



**GEOLOGICAL
SOCIETY OF
MINNESOTA**

N E W S

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Dino Update - May 1, National Science Foundation: While scientists have long suspected that birds, and not more basal reptiles, are dinosaurs' closest living relatives, for years that hypothesis rested largely on morphological similarities in bird and dinosaur skeletons. Now, molecular analysis, or genetic sequencing, of a 68-million-year-old *Tyrannosaurus rex* protein from the dinosaur's femur confirms that *T. rex* shares a common ancestry with chickens, ostriches, and to a lesser extent, alligators.

WELCOME, NEW MEMBERS

Brian Allison
Julie Gillis
Anita Hall
David L. Hicks
Debbie & Doug Nonemaker
Michael D. Pedersen
Tony Rozycki
Michelle Sutherland
George Tkach
John Utley

**Fluorite District Field Trip
Pre-Trip Meeting
May 19**

The first informational meeting for the Illinois/Kentucky field trip was held on March 31. Surprisingly, there were seven attendees in spite of the snowy weather. Twenty people have signed up for the trip planned for June 21 thru June 26, not counting travel days. We will explore some of the Fluorite regions of southern Illinois and western Kentucky. There is also a dig scheduled for fluorite and an evening tour with black lights. We are also planning visits to Fluorite museums in Marion, Kentucky and Rosiclair, Illinois and we will be meeting with some local geologists. We will also tour Mammoth Cave with a local geologist. **A second trip meeting is scheduled for May 19 at 7:30 pm.** Please attend if you are interested in joining the trip.

For more information, or for directions to the meeting place call: Sandy Steffner 952-831-6165
or e-mail esteffner@yahoo.com.

Announcements

May 19: 2nd Pre-Trip Meeting for the Illinois-Kentucky Fluorite District Trip

May 30: Science Museum: "Exploring the Microscopic World of Sand Grains" opens

Aug. 3 & 4: Field Trip to the Upper Peninsula of Michigan

Aug. 21: State Fair Begins

Sept. 22: First Lecture of 2008-2009 Series

Oct. 4: Field Trip to the Duluth Area

GSM NEWS

Editor: Judy Hamilton
Production Mgr: Katy Paul

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:

Ly Preece, President
Dick Bottenberg, Vice President
Ed Steffner, Treasurer
Gerry Paul, Secretary

Directors in addition to the officers listed above: Kathy Ahlers; Kate Hintz; Sandy Steffner; Harvey Thorleifson; one vacancy.

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

Notes from the Town Hall Meeting

The first Minnesota Geology Town Hall Meeting, organized by the Minnesota Geological Society, was held on April 5, 2008. Representatives from colleges, governmental agencies, clubs, and teacher organizations presented information on their programs. (photo, page 3)

Dr. Harvey Thorleifson of the Minnesota Geological Survey gave the kickoff presentation describing present programs and future opportunities for outreach. Participants discussed the many resources that exist and how this information could be made available to the general population, clubs, teachers and young people.

The consensus was reached that a central source is needed on the internet to provide information such as print and internet resources, available speakers, club activities, field trips, information concerning government agencies and their programs as well as the resources of area colleges.

The need for another meeting in the fall was discussed.

Thanks to Kathy Ahlers, Dick Bottenberg, Steve Erickson, Ly Preece and Doug Zbikowski for all the work of organizing the meeting.

Presenters

Donald Del Greco	DNR Parks and Recreation
Roger Johnson	MN Archeological Society
Lindsay Iredale	Normandale C College
Jim Stark	USGS
Kate Pound	St. Cloud State University
Stephanie Theriault	University of St. Thomas
Steve Kostka	DNR Lands and Minerals
Jan Falteisek	DNR Waters
Harvey Thorleifson	MG Survey
Steve Olson	Minnesota Mineral Club
Lee Schmitt	MN Earth Science Teachers
Sandy Fuller	Anoka Co Gem & Mineral
Peggy Korsmo-Kennon	Bell Museum
Doug Zbikowski	MN Geological Society

~ By Lee Kaphingst

MEMORIALS

Eva Selander, who many will remember as a feisty woman, passed away January 25, 2008. She was 94 years old. Eva was our GSM president in 1985. She had many interests besides geology among which was politics. If you wanted a good political argument, you would talk to Eva. Her memorial service was April 6, 2008.

