Spring 2012 *Promoting public interest and educational support in the geological sciences* Volume 66, No. 1

The Geological Society of Minnesota News

Volunteer opportunities, field trips, lectures, and public service, since 1938

Paul Kibler Sims died in Denver on October 29, 2011, at the age of 93. He was born on September 8, 1918, in Newton, Illinois. A teacher urged him to go to college, and after two years in the University of Illinois Business School, he became enthralled by a geology course taught by Harold Scott.

In 1940, he completed his A.B. in Geology, and he married the homecoming queen, Dolores Thomas. He then completed a Master's degree in Geology at University of Illinois in 1942, he worked for the Illinois State Geological Survey for a year, and he then worked with the US Geological Survey (USGS) from 1943 to 1944.

Paul then served two years with the Navy in the Pacific theatre. In 1946, Sims returned to USGS, and he also enrolled in the PhD program at Princeton. He completed his Princeton PhD in 1950. From 1951 to 1961, he was with USGS in Denver, and he spent a month of 1953 in Washington on special assignment working on uranium in Russia. As Sims' reputation in Precambrian geology subsequently grew, he was invited by Preston Cloud of the University of Minnesota to lead the Minnesota Geological Survey (MGS), as successor to George Schwartz. Sims assembled the first full-time Minnesota Geological Survey staff, and he focused on the Precambrian rocks of the state. A major achievement resulting from Paul Sims' time as MGS Director was publication of 'Geology of Minnesota: A Centennial Volume', edited by P.K. Sims and G.B. Morey, in recognition of the hundredth year of the state geological survey.

Sims then re-joined the USGS at the Denver office, from 1973 to 1995, followed by service as an Emeritus Scientist. During this time, Sims' principal scientific achievements were contributions to knowledge of the Precambrian rocks of North America, especially the regional geology and metallogeny of the Lake Superior and Rocky Mountain regions.

P.K. Sims became a Geological Society of America Fellow in 1948. He was Colorado Scientific Society President in 1957, and became an Honorary Member in 1977. He was very active with the Society of Economic Geologists (SEG).

Sims was preceded in death by his wife, Dolores. He is survived by Holly Stein, his daughter Charlotte (former Miss Minnesota), son Thomas, his grandchildren and great-grandchildren. P.K. Sims was a consistent, reliable, unselfish, dignified gentleman. He will be missed.

Upper photograph: GSM field trip to Minnehaha Falls, July 12, 1942

Inside this issue:

from the archives: three geologists examining a basal conglomerate at Taylor Falls, GSM Field Trip, September 1939

GSM News

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The Geological Society of Minnesota is a 501(c)3 nonprofit organization. The purpose of this newsletter is to inform members and friends of activities of interest to the Geological Society of Minnesota.

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Membership dues are: $10 Full-time students; $20 Individuals; $30 Families

GSM News is published four times a year: **February 15, May 15, August 15, and November 15**. Deadline for article submission is the first of the month, before the date of publication. Send all material to:
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MGWA Spring 2012 Conference: Conduits, Karst, and Contamination - Addressing Groundwater Challenges

The MGWA Spring 2012 will be held on April 19, 2012, from 8am - 4:30pm, at the Continuing Education and Conference Center, University of Minnesota, St Paul

This conference brings you a series of talks dealing with several aspects of Minnesota's groundwater. The speakers are as follows:

Dr. Beth Parker, University of Guelph,: 'Characterization Techniques for Identifying Hydraulically Active Fractures in Sedimentary Rocks'.

Jessie Meyer, University of Guelph,: 'High -Resolution Head Profiles for Flow System Characterization in Fractured Sedimentary Rocks'.

Dr. Tony Runkel, Minnesota Geological Survey,: 'Vertical Fractures: What We are Learning from Outcrops and Implications for Aquitards/Structural Control in Fillmore County Springsheds'.

Jeff Green, MN Department of Natural Resources,: 'Conduit Flow Characteristics of the St. Lawrence Aquitardifer'.

Dr. E. Calvin Alexander, University of Minnesota,: 'The Impact of Karst on Agriculture'.

Bob Tipping, Minnesota Geological Survey,: 'Estimating Vertical Travel Times to Upper Bedrock Aquifers - Twin Cities Metropolitan Area'.

Lanya Ross, Metropolitan Council,:' What the Clean Water Fund is Doing for Minnesota Groundwater'.

