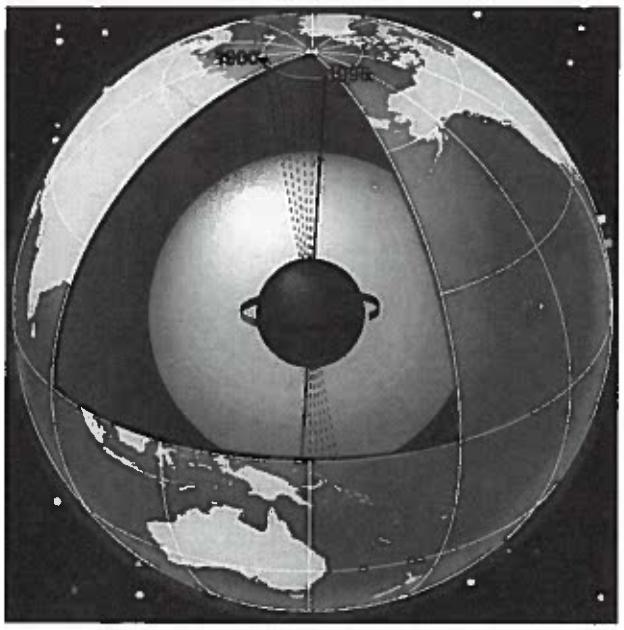
Department of Geology

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Song: Uncovering Secrets of the Inner Core



This diagram illustrates how the fastest path through the Earth's solid inner core has shifted over time, showing that the core moves at a faster rate than the rest of the Earth. Xiaodong Song's findings have been hailed as one of the most important discoveries of the century by *Discover* magazine.

Assistant Professor Xiaodong Song has done groundbreaking work using seismic data to better understand the Earth's core. Song recently came to the Department of Geology at Illinois from the Lamont-Doherty Earth Observatory of Columbia University, where he had been researching and teaching for three years after earning his Ph.D. in geophysics from the California Institute of Technology. His Ph.D. research investigated the properties of the Earth's core and lowermost mantle. His work at Lamont provided observations proving that the Earth's solid inner core rotates at a faster rate than the rest of the planet. This finding was listed as one of the most important scientific discoveries of the century in *Discover* magazine and one of the most important breakthroughs of the year in *Science*.

It has long been theorized that the inner core, which is solid, may move separately from the rest of the Earth—like a beach ball in water. In fact, the Earth's magnetic field is explained by the convective motions in the fluid core. This idea is known as the Dynamo Theory. According to this theory, electromagnetic force generated by the interaction of the magnetic field in the outer core and the conducting inner core causes the inner core to rotate a few degrees per year. These few degrees translates to about 10 kilometers per year —clearly the core rotation is very fast in the context of geologic time. However, until Song's work, no one had been able to observe or prove this hypothesis.

"With this kind of speed, we should be able to observe the movement," says Song, "but the trick was figuring out how to do it." Song took advantage of his Ph.D. research concerning the anisotropy of the inner core. Seismic waves that go through the Earth go at different speeds and directions, depending on the composition of the part of the Earth it's traveling through (see image). In his research, Song had found that the inner core is not homogeneous and that seismic waves go faster along a roughly north-south axis than along any other. As luck would have it, however, the inner core is not exactly symmetric around the north-south axis. The fastest path was found to be tilted about 10 degrees off the pole and the wave speed changes laterally in the inner core.

Song and his Lamont colleague, Paul G. Richards, were able to observe the inner core's movement by reviewing seismic data over the course of about 10 years. They found that if they took measurements from the exact same station (relative to the mantle) and used earthquakes from the exact same point, they could observe a change in seismic speed with time, thus proving the core had rotated.

Song's next step is to use similar seismic data to understand the properties of the inner core. It is unclear whether the anisotropy of the inner core is caused because the core is a single giant anisotropic crystal or that there are different phases of iron in the core or even a transition zone within the inner core. Song hopes there are further clues about the composition and motion of the core in the seismic data he has collected.

Our "Year in Review"

The year 1999 has seen a number of changes in the Geology Department. We are delighted to welcome two new faculty members to the department. Professor Xiaodong Song, a seismologist, came to Illinois from Cal Tech, via the Lamont-Doherty Geological Observatory. His research focuses on understanding the nature of the Earth's interior. Already, his work demonstrating that the core does not spin at the same rate as the mantle has garnered international headlines. Professor Craig Lundstrom joins us from the University of California, Santa Cruz, via Brown University. He is an isotope geochemist and has been setting up a new mass spectrometry lab in the Natural History Building. Professor Tom Anderson, on our faculty for 32 years, retired at the end of the fall semester. Fortunately, Tom will continue his research as an emeritus professor. We look forward to adding two more new faculty members to our roster during the next year, for we are now in the midst of searches for a geomicrobiologist and for a new R.E. Grim Professor in either mineral science or sedimentary geology. We've clearly entered a growth mode and are excited about building new and educational opportunities in the department.

At the beginning of the fall, Professor Jay Bass, who energetically guided the department for the past two years, dove back into his research and teaching program. We all owe Jay a hearty thanks for his efforts on our behalf! I have become the department head. Though I've been teaching structural geology, geotectonics, and field geology at Illinois since 1983, this is my first experience with administration, so this fall was an intense learning experience. I've really enjoyed the opportunity to meet with our alumni and have been warmed by the continuing enthusiasm that alumni have for the activities of the department, and for the financial support that alumni provide through *GeoThrust*.

You may have noticed that, in honor of the new millennium, we've gone from publishing two alumni newsletters a year to publishing one Department of Geology "Year in Review". You'll find that this review, in addition to popular news about departmental and alumni activities, also contains a record of research and teaching activities in the department. We hope this information helps to give a sense of the scientific and educational mission of the department.

Please enjoy this publication and stop by if you're in the area — NHB is having a bit of a face lift, with new paint and new lights in public spaces. Otherwise, look for your departmental friends at the receptions we sponsor at the AAPG and GSA meetings.

— Stephen Marshak

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Year in Review is published once a year by the Department of Geology, University of Illinois at Urbana-Champaign, to summarize the activities and accomplishments within the department and news from alumni and friends.

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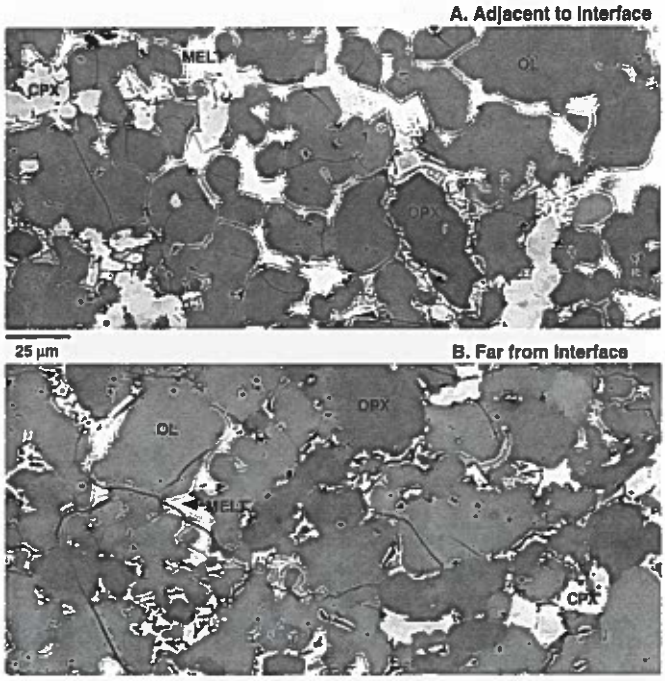
College of Liberal Arts and Sciences
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Lundstrom Looks at Magmatic Processes



Top: Back-scattered electron images of peridotite shows clear differences between melt and mineral modes of "A" the region closest to the basanite-peridotite interface and "B" the region farthest from the interface.

Bottom: Craig Lundstrom sitting at his newly assembled mass spectrometer.

Craig Lundstrom recently joined the Geology Department as an assistant professor after completing a post-doc at Brown University. He is a geochemist who received his B.A. in chemistry from Colorado College and his Ph.D. in Earth Sciences from the University of California, Santa Cruz. Lundstrom uses uranium-series (U-series) disequilibria to study magmatic processes on the Earth. U-series isotopes have much shorter half lives than more conventional isotope systems such as Sr. The half lives of the isotopes Lundstrom studies (radium, thorium and protactinium) range from 1,600 -350,000 years and thus can be used to study geologically short-timescale processes. Using new techniques of mass spectrometry, Lundstrom can measure samples as small as one femtogram (10^{-15} grams), just a few million atoms.

Recently, Lundstrom has been studying U-series isotopes in basalt samples taken from mid-ocean ridges. He is striving to understand the rate at which the mantle melts and to characterize the amount of partial melting that occurs in the mantle beneath the ridge axis. So far Lundstrom has found that the melt (basalt) starts to rise as soon as it comprises one part per thousand of the mantle, and that melt rises at a rate quicker than the solid mantle (peridotite). In addition, Lundstrom found that mantle flows at the same rate as the ridge spreads, thus confirming that the sea-floor spreading is a passive process. These findings were published in *Earth and Planetary Science Letters* in 1998.

In a related area of inquiry, Lundstrom has conducted experimental studies on the interaction between basalt and peridotite. He wants to understand how the melt interacts with the mantle. Can basalt, for example, re-equilibrate with the mantle as it ascends? Lundstrom found that as the basalt interacts with the peridotite, sodium and alkali elements from the basalt rapidly diffuse into the peridotite. The diffusion of sodium into the peridotite triggers further partial melting. Instead of 10 percent of the solid melting at a given pressure and temperature, the solid melts at 20 percent. So, as melt rises through peridotite, it generates more melt. Previously it was believed that basalt doesn't interact at all with peridotite as it ascends. Lundstrom's work shows that the peridotite can melt without an increase in temperature. The results of this research—which he conducted using a piston cylinder apparatus similar to the one he has just built at Illinois—was reported in the February 3 edition of the journal *Nature*.

Lundstrom now plans to move out of the mantle, on to the Earth's surface. He hopes to use the U-series disequilibria approach to look at the formation ages of carbonate rock. Results of such work can be used for looking at the evolution of landscape (including such processes as uplift and erosion) and evolution of the environment.

Two Faculty Searches Underway

After losing several faculty members to retirement, the Geology Department has begun to grow again. Two faculty searches are now underway. One seeks a geomicrobiologist, a person who can study the role of bacteria in the earth system. Like other sciences, geologists have begun to explore new interdisciplinary opportunities. This person would combine expertise in biology with expertise in geology. A person with this background could attack many important topics ranging from the origin of life, to bioremediation of contaminated aquifers, to the maturation of petroleum, to the nature of the carbon cycle. Many of these subjects have important applications in the environmental or petroleum industries. So far, the search has identified many outstanding candidates, several of whom were interviewed during the first weeks of February. The position is being partially funded by the Environmental Council, a campus organization that works to foster interdisciplinary research and teaching that addresses environmental issues.

