

DOWN TO EARTH

DEPARTMENT OF GEOLOGY AND GEOPHYSICS, UNIVERSITY OF UTAH

FALL 2001

Message From the Chair

I hope everyone had a good summer. Personally, mine went too fast - two months of teaching in China was followed by several weeks of work in southern Alaska. I am ready for a rest now that the semester is underway! But - the Olympics are looming ever closer on the horizon so I suspect there will be plenty to keep us occupied as the parking lots close down, and the security is enhanced. We've been having record high temperatures so far this fall - lets hope Mother Nature decides to call in some snow before too late in the year.

Some news I would like to share: Frank Brown double dipped in the awards this spring - he was appointed a Distinguished University Professor, and also won the Rosenblatt Prize for excellence in academic life. Thure Cerling put us on the map once again, this time with his appointment to the National Academy of Sciences. Jessica Moore, one of our undergraduates won an award for her presentation at the AAPG meeting in June. Way to go Jessica! She is working with Marjorie Chan to set up a student chapter of AAPG using some of the funds that were presented to the Department on behalf of her award.

The staff is staying busy arranging interviews for faculty candidates and coordinating student job interviews. Four Geological Engineering faculty candidates visited in September. The sedimentary faculty job candidates will be interviewing in the spring. Our graduate students are busy interviewing with companies - the petroleum industry is in an upswing in spite of mergers and other happenings. By the way - student recruitment was up this year - we have 25 new graduate students, which is a record for as long as I can remember!

Well - Good Luck, and pray for snow!

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IN THIS ISSUE:

DEPARTMENT DEVELOPMENT	2
ALUMNI & FRIENDS	4
RESEARCH	5
STUDENT NEWS	7

Sharpen your field mapping skills

Dr. Erich Petersen

Based on the enormously successful outcome of the Argentinian mapping exercise sponsored by RTZ for U of U and NMT students, a second field exercise is being proposed. The program was organized by our very own Hans Rasmussen (M.S. '90). Hans was also instrumental in organizing the SAGE field camp. If you are interested in participating next summer (~ two weeks) please contact Erich Petersen. Space is limited.

DEPARTMENT DEVELOPMENT

Dean, Frank Brown, awarded Rosenblatt Prize

Tiffani Copyak

Dr. Francis H. Brown, dean of the College of Mines and Earth Sciences and professor in our department, was awarded the Rosenblatt Prize during last Spring Commencement. The \$40,000 Rosenblatt Prize is awarded annually to a faculty member who displays excellence in teaching, research, and administrative efforts.

Frank Brown is a well known professor in the college of Mines, joining the University of Utah as an Assistant Professor in 1971. In 1988, he served as Chair of the department, and in 1991 became the Dean of the College of Mines and Earth Sciences. Frank has been awarded Outstanding Teaching Award numerous times for his efforts to enhance the learning experience of his students, and he became a Distinguished University Professor in 2001.

Frank's research is focused, but not limited to, hominid fossils in Africa that give insight to human evolution. Last spring, he coauthored a paper in Nature announcing the discovery of a second species, Kenyanthropus, existing 3.2 -3.5 million years ago that may have cohabitated with the famous "Lucy." The research team unearthed the skull and new

questions as to the lineage of human evolution. Brown has also been involved in research studies applying tephrostratigraphic techniques elsewhere in Africa and the western U.S.

Most outstanding is Frank's dedication to the College of Mines. The numbers of students affected by Frank Brown's efforts are incredible. He continuously strives to better the college as a whole. Dr. Kim McCarter, Chair of the Mining Engineering Department, indicates that "Dean Brown is firmly committed to the well being of the entire College and has expended considerable effort in achieving goals which will improve conditions for all programs in the College." Frank is concentrating efforts to raise funds to provide a new building that will bring faculty and research facilities closer together.

After the announcement of this great award, Frank immediately indicated that the cash award would go to a new endowment fund to support educational activities. We are extremely fortunate to have the continuous efforts and friendship of Dean Frank Brown.

