# Geology News

Department of Geological Sciences | University of Colorado at Boulder | 2009-2010

Spring Graduation 2010

## Contents



# Letter from the Chair

**Lang Farmer**

As threatened in last year's newsletter, I did in fact take over from Mary Kraus after her 6 years as departmental chair. Fortunately it has been a smooth transition, at least from my perspective, largely because Mary handed over the department in such fine shape.

For those of you that don't know me, I joined the department faculty in 1985 and have since enjoyed a fruitful association with both the department and the university. I'm a radiogenic isotope geochemist, with a clean lab and mass spectrometer facility located on the fourth floor of the Benson Earth Sciences Building.

With regard to the state of the department, we did manage to remain afloat this year despite the poor economic times. We grew to about 190 undergraduate majors, most of whom are following our traditional geological sciences major track. Our environmental geoscience major track, however, was seriously revamped and is ready to take on its first batch of students next fall. The new track is an improvement, if for no other reason because it will allow a larger fraction of our faculty to teach major courses both at lower and upper division levels. The course offerings for the environmental geoscience track include a lower division course in "Planet Earth" and upper division courses in biogeochemistry, paleoclimatology, earth materials and geomorphology. You can read about this new major track, and a whole lot more, at the department's website. The website has a great new look and all updated information, thanks to the efforts of many but most importantly Dan Mitchell, the department's IT person.

A few changes to the faculty ranks occurred this year. Scott Lehman stepped down as a faculty member to return to his research life at INSTAAR. But we managed to land Dr. Kevin Mahan who will join us next fall as an assistant professor in structural geology/metamorphic petrology.

The Department continues to be active in CU's Science Education Initiative (SEI), with much of the effort over the year having gone into modernizing a number of our upper division major courses. We only have one full year of funding left in the program but are looking forward to the lasting improvements in our undergraduate curriculum that the SEI has engendered.

The Geological Sciences Advisory Board remains a going concern and met twice this year under the leadership of Dean Miller. The board itself underwent a few changes. Neil Fishman rotated off the board after numerous years of excellent service, including a stint as Advisory Board Chair. In contrast, alumni Joe Zamudio and Ted Ball abandoned all hope and joined the board. Among other activities this year, board members helped organize last summer's 6th Annual Bill Bradley field trip. This field trip is not only a great way for incoming graduate students to acclimate to their new surroundings, but also an opportunity for alumni to reconnect with the department. If you will be in the Boulder area this year on the weekend of August 22-23 and would like to participate in the 7th Annual Bill Bradley field trip, just drop me an email (farmer@colorado.edu). We hope you will all enjoy this year's newsletter and the descriptions of the variety of departmental and alumni events that took place over the year. As was the case last year, however, the newsletter lacks a printed donor list. But we recognize that many of you miss the chance to peruse the list of friends and colleagues mentioned therein. So as a compromise, I can email a suitably discrete electronic donor list to anyone who so requests.

Of course, this discussion naturally brings up the issue of donations, themselves, for which we have conveniently included the usual envelope in the newsletter. In my first year as chair, I have witnessed not only generous giving on the part of alumni and friends but have also seen just what a difference these dollars are making to our program. The department had its share of budget pressure over the year but because of your donations we still managed to provide field trip funds for undergraduate and graduate students, grant graduate fellowships, and dole out graduate and undergraduate scholarships. Without your support these activities would not have been possible and the quality of our educational program would surely have suffered. So I thank all of you and hope you will consider a donation to the department again in the upcoming year.

**We want to thank our Advisory board members for donating their time and energy to the department**

## Notes from the Advisory Board
**By Dean Miller**

I think it appropriate to begin my first column as Chair of the Alumni Advisory Board by acknowledging the remarkable contribution my predecessor, Neil Fishman, made to the Department of Geological Sciences. Neil's contribution to the Department cannot be overstated. He was a tireless advocate for the Department, but always pursued the Department's interests with compassion and good humor. His knowledge of both the issues facing the Department and the University as a whole were remarkable. I have some very big shoes to fill.

Fortunately, the transition between Chairs will be made easier by having the immediate past Department Chair, Mary Kraus, agree to stay involved with the Advisory Board as an alumni liaison. This will be a huge help to the Department and the Advisory Board by providing continuity with our alumni outreach and fundraising efforts. This is especially important given that many of the Department's endowed accounts have taken a significant hit because of the financial crisis. Hopefully, this trend will turn around through a strengthening economy and the continuing generosity of our alumni.

The Department has revamped its website (http://www.cugeology.org), which includes a user-friendly Alumni Resources link where you can make a donation to the Department and update your contact information. You also can learn about the research being conducted by Department faculty and students on the website.

The Advisory Board has worked with the new Department Chair, Lang Farmer, for nearly a year now, and it is clear the Department is in good hands. Lang has hit the ground running and is maintaining the academic momentum of the Department. It is an exciting time for the Department, which has brought in some top-notch and highly motivated young faculty. There is no question that the Department of Geological Sciences has become a high-powered research institution, while maintaining excellence in teaching. In fact, it was recently reported that from 1996 through 2007, the University of Colorado ranked third behind the USGS and NASA for the most cited publications in geology.

The Advisory Board has had a busy year. Last August, several members of the Advisory Board attended the annual Bill Bradley Field Trip, where incoming graduate students are introduced to the local geology by Department faculty and Advisory Board members. The two-day event is a lot of fun, and includes a stay at the Mountain Research Station on Saturday night. In addition to learning the local geology, the trip is a great opportunity for new graduate students to get to know each other and begin to get a sense of community that is unique to the Geology Department. Alumni are welcome to come along on the Bradley field trip, which takes place every August. If you are interested, please contact Lang Farmer. It is a pleasure to welcome Joe Zamudio and Ted Ball as the two newest members of the Advisory Board. I have known both Joe and Ted since we were graduate students together in the 1980s and am looking forward to working with both of them. The Advisory Board also held another career night for current students in the Department where Advisory Board members provide insights on job hunting and networking strategies. Dawn Kaback is the driving force behind the career nights and does an outstanding job.

Finally, one of the highlights of serving on the Advisory Board is getting to know the students in the Department. At each Board meeting, we have either undergraduate or graduate students share their thoughts and concerns about the Department. I am pleased to report that the feedback we receive is overwhelmingly positive. Both undergraduate and graduate students consistently tell that the Department is providing a high-quality educational experience. Most telling is the feedback we get from students who previously attended other universities. Without exception, they tell us that the educational experience they are having in the Department is better than they had previously.