Perry Jones, U.S. Geological Survey,: 'White Bear Lake Groundwater-Interaction Study'.

Dr. Mindy Erickson, U.S. Geological Survey,: 'Contaminants of Emerging Concern in Minnesota Waters'.

Minnesota Congresswoman Betty McCollum receives Groundwater Protector Award from National Ground Water Association

By the National Ground Water Association

Congresswoman Betty McCollum (D-MN) has received the 2012 Groundwater Protector Award from the National Ground Water Association (NGWA).

The Groundwater Protector Award honors people in government, industry, and the private sector for their public service efforts in conjunction with groundwater conservation, protection, and use.

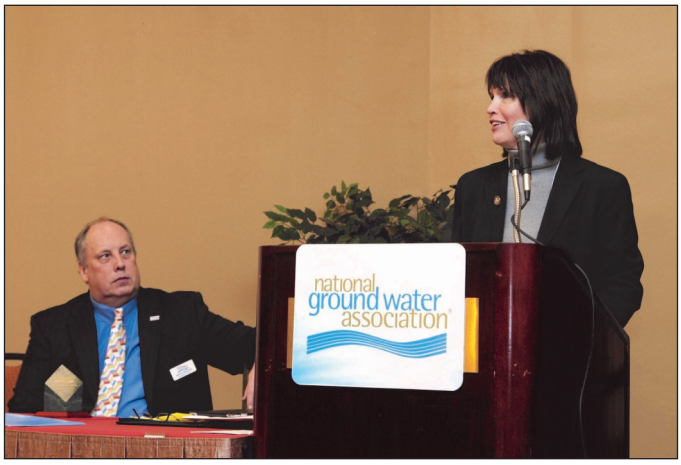
Congresswoman McCollum is being recognized for her leadership in championing a National Ground Water Monitoring Network to provide information on the source of water supply for nearly 130 million Americans and approximately 40 percent of the nation's irrigation water.

"Representative McCollum's commitment to protecting groundwater is important and farsighted. She understands how vital groundwater is to our country's future, from drinking water supplies and cropland irrigation to energy production and the health of our ecosystems," said NGWA Executive Director Kevin McCray.

"It is no exaggeration to say that groundwater is part of the lifeblood of our country. So Representative McCollum's support of the National Ground Water Monitoring Network is most worthy of our 2012 Groundwater Protector Award," McCray said.

About 44 percent of Americans regularly depend on groundwater for their drinking water supply. Minnesotans use almost 863 million gallons of groundwater daily—372 million gallons of which is used for public water supplies, 78 million from privately owned household wells, and 216 million for farm irrigation.

NGWA, a nonprofit organization composed of U.S. and international groundwater professionals—contractors, equipment manufacturers, suppliers, scientists, and engineers—is dedicated to advancing groundwater knowledge. NGWA's vision is to be the leading groundwater association that advocates the responsible development, management, and use of water.



With Betty in the photo is Kevin McCray, Chief Executive Officer, National Ground Water Association.

GSM Lecture, Monday, April 2, 2012

Oceanography-Past, Present, and Future

by William E. Seyfried, Ph.D., Professor, Department of Earth Sciences

Since the dawn of human existence there has been a fascination with the ocean. Part of this involves innate curiosity, but the ocean through time has provided resources for human existence and development, and also a means for transportation as civilizations expanded in search of trade. The ocean, of course constitutes more than two-thirds of the surface of the earth, and from its illuminated surface to the darkest depths there exist unusual ecosystems supporting amazing sea creatures. In terms of the geosciences, the discovery of seafloor spreading and plate tectonics was fundamentally linked to advances in ocean science. Indeed, the development of high resolution sonar, and more recently, satellite altimetry, has allowed geological structures thousands of meters below the sea surface to be viewed as never before, revealing great mountain chains and deep sea trenches unrivaled by anything on the Earth's surface. These discoveries proved the existence of a dynamic earth in which lithospheric plates are in constant motion fueled by heat from the earth's interior. The discovery of hydrothermal vents at mid-ocean ridges, which sustained and nourished spectacular microbial communities, was transformational, and ranks as one of the more important in science in the twentieth century. This lecture will focus on broad aspects of oceanography (past, present and future) that have and will benefit from technological developments as we move forward as a civilization. It is clear that the future will allow scientific communities and even individuals to explore the depths of the ocean and hopefully with this knowledge will come collective wisdom to maintain the ocean-earth system for future generations in spite unprecedented environmental challenges.

