoes. To see more photos, visit my albums at https://picasaweb.google.com/dewilhelm53; they are arranged in reverse chronological order. These Chautauqua and many others will be offered again this year; see the University of Dayton web site http://campus.udayton.edu/~physics/gkm/chau if you might be interested.

Dave Wilhelm

MGS makes progress on Quaternary strata

The majority of all drinking water in Minnesota comes from wells, many of them hosted in the ice age sediments of the past two million years, a time known as the Quaternary. To improve information products meant to support drinking water protection, the Minnesota Geological Survey (MGS) is better defining sediment layers, most recently by releasing statewide cross-sections (OFR 16-1) and a report on naming of strata (RI-68 Quaternary Lithostratigraphic Units of Minnesota).



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