## Department Of Geological Sciences Advisory Board Members

**Ted Ball**
Los Alamos National Laboratory

**Neil Fishman**
U.S. Geological Survey

**Stephanie Gaswirth**
U.S. Geological Survey

**Richard Goldfarb**
U.S. Geological Survey

**Edmund (Gus) Gustason**
El Paso Exploration and Production

**Colette Hirstius**
Shell Exploration & Production

**Dawn S. Kaback**
Geomatrix Consultants

**Eric Leonard**
Colorado College

**Ben Lowry**
Colorado School Of Mines

**Dean Miller - Chair**
Davis Graham & Stubbs, LLP

**Erik Oerter**
Colorado Geological Survey

**Penny Patterson**
ExxonMobil Exploration Company

**Anna M.R. Wells**
St. Anselm Exploration

**Joe Zamudio**
ITT Visual Information Solutions

## Faculty Activities

**Becky Flowers'** group is engaged in tectonics projects in Canada, Montana, Colorado, Costa Rica and South Africa. PhD student Alexis Ault continues her thesis work using low temperature thermochronometry to resolve the history and causes of burial and unroofing in the northwestern Canadian shield, and published a 2009 paper in EPSL on this topic. Becky and Alexis are collaborating with faculty member Kevin Mahan and MS student Katy Barnhart using structural analysis, geochronology, and metamorphic petrology to decipher the evolution of a lower crustal exposure in the Wyoming Craton. Alexis and Katy spent 6 weeks of summer 2009 carrying out geological mapping in the Madison Range of Montana focused on this problem (see photo). MS student Rachel Landman is working in central Colorado to resolve the Tertiary cooling and unroofing history of the Gore Range and its implications for the role of the Rio Grande Rift in the evolution of the Rocky Mountains. Rachel spent several weeks of fieldwork in the Gore Range in summer 2009, and was awarded a 2010 Exxon Mobil Geoscience grant to expand her studies in the region during the coming summer. Undergraduate Ryan Nell is participating in a pilot study in collaboration with Rutgers University and Costa Rican colleagues to evaluate the viability of using low-temperature thermochronometry to decipher the erosional history of the Talamanca Range, Costa Rica. Ryan spent several days in Costa Rica in January 2010 collecting samples for this project. Becky also recently obtained NSF funding to launch a new project in South Africa aimed at understanding the timing and causes of uplift of the southern African Plateau.

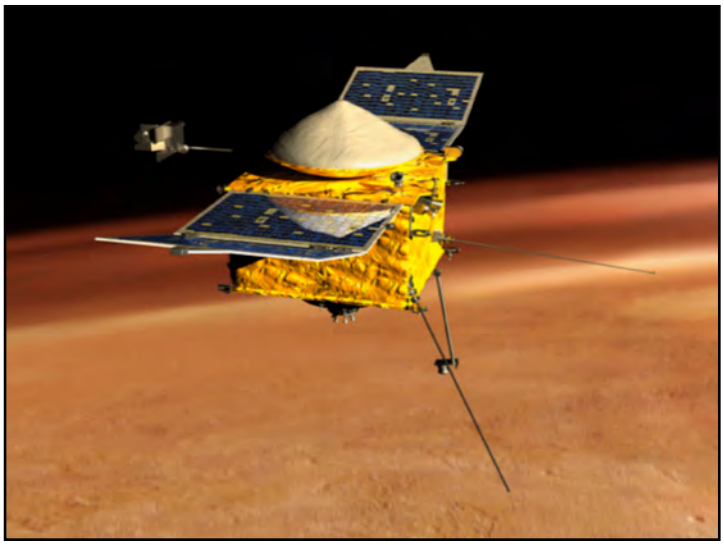
**Professor Brian Hynek** recently returned from 10 weeks in Antarctica, as part of NASA's 2009-2010 Antarctic Search for Meteorites recovery team. In the past 33 years, this program has collected over 10,000 meteorites – more than one third of those known to date. Meteorites are key for reconstructing the earliest times and conditions of our solar system and they also record planetary formation and evolution. The team was flown in by ski plane to a remote camp in the Miller Range for 45 days of searching. The nearest neighbors were 400 miles away at the South Pole. An invitation was sent to them for our Christmas Dinner and New Years Eve parties, but no one showed up. Days in the field were spent searching half a million year old blue ice fields with snowmobiles and on foot in regions so isolated that the only rocks present came from outer space. While enjoying "pleasant" weather and 24 hours of sunshine a day, the team of eight collected over 1000 meteorites for future study by researchers around the world. This was probably the most successful season ever in terms of scientific quality, with the recovery of three martian basalts, at least five lunar samples representing mare, highlands and impact breccia, three pallasites (core-mantle boundary material of a differentiated asteroid), several irons (asteroid core samples), and over two dozen HEDs (rocks from the asteroid Vesta's surface lava flows and also mantle material). This season's bounty will keep the meteorite community working for years to come.

Typical Antarctica attire to ward off frostbite

Alexis Ault, Katy Barnhart and Kevin Mahan mapping in the Madison Range Montana in July 2009

The MAVEN spacecraft mission to Mars, being led by GEOL **Professor Bruce Jakosky**, is on track for a November 2013 launch to the red planet. MAVEN is the Mars Atmosphere and Volatile EvolutioN mission. It is designed to determine the role that escape of the Martian atmosphere to space over time played in changing the climate from an early, warm and wet environment in which life might have existed to the cold and dry place that we see today.

MAVEN was selected through an intense two-stage competition from 20 proposals. CU's partners on the mission include NASA's Goddard Space Flight Center, University of California at Berkeley, Lockheed Martin, and NASA's Jet Propulsion Laboratory. The total mission cost is capped at $485M (expressed in



Artist's conception of the MAVEN spacecraft in orbit around Mars. For scale, the High-Gain Antenna (at top, covered with a white shroud) is 2 m in diameter

2006 dollars, when the competition began), equivalent to more than $600M over the project lifetime.

The project this year is in what is called Phase B in NASA parlance. During Phase B, the spacecraft and instrument designs are developed in more detail and compared against the requirements to ensure that they can carry out their functions. It culminates in a Preliminary Design Review, a week-long review in front of a Review Board whose members have the experience to see if the team has made solid engineering decisions that won't create problems. The PDR is scheduled for July.

After a ten-month journey beginning at launch, MAVEN will go into orbit around Mars in September 2014. It's orbit allows it to obtain measurements of the Martian upper atmosphere, along with remote-sensing of the entire atmosphere. It's primary science mission lasts one Earth year, but it carries enough fuel for an extended mission of at least a second Earth year.

In addition to Jakosky being the mission Principal Investigator in charge of the entire project, CU's Laboratory for Atmospheric and Space Physics will be providing two of the science instruments, operating the Science Operations Center, and leading the effort for education and public outreach. Students will be involved in all aspects of the project, giving them an educational opportunity that few undergraduates have.

**Gifford Miller** reports a busy year of field and administrative activities. The AGU awards ceremony honoring new Fellows was a special treat, with the award being presented by AGU President Tim Grove. Tim and Giff were undergraduate classmates together at CU-Boulder in the early 1970s….Tim is now on the faculty at MIT. 2010 includes a 3-week field season in the highlands of Iceland during February-March with PhD students Kate Zalzal and Darren Larsen, and University of Iceland colleague, Aslaug Geirsdottir, a former CU-PhD. They recovered sediment cores from lakes to reconstruct climate histories. A 7-week field season along the west coast of Australia is scheduled during May and June of this year to provide an archaeological context to his recent finding of human cooked eggshells of a 200 kg giant extinct bird. He will be accompanied by MSc student Chris Florian and a cadre of Australian and US colleagues. He follows the Australia leg with a 3-week field campaign to northern Baffin Island in July – August with PhD students Kurt Refsnider and Kate Zalzal. The Baffin campaign includes 34 hours of helicopter support to quantify the rate of disappearance of the Barnes Ice Cap, the last remnant of the great North American ice sheet that covered much of the continent 20 thousand years ago, and with the current intense warming of the Arctic, is now starting to melt rapidly. Helicopter support also allows access to other small Baffin Island plateau ice caps that are receding rapidly. These non-erosive ice caps expose the plants that were living there when they formed as they melt back. Radiocarbon-dating these plants allows Giff and his students to place the current warming in a millennial perspective and to quantify the timings of ice-cap growth. In addition to his research activities, Giff has recently been appointed Associate Director of INSTAAR, where he hopes to build on his experience overseeing the design and construction of the Benson Earth Sciences Bldg to do the same for a new INSTAAR building. Donations by devoted alumni are encouraged.

