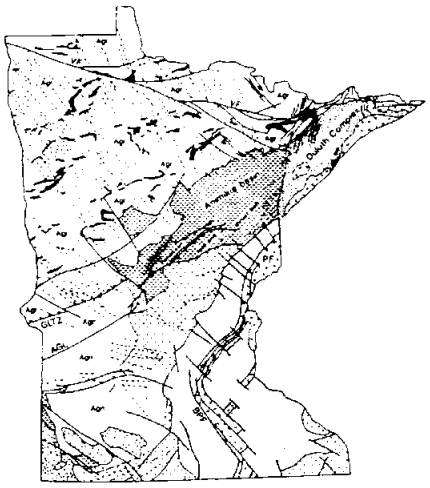

GEOLOGICAL SOCIETY OF MINNESOTA

N E W S

WINTER 2005
VOLUME LIX NO. 4
http://www.gsmn.org

◄◄2006 BOARD MEMBERS►►

Roger Benepe
Cindy Demers
Bill Farquaher
Kate Hintz
Janet Hopper
Dorothy Kuether
Gerald Paul
Edward Steffner
Sandra Steffner

Many thanks to Ted Chura (Treasurer) and Paul Martin (President 2003 and 2004) who are leaving the board after having served for 4 years. Please congratulate and thank them both for all of their hard work and dedication. The positions they vacate will be filled by Edward Steffner and Sandra Steffner.

Officers will be announced at the first lecture in January, and will also be listed in the next (February) edition of the newsletter.

New Editor…

Beginning in 2006 we will have a new Newsletter Editor. Kathy Ahlers has graciously agreed to take over the newsletter responsibilities. I will continue to work with her for the next couple of issues until she feels confident on her own. And of course, I'll continue to submit articles for the newsletters when I can.

Kathy wanted me to "….emphasize that I will be your apprentice and will need members' patience as I learn my job. Also, I'm excited about the opportunity to get to know more of the members, and I look forward to encouraging new writers and hope that they will answer the phone when it's my name on the caller ID! "

Please give Kathy your assistance by providing items of interest for the newsletter publications. Articles written on geological topics that are of interest to you, descriptions of field trips that you have taken part in, locations that may be of geological significance to members, trips that you have taken to other countries and the geological features you saw there, etc. would all be welcome. (As always, the editor reserves the right to edit or reserve the article for future use.) Send these to Kathy via e-mail at: ahler002@umn.edu Thanks to all of the membership for helping me these past several years. Your compliments, articles, criticism and encouragement, have all been greatly appreciated. *~Katy Paul*

Announcements

IF the date on the mailing label on this newsletter ends with 2005, this is the last newsletter you will receive. Renew your membership now, and continue to enjoy the benefits that the Geological Society of Minnesota has to offer.

GSM *NEWS*
Editor: Katy Paul
952-829-7807

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 three weeks before the date of publication Contact the editor if you have anything to submit.

Send all GSM membership dues, change of address cards, and renewals to the GSM Membership Chair: Gail Marshall, 12232 Allen Drive, Burnsville, MN 55337; phone: (952) 894-2961

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

Dinosaur Tracks – Dinosaur Ridge, Morrison, Colorado
Photo by Katy Paul

During the Cretaceous period, about 100 million years ago, a shallow sea extended across North America, from the Arctic Ocean to the Gulf of Mexico. The shoreline of this sea was a popular pathway for dinosaurs. Dinosaurs frequented several hundred miles of coastline at this time, leaving large numbers of tracks. This has given rise to the concept of a “Dinosaur Freeway” where the shoreline of the Cretaceous seaway might have been a dinosaur migration route. The photo shows some of these tracks which are exposed at Dinosaur Ridge, near Morrison, Colorado.

The tracks of carnivorous dinosaurs, which average about nine inches in length, were probably made by animals about the size of living ostriches. Herbivorous dinosaurs such as the Iguanodon-like, duck-billed dinosaur, left tracks that indicate they walked on all fours. A dozen individual trackways are recorded. The carnivores probably weighed only a few hundred pounds and walked upright on their hind legs using longer steps than the hervibores.

