The Illinois Survey: Serving the New Century

"As we enter the new century, let's intensify our efforts to be at the forefront of those institutions that provide the earth science support so critical to preserving the environmental and economic well-being of the citizens they serve," said Chief Bill Shilts during his October 21st State-of-the-Survey address.

Speaking to Survey staff, Shilts noted that changes in the priorities of the Illinois state government should enhance Survey programs and allow "major changes in our way of doing business."

"Efforts by Governor George Ryan are underway to bring more of Illinois citizens' tax dollars back to Illinois," said Shilts. Of special geological benefit to the people of Illinois is the active state support of initiatives for increased federal funding of the Central Great Lakes Geologic Mapping Coalition.

Development and protection of our state's resources, particularly water, are nearly impossible without detailed knowledge of the subsurface.

The Coalition's pilot mapping project in the Antioch Quadrangle of northern Lake County began this past summer. This Coalition project will develop the basic formats for the mapping to be carried out in the central Great Lakes region. Standards will be developed for analytical and mapping techniques and protocols. In addition, a number of innovative methods for mapping in three dimensions will be tested.

The Coalition geologic mapping program will be especially important in providing the new geologic information needed for state initiatives:

- To improve the condition of the Illinois River and its drainage basin.
- To support urban planning for Illinois metropolitan and suburban areas.
- To support more environmental assessment activities for the Illinois Department of Transportation, which has obtained increased funding to improve state infrastructure.
- Another cooperative project, with the Kentucky State Geological Survey, is an economic analysis of geologic mapping (1:24,000 scale, or 1 inch = 2,000 feet). Kentucky was the first state to have complete statewide geologic mapping, and information about the costs and benefits of that program should help Illinois efforts to raise funds for its own program. Other surveys in the U.S. and elsewhere have expressed keen interest in the report that will be generated after the analysis is complete.

Shilts noted that integrated science is the current trend—at the Survey, and throughout the nation. This type of cooperative science calls for the pooling of staff expertise, materials, equipment, and other resources to address societal and scientific issues with greater economic and performance efficiency.

"The ISGS has a long and productive history of partnerships with its sister state surveys and agencies, university and regional partnerships, and corporate contracts," Shilts continued. "These existing initiatives have made the Illinois Survey a national example of a geological survey that has made the transition to integrated scientific research carried out in partnership with other governments and agencies."

Looking toward the future, Shilts believes "geologic mapping will dominate our program for the foreseeable future, a trend that is taking hold as legislators, natural resource agencies, and regulatory agencies begin to realize that development and protection of our state's resources, particularly water, are nearly impossible without detailed knowledge of the subsurface."

In the geologic mapping programs around the country, the emphasis has shifted from bedrock mapping to surficial sediment mapping to address a wide range of societal issues. "This trend is very much in line with our focus on mapping our persistent glacial cover in three dimensions through the Central Great Lakes Geologic Mapping Coalition," said Shilts. Survey geologists will also continue STATEMAP-funded projects in the St. Louis Metro East and Peotone areas. Geologic mapping is at the front of Illinois efforts to restore watersheds, and the multi-disciplinary teams are a critical element in being able to produce up-to-date maps in a timely manner.

In his closing remarks, Shilts noted that, "This state continues to lead the nation in its commitment to devote major resources to institutions that provide the scientific research and service that its citizens require to make their everyday decisions. Let's continue to be a state survey that we can be proud to represent."
Fall Field Trip

Field trip participants enjoy the scenery and a quiet moment at Sugar River Forest Preserve.

The rolling gray clouds overhead threaten to pour morning rain, but 224 individuals still register for the October 16th ISGS field trip at Rock Cut State Park in Winnebago County. Rain or shine, the group will set out on its geological exploration. For more than 60 years, the ISGS public field trips have been a popular event for the scientists, teachers, students, amateur rock and mineral enthusiasts, business owners, and families who participate in them.

