

# Geology and Geophysics Newsletter

Fall 2002

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## Message from the Chair

-Marjorie A. Chan

Greetings from the Department of Geology & Geophysics! This year marks a new era for me and perhaps also for our Department. Prof. Ron Bruhn finished his 3-year term as Department Chair, and added a curriculum path that introduces our students to the petroleum industry. I am just taking over as chair, and two of my goals are to help build our student numbers and to reconnect with our alumni. I view this as my chance to get to know the Department, its students and faculty, and alumni better. Alumni involvement and Department community and collegiality, added to excellence in academics, will truly build and enhance our programs. The addition of two new faculty- Dr. Fulvio Tonon (geological engineering) and Dr. Cari Johnson (sedimentary geology) bring new enthusiasm and direction for our students. We have also started a more formal effort in outreach that is spearheaded by Dr. David Dinter (lecturer and research faculty).

Highlights of last year:

- \* The start of a new American Association of Petroleum Geologists (AAPG) student chapter
- \* Prof. Thure Cerling named University Distinguished Professor (joining the ranks of University-honored faculty Frank Brown, John Bowman, Tony Ekdale, David Chapman, Bob Smith, and Ron Bruhn)
- \* A marvelous, once-in-a-lifetime field trip for 15 graduate students to East Africa led by Frank Brown
- \* A career day seminar that brought in alumni and industry folks to share their expertise
- \* Discoveries of new dinosaur sites and species in Utah by Prof. Scott Sampson and students
- \* And many other milestones in faculty research and teaching

Utah is a happening place. This academic year, two national meetings will be held in Salt Lake City- the SEG (Oct., 2002) and AAPG (May 2003), and other national meetings will be held close by- GSA (Oct. 2002) in Denver and AGU (Dec. 2002) in San Francisco. We hope to have good representation at the meetings by our students and faculty, and hope to see many of our alumni.

I know many of you haven't heard much from our Department lately, but some of you saw Salt Lake City in the 2002 Olympics, so you know we're still here and we survived much of the campus reconstruction. This newsletter is an attempt to let you know a bit of our current status. We hope the next issue will contain more news of our alumni (that you send in), and eventually grow into a more extensive newsletter. I look forward to serving the Department over the next three years, and having your participation!

## About our Department

What is the make-up of our Department? The University of Utah is the flagship university of the state, and only our Department offers a Ph.D. in the Earth Sciences. We have 21 regular tenure-track faculty, 6 emeritus faculty, 14 research faculty, several visiting scholars and postdocs, 4 office staff, 5 technical/lab staff, about 80 graduate students and about 70 undergraduates. The Seismograph Stations is part of our Department with an additional staff of 8. Two of our regular faculty also have administrative positions within the University: Dr. Frank Brown is the dean of our College of Mines and Earth Sciences, and Dr. David Chapman is the dean of the Graduate School. We offer degree programs in geology, geophysics, geological engineering, environmental earth science, and environmental engineering. Our faculty bring in approximately 2 million dollars a year in grants and contracts. Several of our faculty have industry-supported consortias.

## Challenges

The University of Utah receives ~ 17% of its funding from the state, and we have been faced with budget cuts like so many other state universities. We hope for better economic times and a generous state legislature! But we must also rise to the challenges with proactive leadership and support from our alumni.

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## What lies ahead

What is the future of Earth Science? Some of our alumni have gone through different careers both in and out of the geosciences. It is true that job prospects in our field are cyclic. Earth Science is more relevant to our society than ever, but one of the most difficult tasks is making the public more aware of its importance. Education and outreach are increasingly important so that we can continue to train Earth scientists who will meet societal needs. We must show that Earth Science is a robust capstone to all the sciences. Our science needs to be part of K-12 curriculum, and we need good, enthusiastic teachers who can teach and implement Earth Science methods. We must build community partnerships to ensure that our science is incorporated into decision making about resources, policies, and land use. The field of Earth Science is bright and promising, and built on the youth and students who will shape the future.

