



The Auger



Summer 2007

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The Newsletter of the Minnesota Association of Professional Soil Scientists

President's Message

By Scott Smith, PSS, MAPSS President

A funny thing happened on the way to the legislature. A bill was introduced which would amend the statute governing who is allowed to design wastewater treatment systems. The current statute allows anyone certified by the Minnesota Pollution Control Agency (MPCA) as a Designer I to design systems up to 10,000 gallons per day and mandates that larger systems be designed by a licensed professional engineer. The purpose of the amendment was to address the design of new classes of sub-surface treatment systems (SSTS) proposed by the MPCA to serve multiple homes.

The Minnesota On Site Wastewater Association (MOWA) took a strong position that a Designer I should be allowed to continue to design systems up to 10,000 gallons per day. The American Council of Engineering Companies (ACEC) of Minnesota held that system design is engineering and should be left to professional engineers. The MAPSS Executive Committee (EC) took a position that ISTS/SSTS site evaluation involves the practice of soil science and that a licensed professional soil scientist (PSS) should be involved. Our position was not conveyed to the authors of the amendment.

In fact, ISTS/SSTS design does require the practice of soil science and engineering. There are practical and economic realities, though, which dictate that for the foreseeable future Designer Is will continue to be exempt from licensure for the design of systems at some level of flow. In St. Louis County, difficult soil conditions are more often the rule than the exemption, and the best designers know when they require the assistance of a PSS. Savvy developers have learned that a subdivision plat proposal has a smoother path through the regulatory review process when accompanied by a septic site suitability report prepared by a PSS who is also a certified designer. Some Designer Is, however, continue to argue that they are completely qualified by virtue of their MPCA certification, while they may not be able to distinguish redox from chicken pox.

The legislation was amended to include a sunset date and to require that the commissioner of the MPCA report to

the legislature after consulting with several affected entities including MAPSS. I invite anyone interested in representing MAPSS during these discussions to submit a statement of interest and qualifications to the EC. The EC will develop criteria by which to make our selection.

On a related note, many individuals have expressed interest in serving MAPSS as our representative to the MPCA ISTS/SSTS Technical Advisory Committee. It is gratifying to have so much interest in service to MAPSS, and I invite you to submit statements of interest and qualifications to serve in this capacity in 2008. Again, the EC will evaluate the qualifications and make our selection.

Finally, I am looking forward to seeing you all at the summer tour in Cloquet. My thanks go out to Terry Cooper and Howard Hobbs who have put together what promises to be a fascinating itinerary. Those of you who plan on extending your visit to enjoy Duluth and the North Shore (highly recommended) may wish to consider Duluth's newest accommodations. The Sheraton Hotel, opened in May, is located downtown, one block from the Fitgers Brewery complex of restaurants and shops. The Canal Park Lodge replaces the Canal Park Inn and is scheduled to open in June. If you decide to stay, please join me immediately following the tour at the Fitger's Brewhouse, Duluth's finest brew pub, for an El Nino double hopped India Pale Ale. I'll see you there!

President Scott Smith smiths@co.st-louis.mn.us

The next Executive Committee meeting will be held in June via teleconference.

**MAPSS Summer Tour - Cloquet
(registration form attached)**

Friday, August 17, 2007

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The Auger is the newsletter of the Minnesota Association of Professional Soil Scientists. It is composed of articles submitted by the MAPSS membership and is published three times each year (February/March, June and October). The Auger is available in PDF format on our website: www.mnsoilscientist.org.

If you want to contribute articles, contact the editor: Suzanne D'Souza at 612-741-1365, suzdsouza@hotmail.com or mapss@mnsoilscientist.org

Upcoming Events

July 25, 2007 – Wednesday

Forum of Women in the Environmental Field event. <http://www.fwef.org>

August 17, 2007 – Friday – all day

Spodisols? Forest Soils and Geology in Carlton County - MAPSS Summer Tour will be held at the Cloquet Forestry Center.

September 26, 2007 – Wednesday

Forum of Women in the Environmental Field event. <http://www.fwef.org>

November 4-8, 2007 – Sunday through Thursday

ASA-CSSA-SSSA International Annual Meeting in New Orleans, LA

November 14, 2007 – Wednesday

Forum of Women in the Environmental Field afternoon political networking event. <http://www.fwef.org>

December 7, 2007 – Friday

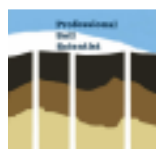
MAPSS Winter Meeting will be held in St. Cloud. The topic this meeting will be Fluid/Water Movement in Soils. Contact Mike Lieser if you would like to present a talk at this meeting at either 218-736-0841 or ml.lieser@charter.net.

July, 2008

Worlds Underfoot opening at the Smithsonian in Washington DC!

PSS: How Can We Promote It and Ourselves?

The following logos have been submitted to Dennis Fuchs.



MAPSS Officers - 2007

President	Scott Smith, PSS
President Elect	Mike Lieser
Past President	Roger Risley
Secretary	Mark Wespetal, PSS
Treasurer	Bob Whitmyer, PSS
Exec. Secretary	Suzanne D'Souza, PSS (<i>ex officio</i>)
Student Rep.	position open (<i>ex officio</i>)

"The nation that destroys its soil, destroys itself."

Franklin Delano Roosevelt

Executive Secretary Update

By Suzanne D'Souza, PSS

Legislative

A summary of the legislative session can be found on the MAPSS website, www.mnsoilscientist.org. Feel free to contact me at 612-252-3687 or suzanne.dsouza@amec.com. The website for the Minnesota Legislature is: <http://www.leg.state.mn.us>.

Website

If you see anything that needs changing on the website, know of an event or job, hired a new employee, retired, or have any ideas, please send it to Suzanne or to mapss@mnsoilscientist.org for posting on the website.

Board of AELSLAGID

The next exam date is October 19, 2007 (*application deadline is August 19, 2007*). <http://www.aelslagid.state.mn.us/deadlines.html>

Of the 16,438 professionals licensed and certified through the Board of AELSLAGID, only 98 are Professional Soil Scientists (only 42 PSS are MAPSS members).

Smithsonian Exhibit

\$9,374.55 has been raised for the Minnesota soil monolith for the Smithsonian Soil Exhibit as of May 1, 2007. www.soils.org/smithsonian/

Trends and Challenges in Soil Science

By Philippe Baveye

Excerpted from Baveye, P. 2006. A future for soil science. *Journal of Soil and Water Conservation* 61(5):148A-151A. © 2006 by the Soil and Water Conservation Society.