Also passed away was **Everett Luhmann** on January 19, 2008. He was 85 years old. His wife, Doris, and he attended many field trips and were both fun people to sit and chat with. Occasionally, they would attend a lecture driving all the way to Minneapolis from Rochester. Everett's memorial service was January 26, 2008.

Participants in the First Minnesota Geology Town Hall Meeting, brainstorming ideas.

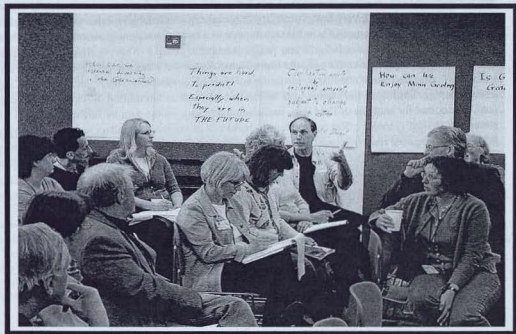
STATE FAIR ... JUST AROUND THE CORNER

The Kimball Memorial Banquet, May 5, signaled the end of this season's lecture series and the beginning of our field trip season. The GSM State Fair information booth can't be far behind. Although the fair doesn't start until August it's not too early to start planning.

In the next couple of months, the Show and Exhibit Committee will start putting together a list of workers for the booth. We will need 72 people, each to work a 4-hour shift at the fair. The fair starts on Thursday, August 21 and ends on Labor Day, September 1. Each day is divided into three shifts, 9a.m. to 1pm, 1pm to 5pm, and 5pm to 9pm. Two people are required for each shift. (Rules of the Minnesota State Fair Administration.)

You don't have to be knowledgeable about geology to staff the booth, just enthusiastic. When people ask you a question at the booth, invite them to a lecture with talks by experts. There are also books and other material to show them.

Even though it's early in the year, this is a good time to get the shift you want. Call Tom Schoenecker at 952-474-4600 and claim your spot.



POTENTIAL FOR GEOLOGIC CARBON SEQUESTRATION IN MINNESOTA

Increasing concern about climate change has necessitated the assessment of ways to reduce greenhouse gas emissions, while concurrently increasing our preparedness for climate change and variability. Emissions reductions can be achieved by reducing combustion of fossil fuels, and by reducing other activity that generates greenhouse gases. Changes in land use can induce increased storage of carbon in soil and vegetation, thus facilitating terrestrial sequestration. In the case of stationary sources of carbon dioxide (CO₂) emissions, however, such as the electrical generating stations, ethanol plants, and other stationary sources that make up over one-third of Minnesota CO₂ emissions, the technology to capture CO₂ is available. The likely fate of captured CO₂ would be storage by injection into geologic formations where it can be stored for long periods of time to prevent its escape to the atmosphere. Another geologic technique is mineral carbonation, in which CO₂ is reacted with material from mining, producing mineral products for disposal or use in construction. While the Duluth region has favorable geology for this option, the method is not fully developed and the costs remain high. With respect to the deep injection method, an option for Minnesota is export of CO₂ by pipeline to one or more potentially willing jurisdictions such as North Dakota or Illinois, where apparently suitable geologic repositories have been confirmed, or alternatively credits could be purchased. It is possible, however, that saline formations in Minnesota could be confirmed as geologic CO₂ repositories.

The only rocks in Minnesota that potentially have the required reservoir properties below about a kilometer depth, the depth required for efficient CO₂ storage, are sedimentary rocks associated with the Midcontinent Rift, an extension of the Lake Superior basin that extends to Kansas. Criteria for potential include depth, porosity, permeability, seal, integrity relative to previous drilling or fractures, appropriate chemistry relative to lack of drinking water potential and chemical trapping mechanisms, and adequate data availability. The prospective rocks are known largely on the basis of geophysical surveys, indicating two north-south belts on either side of the Twin Cities. It is stressed, however, that currently available data indicate that there is a very low probability of success in confirming suitable geologic conditions for deep geologic sequestration of CO₂ in Minnesota, due to a lack of adequate permeability. Should more conclusive information be needed, a 3-year program including deep (~2 km) drilling will be required. A one-year pre-drilling phase costing about one million dollars would include geophysical surveys, further analysis of cores and water chemistry, including analysis of regional diagenesis, and numerical modeling of CO₂ storage. Drilling in the second year would cost as much as ten million dollars. A third year would then be required for analysis of field data, including integration of the data by further numerical CO₂ storage modeling. A major effort costing tens to hundreds of millions of dollars would then be required to fully test for required reservoir capacity and properties, and the probability that these requirements would not be confirmed, despite this effort, is high. Minnesota may therefore be forced to rely on other methods to achieve climate change-related objectives.