Excerpts from “A Field Guide to Dinosaur Ridge” by Martin Lockley

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I visited Dinosaur Ridge this past summer, and really enjoyed the walk around the ridge. The photo on the back page illustrates the layers of rock contained within the ridge, also known as a “hogback”. Fossils of dinosaurs are visible in some of the rock layers. *~Katy Paul*

Minnesota State Fair 2005

Once again, the GSM State Fair booth was a success. This year, Katy Paul and Judy Hamilton updated the table, removing the large, cumbersome rocks and replacing them with 32 smaller Minnesota rocks. Katy also produced a large laminated key identifying the rocks and where they had been found, as well as two small laminated keys with explanations of the rocks. Visitors to the booth enjoyed the variety of rocks, being able to read about them in the keys, and the children, as usual, liked the magnifying glasses used to get a better view of each rock. GSM volunteers liked the keys too.

In reply to some questions and comments written in the booth notebook by GSM members:

Unfortunately, the popular bedrock map that previously adorned the backdrop was torn in half and some of the lamination pulled off. This was not discovered until too late. The Survey has more of these and we will get a new one for next year.

The suggestion for a piece of iron pyrite is a good idea since many fair visitors inquired about this. We will add a piece next year. Also the idea for a meteorite is good, but since we want only Minnesota rocks on the table, we might be hard pressed to find a sample in our state. If we did find one, could we claim it as a Minnesota rock? If a member has one in his/her possession and wishes to donate it, we would be happy to include it in our display.

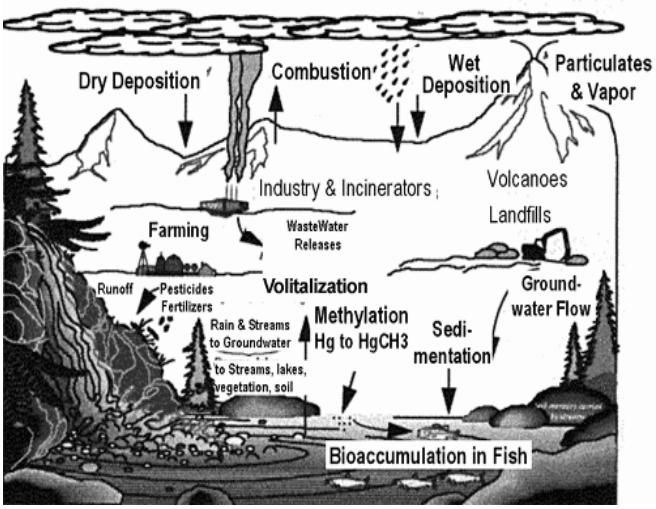
A tray or bucket of small rocks for the children to dig through has been suggested several times in years past. The logistics of this just doesn't work. Lines of people would be held up and then the question is, who is going to provide and donate these rocks and care for them during the year? We already have heavy boxes of display rocks to haul in and out of the fair grounds. And finally, a new vacuum cleaner was purchased shortly after the end of the fair and will be available in the booth next year.

There were other comments but space in the newsletter is limited. We will address other items next year when we begin the setup.

A huge thanks to all the volunteers who staffed the booth. Without you, we would not be able to continue being a part of the Great Minnesota Fair. Some volunteers worked more than one shift. Now, that's dedication!

As in previous years, Tom Schoenecker put in many hours calling GSM members to staff the booth, sending out the letters and schedules, not to mention his time during the year taking care of the financial part of the booth. And we appreciate the people who helped set up the booth, take it down and then bring it back to the Minnesota Geological Survey when the fair was over.■

THE MERCURY CYCLE



Be Aware When discarding Batteries, Electronic Instruments, Computers, Irons, Thermometers:

-When mercury-containing waste is incinerated, the mercury is vaporized into the air.
-When mercury-containing devices are disposed in a landfill, mercury can reenter the environment through gases, and through leaching into the ground water.
-When mercury-containing waste (including fixatives, medicine, cleaning solutions) are dumped down the drain, the mercury eventually returns to the water supply, and is converted to methylmercury by bacteria in sediments. Methylmercury bioaccumulates in aquatic animals, and the concentrations can increase by a million fold in animals at the top of the food chain.
-The primary pathway for mercury to impact human health is through eating mercury-contaminated fish.

