



GEOLOGICAL SOCIETY OF MINNESOTA NEWS

SUMMER 2003
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<http://www.geo.umn.edu/orgs/gsm/>

DNR MINERALS TEACHER EDUCATION WORKSHOP Aug 5-7

Annual three-day workshop offers geology and earth-science training for K-12 teachers, parents that home school, and other educators. It consists of one day of classroom sessions, 1-1/2 days field trips and mining tours. Topics include general geology, rock and mineral ID, and mine reclamation. Held in Hibbing, \$30, space is limited. Interested? Visit:

<<http://www.dnr.state.mn.us/education/geology/workshop/index.html>> call (651) 296-4807; e-mail yjcki.hubred@dnr.state.mn.us

Minnesota Geological Survey Faces Budget Cut as Legislature Faces Deadline

The Minnesota Geological Survey is facing a budget cut of at least 8% for the coming two years as state lawmakers enter the final stage of wrestling with the state budget.

The Legislature must adjourn on Monday, May 19, under the Minnesota Constitution. As this newsletter goes to press, most key budget decisions remain unresolved.

The MGS is funded through the University of Minnesota's budget bill. The budget request submitted to the Legislature by Gov. Tim Pawlenty included deep cuts in funding for all higher education institutions. Gov. Pawlenty's recommendation cut the part of the U of M budget that funds the Survey by 14% below the 2003 level. This would have cut the survey by \$168,710 a year for the next two years - to \$1,036,359 annually in each of the next two years.

Republican lawmakers, who control the Minnesota House of Representatives, passed a higher education budget bill that restored some of the cuts proposed by the Governor. Under the House bill, MGS would lose a little less - about \$150,000 per year.

DFL lawmakers in the state Senate passed their version of the higher education budget bill with \$100 million more than the Governor proposed. However, it still cuts funding to the Survey by about \$125,000 a year in each of the next two years. Because the House and Senate passed wildly different bills, a conference committee - which consists of five House members and five Senators - has been appointed to negotiate a compromise package that can be re-passed by both sides of the Legislature and sent to the Governor's desk. As of May 12, no progress had been made.

The budgets for the agencies that use the Geological Survey - including the Department of Natural Resources, Pollution Control Agency, Department of Health and others - likewise remain in limbo with the adjournment deadline less than two weeks away. As with the higher education budget, the House and Senate passed budget bills with significant differences on funding and policy.

Should the Legislature fail to pass a state budget package by the constitutional adjournment deadline of May 19, two things can happen:

- The Governor can call lawmakers back for a special session to continue to work toward agreement, or
- If there is no special session (and only the Governor can call one), or if there is no agreement in a special session, state government would completely shut down on July 1. The state's two-year budget cycle ends on June 30, and with no budget bills enacted, there would be no legal authority to spend money for any state government activity.

-Tom Smalec

Announcements

Some of you asked for the source of the image in the first slide of Howard Hobbs' presentation on 4/21/03. It is located here: http://www.jpl.nasa.gov/srtm/northAmerica_radar_images.html

Get ready for the FAIR!

State Fair runs Aug. 21st
thru Labor Day, Sept. 1st

GSM NEWS

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Reporter: Tom Smalec

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. Send all material for *GSM NEWS* to: GSM c/o Katy Paul, 6901 West 84th St., #351, Bloomington, MN 55438, phone/e-mail listed above.

OFFICERS:

Paul Martin, *President*;
vacant, *Vice President*;
Ted Chura, *Treasurer*;
Judy Hamilton, *Secretary*.

Directors in addition to the officers listed above: Cindy Demers; Bill Farquhar; Marlys Lowe; Rose Mary O'Donovan; Tom Smalec.

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

President's Letter...

Since this is the end of our lecture series for 2002-2003, this seems to be a time for a whole lot of thank yous.