William E. Seyfried, Jr. is a professor of geochemistry in the Department of Earth Sciences at the University of Minnesota. Throughout his career, he and his students have played an important role in the development of novel chemical sensors to investigate the chemistry of hydrothermal vent fluids at mid-ocean ridges. He has participated in research cruises that have explored seafloor volcanic systems on the Juan de Fuca Ridge (northeast Pacific Ocean), East Pacific Rise (east-central Pacific Ocean), the Galapagos Rift (equatorial Pacific Ocean), and along the Mid-Atlantic Ridge (26-36°N). Seyfried is former Head of the N.H. Winchell School of Earth Sciences (1994-2005). He is a Fellow of the Geochemical Society (2010), European Geochemical Association (2010) and the American Geophysical Union (2011).

GSM Lecture Monday, March 5, 2012

Current Status of the World's Climate

by Craig Edwards, Game day meteorologist at Target Field, for the Minnesota Twins, and back-up meteorologist for Minnesota Public Radio

The planet is warming. Rising temperatures have been documented via upgrades in satellite sensing and surface temperature probes. It is challenging to confirm the historical context of the warming in the past several decades when compared to hundreds and thousands of centuries. Minnesota is an outstanding starting point to capture what is taking place and more importantly validate simulated warming from model output. In a sense Minnesota could claim to be the world headquarters of decadal warming. In our generation we have witnessed milder winters and rises in summertime dew points. The warming of the northern latitudes is predominant in the winter season. Overnight minimum temperatures are not nearly as cold as just twenty years previous. Comparisons will be presented in regard to establishing the new normal for the Twin Cities. A reality check will be offered in regard to temperature changes that could be a result of population/urbanization around the International

Airport thermometer. Population growth, overlaid with rises in carbon dioxide concentration in the last century mirror the steady climb in global temperatures. If anthropogenic carbon dioxide continues to thicken the greenhouse layer will the planet survive or thrive!

Meteorologist Craig Edwards has a wealth of forecasting experience in the most active weather region of the country. Mr. Edwards' career with the National Weather Service began in Milwaukee in 1972. From 1991 to 2006 he served as the Chief Meteorologist in the Twin Cities, overseeing the modernization and restructuring of government weather services, including deployment of Doppler radar. He grew up in the Fox River Valley area west of Chicago, earning a BS degree in meteorology 1971 from Northern Illinois University. Mr. Edwards currently holds the unique title of the game day meteorologist at Target Field, working for the Minnesota Twins. He also serves as the back-up meteorologist for Minnesota Public Radio. Craig is a member of the American Meteorological Society and the National Weather Association. He has served as President of the local Chapter of the AMS both in Indianapolis and Minneapolis.

GSM Lecture, Monday, February 20, 2012

Geological History of Grasslands in the Great Plains

by David Fox, Ph.D., Associate Professor, Bell Museum of Natural History, Department of Geology and Geophysics, University of Minnesota

Understanding the origins of modern grasslands is a topic that currently engages a diverse community or Earth and life scientists. My talk will focus generally on the geological and evolutionary history of grassland ecosystems and on the grasslands of the Great Plains specifically. The fossil record of the region over the last 20 million years records substantial changes in the ecology of mammalian communities that have been interpreted as reflecting the spread of grasslands over that interval. However, the plant fossil record, particularly the record of microscopic siliceous bodies called phytoliths, suggests that open habitats actually appeared earlier. My approach to this problem has been to use the stable isotope geochemistry of fossil teeth and carbonates preserved in fossilized soils (paleosols) to estimate the abundance of grasses in ancient ecosystems that used the specialized C4 photosynthetic pathway found in modern warm growing seasons grasses. The plant biomass of the Great Plains today is dominated by grass species that use the C4 photosynthetic pathway, which increases efficiency at low atmospheric CO2 concentrations by reducing loss of CO2 from the plant when not photosynthesizing. This pathway has evolved multiple times and appears to be an adaptation to decreasing atmospheric CO2 levels during the Oligocene. C4 plants have distinct 13C/12C ratios relative to plants using the more ancient and more common C3 photosynthetic pathway, and both consumers of the plants and the soils in which the plants grew inherit these isotopic differences, providing a means to estimate C4 grass biomass in the geological past. I will present data from fossil large-bodied herbivores (horses, elephants, camels), small-bodied herbivores (rodents, rabbits and hares), and fossilized soils to examine the long-term history of ecological change among mammals and the regional abundance of C4 grasses. Integrating my own data with various other lines of paleontological and geochemical evidence indicates that 1) open, grass-dominated habitats first appeared in the region during the late Oligocene to early Miocene; 2) the modern, C4-dominated grasslands of the Great Plains evolved gradually from the late Miocene to the early Pleistocene; 3) the ecological response of large-bodied herbivores to changing environments were delayed by several millions for reasons that are not yet well-understood; and 4) diets of small mammals indicate patterns of resource partitioning over time in response to the patterns of environmental changes.

