GEOLOGICAL SOCIETY OF MINNESOTA

NEWS

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http://www.geo.umn.edu/orgs/gsm/

MEDICAL GEOLOGY ACTIVITIES AT THE U.S. GEOLOGICAL SURVEY

Medical Geology is experiencing resurgence in the U.S. with one significant difference. This time the U.S. Geological Survey (USGS) is strongly supporting the effort. In previous years the interest and enthusiasm of individual scientists, primarily in the academic community, drove medical geology research in the U.S. However, during the past 3 years the USGS has accepted research on geologic materials and processes that affect human health as being an integral part of its mission and is encouraging USGS scientists to enter the field.

For example, the USGS has signed memoranda of understanding with the Armed Forces Institute of Pathology, the Environmental Protection Agency, the National Institute of Environmental Health Sciences, and the Centers for Disease Control and Prevention. The USGS is developing a funding initiative on environmental health for fiscal year 2003 and will soon brief Congress on this issue. A very substantial proportion of this year's Post Doctoral Fellowships has gone to applicants with biomedical or public health backgrounds. USGS scientists are currently engaged in research on the health impacts of toxic metals (As, Hg, F, Se, Al, Zn), dusts from Africa, vermiculite and coal mining, organic compounds, radionuclides, microbes and other pathogens, and the general issue of global climate change. USGS scientists have helped to organize workshops and symposia around the world on these and other health-related issues.

Most of these research projects are collaborations with biomedical researchers from federal, state, and county agencies, universities, and research hospitals in the U.S. and in other countries. Prominent among the other federal agencies that have joined with the USGS in promoting Medical Geology is the Armed Forces Institute of Pathology. (See back cover) Both agencies are convinced that Medical Geology will continue to grow and will be a visible and important part of their missions for years to come.♦

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Announcements

* Have you remembered to renew your GSM membership? Look at the address label on this newsletter. If the date on the label does not say 10/01/02, you still need to send in your membership dues. Mail to Gail Marshall, Membership Chair, at the address listed in the box below.

* The meeting room for the continuation of the 2002 Lecture Series is still to be determined. Check the GSM website, or call 612-724-2101 in early Jan. '02 to find out if we will continue to meet in the same room in Amundson Hall.

GSM *NEWS*
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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: William Robbins, *President*; (Vacant) *Vice President*; Steve Erickson, *Treasurer*; Judy Hamilton, *Secretary*.

Directors: In addition to the officers listed above: David Christianson; Paul Lemke; Rose Mary O'Donovan; Gail Marshall; Katy Paul.

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

News from the Board...

At the fall annual meeting, members of the Geological Society of Minnesota (GSM) elected the slate of candi - dates selected by the nominating committee. The new GSM board members are Ted Chura, Paul Martin and Nina Ward. At the same time, Judy Hamilton was elected for a second term on the GSM board. The GSM board met on October 6, 2001 and elected Steve Erickson as president, Paul Martin as vice president, Ted Chura as treasurer and, for a second year, Judy Hamilton as secretary.

This year's GSM lecture series, "Forming and Finding Earth's Hidden Treasures", is now well underway, and all we need is your attendance! The strike by Minnesota State employees had the potential to seriously affect the lecture schedule. In actuality, the only effect was to switch the order of the first two speakers. An additional talk will likely be added to the schedule this spring, on "Finding and Forming Diamonds" by Robert Kirk, PhD. Bob is a GSM member and in the mid 1950s, was on the team at General Electric that made the first artificial diamonds. These were certainly the first artificial diamonds authenticated by modern analytical tools. Previously, there had been many totally unsub - stantiated claims dating back to alchemists. The date for this talk will be announced in this newsletter, on GSM's web site and at lectures prior to this talk.

GSM needs a video library chair to carry on the work so ably performed by Alex Lowe. A new video library procedure could be considered, and might use phoning and computers to allow selection of specific tapes to bring to the lecture. If interested in volunteering in this capacity or discussing the library procedure, please call me, Bill Robbins, at 651-733-9894.

