Spring 2016 *Promoting public interest and educational support in the geological sciences* Volume 70, No. 1

The Geological Society of Minnesota News

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

From the President's Desk…

After a 4 year hiatus I am excited to be back on the GSM Board and am honored to be elected as your President. The GSM continues to be a vibrant organization with active members who want to keep up with geological history, events and happenings in Minnesota, the US and worldwide. We do this by learning from experts at our lectures and labs, as well as by first-hand experience on field trips. Most of us are not geologists, but we sure enjoy our geology!

Thank you to outgoing President Dave Wilhelm and Board Members Deb Preece and Roger Benepe for your 4 years of leadership, service and dedication to the GSM. In fact, thanks to the entire 2015 Board: the budget is balanced and membership is growing. The lectures are A+, the field trips are 1st class and the State Fair booth runs like clockwork. What else can I say?

Thanks also to past Presidents and Board Members who continue to provide leadership on committees and guidance as periodic attendees to Board meetings: Steve Erickson, Joanie Furlong, Sherry Keesey, Katy Paul, Ly Preece, Bill Robbins, Alan Smith, Ed Steffner, Sandy Steffner, Randy Strobel, Harvey Thorleifson, and Doug Zbikowski. Of course they all don't come to all the meetings, but I can only conclude that our Board meetings must be interesting if these mentors keep showing up. (By the way, all GSM members are invited to the interesting quarterly Board meetings. The next one is 12 May.)

GSM President, Dick Bottenberg

2016 for the GSM looks to be another banner year. Our State Geologist, and fellow GSM member Harvey Thorleifson kicked off the 2016 lecture series with a cornerstone lecture titled: *Diamonds: Where do they come from and where are they going?* It was interesting to learn about the process used in Canada to locate the sources of the diamonds strewn about by the glaciers and about the people who were involved in that very recent treasure hunt.

Steve Erickson's schedule of top notch lectures is on the GSM website www.gsmn.org. Dave Wilhelm has taken over field trip coordination; this year's schedule is in the works and will be posted on the website once available. Becky Galkiewicz is leading an effort to assess the status of the geological markers throughout the state. Please see her article in this edition. Your help will be needed! We are also looking into working with the Minneapolis Park Board to replace the missing and damaged markers at Minnehaha Falls Park.

I look forward to another year of friendship and geology.

Dick Bottenberg

Upper photograph: GSM field trip to Minnehaha Falls, July 12, 1942

Inside this issue:

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from the GSM archives: Lunch in Brule River state park, field trip along the south shore of Lake Superior, in Wisconsin, circa 1939.

GSM News

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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! - Claude Buettner, Eden Prairie; Barbara Chapman, Edina; Geoff Couling, Bloomington; John Farmer, Fridley; Douglas Herron, Minneapolis; John Hiller, Minnetonka; Paul Kunkel, Eden Prairie; Sheila Maybanks, Woodbury; Deborah Naffziger, Mpls; Phyllis Peterson, South St. Paul; Gerald T. Stahl & Jane Hancock, Mpls; Norm Schiferl, New Brighton; Norm Smythe, Champlin; Stephen Trynoski, St. Paul; Marianne Watters, Oakdale; Shawn West, Albany

Institute on Lake Superior Geology

The 62nd Annual Institute on Lake Superior Geology will be held from Wednesday, May 4 to Sunday, May 8, 2016 in Duluth.

http://www.lakesuperiorgeology.org/

GSM Member Spotlight

How long have you been a member, what got you interested in Geology and what do you dig about the GSM?

Spotlight on: Dick Bottenberg. This is my 9th or 10th year as a member.

