



# GEOLOGICAL SOCIETY OF MINNESOTA

# NEWS

FALL 2010  
VOLUME LXIV NO. 3

<http://www.gsmn.org>

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## WELCOME NEW MEMBERS

**Bremer, Chris**  
**Carpenter, Roger**  
**Lorenz, Phil**  
**Maijala, Reino & Darla**  
**Manninen, Rita & Gerry**  
**Roe, Sallie**  
**Rosok, Kate**  
**Walker, Catherine**

## President's Message

Greetings!

It's August, State Fair time again, and all is normal in the world of the GSM. It's just like clockwork.

Randy Strobel led 29 geology enthusiasts on an adventurous field trip to the Colorado Rockies and Janet Hopper has more trips planned. Steve Erickson has once again lined up a thought provoking lecture series and Judy Hamilton keeps editing and sending out remarkable Newsletters. Doug Zbikowski and Ed Steffner finished off the \$40K State Park Marker Project grant and have obtained yet another grant to install more markers. With machine-like regularity and precision, Tom Schoenecker and his team have all aspects in place to set up, staff and run the GSM booth at the 2010 State Fair. Alan Smith, Ly Preece and Harvey Thorleifson continue to upgrade and expand the GSM website. Theresa Tweet, Janet and myself are planning the 2<sup>nd</sup> annual Auction and Banquet for 22 January, 2011. Bill Robbins keeps on sending out lecture reminders with astute summaries and Harvey keeps coming up with good ideas. And, just like clockwork, we kick off the 2010-2011 lecture series at the Grand Buffet in St Louis Park on 20 September.

Right on time the new board members are digging in and making a difference. Darrell Mytty has taken over the membership chair from Katy Paul who continues to help with the newsletter and State Fair. Janine Atchison signed up as VEEP and helps run the board meetings.

Of course, just like clockwork we need your help: we have openings on the board for a treasurer and a board member and the committees can always use your talents.

So thank you volunteers for your consistency and clockwork. I look forward to enjoying the activities and conversation as we continue our geological journey together.

Dick Bottenberg, President

## EDITORS'S NOTES

### BOARD MEMBERS NEEDED

We are in need of one new Board Member for next year and we are currently in need of a Treasurer.

If you would like to be nominated to fill one of these positions, please let Bill Robbins know. You can call him at 651-739-1146.

## ANNUAL MEETING/ FALL BANQUET

**September 20, 2010**  
**Grand City Buffet**  
**8912 Hwy 7**  
**St. Louis Park, MN**  
**(952) 912-0888**

**Lecture: Glacial History of Minnesota**  
**By: Barb Lusardi, MN State Survey**

**Business: Election of new Board Members**

### GSM NEWS

**Editor:** Judy Hamilton  
**Production Mgr:** Katy Paul

The Geological Society of Minnesota is a 501(c)3 nonprofit organization. The purpose of this newsletter is to inform members and friends of the activities of the Geological Society of Minnesota. GSM NEWS is published four times a year: **February 15, May 15, August 15, and November 15.** GSM NEWS welcomes unsolicited Geology and Earth Science related articles and photographs. Deadline for article submission is the first of the month, before the date of publication. Send all material for GSM NEWS to the address below.

#### OFFICERS:

Dick Bottenberg, *President*  
Janine Atchison, *Vice President*  
Vacant, *Treasurer*  
Ly Preece, *Secretary*

Directors in addition to the officers listed above: Allan Bowles; Paul Jansen; Darrell Mytty; Alan Smith; Harvey Thorliefson; and Theresa Tweet.