This is my final letter as GSM president: I wish to thank all of you who have helped GSM and me during the last two years. Contributions of time and effort are vital in keeping the organization functioning, and I appreciate how much people are willing and able to accomplish.

~Bill Robbins, President

STATE FAIR 2001

Once again the Minnesota State Fair Exhibit 2001 went well. We generated some new members for GSM and had fun doing it. The children still enjoy being able to touch the rocks on display. We are always delighted to see their curiosity. We enjoy the parents too, and again, several had brought along a rock they had found, and wondered if we could tell them what it might be. They love to tell us about their travels to other locales and the kinds of rocks they saw there, and also what they have in their backyard.

This year, 51 GSM members filled 72 time slots. That's down 10 people from last year. Thanks to those dedicated members who did several shifts, we kept the booth going, talked to many fair goers, and kept the Fair Administrative Staff happy by having someone there all the time.

Listed below are the names of those folks who staffed the booth. Take special notice of Dick Heglund's number of visits. He worked five shifts! He says he enjoys doing it. Dick is a retired schoolteacher who still likes to teach. Bill Robbins came in second for times spent at the fair with four shifts! Others, as you will notice, did two shifts.

All the fair workers are greatly appreciated for taking time from busy lives to continue this yearly tradition. Sometimes it's hot in the Education Building and sometimes the shifts seem long, but everyone held in there, and hopefully, we generated lots of interest in the Minnesota Geological Society.

A special thanks goes to our new Chairperson, Tom Schoenecker, who jumped right in there and put it all together with phone calls, setup and takedown and a couple of extra trips to the fairgrounds to correct some problems. Thanks also to the set-up committee, as well as the take-down committee and everyone else who helped Tom but whose names I don't have at this printing.

It was a great success.

–Judy Hamilton, GSM Secretary

Ken Barklind
Walt Blowers (2)
Charles Brennecke (2)
John Bussard (2)
David Christianson
Marty Collier
Fran Corcoran
David Doty
Doug Earl
Steve Erickson
Victor & Patricia Grambsch
Judy Hamilton (2)
Elaine Handleman
Dick Heglund (5)
John & Karen Howell
Sylvia Huppler
Jay Hutchinson
Dan Japuntich
Orell Jensen
Pat Johnson
John Jordan
Dean Kjerland
Dorothy Kuether
Paul Lemke
Diane Lentsch
Alex & Marlys Lowe
Ev & Doris Luhmann
Mark & Anne Lukkarila
Gail Marshall
John Matlock
Conrad Nelson
Galen O'Connor
Val O'Malley
Clarence Ooten
Katy Paul
Gerald Paul
William Paule
David & Lisa Peters
Lee & Deb Preece
Bill Robbins (4)
Mark Ryan
Dee Schmaltz
Tom & Edna Schoenecker (2)
Bob Scruggs
Alan & Kay Smith
Don Swensrud
Roger Willette
David Wilson
Winni Wilson
Dode Wonson
Doug Zbikowski (2)

MEDICAL GEOLOGY

"Medical Geology" is defined as the science dealing with the relationship between natural geological factors and health in man and animals, and understanding the influence of ordinary environmental factors on the geographical distribution of such health problems. Medical Geology is therefore a broad and complicated subject which requires interdisciplinary contributions from different scientific fields if the problems are to be understood, mitigated or resolved.

Naturally occurring metals and non-metals can have detrimental effects on health when ingested in abnormal quantities. Metals have always existed and will forever exist, but we cannot avoid the fact that all humans and animals are affected by metals in the environment. Some metals are necessary for our wellbeing and others are detrimental to our health. Human activities of all kinds have led to metals being redistributed from sites where they are fairly harmless to places where they affect humans and animals in a negative way. This serious problem is being intensified in locations where acid rain and associated acidification accelerates this process to make some heavy metals (such as mercury), more easily accessible and thus absorbed in the nutritional chain. Another consequence of acidification is that some essential trace elements, such as selenium, become unavailable to living organisms.