The other search seeks a candidate to fill the R.E. Grim Professorship, a position that has remained vacant since the retirement of Richard Hay in 1997. This search will try to draw candidates in either mineral science or sedimentary geology. As it is an endowed position, the successful candidate will be hired at either the associate or full professor rank. Thus, the department is focusing on applicants with strong track records in research and teaching.

The department's hydrogeology program was recently ranked as eighth in the nation by *U.S. News and World Report*.

Leighton Receives 2000 Alumni Achievement Award

The Department is delighted to announce that Morris (Brud) Leighton, B.S. '47, has been awarded the 2000 Alumni Achievement Award from the Department of Geology. This is the Department's highest honor, and is presented to recognize a career of accomplishment. Leighton's original connection to the University of Illinois and to geology came through his father, who was chief of the Illinois State Geological Survey (ISGS). Leighton originally considered other fields before he returned to geology and a highly successful career. Leighton spent the first 30 years of his career in oil exploration, primarily with Exxon (then called Esso), with whom he held various posts, including chief geologist for Latin America. During his time in the industry, he played a key role in developing major oil plays in the North Sea and Australia, among other places. From 1983-1994 Leighton returned to Champaign-Urbana, serving as chief of the ISGS. "Brud continues to contribute to the Geology Department, both as a GeoThrust member and as an adjunct professor," says Steve Marshak, department head. "In our petroleum geology course, Brud gave an outstanding overview of world petroleum promises and of how an oil company develops an important play. This teaching could only have come from someone with many years in the industry." Congratulations, Brud! Leighton's award was presented at the Annual Geology Department Awards Banquet, which was held April 28.

Mega-Project At the Top of the World

Professor Wang-Ping Chen is beginning a large-scale project to investigate active mountain building across the Himalayan-Tibetan zone of the India/Asia continent-continent collision. The project, called HI-CLIMB (Himalayan-Tibetan Continental Lithosphere During Mountain Building) is an international collaboration involving researchers from the U.S., China, Nepal, Germany, and France. The group will examine the effects of the collision through the entire thickness of the lithosphere. Professor Chen, who will be directing much of the project, will focus his attention on obtaining high-resolution seismic data from an instrument array that records energy from natural earthquakes. He is particularly interested in the nature of deep earthquakes.

Tom Anderson—Great Teacher, Researcher—Retires

After 32 years at the Department of Geology, Thomas F. Anderson retired January 1. But retirement for Anderson won't mean he'll disappear from the department. He plans to spend much of his time writing up research he hasn't had time to publish over the last few years. "I'm keeping all the parts of my job I love and letting the rest of it go," he says with a smile. "I'm really looking forward to doing research at my own pace."

It won't be all work and no play for Anderson, however. He and his wife, Nancy, will be traveling extensively over the next several months. So far they have trips planned to the Caribbean, England, Switzerland and Jerusalem.

Although he is an isotope geochemist, Anderson also has spent much of his career in oceanography. This grew out of his graduate school experiences at Lamont Geological Observatory (now Lamont-Doherty Earth Observatory) at Columbia University, which is one of the principal oceanographic centers in the country. "I learned oceanography by osmosis," he says. "I've pretty much been the resident oceanographer for the last 25 years."

Anderson also has spent many years doing research that began with his Ph.D., which determined rates at which oxygen atoms move in crystals. Because calcium carbonate is commonly used for determining radiocarbon dates, Anderson wanted to see if there was significant exchange between the CO_2 and the calcium carbonate, which could throw off radiocarbon dates. He broadened the study to include oxygen isotope exchange.

Tom Anderson and his wife, Nancy, talk with friends at Anderson's retirement dinner.

"I'm keeping all the parts of my job I love and letting the rest of it go," he says with a smile. "I'm really looking forward to doing research at my own pace."

Although Anderson started out being primarily interested in isotope exchange reactions involving carbonates, this work led him to also look at the oxygen exchange in feldspars and micas. By using isotopes as tracers Anderson became involved in the geochemistry of light stable isotopes, a developing field in the mid-60s, especially the isotopic record of sedimentary carbonates.

About 20 years ago Anderson began to study the isotope geochemistry of sulfur in coal. The goal was to understand how sulfur gets in coal in order to get it out. Building on this experience, Anderson and his students initiated a number of studies on the sulfur, carbon and iron geochemistry of organic-rich marine sediments. "A return to the oceans," he quipped. One of the rocks he continues to work on is the Oxford Clay of England. "It's a treasure trove of well-preserved vertebrate and invertebrate fossils, as well as nearly pristine organic matter. It's been lots of fun to work on that," says Anderson.

Anderson, who joined the department in 1967, developed four courses during his tenure: Geology 117, "Oceans;" Geology 118, "Earth and Environment;" Geology 360, "Geochemistry;" and Geology 433, "Isotope Geology." Anderson also helped develop Geology 130, "Illinois and Changing Earth Systems," which is team taught with faculty from Geography and Atmospheric Science.

Anderson likes to introduce relevant modern and cutting-edge research into his courses. "It makes it fun for me and more interesting for the students," he says. His impact has been long lasting. "One of the first courses I took as a graduate student was Tom Anderson's isotope geochemistry course," says James Kirkpatrick, Ph.D. '72, professor of geology and executive associate dean in the College of Liberal Arts and Sciences. "This was a new field then, and there was no textbook. We read and discussed research papers and had to make a comprehensive picture out of widely dispersed information. Although I did not become an isotope geochemist, the experience of doing this had a profound influence on my entire career. Tom is a great teacher."

Visiting Scholars, Post-Docs Collaborate With Department Faculty

Bonheyo: Origins of Early Life in Ancient Hot Springs?

Scene from the Yellowstone hot springs where Bonheyo seeks clues to the origins of life.

Post-doctoral researcher George Bonheyo is working with Assistant Professor Bruce Fouke to understand the modern and ancient microbial populations of the travertine-depositing hot springs of Mammoth Terrace in Yellowstone National Park. This work will expand our knowledge of modern microbial diversity and origins of early life on Earth. In addition, Bonheyo's project will help identify microbial fossils and biomarkers. These data may be used to identify signs of early life elsewhere in the solar system.

Bonheyo, who received his B.S. from Bucknell and his M.S. and Ph.D. in microbiology from the University of Illinois, is studying the hot spring system in order to develop a model to identify the microbial species present during the active precipitation of travertine. The microbes, which encompass all three domains (archaea, bacteria and eukaryotes) are dependent upon the geochemistry of the spring for life and, in turn, create by-products that affect the geochemistry of the spring. These changes affect crystal growth morphologies and perhaps crystal chemistries within the hot spring. Microbial species are identified based on their signature ^{16}S rRNA gene sequences. Those species are then associated with metabolic processes that alter the spring geochemistry. Bonheyo's work will correlate microbial populations, spring geochemistry, and carbonate precipitation chemistry, fabrics, and rates.

Bonheyo also is using the contemporary "depositional facies model" to study ancient travertine deposits and try to interpret the fossil record. Microbial cells get trapped within carbonate travertine deposits in the hot spring system. Cells may be trapped either between crystals or within crystal fluid inclusions. Fluid inclusions 10 to 50 μ in diameter occur in great abundance in Mammoth travertine, and a majority contain dark organic masses that may be microbial remains. It is possible then that these entombed cells (and their associated DNA) then have a high probability of being preserved. However, the mechanisms, time frame, and preservation potential for DNA in travertine carbonate is not understood. Bonheyo is screening ancient carbonate crystals for diagenetic alteration prior to removing and identifying fossil DNA entombed in fluid inclusions.

Bonheyo has been awarded a prestigious Earth Sciences Postdoctoral Research Fellowship from the National Science Foundation. His project is titled: "Geochemistry and Molecular Microbiology of Travertine." Only 10 of these awards are granted nationwide.

From Paris to Brazil, Whittington Traverses the Globe

Alan Whittington, a post-doctoral research associate working with Steve Marshak, received his Ph.D. from the Open University, in the U.K., and his undergraduate degree from Cambridge. He did his Ph.D. field work in the Himalaya Mountains of Pakistan. Prior to coming to Urbana-Champaign, Whittington spent two years as a post-doctoral researcher in Orleans, France, and at the Institut de Physique du Globe in Paris.

Whittington is working with Marshak on two different projects. They are investigating the development and longevity of the Ozark Plateau of the southern mid-continent and its relationship to the New Madrid Seismic Zone. The plateau exposes basement rocks which are buried to more than 3 km deep in the adjacent Illinois basin, and may be a result of rigid block tectonics resulting from far-field stresses associated with Paleozoic orogeny at the continental margins.

The other project concerns Paleoproterozoic tectonics in Brazil, and will combine structural, metamorphic and geochronological investigations to ascertain the sequence and style of orogeny and orogenic collapse preserved in the Transamazonian orogen.

Prior to coming to the University, Whittington was involved with understanding the viscosity, heat capacity, and other physical/chemical properties of magmas as a function of composition, temperature and water content.

Kalinichev Visiting from Russian Academy of Sciences

Visiting scholar Andrey Kalinichev is working on computer simulations of the molecular behavior of geochemical systems, including aqueous fluids and mineral/fluid interfaces. Kalinichev's background is in molecular and chemical physics, but he's been involved in molecular computer simulations of the properties of geochemical materials for about 20 years.

Most chemical reactions near the Earth's surface and in the crust involve a fluid phase or occur at fluid/mineral interfaces, but in many fundamental respects these reactions remain poorly understood at the molecular level. Computer simulation techniques enable researchers to realistically model properties of complex, many-body systems on an atomistic microscopic scale using a limited number of approximations, the crucial ones being intermolecular potential functions. Provided one has a reliable way to calculate potentials of intermolecular interactions, the simulations can lead to molecular-level information on a wide variety of properties (thermodynamic, structural, kinetic, spectroscopic, etc.) of the systems under study.

Kalinichev, collaborating with Jim Kirkpatrick's research group, is focusing on geologic systems that affect the Earth's carbon dioxide budget. This project involves experimental and computational studies of dissolved anionic species interacting with mineral surfaces which develop pH-dependent anion exchange capacity or have permanent anion exchange capacity due to isomorphic substitution. Kalinichev and Kirkpatrick are now mainly focusing on carbonate species, but other geochemically significant species such as chloride and nitrate are also being studied.

One application of this research would be in controlling global warming. In order to limit global climate change caused by excess CO_2 (primarily man made), the CO_2 must be captured and stored, perhaps underground or in the ocean. However, deep-well injection of CO_2 could significantly change local groundwater chemistry. Understanding the molecular mechanisms controlling the properties of water-carbon dioxide-based fluids and their interaction with mineral surfaces is necessary before large-scale CO_2 storage can take place.