The discipline of soil science is experiencing a profound crisis. Every few months, it seems, another soil science department in some university in the world changes its name to one in which the word "soil" no longer appears. Growing numbers of researchers are also lobbying for newly-concocted expressions like "hydropedology" or "critical zone science" to replace the allegedly outmoded appellation of "soil science." These trends are accompanied by a sharp decrease in the clientele of most soil science programs. Results of institutional and graduate

MAPSS Committees - 2007

Award Committee – temporary committee to be appointed in 2007

Education Committee

Peter Hartman, PSS – Chair
Jorja DuFresne, PSS
Howard Hobbs, PG
Thomas Jackson, PSS
Kim Steffan, PSS

Election Committee – temporary committee to be appointed in 2007

ISTS Committee

Robert Whitmyer, PSS – Chair
Peter Miller, PSS
Mike Rutton, PSS
Mark Wespetal, PSS
Mary West, PSS

Membership Committee

Dennis Fuchs, PSS – Chair
Al Giенcke, PSS

Professional Practice Committee

Peter Miller, PSS – Chair
Jim Arndt, PSS
Kelley Bopray, PSS
Tom Fait, PSS

Scholarship & Funding Committee

Roger Berggren, PSS – Chair
Jim Anderson, PSS
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Advertise in the Auger!

Ad Type	Amount	Cost
classified	first 40 words	\$5.00
	additional words	\$0.20/word
position*	first 40 words	\$5.00
	additional words	\$0.20/word
ad copy	MS Word ready format	\$15.00/column in
business card	standard size	\$25.00

Your advertisement will also be added to the MAPSS website for the duration of one issue of the Auger. Contact the editor: suzdsouza@hotmail.com or mapss@mnsoilscientist.org.

*free to MAPSS members and will be included on the website

**"We are part of the earth and it is part of us...
What befalls the earth befalls all the sons of the
earth"**

Chief Seattle, 1852

Trends and Challenges - continued

student surveys carried out in 1992 and 2004 indicate that enrollment in M.Sc. and Ph.D. programs in soil science in U.S. and Canadian universities has dropped on average by about 40 percent during the past decade (Baveye et al., 2006). There is undeniable interest in soils among scientists, as evinced by the fact that in June 2004, the prestigious journal *Science* devoted a special section to "Soils, the final frontier" and had a picture of a soil on its cover. Yet less than 15 percent of the articles that are currently published on soils-related issues are authored by individuals who are affiliated with a research unit that includes the term "soil" or "soils" in its name. Clearly, all of these statistics indicate that the discipline of soil science is losing market share and visibility at an alarming pace.

If this trend continues unabated, a situation may ensue, a few years down the line, where soil-related issues will be dealt with only by engineers, geographers, ecologists, chemists or physicists, all of them well-intentioned but lacking proper training in soil science, and in particular lacking a satisfactory understanding of the complex nature of soils.

One of the comments most frequently made is that soil science education, in colleges and universities, is almost entirely estranged from the practice of soil science in the real world, and benefits little, if at all, from the experience of former students. To play the devil's advocate, one could argue that, with the exception of professional schools, which tend to be very much in touch with their alumni, universities in general operate in a vacuum, as if what their students do after they graduate, especially if they do not join the professoriate, were not their concern at all. Virtually nothing is known about how well university curricula and individual university courses prepare students for their later careers, and particularly for the type of lifelong learning that they will have to carry out later in life. Nobody seems to really care. This is the case across the board, not just in soil science. Yet, in soil science, the situation appears particularly acute.

Perhaps the most significant comments made about the current state of soil science and soil science education concern the fact that very few soil science professors seem to find their discipline intellectually exciting any more.

Concrete steps can be taken to address this recognition issue as well. One way to give soils, their conservation, and the discipline of soil science significantly more visibility than they currently have is for publications like this journal and others in the field to invite articles that show how soil-related issues can have profound societal consequences. A concerted effort in these directions would not only foster a long-overdue conversation among practicing soil scientists and researchers about a

meaningful research and technology-development agenda for the future. It would also give the impression to prospective students and the public at large that the study of soils is eminently exciting, in addition to being vital if we want to leave to our grandchildren a planet earth in halfway decent shape.

REFERENCES

Baveye, P., A.R. Jacobson, S.E. Allaire, J. Tandarich, and R. Bryant. 2006. Whither goes soil science in the US and Canada? Survey results and analysis. *Soil Science* 171(7):501-518.

Message From President-Elect about the Winter Meeting

By Mike Lieser, PSS, MAPSS President-Elect

As your President-elect for 2007, I have been making plans for our 2007 Winter Technical meeting. The Best Western Kelly Inn St. Cloud has been reserved for Friday, December 7th. It is centrally located and has worked well in the past. Our theme is fluid/water movement in the soil medium. This could cover septage, groundwater recharge, pollutants, etc. At this point I have contacted the Department of Natural Resources to discuss their groundwater reservoir and recharge mapping. I am also looking to USDA-ARS for a presentation on soil compaction and how it relates to fluid movement and runoff. We still need more ideas and presenters to help address our theme. Anyone with ideas, a contact, or if they know of a presentation that would fit into our theme and be of mutual interest and would like to share, please email or give me a call anytime. My email is ml.lieser@charter.net and phone is 218-736-0841. I am looking forward to seeing everyone at our upcoming summer tour get-together.

Notes From the Editor

Member Info

A note from Steve Stark: Laurie Brown is recovering from surgery for pancreatic cancer. Please forward your prayers, kind thoughts and good vibes to her and her family. She has a webpage at Caring Bridge, see: <http://www.caringbridge.org/visit/lauriebrown>

SOiL

Over the last couple issues I have been trying to add different articles and tidbits to the newsletter. This issue is probably the most different. As I sit here and put together this issue of the Auger, I decided to search the word soil using the Google search engine. Well, up pops a link to <http://www.myspace.com/soil>. Who knew there is an alternative metal band called SOiL! Isn't the internet wonderful?

Game – Win a MAPSS baseball hat!

The MAPSS member who submits the most mottos (not sayings) using the word *soil* by the day before the summer tour will win a free MAPSS baseball hat. Let me get you started. The North Dakota National Guard's motto is *Strength From the Soil*. E-mail your submissions by midnight August 16 to Suzanne at suzanne.dsouza@amec.com!

Soil Science: Where is it Going?

By Terence H. Cooper, Morse-Alumni Distinguished Professor of Soil Science

If you are reading this article and are a member of MAPSS, you know about Soil Science. Soil is the basis for life on planet earth. We see many articles recently where soil is mentioned in some manner or form. It won't be long and the Smithsonian Museum in Washington D.C. will open an exhibit on soils. On May 6th the Minneapolis Star Tribune editorial page had an article titled: "Don't sacrifice land for ethanol". The editorial states; "*it was inevitable that, sooner or later, the demand for corn would collide with the imperative to protect fragile soil, water and wildlife habitat in farm country. The inevitable arrived last Thursday, when a coalition of grain and feed organizations asked U.S. Agriculture Secretary Mike Johanns to open up the nation's largest soil conservation bank and let farmers plant more corn....*". Later in the editorial it notes; "*It would be ironic -- worse than ironic -- if the government allowed the conservation revolution in biofuels to sabotage the conservation revolution in farming*".

It is the soil that we must protect, yet seldom does the soil get the attention it deserves. In fact recent national journal articles have noted the decline in Soil Science at major universities as departments merge and undergraduate programs obtain more "attractive" names like; environmental science, earth science, natural resources, or earth, wind and fire. Anything, please anything, but boring Soil Science that sounds like agriculture. However, most

programs would note that without this name change, their programs would have too few students to maintain viability. Thus, they continue to attract students, that do take courses in Soil Science, and the areas related to soils.