Career Development Seminar Success

Tiffani Copyak

The department's graduate students began the year with a two-day seminar on career development. Students gathered on August 17-18th for a seminar to guide and assist in career planning. Industry experts presented information on earth science careers in the oil industry, mining industry, hydro-environmental industry, and engineering geology. Hands-on experience was provided at the UGS Core Lab to look at the source, reservoir and cap rocks of the

Cretaceous Sandstone Ferron cores. A Saturday field trip focused on the overthrust belt structure along with sedimentary environments. The Career Development Seminar was a success with positive feedback. Students were engaged and exposed to all major Earth science careers. The career development seminar was worth the effort, and will be repeated in the future.

Petroleum Industry Career Path

Tiffani Copyak

The Petroleum Industry Career Path is a new program offered by the department for students who wish to explore opportunities or focus on training for a career in the petroleum industry. The program not only prepares students for a career path in the petroleum industry, but introduces information on career opportunities and strategies. The program offers four 1 credit hour modular classes offered on a rotating basis. The four classes taught by regular and auxiliary faculty with industry visitors are: Petroleum Geology, Petrophysics and Well Logging, Seismic Interpretation, and Prospect Evaluation. The program has not only received support by the department, but by companies who support educating earth science students for petroleum career opportunities. Dr. Marjorie Chan and Dr. Ron Bruhn visited with supporters in Houston to plan the program to meet industry needs. University alumni were among the supporters and include Jenny Joyce, Yonghe Sun, Roice Nelson, Bill Powell and David Lemons. Program sponsors indicated that the program was an example of how the Department is dedicated to the education and career development of students.

Anyone interested in the Petroleum Industry Career Path can start the program October 16, by taking the Petroleum Geology course taught by Dr. Robert Bereskin. Petroleum Geology will meet in Room 627 WBB, Monday 7:00 - 9:00 p.m. The class will give a detailed instruction on classical and modern investigative methods in analyzing 1) petroleum sources, 2) large-scale reservoirs, and 3) traps and seals. Companies currently recruiting in the Petroleum Industry are Chevron, Marathon, ExxonMobil, Phillips Petroleum, Shell, Enterprise Oil, and BP. The Petroleum Industry Career Path will also educate students on the strategies of these companies to hire earth scientists and the opportunity involved once hired by these companies.

Department Seeks Two New Faculty Members

Tiffani Copyak

The Department is expanding with two tenure track faculty positions available. The Department is currently involved with interviewing for an assistant professor in geological engineering. The candidate will need to demonstrate the potential to develop and/or enhance a vigorous research program that will compliment existing research in the department, in geologic hazards, applied geophysics, hydrology, or subsurface reservoir evaluation.

The second position is a tenure track faculty position in sedimentary geology at the assistant professor level. This position is available to begin as soon as July 2002. The candidate must have a Ph.D. with a strong record of research. The search is for an individual able to integrate traditional disciplines of sedimentary geology with innovative and quantitative approaches to understanding the dynamics of sedimentary systems or basin evolution. The candidate will also be expected to develop and instruct courses at the undergraduate and graduate level and to participate in the supervision of graduate students.

Department Welcomes Maria McCandless

Tiffani Copyak

Maria McCandless joins the department staff as Accounting Clerk, taking charge of keys, copiers, faxing, purchasing, mail, travel, vehicle checkout, AV equipment rental and part time chair secretary. Maria is a Utah native, now living in Salt Lake City with her husband, who is attending the University of Utah for his masters' degree in medieval history. She has an Australian Shepherd named Dipsy. Maria enjoys hiking and has many geology questions she hopes to answer one day. Along with hiking, Maria has a passion for oil painting; one time offered \$500.00 for an amateur painting of a snow scene. Maria likes to find that moment in nature when something appears to be both unreal and at the same time very real. She shares an interest with this department to search for natural phenomenon, however in her case, it is not necessary to solve or understand... it is simply to paint.

ALUMNI & FRIENDS

Around and About...

At the AAPG meeting in Denver, Colorado in June 2001, Dr. Tony Ekdale, Dr. Margie Chan and graduate student Bob Lamond organized a University of Utah Alumni social. The turnout also included former students Rip Langford and Jenny Joyce, along with two alumni who were some of Duke's first students, Rod Vaughn and Ernie Otto.