Kalinichev is head of the physical research laboratory at the Institute of Experimental Mineralogy at the Russian Academy of Sciences. He received his Ph.D. in chemical physics from the Russian Academy of Sciences.

Schilling Looking at Elasticity of Glasses and Minerals

Visiting scholar Frank R. Schilling came to the Geology Department from GeoForschungs-Zentrum Potsdam as a Heisenberg Fellow and is scheduled to be here for one year. By understanding in more detail the relationship between structure and physical properties of glasses and minerals, Schilling hopes to be able to relate the influence of pressure and temperature on their elastic properties. Ultimately he would like to examine the elastic properties of hydrous minerals, which are not clearly understood and are important to understanding subduction processes and earthquake mechanisms.

Schilling is collaborating with Professor Jay Bass and Visiting Assistant Professor Stas Sinogeikin in an investigation of the elastic properties of basaltic glass samples. This work, which uses Brillouin spectroscopy, will help explain how magmas rise. The data show how changes in chemical constituents affect the density, velocities and elastic properties in a highly systematic way.

In another project, Schilling is investigating the thermal transport properties of minerals. Temperature contrasts are one of the fundamental driving forces within the Earth, so precise measurements of thermal transport properties, which are strongly related to the structure of the minerals, are key to understanding how the Earth system works.

Schilling is involved in a third project that concerns the physical properties of partially molten crustal rocks. He is conducting laboratory experiments to make quantitative interpretations of the data from large mountain belts such as the central Andes. Schilling is working to measure electrical conductivity, elastic properties and thermal transport properties of partially molten rocks under defined conditions.

A fourth project Schilling is involved in concerns the quantitative interpretations of geophysical observations. This is a collaboration with several German colleagues and two colleagues in China. He and his colleagues study the interrelationship between various physical properties and the amount of partial melt, in order to understand the chemical composition of the Andean crust. Ultimately he would like to quantify fluid flow through the convecting mantel wedge. The results may help to explain the origin of intermediate-depth earthquakes.

Herrstrom Connects With Geoscience Educators

"Three Sisters," a formation of erosional remnants form the Triassic Sandstone of the Sydney Basin. This photo was taken from Echo Point, in the Blue Mountains of Australia, by Eileen Herrstrom.

Eileen Herrstrom, teaching specialist, attended the "Third International Conference on Geoscience Education," in Sydney, Australia, last January. The conference enabled her to connect with other geoscience instructors and discuss common interests and concerns, such as the effective and appropriate use of technology, results of educational research, and what students learn when teachers teach. Instructors from elementary through college level attended the conference, as well as museum educators and others in related fields.

Herrstrom gave a poster at the conference about part of the National Parks course (Geology 104) given last spring in which she replaced the final exam with a poster project. Students were required to summarize the geology of one park on two sheets of poster board, display their posters during the final exam time, and review others' posters. Her goal was to have students concentrate on a single area, rather than try to memorize the whole United States (this addresses a common criticism of the U.S. curriculum in general, "that it covers too many topics in too little detail.") The exercise also provided another means of assessing students besides a multiple-choice, computer-graded exam, because some students perform poorly in this format. Finally, the project gave students a taste of how scientists exchange information and ideas at professional meetings. Herrstrom's presentation was well received at the conference, with several people indicating that they would try the idea in their own classes and others suggesting ways to improve the project and to evaluate its effectiveness.

The conference also gave Herrstrom some very specific ideas that she will try in the future. One was to have students create a portfolio of breaking science news, summarize each article and then analyze which articles were the most interesting and why. A second project involved building a polarizing microscope from items normally thrown away, including a film canister and the lens of a disposable camera. The person who demonstrated the project had used this idea with junior high school students, who made their own individual microscopes for looking at thin sections. A typical polarizing light microscope costs $5,000, whereas this version cost under $5.

Herrstrom, who joined the department five years ago as an academic professional, is responsible for assigning TAs to courses, supervising 100-level labs, and lecturing for introductory courses. Geology is a popular option for non-majors at the University of Illinois seeking a science course, which is one reason Herrstrom was hired. Prior to her arrival, the faculty had developed several new entry-level courses, and the department now offers about 10 per semester. More recently, the largest class (Geology 100- Planet Earth) expanded from two to three lecture sections, which can accommodate 900 students. Total enrollment in 100-level classes is about 3,000 students per year.

Geology Department Participates in Engineering Open House, Again

This year geology students once again prepared geology displays for an "open house" in conjunction with the Engineering Open House (EOH). The EOH, an annual event, attracts thousands of school-age students to campus to learn about various aspects of science and engineering. Two years ago, the geology display was moved up to a more central area in the Engineering College. Now thousands of students visit the display. In the past, the displays have covered topics ranging from dinosaurs, volcanoes, floods and earthquakes. This year students also will put together a display of field and laboratory equipment from the beginning and the end of the last century.

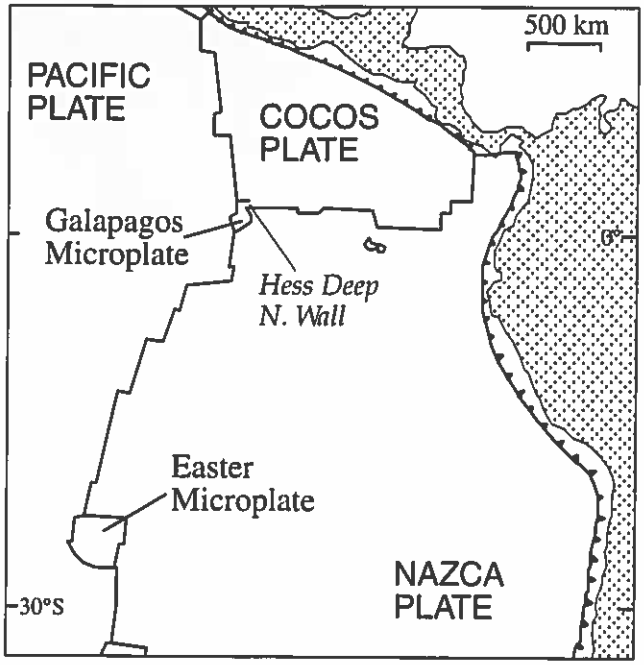
Eileen Herrstrom served as the advisor for the Geology Open House this year. She says she'd like to see geology students doing even more community outreach. Last year Herrstrom participated in National Earth Science week by creating a display for the Champaign Public Library. She has been investigating having geology students teach elementary classes about earth sciences. "After all," she says, "the best way to learn is to teach. Geology is such a natural for drawing kids' interest, I'd like to see our students get out into local classrooms," says Herrstrom.

High-Caliber Research Is the Norm...for Undergraduates

Undergraduates in the geology department are—in some cases—going to the ends of the Earth to gain valuable research experience. Junior Anna Sutton went with research programmer Steve Hurst on a trip last March to study the fast-spreading oceanic crust exposed at the Hess Deep Rift. They traveled on the *R/V Atlantis*, which is owned by the Navy and operated by Woods Hole Oceanographic Institution. Using side-scanning sonar, ARGO (a remotely operated vehicle) and ALVIN (a three-person submersible), the scientists on the expedition (16 researchers from almost as many institutions) studied the sea floor and outcrops about 1.5 miles below the water surface. The team worked for one month, made 15 ALVIN dives, and took about 80,000 photographs with ARGO.

The Hess Deep Rift is located 101 degrees west and 2 degrees north, which is almost due south of Mexico City. It marks a spot where four tectonic plates, the Pacific, Nazca, Cocos, and the Galapagos, interact. The tectonic activity has resulted in a magnificent submarine chasm, providing great views of oceanic crustal structure at the East Pacific rise. The area is not well studied. Two other expeditions to the area logged only nine dives. Hurst was on a 1990 expedition to the area. The cruise last year was a follow up to that original one nine years ago.

"It is really special to be an undergraduate and to see something almost no one else has ever seen," says Sutton. "It was a great opportunity for me and a wonderful addition to my undergraduate career." Sutton put up with a little sea sickness (actually five days; three solid ones in bed!) and chunky milk (when it thawed out the globs of fat got all chunky), but beyond that the experience was nirvana. "I love being outside, I love being in the field," says Sutton.



The Hess Deep Rift marks the spot where four tectonic plates interact.

"Being in the ALVIN itself is a little like being in a cave, although not as scary," says Sutton. "You have to shrink down your reality and create a really small mental world, which takes some mental agility. Even just living on the ship for one month took that agility. Ping Pong became very important," Sutton said.

The cruise occurred in the middle of the spring semester, forcing Sutton to miss four weeks of class and do some creative class planning, but it was worth it. "Going to sea fundamentally rearranges your entire view of the universe," says Sutton. "For that entire month the ship was always moving, it made me feel more connected to the rest of the world. I really sensed the passage of time."

Sutton, who was looking for a research project but hadn't settled on any particular topic, was thrilled with her ALVIN experience. For her senior thesis she is characterizing the uppermost crust in the extrusive section to understand the geologic processes involved. Much of her work will be based on the samples collected and outcrops photographed during the expedition, and subsequent image processing primarily involving photomosaicking.

"Working with Steve has been great," says Sutton. "He's really smart and he expects a lot from me, which is good. It really pushes me."

Another faculty member who has received kudos from his undergraduate students is Jay Bass. Supported by supplementary grant money from the National Science Foundation's Research Experiences for Undergraduates Program, Bass helped several undergraduates over the last several years conduct original research. The University recognized his efforts recently by awarding him the Campus Award for Excellence in Guiding Undergraduate Research.

Two other juniors are being supported by the NSF's Research Experience for Undergraduates Program in Professor Wang-Ping Chen's lab. Frances (Frannie) Skomurski and Laura Swan are helping Chen and his graduate student, Mike Brudzinski, understand earthquakes beneath the Himalayas and the Tonga-Fiji islands.

Swan is looking at digital data collected over the past 20 years regarding the Himalayas and Tibet, where earthquakes in the mantle portion of the continental lithosphere were discovered by Chen and his colleagues in 1979. A large amount of high-resolution, digital data collected in the past two decades make it possible to carry out a systematic study of these puzzling earthquakes. Swan is looking particularly at the depth at which the earthquakes occur, whether they are in the mantle or the lower crust, for example. "We hope these results will advance our understanding of how mountains are built and how the Indian craton is being destroyed in the process," says Chen.

Skomurski is looking at outboard earthquakes, a unique type of deep earthquake west of the Wadati-Benioff Zone of Tonga. Subduction along the Tonga Trench is exceedingly fast (more than 200 millimeters per year), with some of the oldest and coldest slab going down. "Outboard quakes are fairly rare, they don't occur at every subduction zone," says Skomurski. Skomurski modeled the rupture process of the biggest outboard earthquake to date using waveform inversion. She successfully modeled two major sub-events with changing fault plane solutions (this refers to a schematic way to define the orientation of a fault), as well as a precursor event. The results showed that the outboard earthquake shared characteristics with deep earthquakes, such as having multiple sub-events, changing fault plane solutions, relatively fast rupture speeds (as far as earthquake propagation goes), and a substantial source volume.