The history of Soil Science is not so long; in fact it only goes back a few hundred years unless you want to count early hunter-gatherers.

Soil Science the Beginning

The soils story begins with the first gatherers who noticed that plants grew better in some areas than in others. Gathering was largely women's activity so maybe women were the first "soil scientists". When horticulture and cultivation replaced gathering, as the source of food, we might assume that those women chose the soils most favorable for their food plants. Soil knowledge began to accumulate from their experiences.



<http://www.bookworld.com/lucifer/ManStoneAgeHarvest.gif>

Early Soil Science

Nearly two centuries ago scientists began to replace the users as the major contributors to understanding soils. The knowledge of soils became specialized, as ideas and techniques from different disciplines of chemistry, geology, geomorphology, and agronomy were applied to the study of soils. The base knowledge about soils continued to grow and in 1936 the Soil Science Society of America was established. All of these beginning "Soil Scientists," enhanced achievement of our present understanding of the nature of soils and how to use them for the benefit of society.

Vasili V. Dokuchaev (1846-1903) is often called the father of Soil Science. Trained in Russia, he wrote his most reputed works on the soils of the Russian steppes, primarily Chernozems or today Mollisols. He was the first person to make wide geographical investigations of different soil types. He literally "put soils on the map". He introduced the idea that geographical variations in soil type could be explained in relation not only to parent materials (geology), but also to climatic and topographic factors, and the time available for pedogenesis (soil formation) to operate. Using these ideas as a basis, he



Soil Science - continued

created the first soil classification system. He is known for developing the basic A–B–C horizon nomenclature.

Hans Jenny joined the faculty at Berkeley in 1936. International recognition came to Jenny after the 1941 publication of *Factors of Soil Formation*. His synthesis of field studies of soils set down the generic mathematical relationship that connects the observed properties of soil with the independent factors that determine the process of soil formation.

$s = f(cl, o, r, p, t, \dots)$ where s - soil properties; cl - regional climate; o - potential biota, r - topography; p - parent material; t - time.



Hugh Hammond Bennett led the soil conservation movement in the United States in the 1920s and 1930s. He urged the nation to address the "national menace" of soil erosion, and created a new federal agency and served as its first chief — the Soil Conservation Service, now the Natural Resources Conservation Service in the U.S.D.A.. He is considered today to be the father of soil conservation. "Too many people have lost sight of the fact that productive soil is essential to the production of food." H.H Bennett, 1928.



Now we need to make sure that people don't lose sight of the need to include productive soil as important component in the production of energy as well. It will take Soil Scientists to provide the necessary knowledge to monitor the soils as they are used for "energy production". Will this system be a truly "renewable energy source", or are we mining the soil for corn production? The book *Footprints in the Soil* (B.P. Warkentin, 2006, Elsevier Press) tells the story of the people and the ideas that contributed to our present understanding of soils. The stories in this book illustrate the significance of soils to our way of life. The book is about the progressive "footprints" made by these people in the soil and how this has provided our current understanding of what we know about using the soil for growing crops or protecting environmental functions.

However, not many will read this book or any book about soil unless they already have an interest in the soil. So, if we want to help others understand soil better, it is up to those who are knowledgeable of soils to aid others to become more knowledgeable. It is not that hard. It can be done and the more that it happens, the more the field of Soil Science will be understood or at least considered.

So here are my suggestions for you, "persons with knowledge of soils". You are needed to make the next footprint. Don't ever use the word "dirt". If you are in the presence of others who use dirt, gently correct them by saying: "I hear you, but as a Soil Scientists, I always use the word "soil", and not dirt, since soil is a valuable resource and dirt is soil out of place". When you can educate others in any small way about soils, go ahead and do it. Write a letter to the editor, volunteer at your local school, or be a speaker at garden clubs or other civic organizations about the importance of treating our soil like a valuable natural resource that is just as important as water, air or wildlife. Be proud of your "Soil Scientist" label. You are making important contributions to making this planet a better place to live. Make your footprint in the path of others who have gone before in treading in the soil.



Professional Soil Scientist Teaches Students About Soils

By Lori Persson

Brad Wenz, a professional soil scientist and soil conservationist with the Stearns County Soil & Water Conservation District, introduces students to soils through the "Area IV Envirothon" competition every year. The Area IV competition is hosted annually by the Soil and Water Conservation Districts (SWCDs) in Anoka, Benton, Carver, Dakota, Hennepin, Ramsey, Scott, Sherburne, Stearns, Washington and Wright counties.

The "Envirothon" is a problem-solving natural resources competition for Junior and Senior high students. Students are tested on their knowledge of Minnesota's natural resources—aquatics, forestry, soils, wildlife, and a current environmental issue that changes from year to year. Natural resource professionals at the stations test students' knowledge by asking a variety of outdoor-based questions.

Brad has coordinated the "soils" station at the Senior Area IV Envirothon since 1997. In 2007, Brad also coordinated the "soils" station at the Junior Envirothon. Both events were held at the U of M Landscape Arboretum in Chaska.

The soils station is divided into four substations dealing with soil characteristics in different landscape positions. Students answer questions on soil formation, soil properties, use interpretations, and soil conservation.

PSS Teaches - continued

Wenz stated “This is the first time many of these students are exposed to soils in a real-life, hands on manner”. Wenz went on to say, “Teacher feedback is always positive. They say that the team competition approach in an outdoor setting is a unique way to make environmental learning fun and interesting”.

In 2007, 30 teams participated in the Area IV Senior Envirothon, which was one of seven regional Envirothons held throughout the state. The winning three teams from the Senior Envirothon will compete at the State Envirothon near Marshall. The winner of the State Envirothon will compete at the National Envirothon in New York later this summer.



Brad Wenz, in cap, with students.

Mineral Exploration at the Minnesota Geological Survey

By Howard Hobbs, PG

A couple of years ago, I wrote an article for the Auger about a geochemical sampling project at MGS, funded by the USGS. I didn't mention a different sampling project that we were doing, because it was funded by WMC Resources Ltd., an exploration company, and we promised confidentiality for two years. This allowed the company an opportunity to make use of the findings before the competition caught on. We completed the sampling in late 2004, and the data was publicly released in early 2007.

In some ways, this sampling program was similar to that of the USGS. We worked off of 1:250,000 topographic maps, which had been divided into rectangular cells. We dug the samples; GPSed the sites, and took notes on the

material that we sampled. The differences were that the cells were bigger, the samples were larger (about 4 gallons), we were only sampling till, and we didn't have to stay away from roads. As a result, almost all the samples were from road right-of-way. We generally dug into road cuts, so that we could get 2-3 feet below the original surface with minimal digging. The idea was to minimize leaching and other soil alterations, and in some areas we had to get below a surface layer of loess or other non-glacial sediment. Thick loess required deep cuts.

Why just till? We were sniffing around for indicator minerals that could be traced up-ice to a bedrock source. By tracing high values up-ice, one can dramatically narrow down the area to be searched by other means, such as bedrock drilling. This method works if you have a pretty good idea which direction the ice was coming from, as we do in Minnesota. But you can't use ice-flow direction to find the origin of sediment deposited by water or wind.