~Harvey Thorleifson, Minnesota Geological Survey

WOMEN IN GEOLOGY

In 1886, a woman named Rebecca "Carrie" Everson was awarded a patent for a process to separate waste rock from metallic substances. Her patent described a process called flotation separation which eventually became critical to the mining industry as high-grade ores were depleted and, for the most part, only low-grade ores remained. Flotation is a mineral separation process, which takes place in water-mineral slurries, and is widely used for concentrating fine-grained minerals. It takes advantage of the different physical and chemical surface properties of minerals—in particular, their wettability, which can be a natural property or one artificially changed by chemical reagents. The surfaces of some minerals can be made more hydrophobic (water-repellent) by conditioning with selective reagents, often acids. Only hydrophobic particles selectively attach to air bubbles that are introduced into the water-mineral slurry and are carried by the bubbles to a froth layer above the slurry, being separated from the hydrophilic (wetted) gangue particles. Everson carried out a wide range of experiments to define processes appropriate to separate various minerals from different types of waste rock, and this activity gave her patent a firm basis to withstand legal challenges. Shake tables were in use to concentrate ores based on density differences and recovering 92 to 96% of the ore, but flotation could recover 98 to 99% of the valuable ore, and achieve this at much lower operating costs.

To be sure, Everson did not receive any money from her patents, a fate shared by many, if not most, inventors. One possible cause in her case may be the reason alluded to in the following quote: "as a metallurgist, she was a quarter century ahead of her profession." [1915, *Engineering and Mining Journal*]

Another reason may well have been that she was fighting an uphill battle as a woman in a "man's industry," a problem that too often seems to continue to this very day. But the invention was ahead of its time, and her ability to be well ahead of the rest of the industry becomes very clear from the following: "In connection with the mass of litigation over flotation patents it is interesting to note that a patent covering the use of a fat or an oil or a constituent thereof, an acid or soluble neutral or acid salt and water, in ore separation, was given to Miss Carrie J. Everson in U.S. Patent 348157, Aug 24, 1886. This patent long ago expired in all the countries where it was taken out." [*Engineering and Mining Journal* Vol XC1 (1911) p. 745] [Note the 1911 date of the quote vs the 1889 date of the patent]

At the time, US patents expired seventeen years after issuing, and shortly after expiration of Everson's patent, the mining industry was beginning to recognize the utility of her patent as various high-grade ore deposits were depleted. Dozens of new patents were filed, and litigations were initiated as people started to use the techniques she had taught in her basic patent. The litigations eventually arrived at the U.S. Supreme Court. Everson's patent held up well, due to her careful work to develop the whole basis of flotation concentration, which was disclosed in the Everson United States patent No. 348,157 and in the Froment British patent.

Discouraged by the death of her husband, her own financial situation, and the inability to get financial backing for her ideas, she gave up trying to commercialize the process. She pretty well lost interest in the subject, and both she and the patents lapsed into oblivion. She was recognized after her death, including a nomination to the Industrial Hall of Fame. For reference, Rebecca "Carrie" Jane Billings Everson's patent, US Patent 348,157, was issued on August 24, 1886, and a second patent, US Patent 471,174, was issued to her and Charles B. Hebron on March 22, 1892.

After her death in 1914, there was a good deal of interest in the Mining community. Inquiries resulted in her "rediscovery", and articles about her appeared in several mining journals as well as the Denver Rocky Mountain News.

(Excerpted from "Women Inventors" by Linda Jacobs Altman, printed in *The American Profiles* series, published by Facts on File, Inc. Issue ix, 118p. Submitted by Bill Robbins)

Earthquakes in the Midwest

April 18th, 2008: At 4:37 a.m. local time, a magnitude-5.2 earthquake rumbled across southern Illinois, producing a rude awakening for people across the Midwest. The focus of the temblor was about 11.6 kilometers deep, according to the U.S. Geological Survey (USGS). The earthquake's epicenter, seven kilometers north-northeast of Bellmont, Ill., is in the Ozark Dome region of the Illinois Basin, which covers parts of Indiana, Kentucky, Missouri and Arkansas. Earthquakes have occurred periodically in the region, with the most powerful a magnitude-5.4 earthquake in southern Illinois in 1968, according to USGS.