## Memorial

Dr. Stanley H. Ward, Emeritus Professor of Geophysics and Former Chairman of the Department of Geology and Geophysics at the University of Utah, died July, 28, 2002 in Anacortes, Washington. He was preceded in death by his wife Shirley. Professor Ward was a distinguished scholar, teacher, and administrator. His career encompassed employment at Nucom Ltd., the University of California, Berkeley, and the University of Utah. He served as chairman of the Department of Geology & Geophysics for 10 years, and he also formed the Earth Science Laboratory of the University of Utah Research Institute in 1977. After retirement from the University of Utah, he held appointments at the University of Arizona and the University of British Columbia. Professor Ward earned his Ph.D. from the University of Toronto in Engineering Physics for original work quantifying the electromagnetic response of conductive ore deposits. His publications were numerous and diverse, including applications of electromagnetics to hydrogeology, mineral exploration, geothermal reservoir description, earth tectonics, and the Lunar crust. Professor Ward imparted a spirit of accomplishment in his students, who were given resources in funding and significant research topics. Professor Ward believed in a broad education for geoscientists and tried to insure that his students understood the geological background for their geophysical endeavors. He was particularly good at identifying "talent in the rough" and helped many students realize latent abilities. Professor Ward represented a generation of mining geophysicists who were equally at home laying out wire through moose pasture, solving Maxwell's equations, designing electronics equipment, or engaging in after hours jollification in dusty western towns. We will miss his enthusiasms; we will miss his strengths and his vulnerabilities. No longer will we hear the old familiar voice from

## What we are doing

The research going on in our Department is exciting. Our research spans across our state and into all the continents. Faculty and students regularly work in China, Egypt, Mongolia, Africa, South America, Antarctica, Europe, and elsewhere. Over the last few years our students have been on exciting trips to Mount Saint Helens and the Pacific Northwest, southern Utah, New Zealand, and Africa. Students have been on industry-supported field trips to the Green River basin of Wyoming, the Permian Guadalupe Mountains of West Texas, the Cretaceous Book Cliffs of Utah, and the Wyoming Overthrust Belt. We are fortunate to be close to marvelous geology, but it is important to get broad exposure, and thus field trips play an important role in the education of our students.

the back of the lecture hall hail a soft spoken conference speaker, "Speak up, we can't hear you". We will not soon see his like again.

## Earthscope

EarthScope, a *downward looking earth telescope*, is a bold, nationwide University initiative to apply modern observational and analytical technologies to investigate the structure and evolution of the North American continent and the physical processes controlling earthquakes and volcanic eruptions. EarthScope will consist of 1) a 2000+ station seismic array, 2) a 1500-station GPS array, 3) a drill hole into the San Andreas fault, and 4) a dedicated satellite mission to provide radar images of ground deformation. EarthScope will focus on the western U.S as natural active tectonics laboratory. Efforts to move EarthScope through Congress have so far, been quite successful. The Senate Appropriations Committee included EarthScope at the level of \$20M as a new start in FY03. The House has to mark up the Bill and any differences will be dealt with in the House-Senate Conference in Oct. While it is too early to declare victory, its proponents and the NSF Earth Science Research program believe that there are enough positive indicators to move forward with plans and support for its implementation. The University of Utah has played a notable role in EarthScope with Bob Smith serving on its organizing committee and has working with University officials and the Utah Congressional delegation seeking the congressional funding.

## Retirements

In 2001-2002, the department celebrated the retirements of M. Dane (Duke) Picard and William T. Parry. Duke's retirement party was a luncheon held at L'Avenue restaurant, where colleagues gave tribute and presented him with fine wines, a framed Utah photograph, and his John McPhee books all inscribed and signed. Bill's retirement party was held at the Pointe restaurant in the new Huntsman Cancer Center, that has a spacious view over the Salt Lake valley. Colleagues and former students praised his teaching and research and presented him with artwork and a copy of U.S.G.S. Monograph 1 of Lake Bonneville, signed by G.K. Gilbert himself!