**Karl Mueller** reports "It's been an interesting year." An undergrad field course in active tectonics kept Karl busy running around the Eastern California shear zone with 16 undergrads over spring break. The course focused on mapping and analysis of active structures, including spectacular strike slip and normal fault zones in Death Valley, Owens Valley and Panamint Valley.

Giff Miller with PhD students Darren Larsen and Kate Zalzal in Vestvirdir, northwestern Iceland, during their Feb 2010 field campaign to recover sediment cores from lakes on the high plateau near the Drangajokull Icecap. The cores will allow them to develop high resolution records of Holocene climate variability, under sponsorship from the US and Icelandic science foundations (NSF and RANNIS)

These active slipping faults have all recently been scanned with an airborne laser (Lidar) as part of the Earthscope Program. Students used the super high-resolution lidar topography (which resolves objects the size of a creosote bush) with imagery from Google Earth to map active faults, and uncover evidence for recent earthquakes.

While Dr. Mueller saw plenty of evidence for recent fault movement on the field trip, the magnitude 7.2 earthquake that occurred on Easter Sunday in Baja California was really remarkable. As luck would have it, the earthquake occurred in an area that he had mapped as a graduate student 25 years ago. He made it to San Diego in time to join a team of earthquake geologists heading into Mexico to map the rupture and measure offset features along its 50-kilometer length.

The landscape was a geological wonderland. 1-3 meter high fault scarps ripping across the desert landscape, rock shrapnel covering the floor of canyons, sandblows caused by liquefaction and large rockfalls triggered by aftershocks while we camped alongside the fault.

After mapping all day, everyone regrouped in camp to cook dinner and review the day's discoveries. What a difference 25 years have made - professors and graduate students sat around the campfire downloading GPS waypoints, fault traces and offsets features into laptops. Things got a little surreal when a helicopter from a civil defense agency landed while Karl was walking across a playa and asked what the heck he was doing in the middle of nowhere and whether he needed any help. The next day, a larger helicopter arrived and deposited a couple of reporters from a local newspaper to interview geologists and get a quick lesson in earthquake geology.

All in all, it was clear that technology has transformed fieldwork in the earth sciences, in particular the use of small, handheld devices that simplify mapping and allow different datasets to be immediately compiled in a digital format. NSF has already funded a RAPID proposal to run high-resolution lidar along the fault rupture, due out in about another month. A video on YouTube captured the dust cloud generated during the earthquake (it looked like Armageddon), while geophysicists generated displacement fields of the ground displacement within a matter of days. What an absolutely amazing world we live in.

During the last year, **Matt Pranter** and his research group (Reservoir Characterization and Modeling Laboratory – RCML; http://spot.colorado.edu/~pranter/Reservoir3.html) have been very active. Since 2003, they have conducted research on the fluvial and shallow-marine deposits and associated natural-gas reservoirs of the Cretaceous Mesaverde Group in the Piceance Basin. A primary research goal is to obtain statistical information and develop conceptual models of deposition that are applied in the analysis, interpretation, and modeling of the sedimentary deposits and reservoirs. The research involves a combination of detailed outcrop and subsurface studies based on cores, geophysical logs, 3-D seismic, and other data. Outcrops have been evaluated on the southeastern and southwestern basin margins and most recently work is focused on the Douglas Creek Arch. Subsurface studies on the Williams Fork Formation have focused on the most productive region in the southern portion of the basin at Mamm Creek, Rulison, Parachute, and Grand Valley fields. Matt's research in the Piceance Basin has been sponsored by 18 companies, the American Chemical Society–Petroleum Research Fund, and through a grant from the Research Partnership to Secure Energy for America (RPSEA; Department of Energy). To date, there have been 14 graduate students, 2 postdoctoral research associates, as well as numerous undergraduate students involved in the research through the RCML. Most recently, Matt and the RCML conducted their annual research meeting in Boulder for their industry associates. The event was well attended (40 representatives from industry; 50+ attendees overall). Graduate students, researchers, and faculty presented talks and posters on their research results.

Three of Matt's graduate students will complete their Masters programs this summer. Rachel Shaak's research has involved the detailed analysis and mapping of the stratigraphic architecture of shallow-marine to coastal-plain strata of the lower Williams

A 2 meter high fault scarp created in the Magnitude 7.0 Easter Sunday Earthquake in northern Baja California. Other features created during the earthquake include eruptions of mud and sand (called sandblows), rockfalls, eruptions of steam along the fault and thousands of aftershocks

Fork Formation in the southeastern Piceance Basin. Rachel will begin her career as a petroleum geologist with ExxonMobil in the fall. Alicia Hewlett will defend her research on the analysis and modeling of the fluvial architecture and static connectivity of the Williams Fork Formation at central Mamm Creek Field. Alicia will begin her career at Devon Energy this fall. Sait Baytok will finish his program and return to Turkey to work with Turkish Petroleum Corporation. Sait's research has focused on the stratigraphy and structural geology of the Williams Fork Formation based on 3-D seismic data and seismic-attribute analysis. Matt's other graduate students, Adel Aboktef, Ali Drushal, Ericka Harper, Kim Hlava, and Jeremy Ring will continue their field-based and subsurface research that varies from the stratigraphic controls on sandstone diagenesis to outcrop-based statistics of reservoir-scale fluvial deposits. RCML postdoctoral researcher, Xiangyang Xie, will become a new Assistant Professor in sedimentology and petroleum geology at the University of Arkansas – his appointment begins in June 2010. Congratulations Xiangyang!

Matt and his students started a new research project this spring that is funded through the National Energy Technology Laboratory and involves the assessment of scale on pore-volume and especially permeability estimates for geologic storage of CO2 in saline aquifers in Colorado sedimentary basins. In addition, Matt is currently collaborating with Dr. Steve Sonnenberg, Charles Boettcher Distinguished Chair in Petroleum Geology at Colorado School of Mines, to develop a research consortium with a primary focus on the more unconventional shale and tight sand/silt/chalk resources of the Mancos/Niobrara formations in the Denver-Piceance-Uinta Basins. This project will merge areas of expertise in petroleum geology and reservoir geology and geophysics at CSM and CU to address the stratigraphic and structural controls on reservoir heterogeneity and productivity associated with the Mancos/Niobrara formations.

Matt continues to be active in AAPG and SEPM, serves as an Associate Editor for the AAPG Bulletin, co-chaired sessions on Tight-Gas Sandstones and Carbonates at the 2009 AAPG/SEPM Convention in Denver, and was co-leader of a 2009 SEPM Piceance Basin Field Trip. At the recent AAPG/SEPM Convention in New Orleans, Matt and his graduate student, Alicia Hewlett, were co-authors on a poster on fluvial reservoir modeling, and Matt taught a "sold out" 2-day short course entitled "From Rocks to Models: Reservoir Geology for Graduate Students".