The geologists are retracing the tour taken September 20th with an earlier group. This route has been chosen for the many quarries and abundant natural resources that exist in close proximity to Rockford, the third-largest Illinois city. At each stop, Survey geologists Wayne Frankie, Jon Goodwin, Russ Jacobson, and Dick Berg introduce the area’s minerals and paleontology as well as land use and environmental issues. Time is allowed for collecting fossils, observing area features, and asking questions.

This trip begins in Rock Cut State Park, where two lakes and the surrounding shoreline provide many recreational opportunities for the public. The group examines the Galena dolomite exposures that form the beautiful bluffs below the spillway along Willow Creek. One of the park’s prominent features, Lone Rock, is a triangular block of Galena dolomite shaped by water erosion. The dolomite is part of the Ordovician System laid down about 450 million years ago and contains a variety of fossils, including the famous Receptaculites oweni, a fossil that looks like a sunflower, but whose affinities (is it an animal or a plant?) are unknown.

Next, the Rockford Sand and Gravel Company allows visitors to examine its dredging operation and to learn about the history of the Rock River valley and the composition of its silt and sand and gravel deposits. At another site, after donning company hard hats, visitors watch in awe as detonated charges fracture a limestone quarry wall. Quite an impressive event!

The rain is still holding off during Day trippers scramble near the edges of Austin Quarry, where they found abundant fossils, including many trilobites, brachiopods, and cephalopods. Geologists were on hand to assist in identification and answer questions.

Two young fossil hunters examine a piece of dolomite for hidden treasures.

Can You Identify This Fossil?

Fossils of this unusual animal can be found in weathered limestone and dolomite in several northwestern Illinois counties between Rockford and Galena. They can also be found in southwestern Wisconsin and in Missouri near St. Louis (see map). Their characteristic tadpole shape makes these fossils easy to identify and gives geologists some idea of how the animal lived.

The long spiny tale of this small (about 1.5 inches) animal was probably used to propel it along the muddy bottom of the sea floor that existed in the midcontinent about 450 million years ago. The large opening at the tip of the body probably was the mouth. Only when the animal was buried rapidly and kept out of reach of scavengers was the delicate skeleton preserved intact. This animal is identified on the last page.

The new carpoids were collected from the Guttenberg Formation in the Upper Mississippi Valley Region.
the lunch stop at the Sugar River Forest Preserve. The fall air has become chilly, and several participants inquire about Survey sweatshirts. Soon a sale table of publications and sweatshirts is set up, and some people shop while others picnic or walk along the meandering shoreline of the Sugar River.

After lunch, the group moves to Austin Quarry, and the search for fossils begins in earnest. Crushed rock for use in road construction and repair had been quarried from this location for more than 30 years. The piles of boulder-sized pieces of drilled and blasted dolomite that remain in the now inactive quarry contain fossils in pristine condition. Trilobites, crinoids, brachiopods, bryozoans, snails, clams, cephalopods, and corals can all be found in the weathered dolomite. A few years ago, about a dozen specimens of an extinct group of echinoderms called carpoids were discovered in the Guttenberg Formation at the south end of this quarry. This very rare fossil—*Aleocystites guttenbergensis*—is only known in the Guttenberg Formation in the Mississippi Valley region (see related article).

Colored Sands Forest Preserve, a prime bird-banding location in the state, is the next stop. Songbirds are banded here when they land during migrations. The park naturalist notes that, over the past decade, he has seen a decline in the numbers of several songbird species. Next, geologists talk about the area’s glacial history and its impact on the Sugar, Pecatonica, and Rock Rivers. The sun is out now, but low in the sky and reflecting off the yellow-leaved aspens as the group follows the trail past the visitors center to the Sugar River to examine an exposure of windblown St. Peter Sandstone. The sand is an especially pure, uniformly fine-grained, and well-sorted quartz sandstone. The brown-sugar color of the sand dunes along the Sugar River suggested its name to early settlers.