First, thanks to all the wonderful lecturers who worked so hard and taught us so much. We're also grateful to Rick Utne, who put together the series on the "Fascinating Geology of Minnesota". We are grateful to the Minnesota Geological Survey staff who let us use their facility for all of our lab sessions, and who provided the geologists to deliver 13 of our lectures and labs. Where would we be without them! (I hope we don't soon have to find out.)

Thanks to the GSM Board and members and to former President Steve Erickson for the assistance they have given Rick in preparing next year's interesting lecture series, entitled "Geologic Landscapes".

Thanks to members who serve on various committees of the society, and to all members, whose membership fees enable us to offer honoraria and reimbursed expenses to our speakers.

Plans are well underway to make our booth at the State Fair more attractive than it has been. Thanks to the Mattsons, long time members who supported this financially, and to Roger Benepe, Tom Schoenecker, and Bruce Goettman, who are making this plan a reality. Thanks in advance to the people who will help by offering to staff our booth during the fair.

Doug Zbikowski continues to lead our Public Service Committee, while Bill Farquhar has taken over the education part of that committee. Ted Chura does more than his fair share as he's our treasurer, and heads our video library.

Gail Marshall is no longer on the Board, but she's as active as before. She's our Membership chair, and is one of the prime organizers for our summer field trips. Please support her and her partners in organizing: Diane Lentsch, Dick Heglund, and Steve Erickson. The three field trips still to be held this summer should be great.

After you look at our Website < www.geo.umn.edu/orgs/gsm/ >, thank Alan Smith for all he does to maintain that informative site.

Former president Bill Robbins' wise counsel is always helpful, and an additional thank you to Bill for preparing the new 2003 directory. Our continued gratitude goes to Katy Paul who prepared this newsletter, and effective with the August edition, has turned over the editorship to Tom Smalec. Thanks for all you've done Katy!

I have not forgotten Judy Hamilton, our secretary, but will say more about her when her term of service is over, at the end of this year. I apologize in advance to anyone whose name I omitted.

If you want your name to be on a list like this next year, or if you just want to become more involved in the work of the society, please know that you are very welcome to join in the fun, and work. Phone or email me or other Board members (phone numbers and emails in the directory).

-Paul Martin, President



The Society of Vertebrate Paleontology Meeting

When: Oct. 15-19, 2003

Who: Over 1500 vertebrate paleontologists from around the world

Where: St. Paul Radisson Riverfront Hotel

What will happen?

- *Presentations by participants on all kinds of paleo
- *Press conference on the latest paleo breakthroughs
- *Social events every night
- *Pre-meeting symposia and field trips
- *Collections visitation and research opportunities
- *Educator's and Preparator's workshops

How can you get involved?

- *Volunteers are needed to man registration tables and merchandise sales booths, as well as to serve as "meeters and greeters" at a Wednesday night (Oct. 15) Science Museum Social Event.
- *A four-hour shift gets you free admission to the meeting for the day that you volunteer (or to the Wednesday night SMM extravaganza if you volunteer for that event).

• INTERESTED IN LEARNING MORE? CONTACT:

KRISTI CURRY ROGERS – krogers@smm.org, 221-4717

Complaining About Gas Prices?

By Terry Almsted, Fredericksburg TX

The price of a gallon of gas is up again. Our daily lives are so dependent upon petroleum products, and so we complain about the rising prices. I'm a native Minnesotan who, by the quirks of fate, got involved with the oil industry years ago, and thought it might be interesting to the members of the GSM just what is involved in looking for oil these days. If I was addressing an audience of people living on the Gulf Coast of the United States, this would be general knowledge, as everyone living there has a cousin, neighbor or work themselves in the oil industry. Minnesotans are a different story, the oil industry is rather a foreign subject.

My experience is in one part of the oil industry, exploration. Along with it are production, refining and transporting to the customers, so I speak of one small part of the whole picture. It's quite an amazing industry, and I wish I could write of all the people involved in getting a gallon of gas to the pumps, but here I hope to just enlighten you on the search for oil.