In fall 2009, Matt taught Introduction to Geology and his graduate-level Petroleum Reservoir Characterization and Modeling course which included a field trip to the Piceance Basin to evaluate the excellent exposures of the Cretaceous-age Iles and Williams Fork formations. In spring 2010, Matt was very excited to teach, for the first time, his new undergraduate (Junior-level) course, Introduction to Hydrocarbon Geology (GEOL 3540). Matt's undergraduate course addresses a range of topics in petroleum geology (see page 11 for additional details).

Professor **James Syvitski** was presented with the A.G. Huntsman Award in Marine Science by the Royal Society of Canada during a November 2009 ceremony. This award was established in 1980 by the Canadian marine-science community to recognize excellence of research and outstanding contributions to marine sciences. James' scientific interests include fjords, rivers, deltas, estuaries, particle dynamics, simulation of sediment transport and stratigraphy, continental margin sedimentation, gravity flows and animal-sediment interactions. A recent study led by Syvitski and published in Nature Geoscience in Sept of 2009 found that most of the world's low-lying river deltas are sinking because of human activity. Delta subsidence makes these areas increasingly vulnerable to flooding from rivers and ocean storms and puts millions of people at higher risk. Syvitski's team found several causes of delta subsidence, including the trapping of sediments that would normally be delivered to river deltas, human construction of levees that move sediment into the oceans and bypassing the floodplains where they would normally settle, and the compaction of floodplain sediment due to groundwater and natural-gas extraction. Results of the study include the prediction that global delta flooding could increase by as much as 50 percent by the end of the century, assuming sea-level rise of about 18 inches by then. James, who is former director of INSTAAR, is currently executive director of CU's Community Surface Dynamics Modelling System, which involves hundreds of scientists from dozens of universities and federal labs. It is funded by the National Science Foundation.

Abstracted from the Colorado A&S Magazine.

James Syvitski receives the A.G. Huntsman Award

# Other Faculty Activities

## Becky Flowers receives NSF Career Award

Assistant Professor **Becky Flowers** has been selected to receive a National Science Foundation CAREER Award. The NSF's Faculty Early Career Development Program, or CAREER, is one of the nation's most prestigious honors directed toward young faculty. The 2010 awards, which come with a five-year grant of up to $530,000, are a great boost to faculty in establishing integrated research and educational activities while helping to address areas of important need.

Becky' research will use recent advances in thermochronological tools to investigate the uplift and erosional history of the southern African Plateau, a unique and particularly intriguing example of continental plateau uplift. This plateau attained >1.0 km of elevation after late Paleozoic time while distal from convergent plate boundaries, unlike most other major continental plateau settings in which horizontal contraction was substantial during plateau elevation gain. Four research questions motivate and will be addressed by Becky's study: 1) What is the unroofing history of the elevated interior of the southern African plateau, and what are its implications for plateau surface uplift given that denudation is a likely response to elevation gain? 2) Is there a spatial heterogeneity of Mesozoic unroofing that mimics the spatial sweep of Mesozoic magmatism, kimberlite emplacement, and regional lithospheric heating across the region? 3) Is regional unroofing instead attributable to the integration of plateau interior-draining river systems in Mesozoic or later time? 4) Is there a phase of accelerated unroofing in post-Cretaceous time that could be attributable to a phase of plateau surface uplift?

Barberton Greenstone Belt region in the eastern Kaapvaal craton, South Africa. This area encompasses an eastern segment of the "Great Escarpment" that separates > 1 km elevations of the southen African Plateau from the coastal plain

University of Colorado graduate student William Yeck servicing Bighorns broadband seismic station near Burgess Junction, Wyoming

## Bighorns Arch Seismic Experiment
### by Anne Sheehan

**Prof. Anne Sheehan** and colleagues from Texas A&M, the University of Wyoming, the University of Texas at El Paso, and Colorado College are currently conducting a large seismic imaging experiment centered on the Bighorn Mountains in Wyoming. The project is sponsored by the NSF EarthScope program www.earthscope.org. The project includes both seismic passive source (naturally occurring earthquakes) and active source (man-made energy sources) components. The passive source experiment began in summer 2009 and the active source experiment will take place in summer 2010. Over 2000 seismometers (40 broadband, 170 short period, 2000 high frequency) will be deployed by 50 students and other researchers. The goal of the project is to seismically image the deep crust and upper mantle structure to test tectonic models of foreland arch formation. The density of the sampling will allow these researchers to make seismic reflection-style images that penetrate the crust. More information on the project can be found at www.bighorns.org.

Chuck Stern receives an honorary degree From Universidad de Magallanes in 2009

## Rapid erosion of the Arctic coast
### by Bob Anderson

Bob Anderson and colleagues Irina Overeem (INSTAAR), Cam Wobus (CIRES/Stratus Consulting) and Masters student Nora Matell have documented extremely rapid erosion rates along the edge of the Beaufort Sea, North Slope, Alaska. The coastline in this region, as is the case in many regions surrounding the Arctic Ocean, consists of ice-cemented peats and silty sediments. Erosion occurs when the ice cement melts. Using a combination of meteorological stations, direct measurements of erosion, and time-lapse cameras, they show that mean annual erosion rates of 15 m/year result from thermal notching of this silt-rich permafrost. This landscape is protected from erosion as long as sea ice covering the Beaufort Sea is land-fast. But as sea ice departs in mid-summer, the erosion rates pick up markedly. The researchers talk about the problem as a triple-whammy that reflects high sensitivity of the coast to the warming of this portion of the globe: as climate warms, i) sea ice departs earlier in the summer and returns later, exposing the coastline to erosion for a longer period; ii) the longer sea ice is away, the warmer the ocean can become, enhancing instantaneous melt rates; and iii) the longer the ice is away, the further its edge will be, meaning that waves can be larger, with attendant enhancement of their efficiency in delivering oceanic heat to the coastal bluffs. The researchers must therefore monitor both the atmospheric and the oceanic conditions.

The cameras can be put in either "event mode" or pure time-lapse mode. In this instance the event mode captured a polar bear sow and her cub lolling around the camera site, the cub using the stadia stick as a scratching post. Failed and tilted blocks along this entire reach of coast reflect recent notching by the ice-free ocean

Thermal notch cuts into ice-cemented silts of the Beaufort Sea coastline near Drew Point, Alaska. Massive ice wedges punctuate the sediments, raising yet higher the ice content of the material. All the ocean has to do is deliver the heat to melt the ice

The time-lapse movies show rapid growth of notches as the sea ice departs, ultimately leading to the toppling of large blocks of permafrost whose interstitial ice then melts quickly in the ocean. The silty sediment released upon the melting of the permafrost simply wafts away in the ocean, and does not stick around to protect the coast (as would gravel or sand). This means that there is effectively no brake on the system; if anything this process ought to lead to acceleration of erosion rates through time.

This phenomenon is occurring on both the coastline of the ocean, and coasts of the many thousands of lakes that dot this landscape.

This summer's effort will involve deployment of higher resolution cameras to capture the erosion processes in action.