## PICP

The **P**etroleum **I**ndustry **C**areer **P**ath 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 courses are taught by regular and auxiliary faculty with industry visitors. The area included are: petroleum geology, petrophysics and well logging, seismic interpretation, and prospect evaluation

## Faculty clips

**John Bartley** [structural geology] is doing field mapping, structural analysis, and detailed geochronology of plutons in the Sierra Nevada and in the Great Basin to examine models for how they are emplaced. He is also mapping the distribution of Mesozoic dikes in the Sierra Nevada and the adjacent Great Basin to determine the amount of Cenozoic right-lateral fault slip across eastern California.

**John Bowman** [isotope geology] continues to investigate fluid flow and fluid-rock interaction in crustal processes. He has also begun an investigation of the processes and rates of crystal nucleation and growth during metamorphism. The objective is to improve our quantitative understanding of these dynamic mineral growth processes using techniques of quantitative textural analysis [measurements of spatial dispositions of crystals, grain size distributions (CSD), etc.], electron and ion microprobe measurements of element and isotope zonation within mineral grains, and appropriate thermodynamic and mass transport models.

**Frank Brown** [geochronology] continues his research on stratigraphy, dating, and correlation of tuffs in the Turkana Basin in East Africa, where Meave and Louise Leakey collect fossil mammals. In addition, he began to work on stratigraphy and dating of a younger sequence in southern Ethiopia, the Kibish Formation (10,000-200,000 years), from which examples of early modern humankind were collected in the early 1960s.

**Ronald Bruhn** [structural geology] is focusing his research on the geomechanics of active deformation in mountain belts and rift zones. He uses field mapping, remote sensing and geophysical methods to study processes of fluid migration, earthquake generation and rock deformation.

**Thure Cerling** [geochemistry] and graduate students Dave Marchetti and Cassie Fenton have been studying ages of debris flows and lava dams in Capitol Reef National Monument and Grand Canyon National Park using cosmogenic isotopes. On the light stable isotope side, Dr. Cerling's group of Ben Passey, Linda Ayliffe and Matt Sponheimer has been studying how tooth enamel forms and how isotopes are incorporated into animal tissues - these will have important implications to fossil studies.

**Marjorie Chan** [sedimentary geology] is finishing studies on Pleistocene Lake Bonneville with Don Currey (Geography Dept), Paul Jewell, and graduate students. Chan's Jurassic projects include: 1) examining the role of hydrocarbons in sandstone coloration and iron concretions fluidized pipes, with Bill Parry (emeritus); 2) fluidized pipes and synsedimentary deformation structures; and 3) the formation of potholes on eolian sandstone surfaces.

**David Chapman** [heat flow] is intrigued by thermal processes in the earth. He is presently working on several projects, all involving temperature fields and heat flow: withdrawal of fluids in the Geysers geothermal system, California; hydrothermal circulation in the sea floor of the Juan de Fuca Ridge; a global analysis of thermal isostasy; and running a global change geothermal observatory in northwest Utah.

**Tony Ekdale** [paleoecology] continues to be engaged in diverse trace fossil projects around the world, including real dinosaur tracks in central Utah (with Rose Difley) and false dinosaur tracks (actually stingray feeding holes!) in northern Spain (with Jordi Gibert and others), as well as miscellaneous invertebrate trace fossils in Scandinavia (with Richard Bromley) and Kenya (with Bob Lamond and Frank Brown). He currently is initiating studies (with Leif Tapanila) on the microbioerosion of shells and carbonate rocks by microscopic marine algae, fungi and cyanobacteria.

**Susan Halgedahl** [rock magnetism] is researching fundamental rock magnetism, with emphasis on experiments to understand magnetic domains, acquisition of thermal remanent magnetization, and stability of the paleomagnetic signal over geologic time.

**Richard Jarrard** [well logging] is studying the waning of hydrothermal circulation in oceanic crust, based on age-dependent alteration effects on crustal geophysical properties. He is also researching tertiary paleoclimate of the equatorial Pacific and Southern Ocean, based on downhole measurements and light absorption spectroscopy.