There are complications a-plenty when you try to apply the method. Most material in most tills was not picked up from bedrock and carried to its site of deposition in one glacial advance going one direction. A lot of material was picked up from previously-deposited till, outwash, lake sediment, loess, etc. And of course for most elements and minerals, even if the major source can be identified, there is a general background from multiple unknown or diffuse sources.

Let's look at a relatively simple example—cadmium. Cadmium is a so-called “transition metal” which is used in rechargeable batteries. It can be somewhat problematic in soils due to potential health effects. On the map (Fig.1), each dot represents one sample in and near Minnesota. The size of the dot is related to the percentile of the value; in the sidebar, each percentile is labeled with a value in parts per million (ppm). Percentile is a measure of how the value of each sample compares with the whole set. So the 25th percentile means that 25% of the samples have lower values, that is lower than 0.12 parts per million. These samples all have the smallest dots. On the other hand, the 100th percentile means that all the other samples have values lower than this one, at 1.13 ppm. This is the biggest dot, though it's not easy to tell the difference between 98, 99, and 100. Cadmium has a big variation in abundance; the highest value is almost 10 times the cutoff value between the smallest dots and the next size up.

Now let's look at the pattern of abundance. There is a strong gradient from northeast to southwest. Most of the area where the Rainy and Superior-lobe tills are at the surface is covered with small dots, though there are some medium ones northwest of Lake Superior. Most of the medium and all the large dots are in the area covered by ice from the north to northwestern lobes, including the Red River, Koochiching, and Des Moines lobes, and the older

Mineral Exploration - continued

gray tills of extreme southeast and southwestern Minnesota. It looks like the source is in the west.

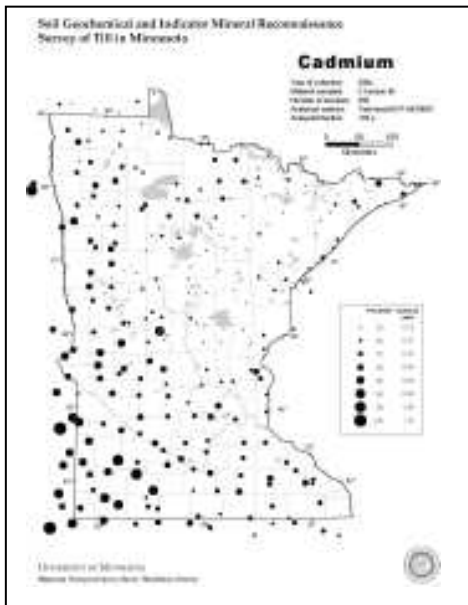


Figure 1

High cadmium values are found in black shales, where high organic carbon content pulls cadmium out of seawater. As it turns out, there is a Cretaceous black shale named the Morden Member of the Carlile Formation that underlies the northern Great Plains. Its only major outcrop area is along the east-facing Pembina-Riding Mountain Escarpment in eastern North Dakota and Manitoba, which forms the western boundary of the Red River Valley. Apparently, cadmium from this shale has been carried east and south into Minnesota, except where blocked by northeastern-source ice.

This brings up a question: fragments of gray Pierre shale are very common in tills of central and western Minnesota, even to the point of comprising the bulk of the till. Black shale fragments are almost non-existent in these same tills. Why is this? Part of the answer may be that gray shale is the surface bedrock over a vast area of the Great Plains, but the black shale is exposed over only a narrow strip of escarpment. More important perhaps is that the shale is soft, and doesn't survive long as fragments in glacial transport. The black shale ends up in the clay fraction of the till.

Looking back at the elevated concentrations in northeastern Minnesota, I notice that they occur mostly in the outcrop area of the Rove Formation, a Precambrian slate straddling the border. Hmm... this slate is black, too. Must be the same phenomenon on a smaller scale.

To sum up, the cadmium map is an interesting example of how the system works, but it doesn't point to a minable deposit. The source was already known, and it is not concentrated enough. But this is true of almost all the elements and minerals analyzed. Explorationists have to look through many possibilities before finding anything worthwhile.

Now let's look at something more exciting—diamond indicators. First let me explain how diamonds occur. They formed originally in the mantle below the Earth's crust, where temperature and pressure are so great that carbon is compressed into its most compact form, diamond. This is the hardest naturally-occurring substance. Ironically, at crustal temperatures and pressures, carbon forms graphite, one of the softest.

Normally, minerals formed in the mantle stay there, and we would never know of the existence of diamonds except that they occasionally got blasted up through the crust in weird explosions. These are different from volcanic eruptions, which are much commoner, have shallower sources, and are better understood. There has never been a diamond blast during the time humans have lived on the planet, so no one has ever seen one, but the evidence remains in many parts of the world.

The remnants of these blasts are "pipes" filled with mantle-derived material called kimberlite, mixed with fragments of the crust broken off on the way up. They are vertical, and presumably extend all the way through the crust. Not all kimberlite pipes contain diamonds, and even the richest pipes contain only a vanishingly small proportion. But diamonds are valuable, and it's worthwhile to move lots of ore to recover them. Naturally, these pipes have been eroded since they were emplaced, along with the surrounding rock. The diamonds tend to be separated from the soft, easily weathered matrix, and accumulate in river channel sand. The grains are heavy and tend to form placer deposits like gold. Placer diamonds are still mined today, but kimberlite pipes are much more concentrated in one place, thus more valuable.

Even as an undergraduate, some 40 years ago, I had heard that diamonds had occasionally been found in glacial deposits. So it has been known for a long time that there was a diamond source somewhere "up north," probably in Canada. But the source remained undiscovered—until recently. It's hard to find diamond pipes in glacier-scoured bedrock terrain. They aren't very big, normally 100 yards to half a mile in diameter. The kimberlite is easily eroded by glaciers, so the pipes are usually depressions at the surface, covered by lakes or swamps. The diamonds themselves are so rare that you could analyze a thousand samples without seeing one. You could spend a lifetime

poking around the bush without ever finding a kimberlite pipe.

What turned the trick was glacial tracing of indicator minerals. There are some minerals derived from the mantle that are usually found in kimberlite pipes, but are thousands of times as common as the diamonds themselves. Because kimberlites are essentially a point source, there should be a “train” of indicator minerals extending down-ice from the source. Ideally, you could trace an indicator train up-ice to a point where it suddenly stops, and that would be the mine site. This has in fact been done, and now Canada is a major diamond producer, even ahead of South Africa.

Our director Harvey Thorleifson was one of the major developers of this indicator mineral tracing process when he was with the Geological Survey of Canada. So it's no surprise that he would want to apply the technique in Minnesota. Figure 2 shows the results for chromium-pyrope (purple) garnets, one of the best indicators. Note that there are only two dot sizes: 1 and 0. One garnet in a 4-gallon sample doesn't seem like much, and it isn't, but the regional background is zero. Somewhere out there must be a kimberlite pipe.