My interest in geology is basically a family affair. During WWII my Dad was a young Naval Officer stationed in Norfolk VA. In order to spend more time with his girlfriend (Mom) he enrolled in her geology class at William and Mary College. Their mutual interest in geology lead to her diamond and a family with 11 children. Field trips in the Shenandoah Mountains and later the Mojave Desert with whatever children were around were fun and inexpensive. I studied Oceanography at the US Naval Academy and took all the geology courses they offered (only 2, not much interest in geology in the Navy). All my brothers and sisters are into rock hounding, of course some more than others. Some of us meet yearly at Tucson for the Rock and Mineral Show and camping with the cactus. Most of the nieces and nephews picked up an interest in rock hounding from Mom and Dad as well. One niece is a geology professor at Idaho State University in Pocatello. My grandkids can spot a Lake Superior agate and a Keokuk geode. I just like being out there with them.

As far as the GSM goes, I enjoy the friends and I really dig working the State Fair booth.

Charlie and Liam Bottenberg hunting for Keokuk geodes!

Notes from the Past

Excerpt from the SPRING 1989 Newsletter:

When I joined the Geological Society of Minnesota four years ago, I didn't know what I was getting into. I joined because the field trips were well advertised at the State Fair. I took Earth Science 101 and Ecology. I liked the field trips. We went to out of the way places, stood around and tried to fill in the blanks in what we saw through scientific exploration and imagination, or vice versa.

As a member of the GSM I have perched on hot rocks amid millions of starving wood ticks, scaled mountains (ok, hills), risked life and limb in razor sharp quarries and been rained on all day so I could learn about where I stood in the world. I actually had fun! We seem to be driven, so to speak, to the most photogenic destinations. To prove my point, 1989 summer possibilities include Brown's Valley, Red Wing, and Jay Cooke State Park.

I didn't know that our lecturers would be distinguished field geologists who had "been there." The lectures are part Geology 101, part Geology 5001, part travelogue and part coffee klatsch. Our lecturers are not only willing, but are exceedingly able to provide clear material and field questions for our audience of widely varied sophistication.

Fran Corcoran, President, GSM

Holiday Celebration – 2015

The 2015 Geological Society of Minnesota's Holiday Celebration was recently held at the home of longstanding members Ed and Sandy Steffner. The weather certainly cooperated with this year's celebration, which marked the end of 2015 and ushered in the New Year. The food was fantastic—probably the healthiest fare that I'd ever enjoyed at a holiday gathering. For discussions, field trips (past and present), upcoming lectures, ideas for future field trips, mining in Ely, photography, etc. were all subjects that were passed across the tables of fellow enthusiasts. As has been done in years past, the evening ended with the caroling of a beautiful collection of Christmas and Winter Holiday music. Thanks again Ed and Sandy for hosting such a wonderful evening and cheers to 2016!

Theresa Tweet

GSM Field Trip Coordinator

Since my term as President has expired, I have decided to take on the role of Field Trip Coordinator, one that has not been filled over the past few years. In this role, I am looking for two main things from our members: ideas and organizers. 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.

A few members are planning field trips over the coming months. You will get notice of those when there is something concrete to report. Beyond that, as of January 31, these are a few of the field trip ideas I have received but as of yet have no "champion" (organizer): local glaciology; a trip led by Jim Miller; Mark Jirsa on the effect of the Sudbury impact on Minnesota; the Canadian North Shore of Lake Superior. E-mail me any other suggestions you might have at dewilhelm53@msn.com. Also, I am planning another tour (or two, depending on interest) of St. Anthony Falls Lab (http://www.safl.umn.edu/) this spring, probably March or April. If you have not already received an e-mail concerning this, you will get one soon. Barbara Heitkamp who schedules these tours at the Lab has suggested that since the experiments change, some people might want to take a second tour if it's been over a year. So the next tour(s) will be open to those who have already done one, but preference will be given to first-timers. Recently, a few GSM members have asked if GSM would be doing another field trip to Michigan in the near future. The answer is that we have no plans at this time, partly because we have visited the UP in both 2011 and 2015 (excellent trips both years). However, for those who missed the deluxe Keweenaw Peninsula trip during July 2015, there is an opportunity to participate in a similar trip next summer. Erika Vye and Bill Rose are planning to lead a trip July 18-22, 2016, similar to the one they did for GSM last year. If you feel you might be interested in such a trip, please contact Erika at ecvye@mtu.edu and courtesy copy me. Tell her you are a GSM member. You can contact her any time before summer, but I suggest doing it sooner rather than later, so that Erika will be aware of your possible interest while they make their plans for the 2016 trip. If you would like to know more about the Keweenaw trip, check out these resources:

Web site of 2015 trip: http://www.geo.mtu.edu/KeweenawGeoheritage/KeweenawGeoheritage/GSM_Geotours.html

My photos from the trip: https://picasaweb.google.com/dewilhelm53 (Click on the four "Keweenaw" albums.) and see Frank & Roxie's great article in the previous (Vol. 69, No. 4) GSM issue.— Dave Wilhelm

Geology Markers throughout Minnesota

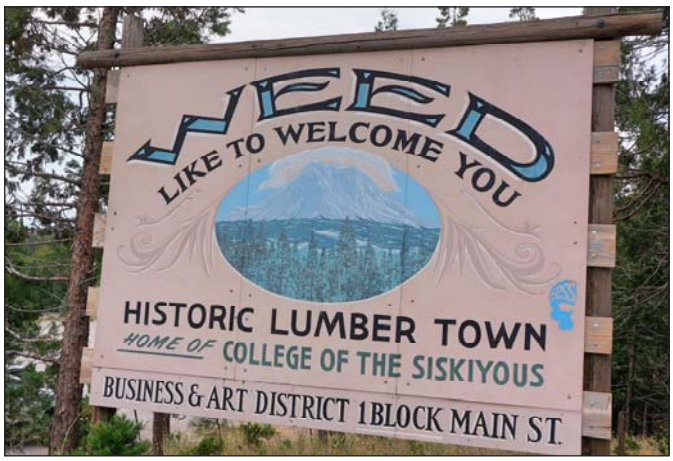
Have you seen the geology marker at Taylor's Falls that describes the glacial potholes? How about the one at Thompson Hill overlooking Duluth Harbor that shows a rift valley? Or the one at Minnehaha Falls in Minneapolis that explains a wandering waterfall? These markers help people understand what has been happening here for the past 3 billion years. There are ~60 markers describing geological wonders, placed around the state by GSM, starting in 1949. This long-term project is on-going and is the Society's gift to the state. But where are all the markers? Wouldn't you like to visit these places to see for yourself? A team of Society members is working to revive the Marker Project. Our goal is to maintain and expand the network of markers and make them better known to everyone. We want to start by encouraging Society members to visit the markers this summer to check the condition of each marker, take photos, and determine GPS coordinates. We'll call it the "GSM Marker Scavenger Hunt."

Currently, the only way people can search for the GSM Markers is to purchase a book from the Minnesota Historical Society, "Minnesota History Along the Highways." Our plan is to put information about the markers onto the GSM web-site so that all of our members can find the markers as they enjoy their journeys around Minnesota. You will be able to access the information on your lap-top, smart phone, or tablet. We also want to make this available to the general public and to out-of-state travelers, which will increase the visibility of the GSM. We need your help! As you make your summer travel plans, please participate in the GSM Marker Scavenger Hunt and help us improve the marker database on the web-site. The project rollout will occur at the May Banquet. If you have any questions, please talk with the Team members.— *Dick Bottenberg, Becky Galkiewicz, Dan Japuntich, Alan Smith, and Ed Steffner*

Chautauqua Contrasting Mount Shasta and Medicine Lake Volcano

On Sunday afternoon, August 2, 2015, I flew into Medford, OR, where Joanie Furlong and Randy Strobel were waiting to pick me up. They had driven from St. Paul the previous week, and the three of us were going to participate in two chautauquas to study volcanos of northern California and southern Oregon. As I deplaned, there was no way to ignore the thick white haze in the air, due to the forest fires last summer in that part of the country. I thought: I'm here to see mountains; this trip could be a real bust. As we drove the 80 miles to Weed, CA, we tried to convince ourselves that the haze was thinning, but it was mostly wishful thinking.