However, outboard earthquakes do not show down-dip compression, which is a characteristic of the Wadati-Benioff Zone. Instead, there seems to be a pattern among the outboard earthquakes that gradually changes from north-south compression to extension

Junior Frannie Skomurski is looking at outboard earthquakes with Professor Wang-Ping Chen

over a distance of several hundred kilometers. "This suggests that we may be dealing with a large piece of coherent slab material that is experiencing deformation on a regional scale," says Skomurski.

"I was looking at different schools with good geology programs and I knew the University of Illinois had good research opportunities," says Skomurski of her decision to come to the University. "After my freshman year I talked to Mike Brudzinski—he's the best teaching assistant ever—about the chance to do research. A week later he asked me, 'how do you feel about earthquakes?'"

Skomurski signed on to work in Chen's lab and hasn't regretted it yet. "Both Laura and I have had lots of one-on-one contact with Mike and Professor Chen. It's really cool," she says. Skomurski presented her work at the fall annual meeting of the American Geophysical Union last December.

"What Frannie and Laura is doing is quite unusual, very high-level stuff, the real deal," says Brudzinski. "They are doing graduate-level work that could be part of a Ph.D. project." Brudzinski knows high quality: He was the first recipient of the Texas-Louisiana Fellowship from the department in recognition for his outstanding achievements as a graduate student.

Senior Kristine Mize is working with assistant professor Bruce Fouke to understand the diagenesis of Yellowstone hardgrounds and the sedimentology of the Chicxulub impact on the Yucatan Peninsula. Fouke also has an astrophysics major and three molecular biology majors doing projects in his lab.

In addition to working with Fouke, Mize has done two internships at the Illinois State Geological Society (ISGS), during which she has helped Hannes Leetaru study Benoist sandstone of south-central Illinois. Although it produces oil, the Benoist sandstone has not been very well studied. Mize and Leetaru are working on a regional map of the area that will help fill in the geological framework of the Illinois Basin.

"What Frannie and Laura is doing is quite unusual, very high-level stuff, the real deal," says Brudzinski. "They are doing graduate-level work that could be part of a Ph.D. project."

Mize, who transferred here as a junior, spent part of last summer working with Fouke on the Yellowstone samples. She learned about using the cathodoluminescence petrography technique. She and Fouke found an unusual formation of travertine that exhibits a bright cathodoluminescent character. However, instead of being a primary precipitate it may be a secondary product of diagenetic alteration. This finding is important for understanding how the hot spring water creates both physical and chemical changes in the travertine.

This spring Mize will begin helping Fouke with a project concerning the giant comet or asteroid that hit the Yucatan Peninsula and is thought to have caused the extinction of the dinosaurs. The impact left a crater five miles deep and 250 miles in diameter. The vapor clouds formed on impact

were very hot and full of water and gas. As they cooled, particles stuck to the water droplets in the atmosphere and formed marble-sized pebbles, known as lapilli. These pebbles are one of the few pieces of direct evidence of what happened in the atmosphere following the meteorite's impact. (For more on Fouke's research, see the Spring 1998 issue of *Geosciences*). Mize is working with Fouke to get a better understanding of the geological processes involved in that event.

"This research has given me a sense of what I want to do in the future," says Mize, who has been interested in geology since the beginning of high school. "It makes me feel more involved in what I want to do as opposed to just going to classes. And Bruce is really dedicated to his students and to his research at the same time. He is a really good motivator."

Susan Riggins is another undergraduate who has gained research experience at the ISGS. Riggins is working with Drew Phillips of the ISGS and Associate Professor Steve Altaner. Her project is being supported by a Special Undergraduate Research Experience grant from the Environmental Council, a campus group of 12 faculty from a cross-section of the sciences that works to promote an interdisciplinary approach to all scientific research. Riggins' senior thesis concerns the vertical facies changes in the sediments of the American Bottoms Floodplain. Her core sample is from St. Clair County in Illinois. By studying the vertical facies Riggins hopes to uncover potentially significant horizontal heterogeneities. "I'd like to both determine how this region was formed and understand what that implies for groundwater flow and possible remediation efforts," says Riggins of her project.

Rocks Are More Interesting Than People Think...

Just about any time of day a visitor wandering into the geology department lunch room will find a conglomerate of geology students hanging out, doing homework, or chatting over a snack or cup of coffee. Geology undergraduates, of which there are about 50, are a tight-knit group.

"There is a core of undergraduates that hang out together," says junior Anna Sutton. "Field trips more than any other activity brings us together."

Most geology majors share an interest in the outdoors and the environment and bond over field trip experiences and long hours spent in lab together.

"Among geology majors, there's an understanding that we share the same interest, we're all excited about rocks (which makes other people look at us funny), and we share respect for the earth and wanting to be part of it," says sophomore Laura Swan.

Sutton agrees, "Rocks are more interesting than most people think. They tell stories, you just gotta learn to listen."

"All the geologists I came in contact with were really neat, and I liked the idea of being a geologist." adds sophomore Frances Skomurski. "I've been interested in dinosaurs since kindergarten, and once I got into junior high school I became very interested in environmental issues. I want to use geology as a tool within the environmental field."

Junior Laura Swan is working with Professor Wang-Ping Chen to understand earthquakes in the mantle and how they might contribute to mountain building.

Swan's interest in geology was encouraged by her family trips out west, mainly to national parks. "I thought the geology of those areas was really cool." Likewise, senior Kristine Mize knew she was interested in being a geologist in part because of her travels and her interest in rock collecting. "We'd go on family trips and I always enjoyed learning about the formations we were seeing," she said. "Then I realized, hey! I can do this for a living!"

Another thing that appeals to many majors is the one-on-one interactions they get from faculty and graduate students. Many point to those experiences being the best part of their University of Illinois education.

Skomurski, for example, says she has gotten enormous amounts of help and guidance from both her advisor, Wang-Ping Chen, and graduate student Mike Brudzinski, who also is in Chen's lab.

Sutton points out that the relationships geology students have with their professors is very different from that in other departments. "After 12 hours of hard work in the field, you put up tents, start fire and drink beer. It's time to relax. This is when you see another side of your professors. That's not true of other departments."

Field Camp—the Tradition Continues

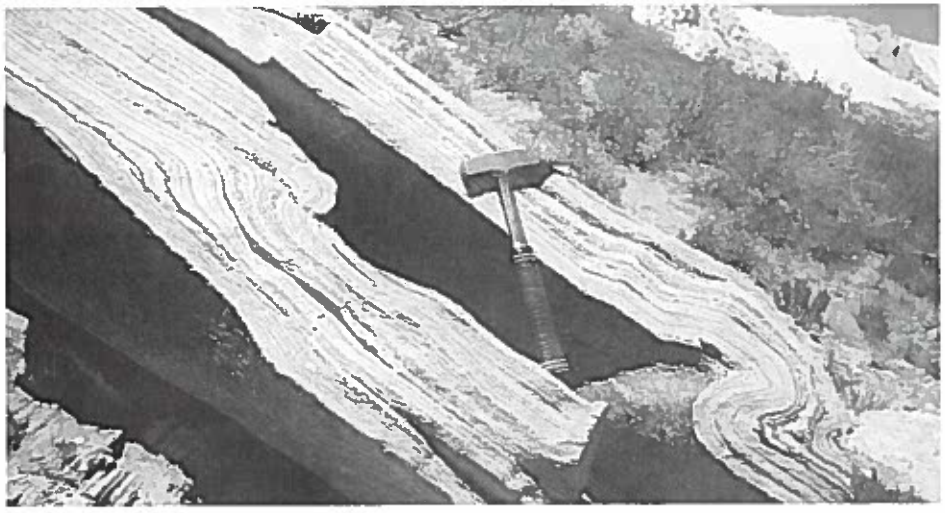
Most pre-1988 alumni fondly remember the Geology Department's field camp based in Sheridan, Wyoming, which operated from 1955-1988. Beginning in 1989, the department switched the camp's venue, and joined forces with four other schools to operate the Wasatch-Uinta Field Camp, based in Park City, Utah. Our colleagues in the camp include the University of Iowa, the University of Wisconsin, Michigan State University, and the University of Minnesota, Duluth. The 1999 summer field camp session marked the 10th anniversary of Illinois' participation in the Wasatch-Uinta Camp.

"Although there was a huge affection for the Sheridan field camp, the expense of such a solo operation required us to find an alternative," says Department Head Steve Marshak. "Fortunately, the tradition of excellent field camp experiences continues with the Wasatch-Uinta camp."

In spite of the location change, the key essentials of field camp remain the same—students work exceedingly hard, learn a heck of a lot, and develop lifetime friendships. Today's camp still focuses on the basics. Students learn how to interpret field relations, how to do geologic mapping, how to take field notes and make field descriptions, and how to construct cross sections and stratigraphic columns. On a typical day, everyone heads to the field by 7:30 a.m. and maps until 5 p.m. After dinner, students draw their office copies of maps and prepare geologic histories. And the obstacles—rattlesnakes, cow dung, cliffs, and cactus—still add excitement to every traverse. Some exercises cover hot terrain in desert-like conditions, while others involve taking students to 10,000-foot-high ridges, well above tree line. During the July 4 weekend, the camp takes a four-day regional trip up to the Grand Tetons. Not surprisingly, students still think of field camp as being a highlight of their college experience. They metamorphose from being geology students into being geologists.

At Park City, students stay at the Chateau Après, a ski lodge that becomes a dorm in the summer. The students sleep three to a room, and eat cafeteria style in the lodge's dining

Taking a dip in the Great Salt Lake.



A textbook example of a box fold near the crest of Bountiful Peak, Utah.

If you're visiting Sheridan, Wyoming, in the near future, take a close look at the new Grinnell Street Mall. One of the bricks in the Mall pavement commemorates the University of Illinois Geology Field camp, which was based in Sheridan from 1955 through 1988. Norb Cygan (B.S. '54, M.S. '56, Ph.D. '62) spearheaded the effort to buy and inscribe the brick. In addition to his long affiliation as a student in the geology department, Cygan taught at the field camp between 1955 and 1969. Thanks, Norb!

Left: The University of Illinois contingent takes a break for a photo shoot.

Right: Judd Tudor climbing the Frontier Formation at Chalk Creek, Utah.

room. Accommodations aren't posh, but Park City is a fun place to be. A boom of building in anticipation of the Winter Olympics provide many places to visit on a Saturday night, and the scenery in the surrounding mountains is a marvel.

One bonus with the Park City program is that Illinois geology students get to meet many students from other geology programs—the Wasatch-Uinta camp has had between 55 and 85 students per year. The mix lets some students build professional relationships that will last their entire career. In addition, students have a chance to meet a broad selection of faculty and ideas.