# Undergraduate Program

## The department is growing - Fast!

Across the country, the number of undergraduate geology majors is on the rise. The American Geological Institute (AGI) reports that geology program enrollments are up 24% nationwide since 2006. Growth here at CU is far outpacing even that impressive number. At the beginning of the 2007-2008 academic year, the number of majors in Geological Sciences stood at 87. By the beginning of the 2008-2009 academic year, that number had swelled to 139. We started off this academic year with 157 majors and by October there were 183. Thanks to December graduations, there was a slight drop in numbers, but that was short-lived. Lately, we've averaged three new majors per week, and, at last count, the department was home to 194 undergraduate majors. Thanks to the leadership of several graduated and soon-to-graduate students, the Geology Club has been helping that expanding major population stay in touch with one another. The department may be growing, but it retains the friendly, intimate atmosphere that so many of you have commented was an invaluable part of your CU geology experience.

## Three new undergraduate courses were offered this year:

**Critical Thinking: Rates and Dates in Earth Sciences**

Becky Flowers, aided by Science Education Teaching Fellow Andrea Bair, launched a new undergraduate course entitled: "Critical Thinking: Rates and Dates in Earth Sciences". The purpose of this class was to introduce students to critical thinking by examining how we resolve the timing of events and rates of processes in Earth Science. Nineteen students ranging from sophomores through seniors completed the class in spring 2009. The course began by considering historical arguments and views on the age of the Earth, explored the modern scientific view, and evaluated the evolution of thought on this issue. It then covered a variety of topics on which much active scientific research is focused. How do we go about determining when mountains rose and when rivers carved canyons? How do we resolve the precise timing of mass extinction events, or when major "Snowball Earth" episodes occurred in Earth history? How do rates of processes on Earth inform us about landscape and climate change over time, and relate to human time scales? The class especially emphasized how to effectively read, critique, discuss, and present scientific papers, with a focus on primary literature that highlighted current scientific controversies. Post-semester student surveys and interviews revealed that students felt the most beneficial aspect of the course was their increased confidence and competence reading and critically analyzing scientific papers.

The inaugural class of the new Introduction to Hydrocarbon Geology (GEOL 3540) course. The picture was taken just before their last exam – do they look stressed? Front row seated: Kara Epple, Sara Heinle, Lauren Wenner, Elyse Myers, Nathan Sahlin. Back row standing: Matt Pranter, Jacob Szarzec, Charles Dalton, Snir Attia, Samuel Shiverick, John Kinney, Patrick Boulas, Connor Newman, Ryan O'Hara

**Critical Thinking: Colorado Rocky Mountains**

Peter Molnar and Lon Abbott teamed up this spring semester to offer another critical thinking course, this one an exploration of how, when, and why the Colorado Rocky Mountains exist. Geological science, with its fragmentary evidence of past events and the inherent feedbacks between potential causative mechanisms, is ideally suited to achieve the educational objective of challenging students to think critically. The geologic story of the mountains that rise right behind campus, topography near and dear to the hearts of virtually all Boulder residents, presents students with a particularly challenging critical thinking puzzle that is well-suited to engaging their interest on a personal level.

No consensus exists about when the present incarnation of the Colorado Rockies rose to their current height above sea level. Without the benefit of firm constraints on when the mountains rose, the mechanism of their surface uplift remains a puzzle. Are the mountain peaks Laramide leftovers, exhumed in geologically recent times by enhanced erosion along modern rivers such as the Arkansas and the South Platte? Are our modern mountains, instead, the result of a spasm of post-Laramide surface uplift that raised a formerly low-lying patch of North America to become the lofty state we know today? If so, when did that spasm of surface uplift occur and what triggered it? And, whatever mechanism one invokes to explain the height of the 14'ers and the other mighty peaks, it must not neglect an explanation for the unusual height of the Great Plains next door. Denver is, after all, the Mile High city.

Students in this class challenged themselves to draw their own conclusions about the timing and mechanism of mountain formation in Colorado based on their critical analysis of 28 primary papers that reach conflicting conclusions and on a guest presentation by Craig Jones, the leader of an interdisciplinary, multi-institution research proposal with the goal of answering some of these long-standing questions. Students then worked in teams to devise their own proposals for research that offers the potential to enhance our understanding of the history and the dynamics of this puzzling patch of North American real estate. These teams presented their proposals to the group in 10-minute, oral presentations modeled after an AGU or GSA special session.

**Introduction to Hydrocarbon Geology**

For the first time in more than 25 years (if not longer), Matt Pranter was very excited to teach an introductory petroleum geology course at the undergraduate level at the University of Colorado! Matt's new undergraduate (Junior-level) course, Introduction to Hydrocarbon Geology (GEOL 3540) addresses a range of topics in petroleum geology using a petroleum systems approach – from source rocks, seals, and traps to petroleum reservoirs, subsurface mapping, 3-D reservoir modeling, and reserves estimation. Students worked on several class exercises. Some exercises were on paper; however Matt believes that for a class on petroleum geology, the students should be exposed, as much as possible, to methods that are actually used in the petroleum industry – therefore, for several projects, the students used similar methods and software that they would use in industry for mapping, creating cross sections, or for reservoir modeling (e.g., Petrel®). The Hydrocarbon Geology course had 15 undergraduate students (see figure) that were primarily geology majors but also included chemical engineering and math majors. Graduate student, Ali Drushal, was the TA/Grader for the course this spring. Matt plans to teach his new course every spring semester.

## Department Integrates Undergraduate Learning Assistants

The Department of Geological Sciences is the latest department to join CU-Boulder's Learning Assistant (LA) Program. The LA Program was designed to tackle the national need for improved science, technology, engineering, and mathematics (STEM) education in K-12 and college levels. The program is currently funded in large part by the National Science Foundation and in smaller part by participating departments. It was developed around three primary goals: (1) improve the quality of STEM education by supporting the implementation of evidence-based best teaching practices in CU STEM courses, (2) recruit and prepare STEM majors for careers in K-12 teaching, and (3) engage STEM university faculty in the recruitment and preparation of future K-12 teachers.

For three consecutive semesters (Spring 2009, Fall 2009, and Spring 2010), the Department has incorporated undergraduate Learning Assistants (LAs) in two different courses – Introduction to Geology Lab 1 and Environmental Geology. LAs for these courses are undergraduate geology majors who have an interest in future careers teaching K-12 science and math. Through a combination of a weekly education seminar and classroom and field teaching experience, they are trained to integrate course content, pedagogy, and practice. These LAs are explicitly hired to support the implementation of best-teaching practices in college-level geology courses while simultaneously providing them transferable teacher preparation experience as well as mentorship from college-level instructors.

Introduction to Geology Lab 1 is taught by graduate student instructors (GSI) who may partner with undergraduate LAs to teach both in the geology lab and in the field. Environmental Geology enrolls about 60 undergraduate students and is taught by a professor who incorporated three LAs into her Fall 2009 course to assist with hands-on small-group activities during the class period.