**Paul Jewell** [hydrology] is currently working on the physical and paleoclimate controls of geomorphology and sediments in Pleistocene Lake Bonneville. He recently finished a project on the limnology and geochemistry of pit mine lakes.

**Cari Johnson** [sedimentary geology] is researching the sedimentology and stratigraphy of the East Gobi basin, petroleum systems, and tectonic implications of regional Mesozoic extension in central Asia.

**William Johnson** [geological engineering] is studying the transport of organic contaminants, macromolecules, and microbes in groundwater. The research is performed in field and laboratory contexts, and is funded by federal and state sources

**Barbara Nash** [igneous petrology] is doing research on the long-term volcanic history of the Yellowstone hotspot, from its first appearance in southern Oregon and northern Nevada 16 million years ago to its present location at Yellowstone National Park. Of particular interest are changes in frequency of eruption, magma temperatures, and isotopic variations that reveal the relative roles of the mantle and crust in the origin of the volcanism. Mike Perkins and Barbara Nash were highlighted in the *Editors Choice* column of the April 5 issue of *Science* for their paper on the evolution of explosive volcanism of the Yellowstone hotspot (Geological Society of America Bulletin, v. 114, 367-381).

**William Parry-Emeritus** [clay mineralogy] continues his research and writing activities. His research presently includes collaborative work on carbon dioxide sequestration with Craig Forster and others, and bleaching of the red rocks in southern Utah with Margie Chan. He has just published Ar-Ar and U-Pb dating and clay mineralogy papers on the Bingham Porphyry Copper deposit. Writing projects include a historical paper on the wooden pipelines in Mill Creek Canyon, the history of apex law litigation in Utah's mines, a book chapter on Utah geology to accompany papers on mining history, and the Geological Architecture of Utah book. Meanwhile, he is learning to fly fish.

**Erich Petersen** [economic geology] recently completed a structural study of porphyry copper deposits in the Millpillas area of Sonora Mexico with his student Noel Carreon who is now an exploration geologist based in Arequipa, Peru. He is carrying out a project on the role of boron metasomatism in porphyry copper deposits with graduate students Jenny Szabo (in Mexico) and Jason Babcock (in Chile). Erich just returned from a lecture series in Santiago, Chile that included a workshop on mapping in hydrothermal systems at Cerro Colorado that was sponsored by SEG. In April, five students presented their work in Denver at "Global Exploration 2002-Integrated Methods for Discovery" an international stand-alone meeting of the SEG.

**M. Dane Picard-Emeritus** [sedimentary petrology] recently had a long piece -9000 words- called "Goodbye to All" that was published in the Journal of Geoscience Education (v50, no3, p. 330 to 339)- sort of a summary of 45 years of teaching. So far he's heard from 4 former students-so he calls that a successful article.

**Peter Roth** [micro-paleontology] is investigating the calcareous nannofossil biostratigraphy in a section of upper Jurassic and lower Cretaceous limestones from northeastern Algeria which contains rich ammonite and calpionellid assemblages. He expects to provide an improved correlation of nannofossil, ammonite and calpionellid zonations and thus a refined biochronology of the Jurassic-Cretaceous boundary interval.

**Scott Sampson** [paleontology] is the department's resident vertebrate paleontologist. He has been working with his graduate students and a number of volunteers unearthing "new" dinosaurs in Utah and Mexico. The ultimate goal in both cases will be to reconstruct ancient, evolving ecosystems that existed in North America during the Late Cretaceous (99-65 million years ago).

**Gerard Schuster** [exploration seismology] is working with Ron Bruhn (joint NSF project) on using seismic tomography to detect the size and location of colluvial wedges, and coring the identified wedges in order to date their formation time. In this way they can determine the frequency and size of ancient earthquakes. He is also working with Bob Nowack (Purdue Univ.) on an NSF project to develop the new method of seismic interferometry and its application to teleseisms and crustal imaging. He just finished a US-Egypt government sponsored project with Cairo University in seismically mapping faults in the Sinai peninsula, and is directing research in the UTAM consortium, sponsored by 13 oil-related companies.