EARTHQUAKE OBSERVATORY

Geologists affiliated with the EarthScope Project have successfully drilled a hole 2 miles deep into the San Andreas Fault, an 800-mile-long rift in California. The entire borehole will be lined with steel and concrete so sensitive instruments can be installed under ground.

EarthScope is a National Science Foundation-funded project carried out in collaboration with the U.S. Geological Survey.

The borehole begins in the Pacific Plate just west of the fault. It passes through the active earthquake zone and ends in the North American Plate east of the fault. These enormous land masses constantly grind against one another in opposite directions, triggering earthquakes of various magnitudes up and down the fault.

A permanent underground observatory known as San Andreas Fault Observatory at Depth, or SAFOD, will be installed at the Parkfield, California Site, for long-term monitoring in this earthquake-prone region. When completed in 2007, SAFOD will be the only observatory with instruments placed directly in an active fault zone where earthquakes originate.

SAFOD will give researchers a unique window into the process of strain build-up and release in the fault zone during numerous "microearthquakes." Seismic instruments will be installed along both plates in a section of the fault where small earthquakes of magnitude 2.0 are frequent. While these microearthquakes usually aren't felt at the surface, they offer important clues about the origin of bigger, more destructive quakes.

The San Andreas fault is creeping at a rate of about 1 inch per year near the drill site. Most earthquakes occur in a zone no more than 10 yards wide.

Scientists now will be able to recreate the earthquake process in the laboratory using real materials and under real conditions that exist deep within the San Andreas Fault. In addition to retrieving fault zone rocks and fluids for laboratory analyses, intensive down-hole geophysical measurements and long-term monitoring will take place within and adjacent to the active fault zone.

Evaluating the roles of fluid pressure, rock friction, chemical reactions, stress and other parameters contributing to the earthquake process will allow scientists to simulate earthquakes in the laboratory using representative fault zone properties and physical conditions.

ARCHAEA

Scientists are now revisiting, and perhaps revising, their thinking about how Archaea, an ancient kingdom of single-celled micro-organisms, are involved in maintaining the global balance of nitrogen and carbon. Researchers have discovered the first Archaea known to oxidize ammonia for energy and metabolize carbon dioxide by successfully growing the tentatively named, *Nitrosopumilus maritimus,* in the lab.

"Data from several cultivation-independent, molecular experiments led us to suspect that Archaea could be involved in the marine nitrogen cycle. Subsequently having the organism isolated in the lab allowed us to confirm our suspicions," said David Stahl, professor of civil and environmental engineering at the University of Washington. Stahl's lab group specializes in environmental microbiology and how microbial communities function in diverse locations including the oceans, hot springs, animal intestines and the human mouth.

Archaea have primarily been associated with extreme environments like hot springs and deep-sea vents, but about a decade ago molecular studies proved their abundance in more common environs including the open ocean, fresh water and soil. Subsequent efforts to grow various samples of these organisms led to this cultivation of *N. maritimus*, or "dwarf belonging to the sea," by Stahl and scientists at the Woods Hole Oceanographic Institution.

As the true range and relationship of Archaea to other microbes is revealed, information about *N. maritimus* will serve as benchmarks for all microbiologists. Biochemical and genomic studies are already underway to learn the mechanisms by which *N. maritimus* uses nitrogen and how its physiology compares to other microorganisms. Studies like these continue to highlight the importance of non disease-causing micro-organisms and their critical role in our understanding of global environmental cycles.■

SNOWBALL OR SLUSHBALL EARTH?

"Snowball Earth" proponents, who say that Earth's oceans were covered by thick ice long ago, explain the survival of life by hypothesizing the existence of small warm spots, or refugia. On the other side of the debate, supporters of a "Slushball Earth" say the planet included large areas of thin ice or open ocean, particularly around the equator. The debate has tended to revolve around the same rock samples and analytical techniques, so a new study has focused on a drill core of little-known black shale deposits from S.E Brazil and applied lipid biomarker techniques to identify prehistoric organisms based on the fatty remains of their cell membranes.