Biography, David L. Fox: I was raised in Birmingham, Alabama. I have an BA in Biological Anthropology from Harvard University and a MS and PhD in

Geological Sciences from the University of Michigan. After completing my PhD in 1999, I spent two years as a postdoctoral fellow at the University of California Santa Cruz working on the evolution of the Great Plains ecosystem using the geochemistry of fossil soils. I joined the faculty of the Department of Geology and Geophysics (now the Department of Earth Sciences) in 2001 and have been an Associate Professor in the department since 2007.

GSM Lecture, Monday, February 6, 2012

History of Deepwater Oil Drilling

by Justin Revenaugh, Ph.D., Professor, Department of Earth Sciences, University of Minnesota

Oil production in the Gulf of Mexico accounts for roughly a third of domestic crude output. Most of that comes from oil wells in shallow water, a technology developed over the course of decades. New wells, needed to continue that level of production into the future, are almost entirely in deep water. The move to deeper water required significant advances in exploration and in drilling, most of which has taken place in the last 10 to 15 years. This lecture will discuss the history of exploration and production in the Gulf, including the culture of oil companies, the offshore leasing process, the developing technologies and the difficulties of operating in very deep water.

Justin Revenaugh is a seismologist and a professor of Geology at the University of Minnesota. He uses earthquake waves to image deep Earth structure. His tools are derived from techniques pioneered in the oil industry and designed to detect and characterize abrupt variations in material properties, including discontinuities associated with phase changes, scatterers created by faulting and jointing of the crust, and slab dregs near the core-mantle boundary.

GSM Lecture, Monday, January 23, 2012

Earthquakes and Japan

by Emi Ito, Ph.D., Professor, University of Minnesota

The Japanese islands comprise a volcanic arc that sits on four different tectonic plates. In northeastern Japan (Hokkaido and Tohoku region) old Pacific Plate is subducting under the North American Plate along the Nippon Trough whereas in southwestern Japan (Shikoku, Kyushu and western Honshu) young Philippine Plate is subducting under the Eurasian Plate along the Nankai Trough. Some subduction zone segments appear to be slipping relatively easily while others have many locked sections. No part of Japan is free from earthquakes with many very small events occurring on a daily basis and very large events occurring less frequently (recurrence of 100 to 400 years?).

This talk will focus primarily on the M9 Tohoku-Oki (Off-shore Tohoku) earthquake of 3/11/2011. In the 9 months since the tragic event, numerous research talks have been given at international conferences and perhaps over a hundred research papers including several special journal issues have been published. I will summarize what the seismologists and geodesists have learned from this earthquake. The topics covered will include the study of the main rupture and numerous aftershocks, crustal displacements, the early warning system, tsunami wave generation, and comparison of tsunami inundation with others tsunami events of the past.

Biography: Emi Ito (Geochemistry); Department of Earth Sciences, and Limnological Research Center, University of Minnesota; 310 Pillsbury Dr., SE, Minneapolis, MN 55455, 612-624-7881, eito@umn.edu; University of Chicago, B.S., 1971; Princeton University, M.A., 1973; Calhoun School (NYC), math and science teacher, 1973-75; University of Chicago, Ph.D., 1979; Carnegie Institution of Washington, Post-doc, 1980-81; At the University of Minnesota since 1982, Director, Limnological Research Center since

2002

Research: My current research is centered on understanding how climate is recorded in various lacustrine sedimentary archives and applying that understanding to the reconstruction of past environment (especially moisture balance) using mainly stable isotope and trace element composition of inorganically formed and biogenic carbonates. We currently have research projects at a site near Jamestown, ND in the northern Great Plains, in Minnesota (Crow Wing Watershed, Fond du Lac Reservation near Cloquet), and the areas around and including the Sea of Galilee (Lake Kinneret) in Israel. I am also part of the international group (Israel, Germany, Switzerland, Japan and US) involved in the deep drilling of the Dead Sea which occurred during the winter of 2010-2011. The initial description of the cores taken from two sites (one near the center and the other near the western shore) was completed in November of 2011.