**Robert Smith** [earthquake seismology] interest lies in earthquake seismology, crustal deformation using GPS, and lithospheric structure. His research projects include geodynamics of the Yellowstone hotspot using seismic and GPS imaging, earthquake hazards of the Wasatch fault using GPS, operating the Yellowstone seismic and GPS network, and intraplate earthquakes and mechanics of lithospheric extension. He serves as the Coordinating Scientist for the newly formed Yellowstone Volcano Observatory, serves as chair of the Southern California Earthquake Research Advisory Council, and is an organizer of the new NSF EarthScope initiative.

**Kip Solomon** [groundwater hydrology] uses environmental tracers (noble gases, CFCs, tritium, carbon-14) to evaluate regional scale groundwater flow systems. His research has developed helium-4 as a groundwater dating tool over a time scale of 50 to 1000 years. Evaluation of natural and artificial recharge.

**Fulvio Tonon** [geological engineering] and his field of expertise covers rock mechanics and rock engineering, underground excavations, uncertainty modeling and information sciences. He is currently starting research activity in the Department on the following topics: uncertainty modeling and decision making with scant information, image processing of thin rock sections and its correlation with rock strength, neural network systems for predicting mechanical properties of wells based on logs and high resolution scratch tests on cores, rock fall hazard mitigation, geophysical methods for characterizing the ground ahead of a tunnel face (with M. Zhdanov).

**Michael Zhdanov** [electromagnetics] finished the work on a new book for his Inversion Theory class in 2002. This book presents a detailed exposition of the methods of regularized solution of inverse problems based on the ideas of Tikhonov regularization, and shows the different forms of their applications in both linear and nonlinear methods of geophysical inversion. This text is the first to treat many kinds of geophysical inversion and imaging techniques in a unified mathematical manner. Another book summarizing the Second International Symposium on Three-Dimensional Electromagnetics held at the University of Utah, was published in 2002 as well. The contributions contained in this volume represent a snapshot of today's state-of-the-art in three-dimensional electromagnetics.

Two of our former students, **Jay Quade** and **Cassie Fenton**, received awards from the Quaternary Geology Division of GSA this year. The Farouk El-Baz Award for Desert Research was awarded to Jay Quade (University of Arizona) and The Gladys W. Cole Award was awarded to Cassandra Fenton (USGS, Tucson, AZ). Congratulations to this amazing collection of talent from our ranks!

**2001-2002 Gifts to the Department**

Arabasz, Walter	Fritz, Richard	Trevena, Arthur	BHP Billiton
Armstrong, Philip	Ginsberg, Merrill	Wechsler, Debra	BP Amoco Foundation Inc.
Barnett, Daniel	Halverson, Mark	Weeks, Marta	ChevronTexaco
Bartel, David	Han, Uk	Wise, Gordon	Conoco Inc.
Bartley, John	Hardman, Elwood	Wood, Gregory	Electromagnetic Instruments
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Bruhn, Ronald	Isby, John		John C. Griswold Foundation
Bucher, Robert II	Loewen, Mark & Natalie	<b>Organizations</b>	INCO
Cerling, Thure	Luchetti, Cynthia	Aramco Services Company	Phillips Petroleum Company
Chapman, David	Nash, Barbara	Myrtle L. Atkinson	Shell International Exploration
Conrad, Maude	Ostermeier, Richard	Foundation	& Production Inc.
Crecraft, Harrison	Otto, Ernest	Baker Atlas Logging	Sumitomo
Ekdale, Allan	Porter, Michael	Services	Veritas DGC Ltd.
Felton, James & Bette	Powell, William	Ruth Eleanor Bamberger &	
Felton, Leland	Stevenson, Ronda	John Ernest Bamberger	
Fisher, Susan	Traynin, Peter	Memorial Foundation	