Send all GSM membership dues, change of address cards, and renewals to:

GSM Membership Chair  
P.O. Box 390555  
Edina MN 55439-0555

Membership levels are \$10 Full-Time Students;  
\$20 Individuals; \$30 Families

## Minnesota's Chemical Landscape

Minnesota is a large state with varied geology. Geologic materials at the land surface play a role in agriculture, public health, mineral exploration, and environmental management. These rocks and soils are the foundation of our environment, and they leave an imprint on the chemistry of our water and our lives. This chemical landscape reflects a combination of natural history and cumulative human *impacts*, and it influences biodiversity and human activity. Geochemical mapping therefore is needed to clarify elemental variations, and support assessment of the natural and human-influenced factors that cause alterations. Although there has been much focused geochemical study in and around Minnesota, there was a need for a broad, regional overview that could provide context for present and future site-specific exploration and environmental investigations. To provide this, the Minnesota Geological Survey recently worked with the Minnesota Pollution Control Agency (MPCA) and the United States Geological Survey (USGS) to combine new and existing geochemical data for soil and water into a geochemical atlas. The result provides an objective view of statewide element geochemical patterns in near surface sediments and multi-aquifer ground water samples. Data collected from soil, soil parent material, and well water samples were analyzed following USGS, Geological Survey of Canada, and Environmental Protection Agency protocols, respectively. The soil data include stream sediments, largely in the western part of the state, and the soil parent material data are from sites underlain by till. The well water samples were from aquifers utilized for drinking water, and vary in depth and geology.

(continued on page 4)

## Life in the Anthropocene

In 2002, Paul Crutzen, the Nobel Prize–winning chemist, suggested that we had left the Holocene and had entered a new Epoch—the Anthropocene—because of the global environmental effects of increased human population and economic development. Since then, the term has entered the geological literature informally to denote the contemporary global environment dominated by human activity.

The epochal idea has merit, according to geologist Richard Alley of Pennsylvania State University. "In land, water, air, ice, and ecosystems, the human impact is clear, large, and growing," Alley told *ScienceNow*, an online publication of the American Association for the Advancement of Science. "A geologist from the far distant future almost surely would draw a new line, and begin using a new name, where and when our impacts show up." Jan Zalasiewicz, at the department of geology at Leicester, UK, says: "Sufficient evidence has emerged of stratigraphically significant change for recognition of the Anthropocene - currently a vivid yet informal metaphor of global environmental change - as a new geological epoch."

Mankind's growing influence on the environment was recognized as long ago as 1873, when the Italian geologist Antonio Stoppani referred to the "anthropozoic era," defined by a "new telluric force, which in power and universality may be compared to the greater forces of earth."

In 1926, V. I. Vernadsky similarly acknowledged the increasing impact of mankind on "the direction in which the processes of evolution must proceed, namely towards increasing consciousness and thought, and forms having greater and greater influence on their surroundings." Vernadsky and Teilhard de Chardin used the term "noösphere" – the world of thought – to mark the growing role of human brainpower in shaping its own future and environment.

In the Geological Time Scale, the fundamental units of the Earth's 4.57 billion year history are named, defined, and arranged. Names such as "Jurassic" are used partly because they are useful and convenient (much as historians use terms such as "Roman" and "Victorian") and partly because the framework of the Earth's history was essentially worked out before radiometric dating was discovered: the early geologists had essentially no idea of how old the Earth really was.

The precise definition of these units has been (and remains) troublesome. Even after the advent of radiometric dating, they were mostly not defined in terms of agreed ages—for instance by saying that the Jurassic Period started at 200 million years ago *exactly*. This is because, even now, radiometric dating remains too imprecise to allow the boundary to be fixed precisely: there would be about a half a million year's "fuzziness" around it. The Anthropocene, if it is to be used as a formal geological term, needs to be placed within a context of Earth history.

Today, one typically looks for a "marker" level where the strata above and below are recognizably different (usually because they contain different types of fossils) and then selects the place in the world that best shows that level. *That* point then is chosen to represent, formally, the beginning of a geological time unit. Its title—it is a Global Stratigraphic Section and Point, (GSSP) but more popularly it is known as a "golden spike"— is the standard reference level for a geological time boundary.