Study finds Minnesota's geothermal energy potential is greater than previously thought

By: John Myers, Duluth News Tribune

Deep below Minnesota's often-frozen surface lies a boiling-hot, pollution-free energy source just waiting to be tapped. That's the finding of a report released this week by the Natural Resources Research Institute of the University of Minnesota Duluth. Researchers for the NRRI and the University of North Dakota found that geothermal heat is closer to the surface and in much greater supply in parts of Minnesota than previous studies had found — more than enough to generate electricity without burning fossil fuels like coal or natural gas. "The potential is three or four times greater than we assumed," said Don Fosnacht, lead researcher on the project and director of the NRRI's Center for Applied Research and Development. "And it's a lot easier to get at than the earlier reports indicated."

Researchers took temperature readings in 100 existing mining exploration holes drilled deep underground, as well as from 795 deep water wells across the state. Parts of western and central Minnesota, including Aitkin County and parts of Koochiching County, show the most promise for shallower, less-expensive drilling, he noted. Northeastern Minnesota is less promising because the hot rock is deeper. Fosnacht envisions drilling nearly 20,000 feet to find heat coming up from the Earth's crust. The system would run fluid through a pipe from the surface down to the area where the rock is nearly 120 degrees Celsius (250 degrees Fahrenheit). All that heat is pushing up from the Earth's core where, nearly 4,000 miles deep, temperatures can reach more than 9,000 degrees. The fluid would conduct the heat and then rise back to the surface, where it would run through a heat exchanger and produce steam to power a turbine and generate electricity.

There would be no fuel to burn and no pollution. The organic fluid would be in a closed-loop system, as opposed to using underground steam in an open system. And, unlike windmills and solar panels, geothermal power would run 24 hours a day, year-round. "After many years, you might have to re-drill the hole because the spot cools a little, but you just move a few feet and hook it up to the existing generator," Fosnacht said. If it sounds too good to be true, it's not.

Similar 10- to 40-megawatt systems (big enough to power small cities) are operating throughout Europe and in some Western states, especially California, where the geothermal energy is closer to the surface and thus cheaper to tap. A 2007 study by the Massachusetts Institute of Technology said deep underground heat in the U.S. could, with an investment of about $1 billion, produce more than 100 gigawatts of electricity by 2050. That's the same amount of power generated by all 104 nuclear power plants in the U.S. Open loop geothermal systems, which release steam from underground, have been criticized for releasing underground gases. And critics have said even closed systems have issues, including one in Switzerland that might have triggered an earthquake. Others say the systems can affect groundwater supplies.

Estimates are that it would cost up to 10 cents per kilowatt to provide the electricity in areas where the heat is deeper — like Minnesota, Fosnacht said. That's more expensive than coal-fired electricity or natural gas, but geothermal methods don't produce climate-warming carbon or toxic mercury emissions. "The big cost is in the drilling and getting started," Fosnacht said, after which geothermal becomes "a baseload source of electricity that is essentially free."

The latest geothermal survey was a much closer look, and it found much more energy underground than a 2004 national study that declared Minnesota didn't have much geothermal potential. The earlier study looked at only four points across the state on land and at tests from below Lake Superior, but it missed the state's best areas. "This is good news, because we now know that Minnesota has more heat and electrical power potential as an alternative energy source on an industrial scale," Fosnacht said.

Fosnacht said he expects Minnesota utilities to take a close look at the research as they form long-term plans to meet the state's mandate to generate 25 percent of their electricity with renewable fuels by 2025. Until now, utilities assumed Minnesota's deep rocks didn't have enough heat. "NRRI has made good progress at taking a closer look at what geothermal resources are here in Minnesota," said Amy Rutledge, spokeswoman for Duluth-based Minnesota Power. "But, from a utilities standpoint, from our standpoint, there's just a lot more evaluation that has to be done, scientifically and economically, on whether this is a good resource for us to invest in for our customers." Dr. William Gosnold was the principal researcher at the University of North Dakota.

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