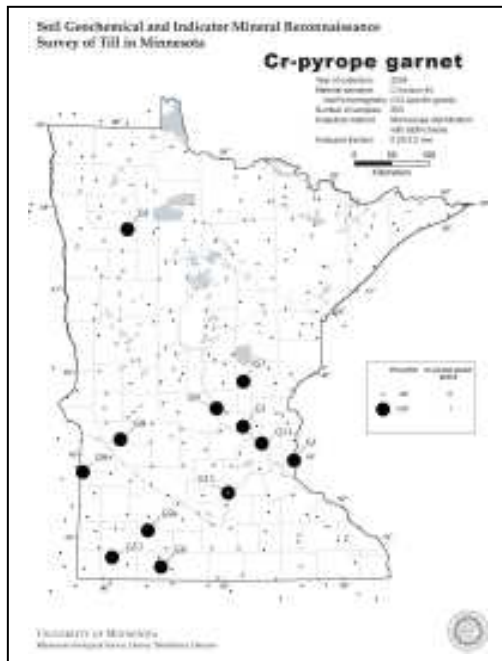


Figure 2

Note that the garnet hits don't form a linear train. It's a bit much even to call it a “plume.” Maybe it's more like a cloud. This is to be expected far down-ice, where a train spreads out under the influence of variable ice-flow direction. Alternatively, the source itself could be a plume or train in an older till. This seems likely in the present case, because some of the hits are in the Des Moines lobe, but a few are in the Superior lobe. What underlying till could have been the source?

We concluded that the source could be in the underlying Hawk Creek-River Falls till, an Illinoian deposit of the Superior lobe. The Superior lobe extended much farther southwest into Minnesota at that time than it did during the last glaciation. (It extended even farther in the very earliest glaciations, judging by Superior agates collected from eastern Nebraska.) The only hit that could not be sourced from the Hawk Creek-River Falls is the lonely dot southwest of Red Lake. That could be a very long-distance stray grain from one of the Canadian kimberlites. The rest of the dots more or less track the subsurface extent of the Hawk Creek-River Falls till. But it's so weak and diffuse that even within the area of the cloud, there are more zeros than ones.

We decided to test this hypothesis by sampling Hawk Creek till, reasoning that if this was the source, the number of purple garnets should be much greater, and possibly a plume or train would show up. Fortunately we have encountered this old red till in many Rotasonic drill holes in and north of the metro area. The cores are stored at the MN DNR Core and Sample Library in Hibbing, and I was able to fill 23 sample buckets. In addition, the MGS has done enough mapping and sampling over the years that we know where Hawk Creek-River Falls till can be accessed at the surface, mostly in or near the Minnesota and St. Croix River valleys. Alan Knaeble and I collected 11 buckets from surface exposures in Minnesota. To complete the sampling, I collected 8 surface samples from Wisconsin. Some were of the River Falls till outside the limit of the last glaciation, some were from the Superior lobe from very early in the last glaciation, and some were from behind the St. Croix moraine, that is, from the main late Wisconsinan glaciation. The River Falls ice entered Minnesota from Wisconsin. Therefore, if the Minnesota samples have purple garnets but the Wisconsin samples are barren, the source must be in Minnesota. If the Wisconsin samples have garnets, the source must be in Wisconsin. On Figure 3, the purple dots are samples from cores, and the blue dots are from surface samples. We haven't got any data back from them, so at this point all the dots are small ones.

The combination of all these samples should show us if the River Falls till is the source for the garnets in the surface samples, and may give a clue to the location of the bedrock source. By itself, this sample set is not going to pin down the bedrock source, but it may be enough to get the private sector involved (depending on what we find). The next step is likely going to be expensive beyond our resources.

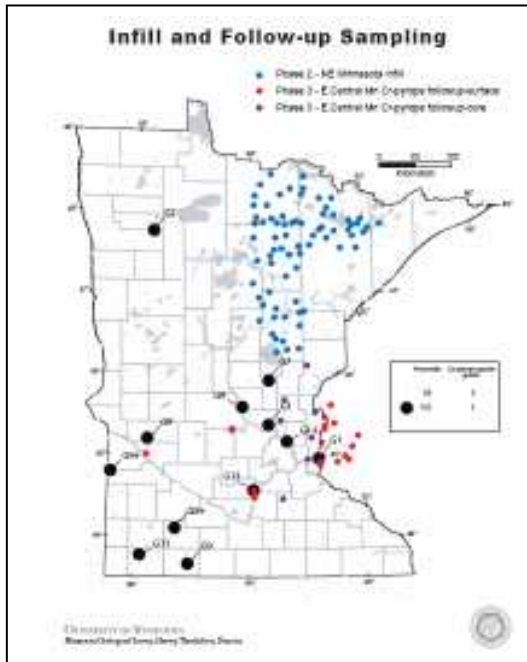
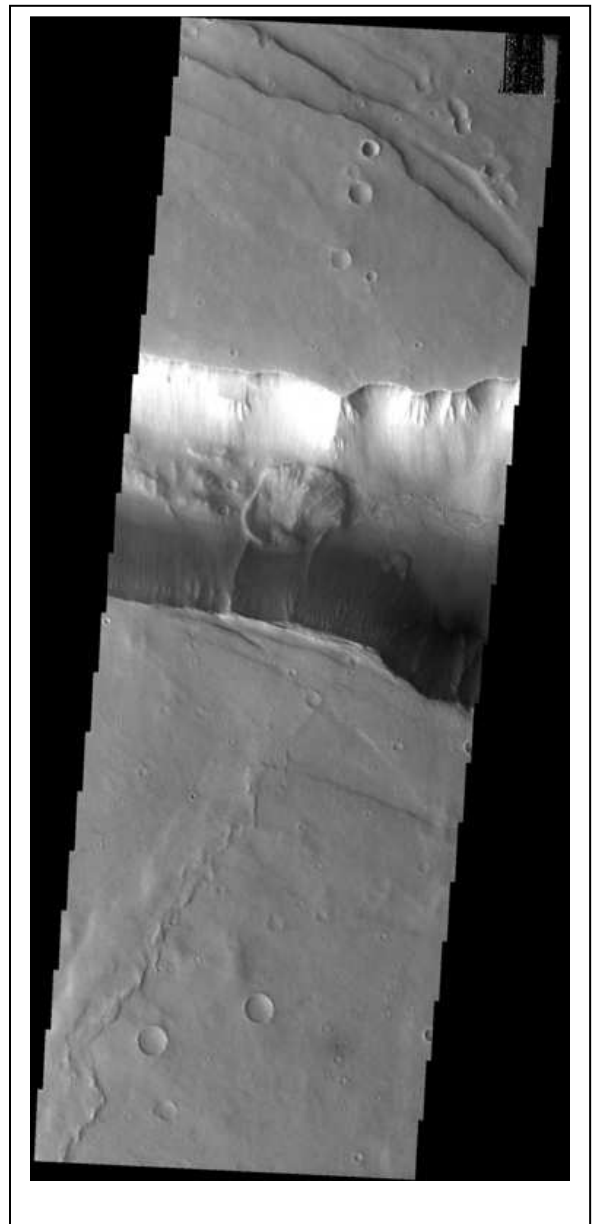


Figure 3

There is a good chance that the bedrock source will be in Wisconsin. We have to accept the possibility that Minnesota will not get any direct economic benefit from this project. But it will still have value as a proof of principle, showing that this drift prospecting technique works in this area. It also can demonstrate that there is some value in glacial stratigraphy on a regional scale. (It has already been used on a local scale for groundwater modeling.)