Weed is named for Abner Weed, a lumber baron in the late 1800s. But there are establishments in town that have fun with the name, Grass Auto Repair for one. And there is The Weed Store, where you can buy tee shirts and other souvenirs that pun the town's name. The Mount Shasta Brewing Company in Weed has bottle caps proclaiming "Try Legal Weed". When they tried to sell their products outside California, the feds said they had to remove that motto. The owner went to court and won the right to keep the slogan.



Each chautauqua was three and a half days: one classroom, two day-long field trips, ending with a half-day wrap-up back in the classroom. On Monday, our instructor, Dr. Bill Hirt of College of the Siskiyous, prepped us for two very different volcanos: Mt. Shasta, a classic snow-capped mountain which towers over Weed (when you can see it) and Medicine Lake Volcano, a shield volcano that only a geologist would recognize as a mountain.

Dr. Hirt's classroom has one special feature: very large windows that face directly toward Mt. Shasta. By the end of the day, we were becoming distracted as the haze cleared and Mt. Shasta glowed in all its glory through the window. Maybe this trip wouldn't be a bust after all.

Mount Shasta from classroom

Mount Shasta is one of the 20 or so large stratovolcanoes that dominate the Cascade volcanic arc of the Pacific Northwest. It is a prominent landmark not only because its summit reaches to 14,117 feet but also because its volume of over 85 cubic miles makes it the largest of the High Cascade stratovolcanoes. The mountain consists of four overlapping volcanic cones that have built a complex shape, including the main summit and the prominent satellite cone Shastina, at 12,330 foot, which has a visibly conical form. Mount Shasta's prominence and obvious volcanic character reflect its recent activity. Although the present stratovolcano has been intermittently active during the past 300,000 years, two of its four major eruptive episodes have occurred since large glaciers retreated from its slopes only 12,000 years ago. Mount Shasta's most recent eruption is thought to have occurred only about 200 years ago, and low-levels of geothermal and seismic activity occur on and around the mountain to this day.

Tuesday was our day to tour Mt. Shasta. Alas, the haze was back. We started by exploring Pluto's Cave, a lava tube, and Deer Mountain Cone Quarry, both features some miles north of Shasta's main peaks. I especially liked Deer Mountain, which is a fairly small shield volcano separate from Mount Shasta itself. The dense olivine and plagioclase-bearing andesite that lines the feeder dike at center of the quarry exposure differs in color and texture from the scoria that was deposited on the flanks of the cone. We could see the angular unconformity that separates tephra layers formed during two eruptive episodes and the lack of any evidence of erosion or soil development between these sets of layers. Plus, the bright red, orange, and brown layers were quite beautiful. Still, whenever we could glimpse Mt. Shasta in the distance, it barely appeared through the haze.

Deer Mountain Cone Quarry

We proceeded south through a forest. Bill had us stop at one point, get out, and cross the road. There it was to the southwest: the haze had cleared and we saw the northeast flank of Mount Shasta in all its splendor, adorned with glaciers. It was stunning! We were ecstatic!

Mount Shasta Northeast

We had lunch beside a well-named mountain stream, Ash Creek. The debris flow deposit at our stop was formed during the summer of 1977 as snow and ice on Wintun Glacier, high above, melted rapidly. The flow covered a distance of about 13 miles. Bill next took us on some quite rough forest roads, warning us that we'd likely need to detour and backtrack since he had heard some of the roads were out due to a recent debris flow. No kidding! One road we were travelling came to an abrupt end where a bridge had once crossed a ravine 20 feet deep. We were duly impressed by the power and destruction that a glacial debris flow can generate.