Metal ions occur naturally in rocks, soils, gases, and waters in both harmless and harmful forms and concentrations. Natural concentrations can be extraordinarily high and have caused serious health problems. Metals are important in environmental health and on the study of human diseases (pathology) because of their potential toxic effects to one or more organs. Exposure to toxic metal ions may occur via three principle routes: percutaneous absorption, ingestion, or inhalation. Dermal toxicity results from local tissue responses through direct contact of the metal with skin, or alternatively, may represent a manifestation of systemic toxicity following ingestion or inhalation. Allergic contact dermatitis induced by nickel is an example of a local tissue response. The adverse cutaneous reactions resulting from chronic ingestion or inhalation of arsenical compounds exemplify systemic toxicity.

The presence of toxic elements in soil or rocks, whether due to natural geochemistry or human activities, including pollution, usually influences human health indirectly, whether ingested via food or drinking water. Although many places in the world rely solely on locally produced food, food consumption in modern industrialized societies is much more diverse, including food produced in different geographical areas. Drinking water, however, is usually obtained locally and therefore strongly related to local geochemistry. Problems of excess intake from drinking water have been encountered for several inorganic compounds, including fluoride in Africa and India; arsenic in certain areas of Argentina, Chile, and Taiwan; selenium in seleniferous areas in the U.S., Venezuela, and China; and nitrate in agricultural areas with heavy fertilizer use.

Heavy metals are not the only elements that are addressed by the subject of medical geology. Classic internationally recognized examples of diseases related to geological factors are goitre (which is due to iodine deficiency), and those diseases caused by excess or deficiency of certain elements such as fluorine or selenium. Cardiovascular mortality and morbidity in relation to water hardness, which is controlled by its geological settings, is also one potential subject of research.

~Continued on page 5

UM Researchers Predict Volcanic Future for East Coast

Two geology professors at the University of Minnesota predict a rough future for the American East Coast -- complete with earthquakes, volcanoes and a major mountain-building episode -- in an article published in the October 19 issues of "Science."

Drs. Dave Yuen and David Kohlstedt were studying the sedimentary rocks being deposited in the Atlantic. They concluded that the weight of the sedimentary rocks accumulated since the Cretaceous will deform the crust, while the presence of water may lubricate the rocks sufficiently to initiate formation of a subduction zone along the margin between continental and oceanic crust in the area. The oceanic trench formed could be up to 2,000 miles long.

The result would create a landscape in Eastern North America similar to that found today in the Cascades or Andes along the western margin of the Americas. On the western continental margin, subduction of Pacific-floor crustal plates under the American continents produces volcanic mountains and related geophysical effects - part of the so-called "Ring of Fire."

Yuen, who worked with a colleague from the Swiss Federal Institute of Technology in Zurich and Joy Branlund, a UM graduate student, estimate that the subduction zone will begin to form within 3 to 10 million years, and run for about 3 million years after it starts. Kohlstedt developed mathematical equations to show that water in rock makes it more pliable - and that wet rocks flow 1,000 times faster than dry rock.

Little geological violence has happened to Eastern North America since it said goodbye to Africa as the Atlantic Ocean began opening more than150 million years ago. But that slow, steady sea-floor spreading, accompanied by relentless dumping of sediment off the coast by American rivers, created a unique sedimentary environment that was perfect for Yuen and Kohlstedt's studies.

While Yuen and Kohlstedt didn't develop any maps to go with their study, noted paleogeographer Christopher R. Scotese of the University of Texas has peered into the future. The website for his Paleomap Project (www.scotese.com) offers some guesses about the shape of things to come - and Scotese does see a subduction zone spreading along the East Coast from Greenland to Antarctica.

Scotese's three maps - looking 50, 100 and 250 million years into the future - show a subduction zone spreading from an existing oceanic trench on the eastern side of the West Indies. Ultimately, the West Atlantic subduction zone eats the Mid-Atlantic Ridge and the Atlantic closes again.