These days, most exploration takes place offshore. The easy areas, dry land, have been surveyed already. The beginning of exploration is a guess as to what might be a likely place for the right conditions for oil to be trapped. A seismic survey ship will be hired to gather data at the area in question. The process of determining what lies in the twenty thousand feet of rock, sitting under a few thousand feet of water, is what offshore exploration is all about. A seismic boat has four main divisions of equipment: the seismic sources, the recording system, the processing system, and navigation. All of these work together to get a picture of what's down there, and even then, after all is said and done, it doesn't guarantee oil is there, only that the rock formations may be capable of trapping oil.

The seismic sources are typically referred to as air guns, as they release air, compressed at 2000PSI, to create a shock wave that travels down through the water, and through the rock layers. It reflects back to the surface as it encounters various faults and density changes. The guns come in different sizes, each one creating a specific frequency content in the shock wave, and they are placed out in the water in an array of up to 100 individual guns. Each gun is roughly equivalent to a stick of dynamite going off when it releases its high pressure air. Indeed, 2000PSI is capable of blowing a hole through a human body. Safety is a major concern around the guns. To gather good data, all the guns in the array must fire at the same time, i.e. within a thousandth of a second of each other. That is where I do my work. I build the electronics that control the gun timing. The guns are towed about 200 meters behind the ship, on what are called strings. At the far end of the strings, are GPS receivers, to tell the boat exactly where the guns are when they fire. Also, each string has electronic instruments to tell the operators exactly what depth in the water the guns are at, as this is critical. Large tubular floats, each about the size of a civil war cannon, and large enough to crawl through, support the guns in the water.

Towed behind the guns, and extending out nearly a quarter mile either side of the ship, and to a length of over a mile, are very sensitive underwater microphones, called hydrophone streamers. To maintain their position, this quarter mile out from the sides of the ship, devices called paravanes that are like kites in the water, pull the streamers outward. The tension on the streamers is monitored constantly, as too much or too little indicates problems. The tension on pulling these streamers through the water is about 2 or 3 thousand pounds each streamer. There is so much drag from towing all this stuff through the water, that the ship burns about 8000 gallons of diesel fuel per day. (They're their own best customer). The shock waves generated by the seismic guns are reflected back from deep in the ground under the water, to these streamers of hydrophones. Then the data is converted to an electrical signal, which is sent by cables to the recording system on the ship. *(continued, next page)*

There will be thousands of hydrophones in a single streamer, and each streamer is valued at over \$100,000. Like the guns, they must be at a certain depth. Too shallow, and they get too much noise from wave action; too deep, and they get reflections from the surface that confuse the data. To maintain the correct depth, a "bird" is placed every so many meters along a streamer. A bird is a cylindrical instrument that has wings that can be controlled from the boat, to cause the streamer to dive or to rise. For the birds to work correctly, the streamers must have near neutral buoyancy. This is accomplished by mounting the hydrophones inside oil filled plastic tubes, the oil being lighter than water. Every job done requires varying the amount of oil, to compensate for differences in water temperature and salinity.

At the other end of the hydrophone streamers, is a recording system. Every time the guns fire, for five seconds, or so, the recording system tapes the data from all the hydrophones. The amount of data is phenomenal: gigabytes each shot, terabytes to the max each job. Each shot requires the logging of the GPS data of each gun string, and of course each hydrophone streamer has a GPS receiver to be recorded. Also recorded are depth data, air pressure on the guns, and gun timing data, should a gun be out of time by a couple of milliseconds.