Integrating LAs into these courses has proven to be a win-win-win situation for LAs, instructors, and students enrolled in the courses. LAs gain teaching experience, instructors receive assistance in facilitating small-group and one-on-one learning experiences in the classroom and field, and students in courses with LAs find overwhelming value in having LAs be a part of their learning experience. Students in these courses who were surveyed said that their LAs helped to promote their conceptual understanding of course material, provided individual contact time when the instructor was with other students, and stimulated their interest in geology.

LA Casey Kidney (left) and GSI Alex Dutchack (right) discuss a lesson

## Update on the Science Education Initiative

The Department is finishing its fourth year in the campus' Science Education Initiative, which is addressing the way science is taught to majors and non-majors alike. In Geological Sciences, individual faculty members volunteer to partner with one of three post-doctoral Science Teaching Fellows (STFs) hired by the Department to implement and assess changes in lectures, labs, homework, and other class activities. The goal is to use approaches and materials known to be effective in the teaching and learning of science. The current STFs are Andrea Bair, MikeVredevoogd, and Leilani Arthurs who received their PhDs in Geology from the University of Nebraska, University of California-Riverside, and Notre Dame, respectively.

Reform of an individual course involves defining student learning outcomes (what the students should be able to do as a result of taking a course), evaluating what is taught and how it's taught, developing and implementing approaches to facilitate student learning, and assessing actual learning outcomes. The focus the last two years has been on upper division courses. Examples of changes in these courses include:

**In Fluid Earth**, STF Mike Vredevoogd and Professor Greg Tucker introduced weekly reading assignments and experimented with small group and whole-class discussions of those assignments. The goals were to improve students' preparedness, and promote greater depth of knowledge, comprehension and retention. To promote preparedness, students were required to write summaries of the readings prior to a class meeting.

While working with Professor Joe Smyth and Teaching Assistant (TA) Kristin Jacob, STF Andrea Bair found the use of "warm-up" activities in **Mineralogy** labs were an effective strategy for improving student focus and learning. The warm-ups are activities that ease students into a specific concept or task that is central to the activities they confront that day. Instead of passively listening to a TA lecture on how to do an exercise, students work through an activity that has them develop, for themselves, the key links between activity and concept. An example of a warm-up activity is an interactive demonstration of basic optical properties of minerals, with questions that connect to knowledge delivered in class lectures. The warm-up begins with the TA demonstrating the appearance of opaque, isotropic, and anisotropic minerals in thin section. Students share their observations in a whole-class discussion and fill in a chart comparing and contrasting the appearance of minerals in the different polarizing configurations. Students then work in groups to answer questions relating the crystallography of the minerals to how those minerals must transmit light to produce the unique patterns observed. The TA monitors each group's work and the students utilize the completed chart and the other products of the warm up throughout the remaining lab exercise. Warm up activities are now being designed for other major-track courses.

**In Environmental Geology** and in **Oceanography**, STF Leilani Arthurs's developed pre/post assessment instruments called concept inventories. These are tests that provide information about student thinking on the fundamental concepts of a course. Administering a concept inventory at the beginning of a semester identifies student knowledge and student misconceptions on specific concepts before those concepts are taken up in lecture. For example, Leilani found that, prior to the start of Oceanography, some students believe ocean basins are topographically lower than continents because the mass of the ocean water depresses the ocean floor, or ocean basins are voids that formed when plates spread apart, or ocean basins formed from erosion of the continents by waves and running water. Instructors can modify their teaching plans to bridge the gap between what students know entering the class and the desired end-of semester learning outcomes. Administering the inventory at the end of the term allows comparison of the pre- and post-instruction results, which quantifies actual student learning gains made during the semester. This reveals where students' highest learning gains were made and identifies persistent alternate conceptions. Knowing this, faculty can continue to improve the focus and effectiveness of their teaching.

These examples are but some of the ways in which the science education initiative is impacting the education mission of the Department. Not all faculty have chosen to participate in the initiative, and not all courses will receive "treatment" before the funding for the STFs expires in June 2011. But faculty who have participated report that transformation can be challenging to them, but worthwhile in the long run. They find many students are definitely more engaged in their learning, there can be more substantive student-professor interaction, and the entire process of teaching can be far more rewarding.

LA Geoffrey Burtner (left) and GSI Stephanie Higgins (right) inspect a map

## Field Trips

Dean Miller giving "counsel" on the 2009 Bill Bradley Field Trip

Graduate students, faculty, alumni and friends on the 2009 Bill Bradley Field Trip

Bob Anderson leading the way on the 2009 Bill Bradley Field Trip

### Vertebrate Paleontology Field Trip

This past spring, Jaelyn Eberle took her vertebrate paleontology class to Pawnee National Grasslands in search of fossil bones and teeth of ancient mammals that once roamed northeastern Colorado some 32-35 million years ago. The fossil-bearing rocks of the White River Formation are best known for their extraordinarily preserved skulls and skeletons of rhinoceros and unusual, pig-like animals coined entelodonts. Despite having been prospected for well over a century (including by the famous, feuding paleontologists E.D. Cope and O.C. Marsh in the 1870s), Colorado's White River Formation is still rich with fossil bones and teeth, and is ripe for further field studies in paleontology. Notwithstanding the cold temperature, threatening skies, rain and snow in the forecast (spring in Colorado!), Jaelyn's students uncovered some pretty neat fossils, including a dozen mammal jaws and teeth and a rare partial rodent skull. The fossils have been incorporated into the extensive collection of Eocene-Oligocene mammals from the White River Formation housed in the University of Colorado Museum's (UCM) fossil vertebrate collection. Honing their fossil identification skills, several students volunteered to identify and catalog their specimens into the UCM fossil collections.

Jaelyn is excited to teach the department's Paleobiology course (GEOL 3410) in fall 2010, working with the department's Science Education Initiative (SEI) whose goal is to improve the teaching and learning experiences in undergraduate geology courses. Jaelyn will also teach a course entitled Paleontology Practicum (MUSM 5914) through CU's Museum & Field Studies (MFS) graduate program this fall.

Daniel & Ben on an outcrop in Pawnee National Grasslands

## 2009-2010 Undergraduate Mentoring Program

**Daniel Griffits** worked with PhD student, Ursula Quillman in the micropaleontology lab. Daniel learned how to identify different species of foraminifera and the procedure for picking samples in the lab. Daniel hopes to turn his work with foraminiferal assemblages into an honors thesis. He comments that his project has confirmed that doing research is fun and interesting.

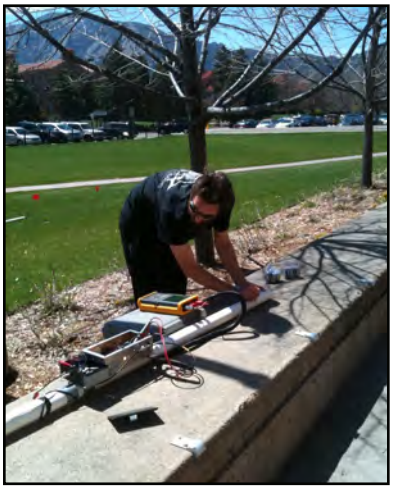
**Joshua Kelly** worked on writing and maintaining software for seismic time series deconvolution. He states, "I did not realize that the earth was so dynamic and am fascinated that you can use an earthquake across the globe to probe the structure on the other side of the planet."