~ Tom Smalec

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Medical Geology, ***continued from page 4***

Many types of rock have elevated uranium contents. These include for example alum shales, certain granites, and pegmatites. Breathing or ingestion of abnormal levels of the radioactive gas radon, derived from natural radioactive sources in such rocks, has in recent years also been acknowledged as a public health hazard. The number of radon-related cases of lung cancer is increasing and qualifying radon to be the major radiation problem with respect to health in several countries. Some current building traditions, such as the use of light concrete made from uranium-rich alum shale, and a reduction in building air circulation (justified from energy conservation aspects) have in many cases aggravated the problem. More recently, focus has been put on radon in domestic water as a potential radiation protection problem. Previous risk assessments have focused on radon emanating from water as an additional source of radon in indoor air. Recent studies suggest that the intake of radon-rich water should also be considered a risk, especially for critical groups such as infants. The radon content of water is directly related to local geological conditions.♦

Here is the text that will soon be in bronze at the newly built roadside pull-off near Great River Bluffs State Park. The marker is located in Winona County, on U.S. Hwy.61, just north of I-90 and about 0.6 mile NW of the Hwy.7 intersection. In addition to the plaque, there will also be several interpretive panels describing the flora and fauna of the area.

GREAT RIVER BLUFFS

From Winona to La Crosse, the Mississippi River valley displays its greatest depth as it extends vertically through more than 240 meters of a sedimentary-rock plateau. Here, Highway 61 follows the narrow strip between the river and the steep bluffs that mark the valley's western wall. The valley walls are composed of sandstone and carbonate rock, which formed from sand and lime mud deposited about 500 million years ago in a warm, shallow sea that covered much of what is now North America. The lower, more sloping parts of the valley walls are composed mostly of weakly cemented sandstone, which erodes easily. On the upper parts of the walls, steep cliffs shape the bluffs. The cliffs are composed of dolostone, a chemically altered limestone that is resistant to erosion.

Bluffs are formed as the Mississippi or a tributary cuts into the soft sandstone, initiating sandstone rockfalls that undercut the dolostone. The dolostone then breaks along vertical joints, leaving steep cliffs. Two of the most prominent bluffs in the area, King's Bluff and Queen's Bluff, are visible southeast of this site on the west side of the valley. King's Bluff is the closer one. Both are within Great River Bluffs State Park and are designated Scientific and Natural Areas by the Minnesota Department of Natural Resources for their unusual geology and rare biological communities.

These bluffs are within the "Driftless Area," an area of deeply eroded stream valleys primarily east of the Mississippi River and covering southwestern Wisconsin. During the Ice Age of the last two million years, glacial ice never passed over and leveled this area, and no drift, or glacially carried sediment (clay, silt, sand, gravel, and boulders), was deposited here. However, the landscape before you was blanketed with a layer of loess—a wind-blown, tan-colored rock dust. This dust was carried by winds from floodplains still bare of vegetation, which were repeatedly loaded with very fine sediment by streams that drained melting glaciers. Today, a distinctive and fertile soil has developed in the top of the loess, which helps to give rise to the diverse and sometimes unique plant communities found on these bluffs.

Erected by the Geological Society of Minnesota
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EDUCATING FUTURE ENVIRONMENTAL STEWARDS

Back in 1965, James R. Lowenstine began to envision a future use for his 1,200-acre estate in northern Wisconsin. Plans evolved for a school that would teach youth to appreciate the natural beauty of the Northwoods and motivate them to become ethical environmental stewards of the future. Six years after his death, in the fall of 2002, Conserve School will open its doors to realize that dream. A non-sectarian, independent, coeducational residential high school, Conserve School will offer students a unique educational opportunity through its innovative, interdisciplinary curriculum focused on 21st century sustainability issues and ethical leadership.

Conserve School is located on 1,200 acres of Jim Lowenstine's former estate in Land O'Lakes, Wisconsin, a small resort community whose population of 800 year-round residents nearly doubles in the summer months. Known for its thick birch and evergreen forests, pristine lakes, wetland marshes, and abundant wildlife, this Northwoods retreat provides an idyllic setting for a school devoted to preserving the balance of nature. Future students will share their home with white-tailed deer, bobcats, black bears, bald and golden eagles, woodpeckers, red foxes, fishers, and other wildlife. School buildings will occupy only 120 acres of the 1,200-acre campus, leaving most of the land and the seven lakes on the property as an "outdoor classroom" for students.