"One of the things I liked best about field camp is that you meet all sorts of people," says graduate student Judd Tudor. Tudor attended field camp as an undergraduate and served as teaching assistant for two years. "When you see someone you first knew from field camp there is a very intense bond. It was great to see field camp friends at a GSA meeting. Some of my best memories of college come from field camp," says Tudor.

Though field camp is a great experience, it can be expensive for the students. Recognizing this, Ed Franklin (B.S. '56) established a generous endowment which will provide scholarships to help students defray the cost of the camp. Other GeoThrust funds also are used to help students out. The start of field camp can also be a bit intimidating to students. To help remedy this problem, Marshak created a new class, called *Review of Field Techniques* (Geology 397), to help students get ready for field camp. In the class, students get practice with compass use, rock description, and map interpretation. They also discuss pointers about mapping techniques.

The view from Bountiful Peak.

Geology in the Early Years of The University of Illinois

by Ralph Langenheim

Although it was not an independent department at the start, geology was part of the University curriculum from its very founding in 1868. During the very first year of the "Illinois Industrial" University's existence, the Department of Science, Literature and the Arts taught mineralogy, and by the second year, the "Natural History Curriculum" included several geology courses (e.g. Principles of Geology; Lithological Geology; Paleontology, Historical and Dynamical Geology, and Geology of Illinois). By 1872 the University had been divided into four colleges: Agriculture, Engineering, Natural Science, and Literature and Science. Each college was subdivided into schools. Most geology courses were administered by the School of Natural History, but mineralogy was offered by the School of Chemistry (both schools were part of the College of Natural Science).

Don Carlos Taft, the first official geology professor, was hired in 1870 as Professor of Zoology and Geology in the College of Natural History. Since geology was taught only to third- and fourth-year students, the first classes would have been taught in 1870-71. Because these early years were a time of flux, we have three choices of birthdates of geology at Illinois. It could be argued that the first year, 1868-69, was the beginning but that might better be thought of as the conception. The next year, 1869-70, with Taft in residence but no courses being taught, might be thought of as gestation. 1870-71, when the first classes were taught, was the birth year of geology.

Don Carlos Taft, the first professor of geology at the University, was an eccentric and colorful character in the history of the department.

Taft was a colorful, independent-minded eccentric. As a young man, he suddenly decided that he had to make something of himself. He worked his way through Amherst College and Union Theological seminary, and upon graduation, became a Congregational minister and teacher in an academy at Elmwood, Illinois. Soon his sermons proved too liberal for the church and he was reduced to teaching geology in the local high school. Taft was brought to Illinois by Regent John Gregory. He quickly established a reputation as a good teacher and gained popularity with the students. Taft was well known for entertaining students in his home and for his determinedly unkempt condition. He took so much pride in paying little attention to clothing and grooming, that students nicknamed him the "great uncombed."

Taft, for example, was found with his pants rolled up and mopping the floor in his laboratory when the Regent brought a new Trustee around to introduce the staff (Solberg, 1968).

Regent Gregory was eventually forced to resign, in large part because of his lenient administrative style. His replacement, Selim Peabody, was a stern disciplinarian with higher academic expectations. Peabody called on the Board of Trustees to evaluate the geology program and, after the report was in, Taft was granted a leave of absence to visit England and his chair was declared vacant. Taft claims that he resigned to save Peabody embarrassment over his (Taft's) eccentricities. Taft, for example, was found with his pants rolled up and mopping the floor in his laboratory when the Regent brought a new Trustee around to introduce the staff (Solberg, 1968). A directory published after Taft resigned stated that he had left the University to join a religious community in Kansas where he was training to become a missionary to Africa. However, a note in the University archives from Taft's son, Lorado (creator of the "Alma Mater" statue among other works of art), states instead that Taft had become a banker in Kansas.

Interestingly, John Wesley Powell, the famous one-armed explorer who

Professor Emeritus Don Henderson ("Hendy") adds this contribution: Geology was first organized as a department in 1919 and stayed that way up to 1934. At that point it was combined with geography to become the Department of Geology and Geography. This arrangement lasted until 1947, when Geology was once again made a separate department.

was the first to lead an expedition through the Grand Canyon, almost joined the University as its first geology professor. Powell had solicited the Illinois Industrial University in 1867 for $500 in return for specimens from his forthcoming scientific expedition to the Rockies. One benefit of the association with Powell is that J.T. Burrill, of Burrill Hall fame, accompanied Powell on this expedition, collecting plants that became the beginning of the University herbarium. Then, in March, 1868, the Board of Trustees unanimously elected Powell to the professorship of Natural History, "his term of service to commence at such time as may be agreed upon between himself and the Committee on Faculty and Courses of Study." (Ill. Indust. Univ., 1st Ann. Rep. Trustees, 1867-68, p. 127). Powell's salary was set at $600 and, at his own request, he was sent to conduct his second expedition to the Grand Canyon, on the understanding that he would be representing Illinois Industrial University. However, on his return from his first Colorado River expedition (March 1869) Powell resigned his professorship ... never having taught a course. Powell went off to fame and glory, shaping the USGS into a premier research organization, and serving as director of the Bureau of Ethnology, leaving geology at Illinois Industrial University to fend for itself. We can only wonder what might have happened had Powell's energy and guile been devoted to the cause of geology at Illinois.

Faculty

Stephen P. Altaner, associate Professor
Thomas F. Anderson, professor; Emeritus as of January, 2000
Jay D. Bass, professor
Craig M. Bethke, professor
Daniel B. Blake, professor
Chu-Yung Chen, associate professor
Wang-Ping Chen, professor
Bruce W. Fouke, assistant Professor
Albert T. Hsui, professor
Thomas M. Johnson, assistant professor
R. James Kirkpatrik, professor and executive associate dean
Craig C. Lundstrom, assistant professor
Stephen Marshak , professor and head
Alberto S. Nieto, professor
Xiaodong Song, assistant professor

Visiting Faculty

Spencer Cotkin, visiting assistant professor
Michael J. Handke, visiting assistant professor
Laura Wasylenki, visiting assistant professor
John Werner, visiting assistant professor

Academic Staff, Post-Docs, Visiting Scholars

Debby Aronson, yearbook editor
George Bonheyo, post-doctoral researcher
David Finkelstein, visiting teaching lab specialist
Richard Hedin, research programmer
Mitchell Herbel, post-doctoral researcher
Eileen Herrstrom, teaching lab specialist
Stephen Hurst, research programmer
Andrey Kalinichev, visiting scholar
Lalita Kalita, research programmer
Alexander Kisliuk, post-doctoral researcher
Ann Long, visiting teaching lab specialist
Peter Michalove, assistant to the head
Jieyuan Ning, visiting scholar
Dawn Sandone, program coordinator
Stanislav Sinogeikin, visiting scholar
Frank Schilling, visiting scholar
Ester Soriano, research programmer
Melinda Tidrick, visiting teaching lab specialist
Tiffany Tsou, resource and policy analyst
Raj Vanka, resource and policy analyst
Alan Whittington, post-doctoral researcher

Emeritus Faculty

David E. Anderson
Albert V. Carozzi
Carleton A. Chapman
Donald L. Graf
Arthur F. Hagner
Richard L. Hay
Donald M. Henderson
George deV. Klein
Ralph L. Langenheim
C. John Mann
Philip A. Sandberg

Adjunct Faculty

Keros Cartwright
Heinz H. Damberger
Leon R. Follmer
Feng Sheng Hu
Dennis Kolata
Morris W. Leighton
John McBride
William Shilts
M. Scott Wilkerson

Library Staff

Sheila McGowan , chief library clerk
Lois Pausch , librarian
Diana Walter , library technical specialist

Staff

Barbara Elmore, staff secretary
Eddie Lane, electronics engineering assistant
Brenda Polk, chief clerk
Pamela Rank, account technician II
Sue Standifer, clerk II

Graduate Students

Oswaldo Araujo
Michael Brudzinski
Dylan Canavan
Andre Ellis
Stephanie Gillain
Keith Hackley
Yoshie Hagiwara
Michael Harrison
Roberto Hernandez
Xiaoqiang Hou
Qusheng Jin
Dmitry Lakshtanov
Serena Lee
Christopher Mah
Peter Malecki
Christopher McGarry
Jungho Park
George Roadcap
Joseph Schoen
Jian Tian
Judd Tudor
Richard Wachtman
Matthew Wander
Jianwei Wang
Matthew Woltman
Aubrey Zerkle
Limei Zhou

Courses Taught in 1999

Geol 100	Planet Earth
Geol 101	Introduction to Physical Geology
Geol 104	Geology of the National Parks and Monuments
Geol 107	General Geology I
Geol 108	General Geology II
Geol 110	Planet Earth — Lab/Field
Geol 111	The Dynamic Earth (Honors)
Geol 116	Geology of the Planets
Geol 117	The Oceans
Geol 118	Earth and the Environment
Geol 143	History of Life
Geol 250	Geology for Engineers
Geol 301	Geomorphology
Geol 311	Structural Geology and Tectonics
Geol 315	Field Geology (field trip to the Rio Grande Rift)
Geol 317	Geologic Field Methods, Western United States (Field Camp)
Geol 320	Introduction to Paleontology
Geol 332	Mineralogy and Mineral Optics
Geol 336	Petrology and Petrography
Geol 340	Sedimentology and Stratigraphy
Geol 350	Introduction to Geophysics
Geol 351	Geophysical Methods for Geology, Engineering, and Environmental Sciences
Geol 352	Physics of the Earth
Geol 360	Geochemistry
Geol 370	Oceanography
Geol 380	Current Problems in Environmental Geology
Geol 397	Field Methods in Geological, Geotechnical, and Geoenvironmental Exploration
Geol 401	Physical Geochemistry I
Geol 415	Advanced Field Geology
Geol 432	Sedimentary Geochemistry
Geol 433	Isotope Geology
Geol 450	Principles of Engineering Geology
Geol 451	Practice of Engineering Geology
Geol 489	Geotectonics
Geol 493A1	Graduate Student Seminar
Geol 493E4	Biomineralogy
Geol 493K2	Geodynamics
Geol 493Q1	Recent Developments in Thrust Tectonics

Research Grants Active in 1999

AMERICAN CHEMICAL SOCIETY-PETROLEUM RESEARCH FUND

A Time-Series Process Model Of Carbonate Diagenesis And Microbial Genetic Preservation In Hot Spring Travertine, Yellowstone National Park, Wyoming, And Gardiner, Montana.
Principal Investigator: Bruce Fouke

Origin, Architecture, & Thermal State of the Lackawanna Syncline, Pennsylvania.
Principal Investigator: Stephen Marshak

CENTER FOR ADVANCED CEMENT-BASED MATERIALS

NMR And MD Investigations of Chloride Sorption and Transport in Portland Cement Systems.
Principal Investigator: R. James Kirkpatrick.

DEPARTMENT OF ENERGY

Molecular Dynamics Modeling of Sorption on Mineral Surfaces.
Principal Investigator: R. James Kirkpatrick.