I could give more examples from the 2004 sampling project, but instead I'll let you read it yourselves. The report is available on our website, <http://www.geo.umn.edu/mgs/>, under Publications and Geology. Click on Indicator Mineral Survey. That will bring up the summary. Click on Open File Report OFR-07-01 for the full report.

We have done two follow-up studies so far. One was the diamond indicator sampling just mentioned; the other was an infill sampling project conducted by the NRRI in Duluth. The NRRI samples are shown by the red dots on Figure 3. In this part of Minnesota, the drift is fairly thin, and it was felt that the original sampling pattern was not dense enough to capture a narrow plume or train. Funding for both of these projects was provided by the Minerals Coordinating Committee. There are other possible follow-up projects, and we will pursue them as opportunity and funding permit.



The landslide in this image occurs within Coprates Catena. The Catena parallels Vallis Marineris (on Mars).
<http://themis.asu.edu/zoom-20070608a>
Courtesy of NASA/JPL/Arizona State University.

"We cannot dig deeper into the Earth and find new productive soil. We cannot pump it from wells, plant it with seeds, or dig it from mines. We must keep what we have or do without, for when soil has been washed or blown into the oceans it is not recoverable."

**Hugh Hammond Bennett
USDA, Soil Conservation Service,
October 2, 1946**

The Sands of Mars

By Trudy E. Bell and Dr. Tony Phillips

Driving, digging, mining: these are things astronauts will be doing one day in the sands of Mars. It's not as simple as it sounds.

January 31, 2005: Imagine this scenario. The year is 2030 or thereabouts. After voyaging six months from Earth, you and several other astronauts are the first humans on Mars. You're standing on an alien world, dusty red dirt beneath your feet, looking around at a bunch of mining equipment deposited by previous robotic landers.

Echoing in your ears are the final words from mission control: "Your mission, should you care to accept it, is to return to Earth--if possible using fuel and oxygen you mine from the sands of Mars. Good luck!"

Right: Astronauts on Mars, an artist's concept.



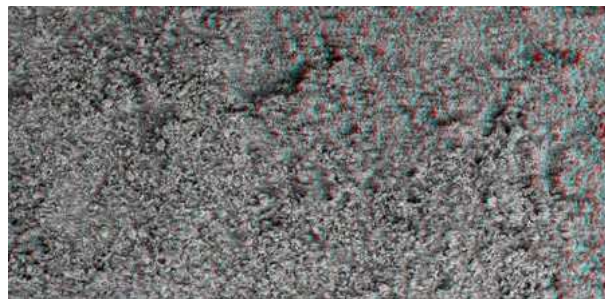
It sounds simple enough, mining raw materials from a rocky, sandy planet. We do it here on Earth, why not on Mars, too? But it's not as simple as it sounds. Nothing about granular physics ever is.

Granular physics is the science of grains, everything from kernels of corn to grains of sand to grounds of coffee. These are common everyday substances, but they can be vexingly difficult to predict. One moment they behave like solids, the next like liquids. Consider a dump truck full of gravel. When the truck begins to tilt, the gravel remains in a solid pile, until at a certain angle it suddenly becomes a thundering river of rock.

Understanding granular physics is essential for designing industrial machinery to handle vast quantities of small solids--like fine Martian sand.

The problem is, even here on Earth "industrial plants don't work very well because we don't understand equations for granular materials as well as we understand the equations for liquids and gases," says James T. Jenkins, professor of theoretical and applied mechanics at Cornell University in Ithaca, N.Y. "That's why coal-fired power plants operate at low efficiencies and have higher failure rates compared to liquid-fuel or gas-fired power plants."

So "do we understand granular processing well enough to do it on Mars?" he asks.



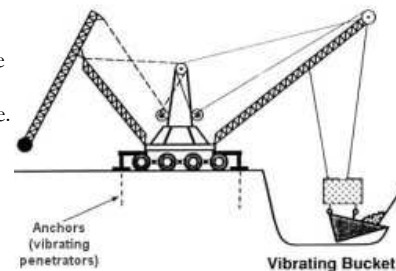
Above: Mars soil in 3D, photographed by the Spirit rover in 2004. Put on your red-blue glasses and take a look. [\[Larger image\]](#) [\[More\]](#)

Let's start with excavation: "If you dig a trench on Mars, how steep can the sides be and remain stable without caving in?" wonders Stein Sture, professor of civil, environmental, and architectural engineering and associate dean at the University of Colorado in Boulder. There's no definite answer, not yet. The layering of dusty soils and rock on Mars isn't well enough known.

Some information about the mechanical composition of the top meter or so of Martian soils could be gained by ground-penetrating radar or other sounding devices, Sture points out, but much deeper and you "probably need to take core samples." NASA's Phoenix Mars lander (landing 2008) will be able to dig trenches about a half-meter deep; the 2009 Mars Science Laboratory will be able to cut out rock cores. Both missions will provide valuable new data.

To go even deeper, Sture (in connection with the University of Colorado's Center for Space Construction) is developing innovative diggers whose business ends vibrate into soils. Agitation helps break cohesive bonds holding compacted soils together and can also help mitigate the risk of soils collapsing. Machines like these might one day go to Mars, too.

Right: Mars-cranes might use vibrating buckets for excavation. Credit: Stein Sture.



Another problem is "hoppers"--the funnels miners use to guide sand and gravel onto conveyor belts for processing. Knowledge of Martian soils would be vital in designing the most efficient and maintenance-free hoppers. "We don't understand why hoppers jam," Jenkins says. Jams are so frequent, in fact, that "on Earth, every hopper has a hammer close by." Banging on the hopper frees the jam.

The Sands of Mars - continued

On Mars, where there would be only a few people around to tend equipment, you'd want hoppers to work better than that. Jenkins and colleagues are researching why granular flows jam.

And then there's transportation: The Mars rovers Spirit and Opportunity have had little trouble driving miles around their landing sites since 2004. But these rovers are only about the size of an average office desk and only about as massive as an adult. They're go-carts compared to the massive vehicles possibly needed for transporting tons of Martian sand and rock. Bigger vehicles are going to have a tougher time getting around.

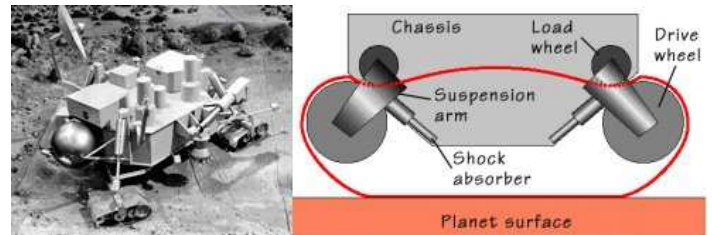


Left: Mars rover Spirit, an artist's rendition. Spirit and her twin Opportunity have been roaming Mars since January 2004. [\[More\]](#)

Sture explains: As early as the 1960s when scientists were first studying possible solar-powered rovers for negotiating loose sands on the Moon and other planets, they calculated "that the maximum viable continuous pressure for rolling contact pressure over Martian soils is only 0.2 pounds per square inch (psi)," especially when traveling up or down slopes. This low figure has been confirmed by the behavior of Spirit and Opportunity.