Ash Creek

The highlight of the day was driving as far up Mt. Shasta as is possible, to an abandoned ski area at 7500 feet which is now just a parking lot. Even though we were barely over half way up, only hikers and climbers can go higher. (Bill told us that the builders of the ski resort consulted a local expert on the advisability of

Bridge washout

building a ski area there. After doing some studies, he advised against it and gave his reasons. It was built anyway. They should have listened!) Near the summit, we could see the Red Banks, a pumice cliff. The broad, glacial canyon extending down from Red Banks is Avalanche Gulch. It is partially filled by a mass of loose rock debris and is flanked by Casaval Ridge to the left and Sargents Ridge to the right.

Mount Shasta South

Wednesday, the Medicine Lake Volcano, including Lava Beds National Monument on its northeast flank, was our destination. It has been active for half a million years and differs dramatically from Mount Shasta.

At 140 cubic miles, Medicine Lake Volcano is the largest volcano by volume in the Cascade Range, yet it does not stand out due to its low profile. It is a shield volcano, a type of volcano built almost entirely of fluid magma flows. The term “shield volcano” refers to its large size and low profile, resembling a warrior's shield lying on the ground. The Medicine Lake shield rises about 3,900 feet above the surrounding Modoc Plateau to an elevation of 7,795 feet, but extends 22 miles east to west and 30 miles north to south, covering more than 770 square miles. Thus its height above the nearby terrain is less than 4% of its width. This low profile is caused by the highly fluid lava it erupted, which travels farther than lava erupted from stratovolcanoes like Shasta. This resulted in the steady accumulation of broad sheets of lava, building up the volcano's distinctive form.

On Wednesday, the haze never completely cleared, although it did allow us to see for a few miles. But for Medicine Lake Volcano, this was not a great concern, since the flattened profile of the mountain does not lead to dramatic vistas. But this volcano did have a number of very interesting smaller scale features.

One such feature was an extensional fracture in the rock, caused where thousands of years ago, magma welled up from deep below, such that the overlying rock bulged up and split open. But for some unknowable reason, this magma upwelling subsided before reaching the surface, leaving only the gash in the rock as evidence of what might have occurred. We had a great time clamoring around in this 30-foot deep fracture.

Extensional fracture

The massive weight of Medicine Lake Volcano has caused the underlying rock to warp down by 1500 feet under the center of the volcano. At its center is a 4-by-7-mile caldera. The small lake from which Medicine Lake Volcano derives its name lies within this central caldera; it provided a pleasant location for our lunch.

Medicine Lake

The most recent eruption occurred around 1,000 years ago when rhyolite and dacite erupted at Glass Mountain and associated vents near the caldera's eastern rim. Glass Mountain consists of a spectacular, nearly treeless, steep-sided obsidian flow down the steep eastern flank of Medicine Lake Volcano. Obsidian is a naturally occurring volcanic glass produced when felsic lava extruded from the volcano cools rapidly with minimum crystal growth. We scrambled over literally thousands of beautiful chunks of glossy black obsidian, ranging from pebbles to large boulders.

Glass Mountain

A common feature of shield volcanoes is lava tubes. A lava tube is a natural conduit formed by flowing lava which moves beneath the hardened surface of a lava flow. After the molten lava has drained from the tube, a long, cave-like channel is left. Medicine Lake Volcano has the largest concentration of lava tube caves in North America. There are 25 with marked entrances; the one we explored is the only one equipped with electric lighting. Lava flows dated to about 30,000-40,000 years ago formed most of these caves. I especially liked the lavacicles on the ceiling, which were produced as the level of lava in the tube retreated and the viscous lava on the ceiling dripped as it cooled. I hope you enjoyed this description of the first chautauqua of Cascade volcanos. In the next Newsletter, I'll conclude with the second chautauqua featuring Crater Lake and Mount Lassen. If you would like to see more photos from this trip, visit my albums at https://picasaweb.google.com/dewilhelm53; they are arranged in reverse chronological order. These chautauquas 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