The team, which included scientists from USC, Caltech, the University of Maryland and a Brazilian mining company, identified a complex and productive microbial ecosystem, including photosynthesizing organisms that could not have existed under a thick layer of ice. If there was ice, it had to have been thin enough that organisms could photosynthesize below it or within it.

Frank Corsetti of USC, a co-author on the study, said "this is the first real evidence that substantial photosynthesis occurred in the Earth's oceans during the extreme ice age 700 million years ago, which is a challenge for the snowball theory."

The evidence does not prove large parts of the ocean remained free of sheet ice during the pre-Cambrian glaciation. Although unlikely it is possible one of the tiny "refugia" under the "Snowball Earth" hypothesis allowed such marine life to exist. But, finding the one anomalous spot would be quite unlikely.

Skeptics also may argue that the rocks do not necessarily date to a glacial era, but the team found evidence of glacial activity in the samples, such as dropstones (rocks dropped by melting glaciers) and glendonites (minerals that only form in near-freezing water).■

History of the Minnesota Geological Survey

By L. H. Thorleifson and G. B. Morey

Minnesota Geological Survey (MGS) was established by the State in 1872 to serve the needs of the people of Minnesota for surveys to ensure their prosperity, health, and security through stewardship of water, land, and mineral resources. The format of these surveys has evolved with science and technology, and their use has been optimized through outreach. MGS works closely with university, government, and industry partners to provide geologic mapping for applications that vary from economic development to public health, according to the needs of the day.

European explorers began permanent written documentation of our geology in the 17th and 18th centuries. Father Hennepin's 1680 description of the Falls of St. Anthony allowed Newton Horace Winchell in 1877 to determine the rate of upstream migration of the falls and thus the duration of postglacial time. US War Department surveys of the early 1800s supported widely read work by naturalists such as Keating, Nicolett, Featherstonhaugh, Beltrami, and Catlin. Lyell's 1845 geologic map of the US and adjacent Canada was followed by the 1852 publication of David Dale Owen's report on the geology of Wisconsin, Iowa, and Minnesota, assembled to identify public lands to be withdrawn from public sale due to their mineral potential.

Following Minnesota Statehood in 1858, a plan for a geological survey was developed, and in 1864, State Geologist A. H. Hanchett was appointed, although his tenure was short due to incompetence. The second State Geologist, H. H. Eames, appointed in 1865, claimed to have discovered gold and his position was terminated in the ensuing scandal. However, the Legislature wisely continued to fund surveys that contributed to economic well-being. The State then asked the President of the University of Minnesota to prepare the 1872 law that established a Geological and Natural History Survey of Minnesota. N. H. Winchell, who had survey experience in Michigan, New York, and Ohio, became first Director, and later Professor and Chair of the Department of Geology and Mineralogy as well as Curator of the Museum. Scientific production on our soils, minerals, rocks, and water by Survey staff was prodigious.

The Survey was discontinued upon Winchell's retirement in 1900 and publication of his Final Report on The Geology of Minnesota in 1901. The U.S. Geological Survey (USGS) remained active in areas such as the Vermilion and Mesabi iron ranges, and State-supported surveys were directed by Department Chair C. W. Hall until his retirement in 1910. The University then asked William H. Emmons of the USGS to take the position as Chair, and Emmons specified reinstatement of a State Geological Survey as a condition of his acceptance. This was done in 1911, and Emmons served as Chair and MGS Director until his retirement in 1944. MGS was based in Pillsbury Hall, rarely if ever had full-time employees, and State funds were used to support highly influential research in fields such as petrology and Precambrian geology by faculty and students. Emmons left operation of the Survey to Professor Frank F. Grout, who succeeded Emmons in 1944. George M. Schwartz followed as Director from 1948 until 1961, extending Survey work into engineering geology, and working with USGS to apply geophysical surveys to the search for iron ore.

Geological Puzzle at Dinosaur Ridge, Morrison, Colorado
Geologists can't agree on what that round stone is or how it got there. (left side of photo)
The oldest (bottom-right) layers were deposited in the late Jurassic, and the higher layers date to the Cretaceous Period
Photo by Katy Paul

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