As the afternoon draws to a close, several of the participants come up to the geologists, thanking them for another great trip. Clearly, some have been on previous excursions. The geologists, too, have found the day’s activities to be an enjoyable way to share information about the geological subjects they love.

**Deep Imaging of Basement Bedrock Reveals Old Fault**

Illinois Survey geologists John McBride, John Nelson, and Dennis Kolata are gaining important new knowledge about the basement bedrock that underlies the thick glacial deposits covering most of Illinois. The geologists are using digital data produced from Vibroseis vibration and dynamite source signals. Reprocessing these data produces new deep seismic reflection profiles that provide the first three-dimensional structural view into the deep crust and upper mantle beneath the Illinois Basin. These new images reveal deeper (down to 52 km) rock sequences and provide some understanding of their evolution.

Deep imaging may help identify possible earthquake hazards in Illinois. For example, the images revealed an unknown, high-angle fault in the Precambian basement that corresponds to the location of the April 1974 earthquake in Richland County, one of the largest earthquakes in Illinois. This quake probably resulted from a reactivation of the fault. Finding old faults and mapping them in three dimensions should help to identify which faults could be sources of future Illinois earthquakes.
Earthquakes:
Questions and Answers

Why are there so many large earthquakes in the United States? Actually, historical data show that earthquake frequency increases with magnitude. In 1999, about 50 large earthquakes (M 7.0 or above) are expected each year worldwide. In the United States, the most damaging earthquakes of the late 20th century were the Loma Prieta (1989), Northridge (1994), and the New Madrid (1811-1812) earthquakes. These recent events have focused attention on the potential for future earthquakes throughout the United States.

What causes earthquakes? Earthquakes are caused by the sudden release of stored elastic strain energy along a fault, or fault line, within the earth's crust. Faults are fractures in the crust that have not completely broken through to the surface. When enough stress accumulates on a fault, it will eventually break and slip, resulting in an earthquake. The amount of energy released during an earthquake is measured in magnitude, which is a logarithmic scale.

When was the last Illinois earthquake? On September 2, 1999, a small, M 3.5 earthquake was felt by residents in northern Illinois from Rockford to the Mississippi River. Some Dixon residents mistakenly thought the ground motions were due to a quake in LaBelle Anticline, a large fault in the earth's crust. Follow-up studies are now planned to investigate the relationship (if any) between these earthquakes and the geological structures of the region.

What is the largest Illinois earthquake? On November 9, 1988, a M 5.4 earthquake was centered near Brightwood in Hamilton County, Illinois. This earthquake was the largest to occur in northern Illinois in the past century, and no larger earthquakes are expected in the future.

Earthquake Recovery: Rapid Response and Repair

"When it comes to natural disasters," says Wen-June Su, a research engineer at the Illinois Geological Survey, "reporters should mention recovery efforts. Few people know, for example, that if a great earthquake hits Taiwan, they are invited to join the team of geotechnical engineers who worked there immediately to help. The Taiwan government responded to its recent earthquake emergency." Su was recently invited to join a team of geotechnical engineers to work on the recovery effort following the M 7.0 earthquake in Taiwan. The team was invited by the Taiwan government to help recover from the earthquake.

Just a few days after the event, Su had little difficulty finding information about the earthquake in the media. Bridges and other critical structures that supported reliable operation were damaged in the dambaij earthquake. Days later, Su saw examples of Taiwan's earthquake preparedness and recovery efforts.

Su also gained information to help Illinois Survey geologists understand what kinds of structures survived intact, or nearly intact, after a high-magnitude earthquake. Such information can be used elsewhere to develop adequate building codes, backup power supplies, and emergency assistance.

Earthquake Hazard Maps Support Seismic Safety

To make earthquake emergency planning easier, Illinois Survey geologists are classifying non-lithified materials (materials other than rock) resting on bedrock for their ability to amplify earthquake ground motions. Loose materials, such as those in river beds, amplify ground motions more than do bedrock. Such data will help Survey geologists understand past earthquake effects. In addition, the Survey will provide data to help geologists work with emergency managers to develop plans to mitigate losses from future earthquakes. Demand for these data is increasing as more communities assess and prepare for the potential impact of earthquakes.