For a new epoch to be formally established, either a GSSP needs to be selected or a date for its inception needs to be accepted, which is then ratified by the International Commission on Stratigraphy (ICS). Because it should be possible to select a stratigraphic unit whose age is known in years, the Anthropocene can be defined simultaneously by both criteria, without the uncertainty that plagued attempts to date older GSSPs.

(continued on page 5)

(Chemical Landscape continued from page 2)

The opportunity to produce this regional geochemical atlas resulted from: 1) systematic sampling and analysis of soils and stream sediments across Minnesota by the USGS, with the participation of the MGS; 2) completion of a statewide geochemical survey by MGS, in cooperation with industry, that sampled soil parent materials where they consist of till; and 3) efforts by MPCA to ensure increased availability of existing Minnesota ground-water chemistry data. Each of the data sets has a statewide distribution and samples from each project were analyzed by separate laboratories following consistent and documented protocols for the media sampled.

The following steps were undertaken to produce the atlas: acquisition of soil and stream sediment data from the USGS, compilation of all geochemical data produced by MGS, and acquisition of ground-water data produced by MPCA; production of page-size monochrome maps for each element depicting results from each medium; production of a color poster showing examples of distribution patterns along with regional geological information; and publication of maps, data and report on the MGS web site. The project did not attempt to establish a database structure to accommodate all public geochemical data in the State, but instead was designed to provide a reference for patterns on a regional scale. The compilation is now available on the MGS web site, as a reference for any activity that requires knowledge on regional geochemical patterns.

By R.S. Lively and Harvey Thorleifson, Minnesota Geological Survey

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**MEMBERSHIP RENEWAL**

**Reminder...** if the label on this newsletter has the date 10/1/10, your GSM membership expires September 30<sup>th</sup>. With your support, GSM can continue to offer a fine lecture program, provide area schools with an invaluable resource through the Outreach Program, and introduce you to the pool of talented professionals in the field of geology. Please renew your membership by filling in the form below and mailing it to the address given.

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**Geological Society of Minnesota  
P.O. Box 390555  
Edina, MN 55339-0555**

**Membership Renewal - October 1, 2010 to September 30, 2011**

- \$10 Student                       \$20 Individual                       \$30 Family
- \$50 Sustaining                       \$100 Supporting                       \$250+ Guarantor

NAME \_\_\_\_\_  
(as you would like it to appear in the GSM Directory)

ADDRESS \_\_\_\_\_

PHONE (\_\_\_\_) \_\_\_\_\_ E-Mail \_\_\_\_\_

(Anthropocene continued from page 3)

The first (of many) formal steps are now being taken. An Anthropocene Working Group has been initiated, as part of the Subcommittee on Quaternary Stratigraphy (the body that deals with formal units of the current Ice Ages). That is itself part of the International Commission on Stratigraphy, in turn answerable to the International Union of Geological Sciences. *All* of these bodies will have to be convinced that the case to formally include the Anthropocene in the Geological Time Scale is overwhelming, justifiable, and beneficial to working scientists, and, if so, agree on a formulation of it that will be widely acceptable. The work involved will take several years to accomplish, and the outcome is not certain. The Geological Time Scale is held dear by geologists (because it is fundamental to their work), and it is not amended lightly.

Assembled from various internet sources, by Katy Paul

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## A GEOLOGICAL WALK

We followed the path a glacier took  
Over a meadow, down a brook,  
And saw its scratches on every stone.  
One great boulder overgrown,  
Had come south from Saskatchewan,  
No telling where the rest had gone.

We sat for lunch on a windy plain  
On top of a terminal moraine,  
On top of a miscellaneous mass  
Of dirt and rocks subdued by grass.  
Four travelers with no relation  
Except their means of transportation.

Out of a field of ice-borne stones  
We chose two smooth striated ones  
High on the sides of a ravine,  
Tourists of the Pleistocene,  
And brought them home. Here they will stop  
Till the next glacier picks them up.