A rolling contact pressure of only 0.2 psi "means that a vehicle has to be light-weight or has to have a way of effectively distributing the load to many wheels or tracks. Reducing contact pressure is crucial so the wheels don't dig into soft soil or break through duricrusts [thin sheets of cemented soils, like the thin crust on windblown snow on Earth] and get stuck."

That requirement implies that a vehicle for moving heavier loads--people, habitats, equipment--might be "a huge Fellini-type thing with wheels 4 to 6 meters (12 to 18 feet) in diameter," says Sture, referring to the famous Italian director of surreal films. Or it might have enormous open-mesh metal treads like a cross between highway-construction backhoes on Earth and the lunar rover used during the Apollo program on the Moon. Thus, tracked or belted vehicles seem promising for carrying large payloads.



Above: An experimental Elastic Loop Mobility System that might work on worlds with dusty soil like Mars and the Moon. Photo credit: Stein Sture.

A final challenge facing granular physicists is to figure out how to keep equipment operating through Mars' seasonal dust storms. Martian storms whip fine dust through the air at velocities of 50 m/s (100+ mph), scouring every exposed surface, sifting into every crevice, burying exposed structures both natural and manmade, and reducing visibility to meters or less. Jenkins and other investigators are studying the physics of aeolian [wind] transporting of sand and dust on Earth, both to understand the formation and moving of dunes on Mars, and also to ascertain what sites for eventual habitats might be best protected from prevailing winds (for example, in the lee of large rocks).

Returning to Jenkins's big question, "do we understand granular processing well enough to do it on Mars?" The unsettling answer is: we don't yet know.

Working with imperfect knowledge is okay on Earth because, usually, no one suffers much from that ignorance. But on Mars, ignorance could mean reduced efficiency or worse preventing the astronauts from mining enough oxygen and hydrogen to breathe or use for fuel to return to Earth.

Granular physicists analyzing data from the Mars rovers, building new digging machines, tinkering with equations, are doing their level best to find the answers. It's all part of NASA's strategy to learn how to get to Mars ... and back again.

This article courtesy of the National Aeronautical and Space Administration and can be found at:
http://www.nasa.gov/vision/earth/technologies/31jan_sandsof_mars.html

mapss@mnsolscientist.org

**Don't forget to register for the
MAPSS summer tour!**

2006 Winter MAPSS Meeting Minutes

St. Cloud, Minnesota, Best Western Kelly Inn
Friday, December 1, 2006 - Call to order at 12:41 PM

Roger Risely, President, introduced Executive Committee members present: President Elect Scott Smith, Past President Dennis Fuchs, Secretary Brad Wenz. Treasures Bob Whitmyer was not present. Executive Secretary Suzanne D'Souza was also introduced.

Virtual Accounts

Roger Risely stated that that Virtual Accounts were approved at the Summer 2006 meeting. Gary Elsner, Professional Practice Committee chair, explained that MAPSS has three Virtual Accounts: Professional Development, Education/Outreach, and Scholarships. Each account will have a Committee assigned to maintain their account balance. We don't have to table funding requests anymore; money will be available for suitable activities based on the amount in each account. Requests will be reviewed and approved by the Executive Committee. Donations lines for each account will be listed on the membership renewal forms. Each committee will be responsible for raising funds for their respective accounts, except Professional Development which will be funded from the CEU fee.

Roger made an appeal to the membership to get involved in Committee work. Many current Committee chairs have been working for several years and if they want to step down they should be able to do so.

Summer Minutes

Motion to approve Summer 2006 MAPSS business meeting minutes by Paul Brandt

Second by Tom Fait

Motion passed

Treasurer's Report

Roger stood in for Bob Whitmyer. Roger agreed to add the Virtual Accounts and their balance as requested by membership. This will be posted on the website.

Motion by Paul Brandt to accept the Treasurer's report pending an audit of this report by the MAPSS Executive Committee.

Second by Mark Perry

Motion passed

Executive Secretary Report

Suzanne D'Souza reported that there is no Legislative action right now. There are some issues regarding improper use of agriculture buildings that is being investigated. The \$9,899.65 balance reported for the Vol. 23, No. 2

Smithsonian Exhibit in April was false. The current balance is \$9,274.55. Someone that lives in Minnesota donated money to another State. Suz asked for articles for the Auger. She also asked members to send in ideas for the website and corrections. Terry Cooper suggested posting meeting presentations on the website. There may be some need to limit access to "members only" data such as the Treasurer's report. Other organizations use passwords that are issued to members and they are changed annually. The EC will look into this. Licensure renewal will occur in 2008. Suz hopes that licensure registration will be available on-line by then.

Executive Committee

Roger Risely reported that the MAPSS EC is working to take advantage of new technology such as expanding the website. He said that the EC volunteered to organize the 2006 Summer tour. He hopes this trend does not continue and that someone steps forward to organize the event for 2007.

Education Committee

Peter Hartman reported that he and Norm Mofjeld ran a soils exhibit for "Science Madness", an event held at the Minn. Science Museum in April. Peter said that this is a great opportunity to expose soil science to the public and it should be done annually. There is no fee for this program.

Scholarship Committee

Roger Berggren, Committee Chair, will work on developing a new mission statement and develop criteria as to how the scholarships should be given. One idea presented was to steer scholarships to students that are taking course work that would lead to Professional Soil Scientist licensure. Doug Miller said that there used to be a Joe Cummins scholarship given out by his estate. The Scholarship Committee should look into the criteria used in that scholarship. The discussion progressed to involve all committee mission statements.

Motion by Paul Brandt for all MAPSS committees that are responsible for Virtual fund accounts [Scholarship, Education, Professional Development] to develop a mission statement that will incorporate the utilization of their Virtual funds, and criteria for dispersion, for the membership to review. These recommendations will be presented to the EC for review prior to the Summer 2007 MAPSS business meeting. These recommendations will be posted on the MAPSS website.

Second by Wayne Jacobsen

Motion passed.

Membership Committee

Dennis Fuchs reported that MAPSS lost 6 members in 2005 and 3 people in 2006. There are 99 MAPSS members as of 11/20/2006. Dennis thanked Dr. Cooper

2006 Winter Minutes - continued

for his work done on the poster and hopes that it will encourage more people to be involved in MAPSS.

Elections Committee

Dennis Fuchs reported that the candidates for President Elect were Mitch Bender, Professor from St. Cloud State University, and Mike Lieser, NRCS Soil Scientist. Mark Wespetal ran unopposed for Secretary. The voting was close. **Mike Lieser was elected President Elect and Mark Wespetal was elected Secretary (there were no write-ins for Secretary).**

Awards Committee (MAPSS Soil Scientist of the Year)

Dennis said that the Awards Committee reviewed a couple of nominations. The Awards Committee sent their selection to the EC. Brad Wenz, PSS, Stearns County SWCD, was awarded the 2006 MAPSS Soil Scientist of the Year.