**Katherine Anarde, Travis Kelsay, and Graham McClave** worked with graduate student, Kevin Befus and Prof. Anne Sheehan on a geophysical study of the Boulder Creek watershed. For two months last summer, they performed shallow seismic refraction surveys in the shadow of the Indian Peaks in the Boulder watershed. Graham commented: "To me, this was extremely valuable as it helped me develop more fieldwork skills, but also gave me pertinent insight on what I might expect as graduate student starting out with my own project. All in all, this experience proved to enhance my abilities as an aspiring geoscientist, and also affirmed my desire to continue on in my education as I look to pursue a career in petroleum geology." Katherine offered the following comments: "Most of my work in the field involved operating the computer (Geometrics StrataVisor) to read the subsurface images. From this experience I was able to go beyond theory and actually apply geophysical methods to a tangible data set. Overall my mentorship increased my passion for the geosciences while enabling me to gain valuable field experience pertinent to future graduate studies." And Travis wrote: "While working for Anne and Kevin I was able to gain greater insight into the fieldwork associate with a geophysical experiment outside of the classroom setting. This experience helped me refine my geologic interests, which in turn helped me with deciding on a graduate program."

Mentorees Katherine Anarde and Graham McClave hiking in to field area, Green Lakes Valley, Colorado

Graduate student Kevin Befus, Professor Anne Sheehan, and undergraduate geophysics crew (Austin Andrus, Katherine Anarde, Travis Kelsay, Graham McClave) returning from a day of work at Green Lakes Valley

**Justin Ball** worked under the mentorship of Vera Schulte-Pelkum writing computer programs to automate some formerly tedious seismic quality control tasks. He also deployed seismometers in the Bighorn Mountains in Wyoming. "I learned to program in Matlab for this project, which I now use daily for school and work. My work in the field was fulfilling and the experience solidified my interest in a geophysics career."



Justin Ball testing home-made electromagnetic ground conductivity meter

**Casey Vockrodt** worked with Vera Schulte-Pelkum and Prof. Anne Sheehan doing map plotting (using GMT, the Generic Mapping Tools Unix scripts) on the computer and running Matlab scripts for seismic analysis. He also had the opportunity to work with seismic receiver functions. "This initial opportunity led to another when I was asked to go to Wyoming to help install some seismometers. These geology opportunities have certainly solidified my career path into the field of science."

**Derek Weller** worked with Prof. Tom Marchitto to attempt to discover whether or not the robustness of the calcite tests of benthic foraminifera can be used as a proxy for seawater carbonate ion concentration during the past. "The mentorship program has been a great experience and it has helped to strengthen my intellectual development in academia. In addition, the mentorship program has offered me numerous opportunities to learn valuable career experience and it has provided me with a greater understanding of academic research. I was allowed to explore various laboratory techniques that are used to test scientific ideas and theories."

**Alex McCaffree** worked with MS student Brent Aigler on his thesis research in the Fraser River watershed. The research goal was to construct a groundwater-flow model for the Winter Park Ranch Water & Sanitation District. During the summer Brent and Alex conducted field work in the Fraser Valley including going to groundwater wells and measuring water levels and conducting soil-infiltration and slug tests. "Going to the field allowed me to experience what a true geologist does. We went out in rain or shine, and spent two to four days in the field during each trip. I also spent time working with the laboratory permeameter, measuring the flow rate through rock samples and calculating permeability to provide inputs for Brent's groundwater model."

Alex McCaffree rappelling down the side of an outcrop in the Fraser River watershed

**Danny Burns** was mentored by Suzanne Larsen, Librarian of the Earth Sciences Library and Professor Brian Hynek. Danny undertook the task of trying to develop a digital index for all of the pre-1940 topographic and special/mining maps of Colorado that the Map Library has in its collection. Currently there is only a paper index that is somewhat difficult to use due to the various scales and editions of maps compiled. Danny worked on assembling a digital index using GIS software that would enable library patrons to see what older and specialty maps the library owns.

**Ryan Nell** traveled to Costa Rica with Prof. Becky Flowers to gather samples for preliminary thermochronology data, specifically U-Th/He dating of apatite and possibly zircon. The mentoring scholarship has allowed Ryan to continue with the samples in the rock processing, mineral picking and analysis phases of the project. The research is a pilot study to establish the feasibility of applying apatite and zircon (U-Th)/He thermochronology to the intrusive rocks that comprise the backbone of the Talamanca range to better resolve the timing, rates, and magnitude of cooling, unroofing, and uplift in the region.

CU undergraduate Ryan Nell travelled to Costa Rica in January 2010 to collaborate with the Costa Rican students in acquiring approximately a dozen samples for thermochronology work. The mentoring money has supported Ryan's continued work on this project at CU

**Hannah Wasserman** is participating in the AVID project (Analysis of Variability in Dolomites) with Prof. David Budd. Hannah has been exploring the petrophysical properties of dolomites and limestones and had the opportunity to do field work (outcrop drilling) in Bonaire, Netherlands Antilles. "I have had the chance to become skilled at porosity and permeability measurements as well as other machinery in the lab. There is no doubt that this has been the most influential and worthwhile decision of my college career. I feel that if more students got involved in a project like this one, universities such as ours would be producing more competitive candidates for graduate school as well as for the geologic industry."

## Graduate Teacher Training and the GTP by Elizabeth Swanner

The Graduate Teacher Program (GTP) at CU Boulder aims to develop teaching skills in graduate students as they prepare for careers in academia and other educational fields. The program recognizes that training graduate students in teaching is as important as research training. Nationally these types of programs are on the rise, and the GTP sets the standard. The program offers workshops in intensive sessions in spring and fall, and weekly throughout the semester. Personalized consultation is also available to graduate teachers, who can fulfill requirements for a certificate in teaching or professional development (internship-based).

I have served as the lead graduate teacher in the Geology department from 2008-2010, acting as a liaison between the GTP and the graduate students in the department. In this role I assist graduate students in meeting certification guidelines, particularly videotape consultations (VTC). During a VTC, I tape a graduate teacher teaching, we watch the tape and then generate ideas to improve teacher confidence in the classroom. I also develop and implement projects to improve graduate teaching more generally in the department. One of these projects was creating an online archive of labs developed by previous TAs in the Introduction to Geology Lab (GEOL 1030). This gave incoming TAs (who are also incoming graduate students) some structure for course design in the busy first semester and beyond.

In the past two years, I've witnessed increasing interest in the GTP in our department. We currently have six students pursuing certification, others attending workshops, and many benefitting from the projects within the department. At GTP workshops in the department our graduate students have discussed teaching challenges specific to our discipline and strategies to address them. Our faculty have been involved as panelists in GTP workshops that have been attended by graduate teachers in all science disciplines. I look forward to a continued revival of interest in graduate teacher training in the department and the development of a graduate culture that values our role as current and future academic educators alongside our strength as researchers.

## FRONT OFFICE NEWS by Marcia Kelly

The Geological Sciences front office staff survived another academic year filled with lots of activity, hard work and new software systems that were integrated by the University.

**Joanne Brunetti** continues in her position as the Accounting Tech with humor and efficiency – both strong job requirements! Joanne works hard to ensure the tracking of finances, travel and procurement. The University implemented a new expense system this year, which has required lots of Joanne's time. She is mastering it quite nicely and has trained other staff, students and faculty in the new system. She is very much the center of Department and faculty financial activity!