The Ozark Dome region is far from any tectonic plate boundaries, where the causes of earthquakes are better understood. The region contains many known faults, but many others remain undetected. Scientists are also uncertain about which of the known faults are still active.

Although less frequent than earthquakes in the western United States, earthquakes in the east-central United States tend to be felt over a much broader region, according to USGS. Earth's crust is older in the Midwest than in California, and therefore is also thicker, cooler and more brittle, so earthquake shockwaves also travel farther and faster in the Midwest.

The USGS Web site received more than 23,000 reports from people who felt shaking from the earthquake, from as far away as Georgia, West Virginia and Alabama. Minor damage to buildings in Louisville, Kentucky from Friday's earthquake, was reported but no major damage has yet been reported.

The Ozark Dome region is northwest of the more seismically active New Madrid Zone where a series of powerful earthquakes stronger than magnitude 8 in 1811 and 1812 caused widespread damage throughout the Missouri Territory, rang churchbells in Boston, Mass., and altered the course of the Mississippi River.

UPCOMING FIELD TRIP PLANS

Here are the preliminary plans of two field trips. Each GSM Member will receive a notice in the mail, prior to each trip, with all of the details, times, locations, etc. In the meantime, you may want to reserve these dates on your calendar.

Upper Peninsula of Michigan

Sunday, August 3rd and Monday August 4th, 2008

Leaders: Gene and Sally LaBerge

(Gene LaBerge is the Author of "Geology of the Lake Superior Region")

We will meet at the wayside on US Hwy-141 just outside Niagara, Wisconsin. Gene plans to show several rock exposures between Niagara and Pembine, Wisconsin and then cross over to the Norway, Michigan area with a stop at Piers Gorge on the Menominee River (the Mich-Wis border). This area shows where a volcanic island chain in Wisconsin collided with sedimentary rocks on an older continent margin in Michigan. It is basically a "subduction zone", which Gene will explain to the group.

We will drive to Ishpeming in the late afternoon and stay there Sunday night -- there are a number of motels in Ishpeming and Marquette. Then we can spend as much time as folks wish on Monday looking at some of the features of the iron mining district, and some of the "impactite" -- or fall-out from the huge meteorite that landed in the Sudbury, Ontario area 1,850 million years ago (and helped cause the huge nickel-copper and platinum deposits at Sudbury). Our last stops would be somewhat west of Ishpeming on the way back toward the Twin Cities.

Duluth Area

Saturday, October 4th, 2008

Leader: Jim Miller

Meet at Moose Lake State Park Agate Center between 8:30-9:00 AM

Some of the highlights of the trip may be:

Thomson Dam - deformed slates of the Thomson Formation

Grandview Golf Course site - base of the North Shore Volcanics

Bardon Peak - Duluth Complex gabbro

Thomson Hill Rest area - lunch and more gabbro

47th Ave Quarry - anorthositic phase of the Duluth Complex

Observation tower Hill - top of the Duluth Complex

Duluth Clinic outcrop - porphyritic basalts of the North Shore Volcanics

Leif Erickson park - interflow sandstone and lavas

Amincon Falls St Pk - Douglas Fault (if time and interest allows)

Trip ends at 5PM

For More information Contact: William Robbins 651-739-1146 robbins.wb@comcast.net

The Art and Science of Sand Photography

The Microscopic World of Sand Grains, an exhibit showcasing the art and science of sand photography by Dr. Gary Greenberg opens at the Science Museum of Minnesota in the Collections Gallery on May 30, 2008.

Greenberg's stunning high-resolution photographs explore the exquisite beauty of sand grains magnified up to 300 times actual size. When seemingly mundane sand grains are magnified through the microscope, they show the beauty and splendor of nature and tell amazing stories of the regional geology and ocean ecosystems.

As an inventor, Dr. Greenberg has developed three-dimensional microscopes as scientific research tools; today with unabashed enthusiasm, he devotes his artistic talents to using his microscopes as tools to capture the detailed beauty of ordinary objects such as grains of sand. He shows us how extraordinary commonplace things are when we stop for a moment to look closely.

His recently published book, *A Grain of Sand*, further illustrates the surprising beauty of individual grains of sand from around the world. The exhibit opens on May 30 with a free reception and book signing with the artist, Saturday May 31, from noon to 3 p.m. ♦



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