SSTS Committee

Mary West reported that the proposed MPCA rule changes are at the Governor's office waiting for his signature. When this happens the draft rules will be sent out for public comment. There is a "grey area" in the proposed rule that covers mid sized septic treatment systems (2500 to 10000 gallons per day, or 4 or more dwellings). The licensing board is consulting with MPCA, MOWA, and the U of M to determine if the design of these systems crosses over into the realm of Professional Soil Scientists, Geologists, or Engineers. MPCA is considering writing an exemption into the rule that says that involvement by these professionals is not needed for these systems. Mary said, as it stands right now, it appears that these professionals must be involved in the design of these systems. The SSTS sub committee members are Mary West, Norm Kuhlman, Laurie Brown, Bob Whitmyer, Mark Wespetal, and Peter Miller. Mary West is stepping down. Mary also reported that the Chapter 7080 rule states that MAPSS must have a member on the MPCA Septic System Advisory Committee. Mary will also step down from that committee. This is a non-voting position. Paul Brandt volunteered to look into that position.

New Business

Membership Cards

MAPSS will resurrect the old membership certificates and issue these to all paid members.

Drop Entrance Fee (Constitution change)

Motion to drop the \$20 entrance fee to new and renewed members by Paul Brandt

Second by Mike Lieser

Motion passed

Soil Judging

Roger asked for discussion about annually funding soil judging competition.

Motion by Scott Smith to fund soil judging for a total of \$200 for annual competition with an additional \$700 for national competition.

Second by Doug Miller

Discussion centered on original intent of the funding. It was felt that the funding was for all schools not just the U of MN. Further discussion regarding whether the funding should be \$200 for each school or a \$200 total for all schools. One member felt that each school could receive \$200 and the balance remaining in the account used for national competition.

Motion to table this issue until a more clear funding structure can be presented to MAPSS membership at the 2007 Summer business meeting by Terry Bovee.

Motion was not seconded.

Scott clarified that the \$200 for annual competition and the additional \$700 is a cap (the total to be given out).

Motion to add funding for annual competition passed

MAPSS Logo

Dennis Fuchs reported that two designs were presented to the EC. The EC would like to review more suggestions before making a decision.

Code of Ethics

Discussion of whether the MAPSS code of ethics is compatible with those of the Board for professionals. The EC will examine this.

Advanced Soil Training For SSTS

Discussion regarding whether MAPSS could team with MOWA to provide advanced soil training for SSTS certification. The EC will examine this and likely support soil training in conjunction with the standard SSTS training.

Archived Soil Information

Dave Aldeen expressed interest in archiving soil information from offices of retiring soil scientists. Kim Steffen offered to store this material in the NRCS State office.

Motion to adjourn by Paul Brandt

Second by Norm Kuhlman

Motion passed

Meeting adjourned at 1:55 PM

Respectfully submitted by Brad Wenz, MAPSS Secretary
12/06/06

Minnesota Association of Professional Soil Scientists (MAPSS)

2007 Summer Tour & Business Meeting

Spodisols? Forest Soils and Geology in Carleton County

**Friday, August 17, 2007
8:30 am – 4:30 pm**

Cloquet Forestry Center in Cloquet, Minnesota

Soils are a result of the five soil forming factors. Trees are a result of soils and climate. Geology is a result of glaciers. Put this together and see what happens in Carlton County on the MAPSS Summer tour. We will have experts tell us about each in different locations. Plus you get to climb up a fire tower, and climb down again. That alone should cover your price of admission. Plus, all the great discussions and the MAPSS business meeting.

Continuing Education Credits: 6.0

Topics & Speakers

Soils and Soil Formation on Sandy Outwash

Terry Cooper and Roger Risley
University of Minnesota and the Natural Resource Conservation Service, respectively

Tour of the Cloquet Forestry Plots and Soils

Ron Severs
Cloquet Forestry Center

Tour of Carleton County – Geology & Soils

Howard Hobbs and Alan Knaeble
Minnesota Geological Survey

MAPSS Business Meeting

A MAPSS business meeting will be held during the conference. All MAPSS members are expected to attend this session.

Don't forget to dress for the weather and critters.

Registration Form – complete this form

Please register by **August 3, 2007** to avoid a late payment and to help with planning.

Name: _____
Address: _____

City: _____
State: _____
Zip code: _____
Telephone or e-mail: _____

Fees:

MAPSS Members:	\$50.00	_____
Non-MAPSS Members:	\$65.00	_____
Student Members:	\$20.00	_____

Late Registration (after August 3, 2007)

MAPSS Members:	\$65.00	_____
Non-MAPSS Members:	\$80.00	_____

Optional CEU Fee: \$10.00 _____

See explanation of this optional fee on the following page

Total Amount Enclosed: _____

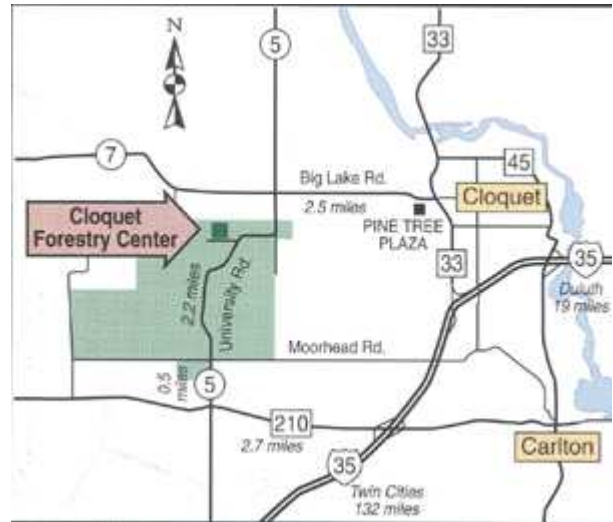
Make checks payable to MAPSS and send it, along with this portion of the registration form, to:

MAPSS 2007 Summer Tour
Mr. Bob Whitmyer
3990 Fairview Road
Duluth, MN 55803-2708



The MAPSS 2007 Summer Tour begins at the Cloquet Forestry Center, Minnesota.

The Cloquet Forestry Center is located in Cloquet, Minnesota. It is located just west of Interstate 35 and north of Highway 210, on County Road 5 in Carleton County, just southwest of Duluth. See map below.



Optional CEU Fee

CEU are obtained without paying the \$10 CEU fee. However, your attendance at the conference will be certified by MAPSS only by paying this fee. MAPSS will certify and maintain a record of your attendance, which will be provided to licensing boards upon your request. All other attendees must maintain their own records. ***MAPSS will not certify your attendance without paying this fee.***

Carpool!

Tired of paying for gas? Do you want to save the world? Or are you just tired and want to sleep during the trip to Cloquet? Why not carpool! Contact Suzanne, the unofficial carpool organizer, at either 612-741-1365 or suzanne.dsouza@amec.com.