In the old days, no processing was done on board the ship. But now, with the advances made in electronics, a lot of data is processed to a point where it can be determined that all is well with the information being gathered. The data from each hydrophone shows up as a squiggly line when printed, and compensation must be made for such things as its distance from the seismic guns. The interpretation of the data is well beyond my explanatory capabilities. The data is organized in conjunction with the navigation of the ship. What is called a seismic line is steered by the ship, again with help from GPS. This line is simply a course the ship follows, and may typically be about 50 miles long. As the ship follows this line, the guns are fired by the GPS navigation system every 50 meters, or so. At the end of a line you may have fired the guns a few thousand times. A whole prospect survey may encompass 50 or 100 lines to be navigated. Because the streamers are a mile or more in length, for the ship to end one line, turn around, and come onto a new line, requires about 4 hours, and the lines themselves are about 12 hours long. You just can't turn around sharply, or you'll tangle your streamers. Each line surveyed costs the client about \$150,000, and since you can do 1 or 2 lines a day, any hours lost due to a tangle in your streamers, or guns failing, or a fishing boat crossing your streamers and cutting them off, rapidly mounts up in the dollars category.

Besides the technical people operating the seismic systems, there is the ship's crew. They keep the boat moving, keep the technicians fed, and maintain a safe and clean environment. Everyone works 12 hours on, 12 off; heck, there isn't anyplace to go after work anyway. Its an interesting amalgam of people. For example, my last trip involved a Louisiana company-owned ship, leased by a Russian geophysical company whose technicians operated the seismic systems, with a mostly Philipino crew, and with Brits, Scots, Australians, Americans and Canadians installing the systems and teaching the operators, and the company hiring the boat was from India, so the company reps were Indian. Everyone must have respect for the others, the ship is only 300 feet long, you can't hide from the society onboard. Courtesy and honesty are rampant. The staff onboard, crew and technicians, normally stay for about 60 days, and get rotated out with a relief crew. Then its fly home for a few weeks, and back out to another job. I'm lucky, I just teach and install, usually on and off in 2 weeks, but for most, its a mighty long commute to work.

I hope this makes you feel a little better next time you fill up your tank. A lot of people, from all cultures and nationalities had a hand in bringing this energy to you. All the easy oil has been found, what's left is in the remote and deep areas of our planet. And don't forget the motto of the oil industry: There's no fuel like an old fuel.♦

You know you're an ardent fan of geology when...

- You ARE watching for rocks.
- You consider road cuts tourist attractions.
- You expect collection site information with your jewelry.
- Your favorite necklace is made by Bausch & Lomb.
- On returning from vacation, the front wheels of your car are almost off the ground.
- You don't think of "cleavage" the same way everyone else does.
- You look at the stone facades of buildings with your hand lens.
- You knew the rock was obsidian in "The Shawshank Redemption".
- You use a pick and shovel while you're on vacation.
- The baggage handlers at airports know you on sight and refuse to help you with your luggage.
- You associate the word "hard" with a value on the Mohs scale.
- You associate the word "saw" with diamonds instead of "wood".
- Your home page has images of rocks.
- You think Herkimer, New York might be a cool place to go on a vacation.
- You follow when you see a university's geology class going on a field trip.
- You associate the name "Franklin" with New Jersey instead of "Ben".
- Your children are named Rocky, Jewel, Crystal, and Beryl.
- You've taken a copy of Dana's Manual of Mineralogy to the bathroom.

From the Editor: Its been fun, but I have decided that it is time for a change, time for someone else to take over the newsletter. Tom Smalec has graciously agreed to do this. So with this issue, I'll be turning over the Editorship to him. But don't think that you won't see any more articles from me in the newsletter. Tom doesn't know it yet, but I plan to deluge him with articles. And I hope that other members will do the same. The newsletter editor's job is very difficult when there is nothing to publish. And a newsletter written solely by one person can get pretty stale. So please submit articles and ideas to Tom. The newsletter represents ALL the membership, and all the membership can submit things for consideration. No guarantee that everything submitted can or will be used, but it sure is great to have choices.