Dr. Margie Chan and Dr. Ron Bruhn visited with some alumni while in Houston preparing the Petroleum Industry Career Path. These individuals, now working in industry, gave insightful input on the development of this new program. The individuals included Jenny Joyce, Yonghe Sun, Roice Nelson, Bill Powell and David Lemons.

Utah Moves to Gain Professional Licensure of Geologists

Tiffani Copyak

During the past summer, the Utah Council of Professional Geologist officially submitted a formal application to the Occupational and Professional Licensure Review Committee for the cause of Utah Licensure for Geologists. The success of the act will depend now on dedicated volunteers and good political advice and assistance. The ad hoc committee heading the efforts has disbanded and reformed as the Utah Council of Professional Geologists (UCPG). The efforts for this movement have been supported by Utah Geological Association and Dixie Geological Society, Utah sections of the Association of Engineering Geologists, American Institute to Professional Geologists, Association for Women Geoscientists, and American Association of Petroleum Geologists. Members from all of the above organizations and unaffiliated geologists have participated in the ad hoc committee to move the Professional Geologist Act to the current political position.

Specific objectives of the UCPG are to:

- Promote the education and professional expertise of geologists practicing in Utah or providing service to Utahns.
- Promote, encourage and support effective and safe geological counseling and analysis to Utah citizens and companies.

- Oppose any local or state action that interferes with the ability of Utahns to obtain competent geological advice.
- Elevate the awareness of and appreciation of professional geologist and the practice of geology before public policy agencies with particular focus on the executive and legislative branches of local and state government.
- Influence the adoption of legislation, ordinances or other public policy statements to enact licensing and peer review statutes that enhance the competency and public perception of the geological profession in Utah.
- Receive membership fees as well as grants of money in order to administer the UCPG solely for the proper accomplishment of these purposes.

The UCPG has been set up to ensure the licensure of geologists in Utah and is not an additional scientific organization. Five Trustees have been appointed to the UCPG: Dean Armstrong, Janet Roemmel, Greg Schlenker, Bill Loughlin and Mark Milligan. Future developments will include officer election and the adoption of bylaws.

If you would like more information on this effort, contact Janet Roemmel, Acting Treasurer of the UCPG at 801.266.7100 ext. 236 or Dean Armstrong, Acting Chair, at 801.466.6769 ext 209.

RESEARCH

Noble Gas and CFC Laboratories

Jim Weigel

For those who have walked around the second floor of the William Browning Building and heard a constant droning of machinery radiating out from behind a closed door, you are hearing science in action. Behind these doors are the Noble Gas and CFC Laboratories. The two laboratories are utilized for determining the age of groundwater and obtaining cosmogenic ages from rock and fossilized teeth.

The centerpiece of the Noble Gas lab is the mass spectrometer (mass spec). The analytical system consists of two Mass Specs: a quadrupole Mass Spec and a magnetic sector-field Mass Spec. The quadrupole can be used to quickly determine the abundance and isotopic analysis of most atmosphere gasses, including Kr, Ar and Ne. The sector-field Linear Mass Spec is designed for precise measurements of ^3He and ^4He . The system is designed to detect the abundance of the five stable noble gases (He, Ne, Ar, Kr, and Xe) that are contained in groundwater or as fluid inclusions in rocks or minerals. The system handles both water and rock samples. The water line is used to extract noble gases from groundwater. The rock line is outfitted with a rock crusher and a furnace where the samples can be crushed or heated to release gases from fluid inclusions or from the crystal lattice. Samples are loaded into the mass spectrometer purification line under high vacuum 10^{-11} torr. Purification consists of a series of cryogenic cold traps and activated charcoal traps. The cryogenic and charcoal traps freeze out the water vapor, argon and the heavier noble gases. The mass spec has two collectors set up for simultaneous detection by either the electron multiplier which is most useful for high-precision analysis of low abundance isotopes, or a Faraday cup for highly abundant isotopes.