Nestled amid the birch trees on the Conserve School site will be five residence halls, an academic building, a recreation center, a maintenance center, and an ecological waste water treatment facility called the "Living Machine" – a series of tanks filled with plants, animals, and bacteria that will naturally filter campus wastewater into effluent that can be used in irrigation.

During construction, great care is being taken to ensure that the fewest possible trees are removed, wildlife habitats are not disturbed, and impact on the ecosystem is minimized. Lumber from trees that must be removed is being used for exterior facing of the buildings, auditorium flooring and student projects. Conserve School is also participating in a regional re-forestation effort to restore the pine ecosystem that existed throughout the Northwoods in the early 1800s.

Experimentation and invention will be stressed throughout the Conserve School curriculum. In addition to college preparatory courses and studies of diverse global ecosystems, students will participate in hands-on, problem-solving activities. They will learn to generate creative solutions for the ecological concerns of the area, use the latest technologies as sustainability tools, and help area residents to understand and resolve issues such as changes in the water levels of nearby lakes, excessive destruction of wildlife habitat by beavers, or decreases in the loon population. To learn more about Conserve School, visit http://www.conserveschool.com.

3-D Mapping

The Midwest's table-top-flat till plains are merely the smooth cover for a turbulent past, according to geologists who have recently published the first set of 3-D subsurface maps for selected sites in the region. The group hasn't worked in Minnesota, but recently released 3-D maps showing subsurface features down to 150 meters for sites in the Chicago suburbs, Fort Wayne, Indiana, and southern Michigan. The geologists report finding more variability than they expected, with complex arrays of deposits and multiple levels of buried landscapes left by numerous glacial advances and retreats. The 3-D maps are derived from surface topographic maps, seismic studies and drilling.

The work is being done by the Central Great Lakes Mapping Coalition, led by geologists from the Illinois, Indiana, Ohio, Michigan and U.S. Geological Surveys. The Coalition aims to survey and identify groundwater and other resources as well as better explain the glacial geology of the eastern Midwest. Their webpage is at www.deq.state.mi.us/gsd/mapping, part of the Michigan state government website.

- Tom Smalec

Medical Geology and Arsenic Poisoning

The National Museum of Health and Medicine has unveiled an exhibit highlighting the developing science of medical geology used by its parent organization, the Armed Forces Institute of Pathology (AFIP), to study health problems associated with arsenic. Founded in 1862 as the Army Medical Museum, to study and improve medical conditions during the American Civil War, the Museum is located on the campus of Walter Reed Army Medical Center in Washington, DC. You can visit their web site at <http://www.natmedmuse.afip.org>

The exhibit, "*Research Matters: Environmental and Toxicological Effects of Arsenic*," explains how geoscience tools are augmenting the skills of medical and environmental professionals to understand exposure to toxic metals and metalloids such as arsenic.

Arsenic can be an organic or inorganic element that is found in nature and is usually present in the form of compounds with sulfur and with many metals such as iron, copper, cobalt, lead, and zinc. A carcinogen, arsenic can be fatal if ingested. In 1999 the National Academy of Sciences reported that arsenic in drinking water can cause bladder, lung, and skin cancer. It may also contribute to liver and kidney cancer. Levels under 60 parts per million can cause nausea, vomiting, and abnormal heart rhythms.

The exhibit looks at the arsenic investigations undertaken by the Biophysical Toxicology Branch of the AFIP's Division of Environmental Pathology. In China, where severe arsenic poisoning struck at least 3,000 residents, the investigation revealed it was due to consumption of chili peppers dried over fires fueled by high-arsenic coal. The AFIP also studied arsenic poisonings caused by coal-burning power plants and contaminated drinking water in Mexico, Chile, and West Bengal. Arsenic has a long history in medicine for both good and bad and the way this exhibit tells the story is quite exciting, because it is bold and innovative. ♦

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