-Katy Paul

WOMEN IN GEOLOGY: Inge Lehmann

Inge Lehmann (1888 - 1993) was born in Denmark, on May 13, 1888. In 1920 she earned her master's degree in mathematics. After 12 years of undergraduate and graduate studies at the University of Copenhagen and University of Cambridge, studies that were interrupted by 6 years of full-time actuarial work, she earned a second master's degree in 1928, in geodesy, from the University of Copenhagen.

Lehmann's career in seismology began in 1925 when she aided N. E. Norlund as he established seismic networks first in Denmark, then in Greenland. By 1928, Lehmann was named the first chief of the seismology department of the newly established Royal Danish Geodetic Institute, a position she held for 25 years.

In 1936 she published the paper that sealed her place in the history of geophysics. Known simply as "P' (P-prime)," the paper suggested a new discontinuity in the seismic structure of the Earth, now known as the Lehmann discontinuity, a region that divides the core into inner and outer parts. Using ray theory and travel time curves to interpret seismograms, Lehmann discovered that the P' phase of seismic waves traveling through the inner Earth was not the result of diffraction, the commonly held interpretation at the time, but a clear indication of an inner core.

Later, Lehmann established herself as an authority on the structure of the upper mantle. Extended parts of her later years were spent as a visiting scientist at the Lamont-Doherty Earth Observatory, Dominion Observatory, the Seismological Laboratory at Caltech, and the University of California, at Berkeley. She also led her colleagues as a founder and president of the European Seismological Federation, president of the Danish Geophysical Society, and vice president of the International Association of Seismology and Physics of the Earth's Interior.

In 1971, Inge Lehmann was presented with the William Bowie Medal, the American Geophysical Union's highest honor, which is granted to a scientist who has made fundamental contributions to the study of geophysics and who has lived up to the AGU ideal of unselfish cooperation in research. Lehmann also was named an AGU Fellow and was awarded honorary doctorates from Columbia University and the University of Copenhagen. ♦

✧ ✧ ✧ ✧ ✧ ITS STATE FAIR TIME AGAIN! ✧ ✧ ✧ ✧ ✧

It's a little early, but think STATE FAIR. The Show and Exhibits committee is now working on a revision to our booth at the FAIR. We hope it will be enough of an improvement to make your time in the booth more pleasant.

In the next two months, the committee will be putting together the roster of workers for this year's booth. We will need 72 people to work the booth during the fair. The fair will be from Thursday, Aug. 21st through Monday, Sept. 1st. Each day will be divided into three shifts. The shifts will be from 9 AM to 1 PM, 1 PM to 5 PM, and from 5 PM to 9 PM. We will need two people per shift.

We know that the May Newsletter may be a little early for you to start planning, however, the August newsletter would be too late. So why don't you check your schedules, pencil in a good date, and call Tom Schoenecker at 952-474-4600, and have him reserve that time (or a good substitute) for you. HURRY BEFORE ALL THE GOOD TIMES ARE GONE. Tom will send you a reminder before the fair starts.

Remember, you don't have to be a Geological Genius, just have an unbridled interest in Geology, and just plain old Rocks, to work the Fair. Your job at the fair is to invite those with the same interests to our lectures and field trips. Membership will hopefully come from that. ♦

FIELD TRIP SCHEDULE - 2003

- June 28-29 **Baraboo Area of Wisconsin** contact Dick Heglund
Leader: Phil Fauble
Wisconsin Department of Natural Resources
- July ?? **The Great Mississippi River Road** contact Gail Marshall
Dubuque, Iowa to Saint Paul, Minnesota
Leader: Ian Williams, University of Wisconsin (tentative)
- August 17 **Geological Walking Tour of Saint Paul** contact Steve Erickson
Guides: Science Museum of Minnesota
Geological Society of Minnesota
Minnesota Mineral Society

Final details of each field trip will be provided to members in a mailing, approximately three weeks before the trip. Questions prior to that time may be directed to the contact person listed above. ♦



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