Groundwater dating is accomplished by measuring the concentrations of both tritium (^3H) and helium-3 (^3He). Tritium is a naturally occurring hydrogen isotope. Natural production of tritium is small compared to the amount of tritium released during atmospheric atomic bomb testing conducted in

the late 1950's through mid 1960's. These atmospheric atomic bomb tests bolstered the concentration of tritium in the atmosphere resulting in traceable tritium spikes. Tritium decays to helium-3 with a half-life of 12.4 years. Thus, measurements of both the parent and daughter isotopes provide a means of computing the age of the water. Surface exposure ages of rocks are possible because cosmic rays that bombard silicates produce ^3He via a nuclear reaction; the more ^3He a rock has the longer it has been exposed at the earth's surface.

The CFC portion of the lab is used to detect the concentrations of Chlorofluorocarbons (CFC) in groundwater. CFC's are a man made organic compound utilized in a wide range of industrial and domestic purposes. CFC gases have been released into the atmosphere over the last 50 years. Concentrations of CFC in the atmosphere have increased due to increased usage and in part to relatively long atmospheric residence times that range between 44 to 180 years. Precise CFC measurements have been conducted beginning in 1978 throughout the globe as a part of the Atmospheric Lifetime Experiment, producing an excellent recorded record of global CFC concentrations. One advantage offered by CFC's as a tracer is that they are uniformly distributed throughout the atmosphere. Partitioning of atmospheric CFC into water vapor depends on the atmospheric concentration and the solubility relationships. Infiltration of meteoric water into the subsurface carries dissolved CFC gases. Once isolated from the atmosphere the concentration of CFC's in water remains constant. When a groundwater sample is obtained and analyzed for the CFC concentration, the concentration in the water is related to the concentration of CFC in the atmosphere at the time the water entered the subsurface.

Folks utilizing the lab in their research include: Andy Manning, Eli Ludwig, Vic Heilwiel, Erin Crowley, Cassie Fenton, Dave Marchetti, Thure Cerling, and Kip Solomon.

Linda Ayliffe Research Reveals Mass Extinction Date in Australia

Tiffani Copyak

Postdoctoral geochemist researcher, Linda Ayliffe, is part of a team of researchers who recently estimated the date of a mass extinction of large mammals, reptiles, and birds in Australia. Twenty-three of the 24 genera of Australian land animals weighing more than 45 kg underwent a major extinction now estimated around 46,400 years ago. The results of the research give rise to new ideas about the cause of extinction, and rule out previous ideas of aridity due to the Last Glacial Maximum. The researchers -- led by Richard G Roberts of the University of Melbourne -- said it was indeterminable if the extinction was due to other climate changes. Two new popular theories however, are the ideas of a hunting "blitzkrieg" - the hunting term for a fast, violent offense - in which humans arrived in Australia and quickly wiped out large animals, or by a slower destruction of habitat by early humans. Supporting the idea of early human impact, is evidence of human arrival occurring 56,000 years ago. The researchers estimate the extinction of the megafauna occurred within 10,000-15,000 years of human arrival. Ayliffe doubts the early human population was large enough to hunt the animals to extinction quickly, and believes early nomadic hunter-gatherers gradually destroyed the habitat. Ayliffe stated that extinct animals include giant snakes and lizards, large ostrich-like flightless birds, and a variety of marsupials: species of kangaroos, marsupial lions, and marsupial rhinos.

The research team gathered fossils from most major biogeographic and climate regions. The focus of the study was to date the burial methods, using

optical and Th-230/U-304 dating methods, on several mega faunal taxa discovered at locations of the humid-coastal fringe, drier continental interior of Australia, and the montane forest of West Papua, once joined to Australia by a land bridge during lowered global sea level. Ayliffe used ratios of Thorium-230 to Uranium-234 to determine the age of cave sediments where extinct species were found, and thus the time of death of the animals. Optical dating was also done and corresponded with the dating Ayliffe found with the Th-230/U-234 method. Both dating methods were used on deposits containing the remains of megafauna in articulated anatomical position to avoid uncertainties introduced by post-depositional disturbances. Ayliffe assured the reliability of data because "it is the first study that's looked at many different species across all environments -- desert, coastal, fringe, semi-arid zones and tropical forest."