MD Modeling of the Thermodynamics and Material Properties of Water-Carbon Dioxide Fluids at High Pressures and Temperatures.
Principal Investigator: R. James Kirkpatrick.

WILLIAM AND FLORA HEWLETT FOUNDATION

Collaborative Research: Imaging Seismic Structures of the Crust and Upper Mantle Beneath China.
Principal Investigator: Xiaodong Song.

ILLINOIS COUNCIL ON FOOD AND AGRICULTURAL RESEARCH

Estimation of Dentrification Rates in the Shallow Groundwater Flow Systems of Big Ditch Watershed, Illinois - Isotope Assessment.
Principal Investigator: Tom Johnson

INSTITUTE OF GEOPHYSICS AND PLANETARY PHYSICS, LOS ALAMOS

Timescales of Crustal Level Differentiation: U-Series Measurements and Geophysical Monitoring at Arenal Volcano, Costa Rica.
Principal Investigator: Craig Lundstrom.

NASA

Core Angular Momentum and the International Earth Rotation Service Coordination Center/ Sub-Centers Activity for Monitoring Global Geophysical Fluids.
Principal Investigator: Xiaodong Song.

JET PROPULSION LABORATORY

Geochemistry of Carbonate Ejecta from the Cretaceous-Tertiary Chicxulub Impact Crater.
Principal Investigator: Bruce Fouke.

NATIONAL SCIENCE FOUNDATION

Transport of the Isotopes ^{4}He, ^{36}Cl, And ^{40}Ar, and the Relationship of the Distribution of these Isotopes to Groundwater Age.
Principal Investigator: Craig Bethke.

Seismic Reflection Profiles in Southern Illinois (funded through the Mid-America Earthquake Research Center).
Principal Investigators: John McBride, Stephen Marshak, and Wang-Ping Chen.

A Seismic Study of the Mantle Transition Zone and Subducted Lithosphere.
Principal Investigator: Wang Ping Chen.

Characterization of Seismic Sources in and Around the New Madrid Seismic Zone (funded through the Mid-America Earthquake Research Center).
Principal Investigators: Wang-Ping Chen and John McBride.

Tectonics of the AraÁuai/Ribeira Orogenic Tongue of Southeastern Brazil and its Significance to the Assembly of West Gondwana.
Principal Investigator: Stephen Marshak

Selenium Stable Isotopes as Indicators of Selenium Transport.
Principal Investigator: Tom Johnson

Constraining the Structure and Rotation of the Inner Core.
Principal Investigator: Xiaodong Song

Windows into MORB Petrogenesis: Measuring U-series Disequilibria in MORB From Transforms.
Principal Investigator: Craig Lundstrom

Proximal Carbonate Ejecta and Breccias from the Cretaceous-Tertiary Chicxulub Impact: Ballistic Sedimentation and Brecciation, $^{87}Sr/^{86}Sr$ Chronology and Diagenetic Alteration.
Principal Investigator: Bruce Fouke

The Asteroid (Echinodermata)Trichasteropsis from the Triassic of Germany: Its Taxonomy, Phylogeny and Paleoecologic Significance.
Principal Investigator: Daniel B. Blake

Paleoecological Setting of Eocene Echinoderms at Seymour Island, Antarctic Peninsula.
Principal Investigator: Daniel B. Blake

Elasticity of Mantel Minerals Under High Pressures and Temperatures.
Principal Investigator: Jay Bass

Polyamorphism and Structural Transitions During Glass Formation.
Principal Investigators: Jay Bass and Jay Kieffer

Experimental NMR and MD Investigations of the Structure and Dynamics of Anionic Species in and Sorbed onto Mixed-Metal Layered Hydroxides.
Principal Investigator: R. James Kirkpatrick

U.S. GEOLOGICAL SURVEY

Mapping of the Pittston 7.5" Quadrangle, Pennsylvania.
Principal Investigator: Stephen Marshak

UNIVERSITY OF ILLINOIS CRITICAL RESEARCH INITIATIVE

Geological, Microbiological, and Biochemical Mechanisms of Microbial Fossilization: A Template for Interpreting the History of Life.
Principal Investigators: Bruce Fouke, A.A. Salyers, J. Sweedler.

UNIVERSITY OF ILLINOIS FACULTY FELLOWSHIP

Imaging the Earth's Converging Tectonic Plates
Principal Investigators: Wang Ping Chen and Ulrich Kruse

UNIVERSITY OF ILLINOIS RESEARCH BOARD

Simulation of Mantle Dynamics: To Simulate Mantle Flows to Understand the Deep Interior of the Earth as Revealed by Seismic Tomography.
Principal Investigator: Albert T. Hsui

Acquisition of a Single Collector Thermal Ionization Mass Spectrometer.
Principal Investigator: Craig Lundstrom.

List of Publications for 1999

This list includes only peer-reviewed articles, chapters, or books.

Jackson, J.M., Stanislav, S.V., and Bass, J.D., 1999, Elasticity of $MgSiO_3$ orthoenstatite: American Mineralogist, 84: 677-680.

Blake, D.B., Hagdorn, H., and Tinitori, A., 1999, Echinoderm taphonomy of the Zorzino Limestone (Norian, Late Triassic), p. 35-38. In: S. Renesto (ed.), Third International Symposium on Lithographic Limestones, Bergamo, Italy. Rivi sta del Museuo Civico di Scienze Naturali 20 (supplement), 136 p.

Finkelstein, D.B., Hay, R.L., and Altaner, S.P., 1999, Origin and diagenesis of lacustrine sediments of the Oligocene Creede Formation, southwestern Colorado: Geological Society of America Bulletin, 111: 1175-1191.

Sinogeikin, S.V. and Bass, J.D., 1999, Single-crystal elasticity of MgO at high pressure: Physical Review B 59: 14141-14144.

Bethke, C.M., Zhao, X., and Torgersen, T., 1999, Groundwater flow and the ^4He distribution in the Great Artesian Basin of Australia: J. of Geophys. Research, 104: 12,999-13,011.

Sinogeikin, S.V., and Bass, J.D., 1999, Elasticity of chondrodite and implications for water in the Earth's mantle: Phys. Chem. Minerals, 26: 297-303.

Webster, G.D., Hafley, D.J., Blake, D.B., and Glass, A., 1999, Crinoids and stelleroids (Echinodermata) from the Broken Rib Member, Dyer Formation (Late Devonian, Famennian) of the White River Plateau, Colorado: J. of Paleontology, 73: 461-486.

Bethke, C.M., van der Lee, J., and Schmitt, J.-M., 1999, The chemistry beneath our feet: Modeling reacting flow in the Earth's crust. In: C. Jablon, ed., *Scientific Bridges for 2000 and Beyond*, Académie des Sciences, Paris, 1-11.

Chen, W.-P., Chen, C.-Y., and Nábelek, J.L., 1999, Present-day deformation of the Qaidam basin with implications for intra-continental tectonics: Tectonophysics, 305: 165-181.

Nowack, R. L., Ay, E., Chen, W.-P., and Huang, B.-S.A., 1999, Seismic profile of the upper mantle along the southwestern edge of the Philippine Sea plate using short-period array data: Geophys. J. Int., 136: 171-179.

Özalaybey, S., and Chen, W.-P., 1999, Frequency-dependent analysis of SKS/SKKS waveforms observed in Australia: Evidence for null birefringence: Phys. Earth Planet. Interior, 114: 197-210.

Nowack, R. L., and Chen, W.-P., 1999, Source-receiver reciprocity and empirical Green's functions from chemical blasts: Bull. Seismol. Soc. Am., 89: 538-543.

Jackson, J.M., Sinogeikin, S. V., and Bass, J.D., 1999, Elasticity of orthoenstatite: Am. Mineralogist, 84: 677-680.

Toohill, K., Siegesmund, S., and Bass, J.D., 1999, Elasticity of cordierite and implications for lower crustal seismic anisotropy: Phys. Chem. Minerals., 26: 333-343.

Johnson, T.M., Herbel, M.J., Bullen, T.D., and Zawislanski, P.T., 1999, Selenium isotope ratios as indicators of selenium sources and oxyanion reduction: Geochimica et Cosmochimica Acta, 63: 2775-2784.

Macedo, J., and Marshak, S., 1999, The geometry of fold-thrust belt salients: Geol. Soc. of America Bulletin, 111: 1808-1822.

Kriven, W.M., Palko, J.W., Sinogeikin, S., Bass, J.D., Sayir, A., Brunaer, G., Boysen, H., Frey, F., and Schneider, J., 1999, High temperature single crystal properties of mullite: J. European Cer. Soc., 19: 2529-2541.

Yu, P., Kirkpatrick, R.J., Poe, B., McMillan, P., and Cong, X.-D., 1999, Structure of calcium silicate hydrate (C-S-H): Near-, mid- and far-infrared spectroscopy: J. Am. Ceram. Soc., 82: 742-748.

Paulsen, T., and Marshak, S., 1999, Origin of the Uinta recess, Sevier fold-thrust belt, Utah: Influence of basin architecture on fold-thrust belt geometry: Tectonophysics, 312: 203-216.

Wu, L.-R., and Chen, W.-P., 1999, Anomalous aftershocks of deep earthquakes: Geophys. Res. Lett., 26: 1977-1980.

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Colloquium Speakers

Spring 1999

January 19 **Lianxing Wen** **Carnegie Institute**
Seismology: New Technique, Fine Structures & New Insights into Earth's Dynamics

January 22 **Peter Reiners** **Caltech**
(U-Th)/He Dating & Thermochronometry of Shallow Crustal Processes

January 25 **James Farquhar** **University of Calif.**
What do oxygen & sulfur isotopes tell us about the Martian atmosphere & its interactions with the planet's surface?

January 27 **Veli-Pekka Salonen** **Finland**
Use of Gypsum in rehabilitation of Eutrophied lakes

January 29 **Craig Bethke** **U of I**
Groundwater flow and the 4He distribution in the Great Artesian Basin

February 1 **Stephen Zatman** **UC-Berkeley**
High Frequency Geomagnetism: The changing state of the earth's deep interior

February 8 **Stuart Rojstaczer** **Duke University**
Hydrology of Yellowstone's Geysers

February 9 **Xiaogong Song** **Lamont-Doherty Earth Observatory**
Structure & dynamics of the earth's core fromseismic body-waves

February 10 **Kevin Mandernack** **Colorado School of Mines**
Stable isotopes as indicators of microbial activity

February 15 **Paul Earle** **UCLA**
Small-scale structure of the mantle & core from observations of high-frequency scattered energy

February 17 **Jan Amend** **Washington University**
Unraveling geochemical bioenergetics in hydrothermal systems-A computational-experimental-analytical approach

February 19 **Feng Sheng Hu** **U of I, Plant Biology**
Climate change & ecosystem response in Alaska: Snapshots of the last 12,000 years

February 22 **Ruth Blake** **Yale University**
Oxygen isotope systematics of Microbial phosphate metabolism

February 26 **Mihai Ducea** **Caltech**
Vertical composition of continental arcs and the origin of batholiths

March 4 **Youngsook Huh** **MIT**
Climate & weathering evidence from the rivers of eastern Siberia

March 26 **Kelly Warner** **USGS**
Lower Illinois river basin-analysis of arsenic & pesticides in ground water

April 9 **Karen Haverholm** **University of Wisconsin**
"What Are the National Science Education Standards and Why Should We Care?"