Lavacicles

STEEL: FROM MINE TO MILL, THE METAL THAT MADE AMERICA— A book review by Mark Ryan

If you've ever wondered how and why Minnesota's iron ore became one of our country's most valuable resources (probably second only to oil) then you'll do well to read author Brooke Stoddard's impressive title, STEEL: FROM MINE TO MILL, THE METAL THAT MADE AMERICA. Stoddard's thoroughly-researched book begins with steelmaking's early history, then charts the progress of the industry's processes through the heyday of America's steel magnates such as Andrew Carnegie and Charles Schwab, and into the modern era. Part II of the book should be of particular interest to GSM members as it deals with the mining of iron ore on the Mesabi Range in northern Minnesota, following its shipment across Lake Superior, to its processing and exploitation in the eastern steel mills. If, like me, you've ever dreamed of taking a voyage across the Big Lake on a thousand-foot ore carrier, Stoddard's precise storytelling style will help you realize that dream - at least vicariously. The book is well-written and heavily detailed in its description of everything from blast furnaces, coke ovens and the open hearth, to how pig-iron got its name; from the rise and decline of integrated mills, to the later-developed basic oxygen furnaces (BOF), and mini-mills of today. My dad worked as a metallurgist and mill superintendent for the US Steel corporation, first at the Duluth Works in Morgan Park (where my brothers and I all worked for a spell), and later at the South Works in Chicago. Even after years of listening to Dad's mill stories and his - sometimes lengthy - explanations of the steelmaking process, this book provided a whole heck of a lot of information I just didn't know. Stoddard has produced a fascinating and wonderfully comprehensive history of America's steel industry. I highly recommend it.

2016 GSM LECTURE SERIES – (*Unless otherwise noted) held at 7:00 PM Mondays at the University of Minnesota, Kenneth Keller Hall, 200 Union St. SE, Minneapolis, MN. Room 3-210. MAP

Last minute changes will be posted on our web site: **http://www.gsmn.org**

GSM will make any decision canceling or postponing a lecture due to inclement weather no later than 3:00PM the day of the lecture. This information will be posted on the GSM home page.

Upcoming Lectures:

Feb 20 Saturday February 20, from 10:00 AM to 12:00 PM: Laboratory: CSI Minerology – Using Electrons and X-rays to Investigate Geological Unknowns; Conducted by Jeff Thole, M.Sc., Macalester College, Macalester College; Olin-Rice Science Center (south end of campus, by tennis courts). Geology Dept. is in SW area of basement. Building 14 on Campus Map Road Map

Feb 22 Geophysical Studies in Minnesota; Justin Revenaugh, Ph.D.,Dept of Earth Sciences, University of Minnesota; Kenneth Keller Hall, 200 Union St. SE, Minneapolis MN 55455

Mar 7 Assessing the Influence of Natural Copper-Nickel Mineralization on Water Quality; Perry Jones, M.Sc., Minnesota Water Science Center, United States Geological Survey; Kenneth Keller Hall, 200 Union St. SE, Minneapolis MN 55455

Mar 21 Volcanoes and Our Past; Kent Kirby, Ph.D., Dept. of Earth Sciences, University of Minnesota; Kenneth Keller Hall, 200 Union St. SE, Minneapolis MN 55455

Apr 4 Wisconsin Wild Minerals; Dr. William Cordua, Ph.D., Geology Emeritus, University of Wisconsin, River Falls, Kenneth Keller Hall, 200 Union St. SE, Minneapolis MN 55455

Apr 18 Topic TBD; Cameron Davidson, Ph. D., Dept. of Geology, Carleton College, Kenneth Keller Hall, 200 Union St. SE, Minneapolis MN 55455

May 2 Have Canoe, Will Travel: Geology of the Boundary Waters Canoe Area Wilderness; Mark Jirsa, M.Sc., Minnesota Geological Survey; Spring Banquet & Lecture, U Garden Restaurant 5:00 – 8:30 PM.

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