Linda Ayliffe comes to the University of Utah from Port Pirie in the state of South Australia. She earned her doctorate at Australian National University in Canberra. She has done postdoctoral research at the University of Manchester, England along with Laboratory of the Climate and the Environment, near Paris. Linda is now working with geochemist Thure Cerling on a study of how Earth's prehistoric climate and ecology were affected by changing levels of carbon dioxide in the atmosphere. The study is part of a larger study to understand future changes due to global warming caused by industrial emissions of carbon dioxide.

Cerling Elected into National Academy of Sciences

Tiffani Copyak

Dr. Thure Cerling was elected into the National Academy of Sciences during the academy's annual meeting in Washington last spring. Professor Cerling is a geologist and geochemist in the department who pioneered methods for studying Earth's prehistoric climate, atmosphere, and ecosystems. The National Academy of Sciences is one of the highest honors for an U.S. scientist or engineer. The department would like to congratulate Thure on receiving such an honorable designation among the science community.

STUDENT NEWS

AAPG Student Paper 2nd Place Award – Jessica Moore

Tiffani Copyak

Jessica Moore was awarded 2nd place for her paper at the AAPG Annual Meeting in Denver, Colorado. Competing with M.S. and Ph.D. papers, undergraduate Jessica Moore took the silver with research on the Green River Formation conducted while participating in the Geology Department Internship Program. The Department will receive \$1000 by which Jessica hopes to start up an AAPG student chapter. The paper, coauthored by her internship sponsor Dave Wavrek, examined both geological and geochemical factors used in determining prevalent water column salinity during source rock formation in lacustrine paleoenvironments. The goal of Jessica's research is part of a larger project to reduce exploration risk and maximize investment return in petroleum systems charged by lacustrine source rock. The approach of the research was to use geologic and molecular investigations of oils to define the relative volume of "effective" source rocks in the Green River Formation. The paper concludes that freshwater

deposits in the Green River Formation are the most prevalent depositional environments, followed by brackish and hyper saline. The results and processes Jessica used can be extrapolated to larger scale petroleum systems analysis in the Uintah basin along with other petroleum systems formed in lacustrine environments. Jessica's accomplishment not only brings honor to the department, but also enhances the internship program the department offers. For more information on the internship program, see www.mines.utah.edu/geo/jobs/intern.html

AEG Wasatch Front Student Chapter

Tiffani Copyak

The Wasatch Front Student Chapter will begin the year with a shrub-planting project in October and will follow in November with a brown bag lunch at a local engineering firm. The student chapter will host "Student Chapter Night" at the January AEG meeting where students can prepare talks on research, hand out resumes to professionals for hire or review, and have an opportunity to introduce themselves to industry professionals. The student chapter is a great place to meet professionals in the Salt Lake Valley to mentor and/or provide internships or job opportunities. If you are interested in joining, please contact Paul Jewell in INSCC 462 or by pwjewell@mines.utah.edu.

Mapping in Hydrothermal Systems

Dr. Erich Petersen

Six advanced undergraduate and eighteen professional geologist from Peru, Ecuador, Chile, Brazil Argentina and Australia attended a 3 day short course on geological mapping in hydrothermal systems run by Erich Petersen and William Chávez, Jr (NMT) at the Cerro Verde Mine in southern Perú. Noel Carreon, our T.A., (MS '02) assisted with the daily logistics and his intimate knowledge of structural mapping. The course was based out of Arequipa, Perú's second largest city. Arequipa suffered a magnitude 8 earthquake earlier this year but the heaviest destruction appears to have been limited to outlying areas and the central cathedral. The course focused on detailed mapping strategies and practical aspects. Topics covered included fracture mapping and quantification, recognition of hypogene and supergene alteration on various scales, identification of supergene and hypogene mineralization, interpretation of leached cappings and applications to exploration. This short course was sponsored by the Society of Economic Geologists. Please visit the course web site at www.mines.utah.edu/pyrite/mappingcourse2001.