Earthquake magnitude is one of the most important ways to describe the potential impact of an earthquake. Magnitude is a logarithmic measure of the energy released by an earthquake. The larger the magnitude, the greater the energy release and the more severe the potential impact. The most useful magnitude is the magnitude-M. This magnitude is based on the energy released by an earthquake. The energy released by an earthquake is measured in joules. The magnitude-M is a logarithmic measure of the energy released by an earthquake. The larger the magnitude, the greater the energy release and the more severe the potential impact. The most useful magnitude is the magnitude-M. This magnitude is based on the energy released by an earthquake. The energy released by an earthquake is measured in joules. The magnitude-M is a logarithmic measure of the energy released by an earthquake. The larger the magnitude, the greater the energy release and the more severe the potential impact. The most useful magnitude is the magnitude-M. This magnitude is based on the energy released by an earthquake. The energy released by an earthquake is measured in joules. The magnitude-M is a logarithmic measure of the energy released by an earthquake. The larger the magnitude, the greater the energy release and the more severe the potential impact. The most useful magnitude is the magnitude-M. This magnitude is based on the energy released by an earthquake. The energy released by an earthquake is measured in joules.
Expo Excitement:
A Window to Understanding

The theme of this year’s Natural Resources Expo—“Why on Earth?”—captured the attention of both participants and the local media. Answers to questions about Illinois geology, flora, fauna, water resources, and waste management were provided during the very popular Natural Resources Quiz Bowl and at several interactive exhibits and demonstrations.

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The Illinois State Geological Survey (ISGS) and its sister state agencies cooperated in sponsoring the October 4th event, now in its second year. Held at the Illini Union on the University of Illinois Urbana-Champaign campus, the Expo called public attention to earth science issues.

Fifth-grade contestants from the Booker T. Washington Tully Monsters (top, from left) Tim Thorp, Van Tien Pham, Paige Stewart, and Dana Westgren rejoice in a right answer during the Natural Resources Quiz Bowl. From Carrie Busey School, the Thundering Herd of Buffaloes (right) David Robertson, Carol Sung, Kelly Li, and Jamal Carter anxiously await an upcoming question.

All schools that participated in the Quiz Bowl last year returned again for a second chance at winning in their division. Cheered on by an enthusiastic, involved audience, the teams answered several rounds of questions designed to use their general knowledge and critical thinking skills: What commonly eaten substance is also known as halite? (Salt.) What is the purpose of the magnetosphere? (It protects against solar wind.) What scientific fact is behind the phrase, “Mad as a Hatter”? (The mercury used in making felt caused brain damage to hatters.)

All participants in the Quiz Bowl, including students in the audience, received a bag of prizes, including activity books from the Department of Natural Resources, gift certificates to local bookstores, and a mineral sample. Teachers received a geode half for their classrooms.

Outreach activities for the public provide a window to understanding they can open.

—Joan Crockett
Exhibits and Demonstrations

Bob Vaiden’s popular “Build Illinois” demonstration used a large sand model of Illinois to illustrate the changing environments, climates, and geologic conditions of Illinois’ past.

In addition, the eight interactive ISGS exhibits covered a broad range of topics and allowed students to participate in an active, hands-on way:

- Earthquake Information. Tim Larson and Bob Bauer helped visitors make and measure their own earthquake while learning how the Central United States Earthquake Consortium maps risks of earthquake damage in Illinois and surrounding states (see related articles).

- Environmental Site Assessment. Staff of the IDOT property assessment program showed how old aerial photographs of the area and other documents are used to help with preliminary environmental site assessments for the Illinois Department of Transportation.

- Geospatial Data ‘R Us. Sheena Beaverson, Rob Krumm and others helped visitors explore the huge range of georeferenced data that can be accessed through the Illinois node of the national spatial data infrastructure.