April 16 **Peter Keleman** **Woods Hole Oceanographic Institute**

April 30 **Cassandra Coombs** **Charleston College**
Volcanoes & resources of the Moon and Mars

Fall 1999

September 9 **Michael Manga** **University of Oregon**
Microstructure in magmatic materials

September 17 **Alan Whittington** **U of I**
Ancient histories of a young orogenic belt-Polymetamorphism in the Himalayas

September 24 **Alexander Alekseev** **Moscow St. University**
Upper carboniferous of Moscow basin

October 1 **Tim Lyons** **University of Missouri Columbia**
Recent advances in the S-isotope, Fe & Mo records of oxygen-deficient sedimentary systems: Examples from Precambrian to recent

October 8 **Dan Blake** **U of I**
The evolution of starfish & the impact of climate decline on Antarctic invertebrate faunas: Paleobiology at Illinois

October 15 **Robert Wintsch** **Indiana University**
Subduction & Ascent of Sanbaqawa Blueschist, SW Japan

October 22 **Tom Hickson** **University of Minnesota**
Petrographic & textural constraints on deep-water sandstone deposition: They're not all turbidites anymore or: How to go blind doing point counts

November 2 **Mark Cooper** **AAPG**
Oil & gas fields associated with inverted extensional faults: A global review

November 5 **Christina De La Rocha** **Harvard**
Silicon isotope Biogeochemistry: Rivers, diatoms, & oceans, Present & past

November 12 **Jim Walters** **University of N. Iowa**
Permafrost degradation caused by a warming climate in interior Alaska

November 19 **Louise Hose** **Westminster College**
Geomicrobiological processes in a hydrogen sulfide-rich Karst environment

December 3 **Steven R. Bohlen** **USGS-Virginia**
Federal science funding & the future of the Earth Sciences

Obituaries

Gerald Keith Anderson, B.A. '49, was killed in a car accident Dec. 22, 1998, in Midland, Texas. He was 73. Mr. Anderson taught geology at Miami University of Ohio and then was employed as a geologist by the Ohio Oil Company (now Marathon Oil). At the time of his retirement from Marathon Oil in 1986, Mr. Anderson was the chief geologist for the Yates Field in West Texas. He was a member of the American Association of Petroleum Geologists (AAPG). He is survived by three children and three grandchildren.

Terry W. Offield, M.S. '55, died Feb. 5, 1999, from complications following heart surgery. He was 65. In 1961 Mr. Offield joined the U.S. Geological Survey (USGS), working on regional geology and mineral resources of the outer Himalayas and on mineral surveys in northeastern Brazil. He went on to work in the USGS Branch of Astrogeology, serving as an advisor for lunar orbiter missions. Author of more than 100 scientific publications, Mr. Offield received the Department of the Interior's Meritorious Service Award and helped start the Geological Society of America's Congressional Science Fellow Program.

Donald J. Colquhoun, Ph.D. '60, died June 4, 1999.

Lois Kent, who taught in the department from 1955-1956, died last September in Champaign. Ms. Kent was a senior fellow in the GSA and a charter member of the Paleontological Research Institute in Ithaca, N.Y. From 1941-1945 she was a junior geologist and assistant geologist for the USGS in Washington, D.C. and from 1956-1985 she was a geologist emeritus for the ISGS in Urbana.

Class News

FIFTIES

Richard M. Winar, B.S. '53, M.S. '55, writes "Greatly enjoyed the articles about Harold Wanless. It was indeed an honor to know him ... Thanks for the fun of recalling him more clearly." Richard also has a new e-mail address: E-mail: rmwinar@aol.com

Bruce W. Nelson, Ph.D. '55, retired in June as professor of Environmental Sciences at the University of Virginia. In his 25-year career at the University, Bruce served as dean of continuing education, associate provost, professor ... and now professor emeritus! Bruce traveled to Malaysia and Mauritius in the 1980s on two separate Fulbright grants and attended a meeting in Beijing last September, which he followed with a trip through Souteast Asia. He writes, "I have enjoyed the newsletter and learning that U of I Geology is an active and vital place. Also, the recent articles on "old timers" are warm reminders of people I have known!"
E-mail: bwn@virginia.edu

Barbara J. (Schenk) Collins, Ph.D. '55, is still teaching biology at California Lutheran University and thoroughly enjoying it. She now has a website with more than 550 color images of wildflowers of the chaparral in southern California. These are indexed according to common and scientific names at http:// ww1.clunet.edu/wf
Note that this is ww1 and not www.

Lorence G. Collins, Ph.D. '59 (and Barbara's husband), has been retired from California State University Northridge since 1993 and spends his time studying myrmekite and the origin of some granite bodies by K-metasomatism. He now has 35 articles on a website: http://www.csun.edu/~vcgeo005. He maintains another site in opposition to creation science at http://www.csun.edu/~vcgeo005/creation.html. This includes an article about a bogus Noah's Ark in Turkey.
E-mail: lorencec@cs.com

SIXTIES

Margaret S. Leinen, B.S. '69, is the new assistant director for Geoscience at NSF. She assumes her duties at NSF after serving as provost for Marine Sciences and dean and director of the Graduate School of Marine Sciences at the University of Rhode Island.

John D. Sims, B.S. '62, retired from the U.S. Geological Survey (USGS) in January, 1999, to enjoy the restoration of his circa 1785 stone farm house near historical Harpers Ferry, W.Va. "The restoration is well underway with my partner, Jim Tower, and I doing almost all the work," John writes. Eventually, Willow Spring Farm, as it is named, will be a small bed & breakfast. John also is principal in a consulting firm specializing in earthquake hazard evaluation. He is currently working on three projects for the USGS.
E-mail: jsims@ix.netcom.com

Ira Edgar Odom, M.S. '58, Ph.D. '63, worked at American Colloid Co. until December of 1999, as a research scientist. "It was an enjoyable 19 years," he writes. "I have become a bit of an expert on silica minerals in clays. I discovered that silica minerals in dusts, from bentonite and other dry clay processing are clay encapsulated. MSHA, OSHA and NIOSH believe this is very significant and explains why clay plant workers seldom, if ever, have silicosis. Before working for American Colloid, Ira taught at Northern Illinois University until 1981. "A wonderful experience!" Ira currently is a full-time consultant. "I'm going strong and looking forward to full-time consulting," he writes.

Paul L. Plusquellec, M.S. '66, Ph.D. '68, retired from CNG Producing Co. in 1996 where he was vice president of exploration and development. These days he is enjoying golf, cooking and traveling from his base in Montgomery, Texas.
E-mail: pbplusque@aol.com

SEVENTIES

James W. Granath, B.S. '71, M.S. '73, has become a consulting structural geologist in Houston. He was previously a structural specialist for Conoco Advance Exploration in Houston.

William Ausich, B.S. '74, has stepped down as chair of the Department of Geological Sciences at Ohio State. "I look forward to life as a professor," he writes. E-mail: ausich.1@osu.edu

John C. Steinmetz, B.S. '69, M.S. '75, has become the director of the Indiana Geological Survey and Indiana state geologist, Bloomington, Ind. He was previously director and state geologist of the Montana Bureau of Mines and Geology in Butte, Mont., and adjunct professor of geology, University of Montana, Missoula.

Tim Rynott, B.S. '79, served as general chair of the Gulf Coast Association of Geological Societies annual convention. The 49th Annual GCAGS Convention was held in September, 1999, in Lafayette, La., where Tim has been working as a petroleum geologist for the past 19 years. He is a past president of the Lafayette Geological Society and considers himself very fortunate to have been able to spend his entire career in one "oil town." "Lafayette, the heart of Cajun Country, is one of the best kept secrets in the South," he writes. He invites fellow alums to come experience the "joie de vivre."
E-mail: rynott@worldnet.att.net

EIGHTIES

Jim Cobb, B.S. '71, Ph.D. '81, was appointed the 12th State Geologist of Kentucky and director of the Kentucky Geological Survey on October 1.
E-mail: cobb@fido.mm.uky.edu

M. Scott Mansholt, B.A. '82, works for Texaco in Bakersfield, Calif., as an environmental coordinator, primarily dealing with waste management, remediation, water issues, property reviews and Web page management.
E-mail: manshms@texaco.com

Dean Rose, B.S. '83, has found a new career crafting metalwork. Based in Champaign, Dean was recently the subject of a feature article in the News-Gazette. Dean taught himself the craft by finding information at libraries and visiting museums and other places with fine examples of metalwork. His company, which he founded in 1992 after leaving the gas and oil business, is called Working Metal Customized Decorative Ironworks. Visit his website at www.soltec.net/blacksmith.
E-mail: artsmith@soltec.com

William C. Dawson, B.S. '74, Ph.D. '84, has been awarded the 1999 Levorsen Award by the Gulf Coast Association of Geological Societies for a paper he presented at the 1999 Annual Meeting. The paper was titled "Top Seal Character and Sequence Stratigraphy of Selected Marine Shales in Gulf Coast Style Basins."

Stephen E. Laubach, Ph.D. '86, and co-author Eloise Doherty received the "Jules Braunstein Memorial Award" from the AAPG for the best poster presentation at the 1999 annual AAPG meeting in San Antonio, Texas. The paper was titled "Natural Fracture Analysis Using Drilled Sidewall Cores." The award was presented at the 2000 AAPG meeting in New Orleans, April 15-20. Stephen, a structural geologist, is a senior research scientist in the Texas Bureau of Economic Geology, at the University of Texas, Austin.

NINTIES

Rich Poskin, B.S. '91, has earned a master's degree in zoology and is now on the faculty of Wabash Valley College in Mt. Carmel, Ill. He teaches biology and geology.

Steven J. Hageman, M.S. '88, Ph.D. '92, has been designated a distinguished lecturer by the Paleontological Society. Each year the Paleontological society identifies six distinguished lecturers who are available to speak to a wide range of groups. Steven is a professor of geology at Appalachian State University.
E-mail: hagemansj@appstate.edu

Ming Kuo Lee, M.S. '90, Ph.D. '93, just received tenure and promotion at Auburn University.

Bruce Miller, B.S. '94, M.S. '95, has become a Field Service Manager for Schlumberger, based in Louisiana. Bruce and his wife, Laura, are enjoying parenthood with their first child.