Submitted by Dorothy Kuether,  
In reading a book of poems By Betty Bridgman (1958)

### National Fossil Day (Excerpt from the Website)

The National Park Service and the American Geological Institute are partnering to host the first National Fossil Day on **October 13, 2010** during Earth Science Week. National Fossil Day is a celebration organized to promote public awareness and stewardship of fossils, as well as to foster a greater appreciation of their scientific and educational value.

Fossils discovered on the nation's public lands preserve ancient life from all major eras of Earth's history, and from every major group of animal or plant. In the national parks, for example, fossils range from primitive algae found high in the mountains of Glacier National Park, Montana, to the remains of ice-age animals found in caves at Grand Canyon National Park, Arizona. Public lands provide visitors with opportunities to interpret a fossils' ecological context by observing fossils in the same place those animals and plants lived millions of years ago. To learn more, go to <http://nature.nps.gov/geology/nationalfossilday>

**Note: the upcoming lectures for 2010-2011 will be held at the University of Minnesota  
Electrical Engineering/Computer Science Bldg. Room 3-210**

## EarthTrek Marks One Year Anniversary

Boulder, CO, USA – The Geological Society of America, along with more than 20 partners from science and industry, celebrated the first anniversary of EarthTrek on 1 July 2010.

EarthTrek, a global citizen science program, aims to link the general public with scientists and their research. The program offers scientifically minded individuals the opportunity to assist researchers in gathering vital data on a variety of topics, with an emphasis on environmental issues. Those participating in the program will gather local data for inclusion in a worldwide database, allowing scientists to study the global environment in a high degree of detail.

After only one year, EarthTrek already boasts over 1,300 members from 38 countries, including the United States, Canada, Germany, Australia, and the UK; the program's Web site can be accessed in English, German, Norwegian, and Czech. EarthTrek intends to further grow its membership, expand into more countries, and offer the Web site in more languages in the coming year.

EarthTrek comprises both regional and global projects. Regional projects include *Operation Rubythroat*; global projects include the *Garlic Mustard Field Survey* and the *Gravestone Project*.

The *Gravestone Project* asks citizens to locate graveyards and to take measurements of marble headstones in those graveyards. The project's goal is to gather data on the weathering rates of marble; in comparing samples of marble from all over the world, scientists hope to gain a more detailed perspective on pollution and climate change.

More information is available on the project's Web site at [www.goearthtrek.com](http://www.goearthtrek.com)

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### MGS Publication Scans Are Online!

During its history, since 1872, the Minnesota Geological Survey (MGS) has published over 40,000 pages of reports, and more than 600 maps. These documents remain a crucial source of information that the people of Minnesota need to ensure wise stewardship of their water, land, and mineral resources. The documents also facilitate societal benefits related to economic prosperity, public health, natural hazards, aesthetic appreciation and preservation of our natural heritage. In the current era, people access much of the information that they need, or wish to view, through the Internet and the web. In 2007, therefore, at the instigation of the MGS Director, Dr. Harvey Thorleifson, the MGS launched a project to scan and web-enable every document formally published in the history of the organization. This has been completed, with the generous support of the Minnesota Digital Library, and the University of Minnesota Libraries Digital Collections Unit (DCU). In particular, the advice and support of Jason Roy of the DCU is acknowledged with appreciation. A major effort was required to assemble the materials to be scanned. This was thoroughly and diligently carried out by MGS Librarian Miriam Clayton, with some assistance from Dr. Thorleifson. Maps and report inserts were categorized, flattened and labeled, and a record kept of dimensions and color of each map. Metadata for the map imagery was provided by Rich Lively at the MGS. While all reports, including bound foldouts, were scanned by a contractor, maps and loose inserts from reports were scanned by the University of Minnesota Libraries Digital Collections Unit. The unfolded collection of maps, having been scanned, has now been archived at MGS. The link to Minnesota Reflections which is acting as the host site for the map images is now active. MGS maps can be found by Searching for Minnesota Geological Survey or by browsing the collection, where listings are in alphabetical order of contributor. The map images web page is searchable by title, author, county and description; maps can be viewed at a variety of zoom levels. Scanned copies of MGS reports are now available for online viewing. The new report link connects to the University of Minnesota Libraries Digital Conservancy program. So try a google search, and see if you can find them!