- Glacier Model and Illinois Glacial Legacy. Barb Stiff and Ardith Hansel, Quaternary geologists, used a glacier model to show how continental glaciers shaped the Illinois landscape, filling valleys, building moraine ridges, forming kettles, and depositing valley trains.

- Earthquake Information. Curt Abert and others from the Geospatial Analysis and Modeling Section helped Expo participants make a web connection to computerized models of the Villa Grove Quadrangle. The models can be manipulated—“sliced and diced”—to reveal the deposits left in eastern Illinois by successive glaciations.

- Geologic Time Line and Fossils. Russ Jacobson and Rod Norby were available to show a spectacular collection of fossils from Illinois and elsewhere—from trilobites, to dinosaurs, to mastodons and mammoths. These early plants and animals are useful in understanding the long sweep of geologic time.

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Survey Honors Staff Achievement

Several staff members of the Illinois State Geological Survey were honored in recognition of performance excellence on October 21, 1999 during the State of the Survey meeting. The awards ceremony was held at the auditorium of the Krannert Art Museum on the University of Illinois campus.

The Lifetime Distinguished Achievement Award was presented to Heinz H. Damberger in recognition of his outstanding career in the field of national and international coal research, especially his innovative and significant contributions to the understanding of Illinois coal geology, his dedicated service to the public and coal industry of Illinois, and his contributions to the national and international prestige of the Survey, for the benefit of the people of Illinois.

Chao-Li (Jack) Liu received the Distinguished Achievement Award for his outstanding achievements in the field of isotope geochemistry, his contributions to the research and service programs of the Survey, his commitment to state-of-the-art laboratory techniques and instrumentation, and his dedication to the morale and well-being of his staff and the Survey, for the benefit of the people of Illinois.

The Outstanding New Staff Member Award was given to Robert A. Bryant in recognition of his outstanding performance in the field and in the laboratory, his high standards of quality and productivity, dedication, positive attitude, team spirit, and work ethic, for the benefit of the Survey and the people of Illinois.

The Villa Grove Mapping Team was honored for Special Achievement by a Team. Team members were Curt Abert, Dick Berg, Ross Brower, Pam Carrillo, Phil DeMaris, Ardith Hansel, Randy Hughes, Zak Lesemi, Alison Lecouris, Don Luman, Don Mikulic, Rod Norby, Mike Sargent, Colin Treworgy, Pius Weibel, and Tim Young. The award was presented in recognition of the team’s achievements in the pilot quadrangle geologic mapping program, creativity and cooperation in accomplishing team goals, state-of-the-art mapping methods developed for this program, and the national recognition achieved for the work on this project, for the benefit of the Survey and the people of Illinois.

A Special Award was presented to John Henriksen, Illinois Association of Aggregate Producers (IAAP), for his support of the mineral resource and mapping programs of the Survey, his commitment to public education and outreach, his support of the Survey’s outreach programs, and the strong ties and cooperative relationship that he has built between IAAP and ISGS, for the benefit of the people of Illinois.

ANSWER to Identify This Fossil:

Ateleocystites guttenbergensis was discovered first by Survey geologist, Dennis Kolata in rock outcroppings near Galena. It belongs to a long extinct group of echinoderms known as carpoids. Unlike typical living echinoderms, such as starfish, sea urchins, crinoids, and sea cucumbers that have a body divided into five equal parts, most carpoids have a symmetrical tadpole-like body. Because scientists differ in their opinions about the location of fundamental structures, such as the mouth and anus, carpoids are at the center of an ongoing controversy about their origin and evolution. According to one interpretation, A. guttenbergensis was a primitive chordate, the phylum that gave rise to vertebrates, including humans; another interpretation suggests that the tail-like appendage was a feeding arm held into the current to collect food particles. Without a living specimen to compare them with, the carpoid controversy is likely to continue. These controversies and others are sure to make A. guttenbergensis an exciting animal to study for years to come.