Steven Sroka, B.A. '80, Ph.D. '96, writes to say that he is now the park manager (equivalent to a director) of the Utah Field House of Natural History State Park Museum in Vernal Utah. The museum is devoted to natural history, especially paleontology, of the Uinta Basin and Uinta Mountains. The museum is 20 miles away from Dinosaur National Monument and is currently undergoing a major fund-raising drive for a much needed revitalization. The museum has over 130,000 visitors a year. All current and past alumni (and their families) are welcome to stop by.
E-mail: nrdpr.ufsp@state.ut.us

Crystal Lovett, B.S. '97, just completed her master's degree in environmental management at Duke University. She is working one year for the Environmental Defense Fund in Raleigh, N.C. Her projects involve developing policy for forestry practices on private lands in North Carolina. In August of this year she'll attend University of Virginia School of Law. "I love getting the newsletter," she writes. "I like seeing how things change (or stay the same) and what people I knew are up to."
E-mail: cgl2@duke.edu

Tim Paulsen, Ph.D. '97, recently joined the faculty of the Geology Department at the University of Wisconsin-Oshkosh. He also is an adjunct assistant professor at Ohio State University. Tim, a structural geologist, conducts research in the Transantarctic Mountains. His research is part of a six-nation study that could shed light on future changes in the world's climate.

Former Faculty News

Ronadh Cox, former visiting professor of sedimentary geology, and her husband, Mark, announce the arrival of their son, Owen, who was born January 4 at 8 pounds 15 ounces. "All three of us are now home, doing well, and having fun!" she writes. Ronadh is now at the department of geology at Williams College. E-mail: Ronadh.Cox@williams.edu

Don U. Deere, a geologist and engineer and former faculty member, received the first Ralph B. Peck Award at the Third National Conference of the Geo-Institute of the American Society of Civil Engineers. Don is a member of the National Academy of Science and the National Academy of Engineering.

Bob Reynolds, an adjunct professor in the Geology Department from 1985-1998 while based at Dartmouth, won the Roebling Medal this year from the Mineralogical Society of America. The Roebling Medal is the highest award of the Mineralogical Society of America "for scientific eminence as represented primarily by scientific publication of outstanding original research in mineralogy."

Frank Rhodes, who was a postdoctoral fellow, visiting lecturer, and professor at the University of Illinois from 1950-1956 gave the featured talk at the AAPG convention. The talk was titled "Summit on Early Science Education." The convention ran from April 15-20 in New Orleans. Frank was president of Cornell University for many years, and is now chair of the National Research Council.

Hans Laubscher, who was a visiting professor here in the 1960s, won the GSA Division of Structural Geology and Tectonics Career Contribution award for 1999. Steve Marshak, professor and department head, was chair of the division and presented Laubscher with the award.

Correction:
Elizabeth Brouwers, M.S. '77, associate regional geologist with the USGS in Denver writes to correct our mistake in the last issue of the newsletter. In the profile of Alex Glass, recipient of the Sohl award, we stated that Sohl spent most of his career with the Smithsonian Institution. Brouwers writes "Norm Sohl is proudly claimed by the U.S. Geological Survey, which he worked for his entire career ... in the early days of the Paleontology and Stratigraphy Branch of the USGS, staff were housed in the same building as the natural history staff of the Smithsonian, but this was always as the USGS." Thank you Ms. Brouwers!

George B. Grim (left; shown here with Jay Bass), nephew of the late Professor Ralph E. Grim, visited the Department to unveil a display case, donated by Mr Grim, containing some of Prof. Grim's several awards. Ralph Grim was a distinguished researcher in clay mineralogy.

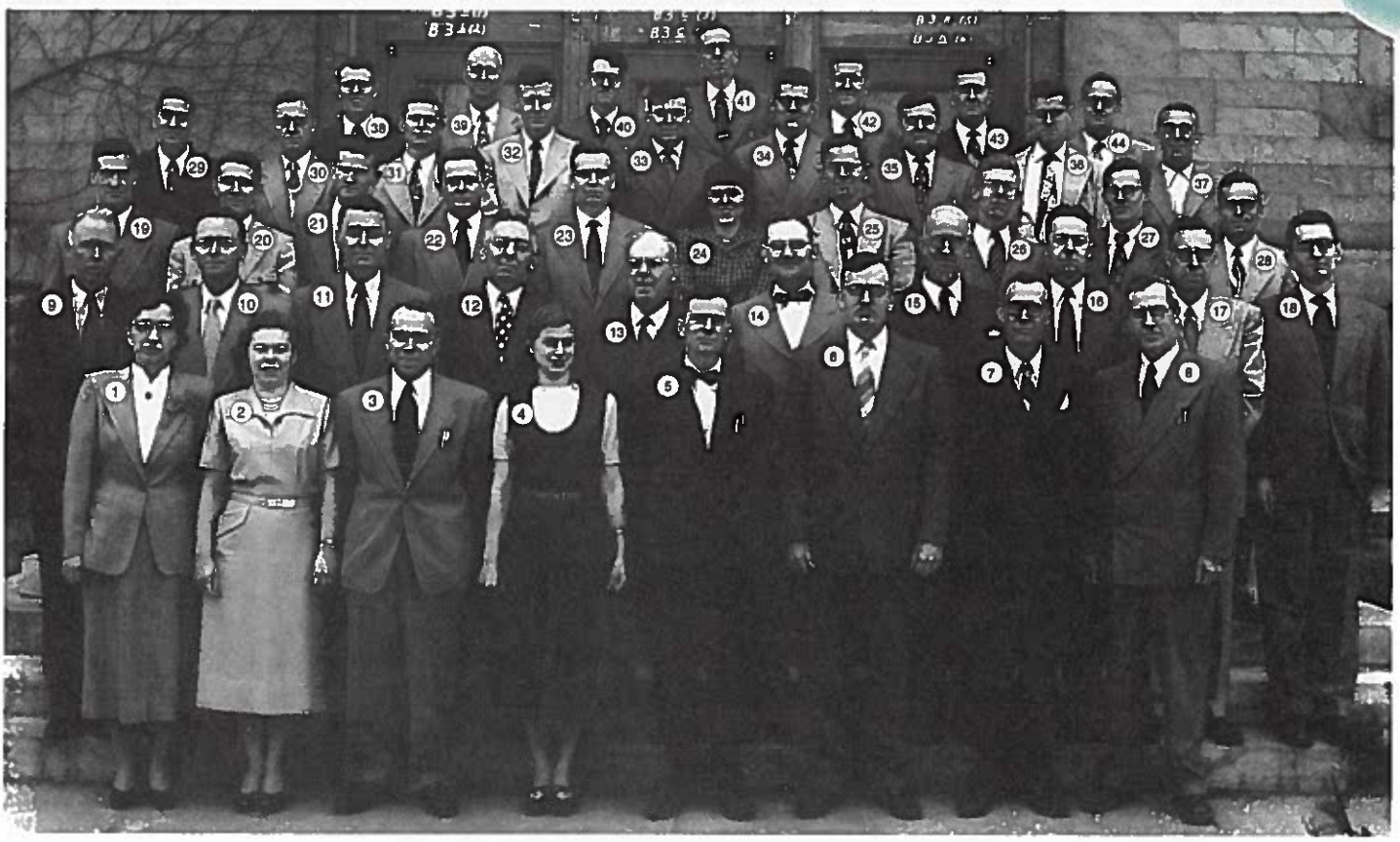
Albert V. Carozzi, professor emeritus, was awarded the Prix Wegmann of the Société Géologique de France. The prize was awarded June 7 in Paris at the society's annual meeting. This honor, which is one of the highest awards the organization gives, was based on Carozzi's lifelong contribution to the history of geology.

Since 1960, Carozzi has translated and annotated more than 20 books on the history of geology. He has translated works from German, Latin and French, most of which were written in the 18th century.

"Basically, I make the publication or manuscript available in an English translation, often with the original text side by side. Then I annotate it in terms of what the work meant in the context of its time and in a modern context," says Carozzi.

Carozzi often travels to Europe to check the formations mentioned in the works. "I go in the field and try to re-check their observations," he says. "Of course sometimes those outcrops are now in the city dump or the city has grown onto it, but generally the outcrop is there. It can be something of a thrill to come upon the same outcrop discussed 200 years ago."

The history of geology was really a secondary interest for Carozzi, who taught and did research in carbonate petrography in the University's Department of Geology from 1955-1989. Upon retiring, the history of geology became his major field of research.



Key to U of I Geology Faculty, Staff, Graduate Assistants
Photograph April, 1952 west entrance NHB

Row 1

1. Rosa Nickell *
   Executive Secretary
2. Secretary
3. William M. Merrill
   Assistant Professor, stratigraphy
4. Secretary
5. Donald M. Henderson
   Assistant Professor, mineralogy
6. Jack Luin Hough *
   Associate Professor, oceanography, engineering geology
7. Bernhead Kummel *
   Associate Professor, paleontology
8. Frank C.? Foley
   Visiting Prof, Kansas State Geological Survey

Row 2

9. Harold R. Wanless *
   Professor, stratigraphy
10. Harold W. Scott *
    Professor, micropaleontology
11. Carleton A. Chapman
    Professor, petrology
12. Ralph E. Grim *
    Research Professor, clay mineralogy
13. Frank DeWolf *
    Professor emeritus, Head Geology and Geography
14. George W. White *
    Professor, Geomorphology; Head Geology
15. J. V. Harrison *
    Visiting Professor; Reader, Oxford University
16. Arthur F. Hagner
    Associate Professor, mineral deposits
17. Paul R. Shaffer
    Professor, geomorphology
18. William D. Johns
    Graduate Assistant

Row 3

19. James Fisher
    Graduate Assistant
20. Vincent Shepps *
    Graduate Assistant
21. Graduate Assistant
22. John B. Droste
    Graduate Assistant
23. Forest D. Etheredge
    Graduate Assistant
24. Jane Gray
    Graduate Assistant
25. Leonard Schultz
    Graduate Assistant
26. John Wehrenberg
    Graduate Assistant
27. Graduate Assistant
28. Graduate Assistant

Row 4

29.
30. Norman Sohl
    Graduate Assistant
31.
32.
33.
34. Ronald (Mike) Lloyd
35.
36.
37. Robert Doehler
    Graduate Assistant

Row 5

38. John C. Hathaway
    Graduate Assistant
39. John Chapman ?
    Graduate Assistant
40. Wilford F. Weeks
    Graduate Assistant
41. Edwin Tooker
    Graduate Assistant
42.
43.
44.

* deceased

This photograph and identifications were generously provided by Don (Hendy) Henderson.

Let's Keep in Touch

Please take a few minutes to let us and your classmates know what you've been doing. Send your news to the Department of Geology, 245 Natural History Building, 1301 West Green Street, Urbana, Illinois 61801; fax 217-244-4996; e-mail geology@uiuc.edu

Name_____

Address_____
(indicate if changed)

_____

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Degrees from Illinois (with year)_____

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