Submitted by Harvey Thorleifson, Minnesota Geological Survey

## Thousands of Quakes Strike Glaciers Every Day

Up to thousands of "icequakes" may shake a glacier a day, rumblings that could shed light on how climate is changing. Just as volcanoes involve magma interacting with rock, so too do glaciers often involve interplays between water and ice. As such, giant events within glaciers can occur, with icequakes in Antarctica known to reach the force of a magnitude 7 earthquake.

To learn more about icequakes, scientists in Alaska used equipment and techniques normally employed for monitoring seismic events to investigate the Bering Glacier, which flows from the St. Elias mountain range to the south-central coast of Alaska. Ice in this temperate glacier is near its melting point, leading to a history of dramatic surges.

In the spring of 2007, researchers deployed 5 monitoring stations a mile or so apart from each other on the glacier. The area proved extraordinarily active, generating 160,000 seismic events over the course of some two months in both the shallow and deep portions of the ice, with an average of one event roughly every 30 seconds.

"A huge number of pops and creaks are occurring all of the time in glaciers," said researcher Michael West, a seismologist at the University of Alaska at Fairbanks. "Something as simple as a warm afternoon or a rainstorm has a direct and almost immediate influence on a glacier that can be tracked by listening to the creaks and groans that the ice makes."

Just as seen with volcanoes, there were quakes that shook the glacier back and forth at relatively high frequencies as well as others that made the ice shudder at low frequencies. A third class was seen as well — hybrids that were high- and low-frequency in rapid succession.

When it comes to volcano-linked *earthquakes*, high-frequency events are often thought to result when pressure from a pool of magma causes solid rock to crack or slip, abrupt motions that send out pulses of waves. The scientists think cracking of brittle ice might explain high-frequency icequakes as well. However, they are uncertain about how volcano-linked, low-frequency icequakes might occur.

Hybrid icequakes suggest a link between how low- and high-frequency quakes work. The researchers suggest pressure from water pooled on the surface might drive existing cracks to pop wide, leading to a burst of high-frequency shaking from this cracking followed by extended low-frequency rumbling due to water gushing into the new opening.

By tracking icequakes over months and years as well as across different types of glaciers, one could pin down what causes different kinds of quakes, the scientists suspect. Once the cause is deciphered, further seismic monitoring of glaciers could then reveal if the icequakes are changing over time — due, say, to season or climate — and explain why.

The primary challenge is that glaciers are extremely challenging places to install equipment. While the highest resolution data probably comes from instruments installed directly in the ice, long-term observations will most likely be done using instruments installed on the bedrock adjacent to glaciers. It is doubtful that in-ice installations will ever be able to run consistently for many years. Since <http://www.livescience.com/environment/080916-small-glaciers.html> glaciers flow, the stations are always moving.

**Minnesota State Fair  
August 26 – September 6, 2010**

Don't forget, the State Fair starts Thursday, August 26. If you signed up to work a shift at our booth, you have received the schedule by now. Katy Paul has updated and reprinted the rock guide for the easel and the flip cards.

Each day is divided into three shifts, 9 a.m. to 1 p.m., 1 p.m. to 5 p.m., and 5 p.m. to 9 p.m. Two people are required (by the State Fair Administration) for each shift. The booth cannot be unattended during the open hours of the Fair.

Remember, you don't need to be a geologist to staff the booth. You just need to hand out brochures, smile and maybe talk about the rocks and fossils on the table. People like to talk to you about their special found treasures also. The children are especially excited about the rocks in the display. Show them the books on the table and photographs (usually of field trips) on the backdrop.

It's really a fun experience.



P.O.Box 390555  
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