**Barbara Amaral** continues to enjoy her position as the front office receptionist and does a fine job of greeting students and visitors and handling phone calls with the utmost kindness and a smile on her face. She has many other responsibilities along with the academic scheduling that she works on with an upbeat attitude. There is a new student information system that Barb has worked hard on to master our academic scheduling and helping students to enroll in classes. Again, all with an amazing attitude!

**Marcia Kelly** is just completing her second year in the department as the Office Manager and supervisor. She's settled into the position after a long learning curve and a change with Mary Kraus stepping down as Chair at the end of June 2009. Marcia has greatly enjoyed working with Lang Farmer and looks forward to another fall with a large new crop of graduate students.

From Left: Barbara Amaral, Marcia Kelly, Joanne Brunetti

The staff works hard to facilitate the daily accomplishments of keeping the department running smoothly. We look forward to assisting students, alums, faculty, and emeritus while helping to accomplish the mission of the department in educating the next generation of leading Earth and planetary scientists.

The Departmental office can be contacted at:
Phone: 303.492.8141
Fax: 303.492.2606
Email: geolinfo@colorado.edu

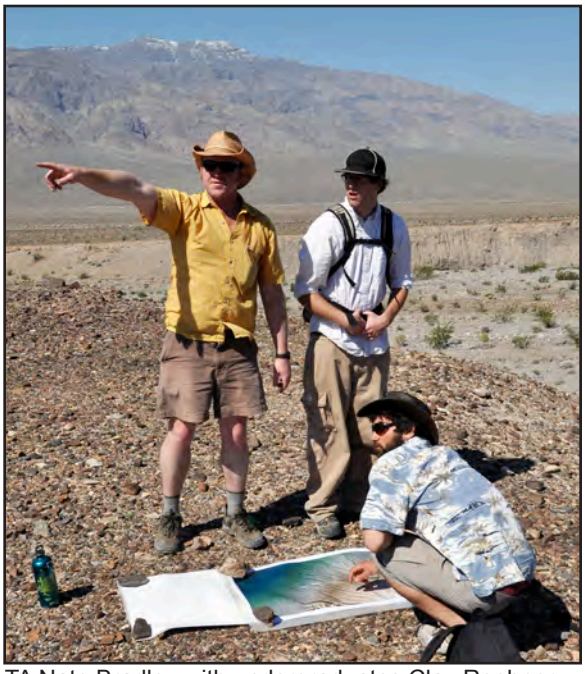
photos by Karl Mueller

Sunset on the Slickrock Member of the Entrada Formation in Arches National Park – an area mapped by undergraduates in Field Geology

Spectacular cross bedding and alteration in Navajo Sandstone in the Coyote Buttes, Northern Arizona

Students in a new course - Field Methods in Active Tectonics at the lowest point in North America – the Badwater salt pan in Death Valley. Support for this course was provided by the Braddock In the Field endowment

Undergraduate students in the Field Methods in Structural Geology traverse across the deformed core of Upheaval Dome in Canyonlands National Park



TA Nate Bradley with undergraduates Clay Roehner and Collin Straus mapping a stream channel offset along the Northern Death Valley fault zone

# News and Awards

## Undergraduate Awards for Spring 2010

| AWARD | RECIPIENTS |
|---|---|
| Assoc. of Women Geologists Outstanding Major | Hannah Wasserman |
| Bruce Curtis Outstanding Junior | Kerry Manley |
| Johnston Memorial Scholarship | Maureen Levoir |
| RMAG Outstanding Senior Award | Mark Robbins |
| T. Keith Marks Scholarship | Katie Anarde<br>Andrew Parker<br>Adam Williamson |

## Graduate Awards for Spring 2010

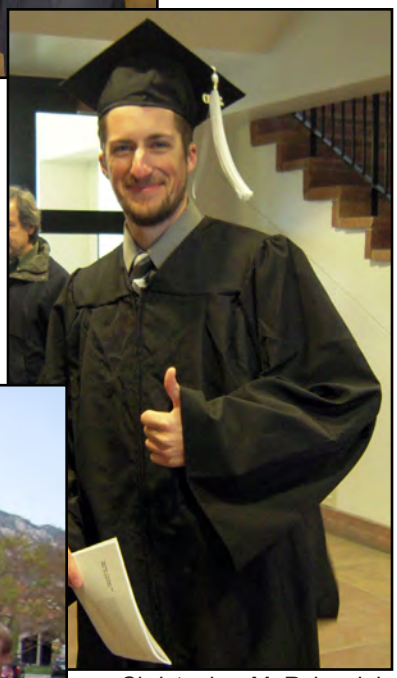
| AWARD | RECIPIENTS |
|---|---|
| Longley, Wahlstrom, Warner | Alexis Ault |
| Spetzler Award for Research | Celia Schiffman |
| W. O. Thompson Award | Kristin Jacob |
| Waldrop Memorial Scholarship | Kate Zalzal |

## Shell Exploration & Production Graduate Research Awards

Shell provided funding that is helping 3 graduate students complete research projects for their degrees.

Leif Anderson
Ursula Quillman
Steven Glaser

Chuck congratulates Morgan McDonnell & her father



Christopher M. Rybowiak

Spring 2010 graduates with faculty

# Geology News

Nicole Cates
& Stephen Mojzsis

Kevin Webster was the one student in Geological Sciences to complete an honors thesis and graduate with honors this spring. He graduated with a double major in Geology and Ecology and Evolutionary Biology. Kevin started as an undergraduate researcher in Prof. Dena Smith's lab early in his career at the University of Colorado and then received funding from the Department of Geological Sciences mentorship program to begin his honors thesis work with Dena. His thesis is titled "The preservation of fossil arthropods in the middle Miocene Barstow Formation, southern California". His research focused on concretions noted for their exceptional, three-dimensional preservation of arthropod remains. Kevin's work provides an important contribution to our understanding of how insects become preserved in the fossil record. In addition, his inventory of the fossil arthropods that inhabited the ancient lake provides clues to understanding the lake's paleoecology. Kevin presented the preliminary results of his honors thesis work at the annual meeting of the Geological Society of America last fall.

Alexis Templeton &
Damhnait Gleeson

Ryan O'Hara

Fall 2009 graduates

# Degrees Awarded (Fall 2009 - Spring 2010)

## B.A. Geology Majors

Rachael Acks
Jeremy Adair
Justin Ball
Michael Beach
Sarah Bruns
Daniel Burns
Sam Cantor
Morgan Tallie Cooper
Jeff Culbertson
Eamon Donovan
Jonathon Galeano
Brian Hankins
Todd Jesse
Travis Kelsay
Casey Kidney
Dylan Lacy
Analisa Maier
Alex McCaffree
Graham Allston McClave
Gregory McCudden
Morgan Kathleen McDonnell
T. Ryan O'Hara
Mark J. Robbins
Danielle Russell
Christopher M. Rybowiak
Kari Justine Schultz
Maxwell Scott
Michael Sweetenham
Kristen Lynn Theesfeld
Kevin Webster
Derek Weller
Adam Nickalas Williamson

## M.S. Candidates Graduating with Degrees

| | Advisor | Thesis Title |
|---|---|---|
| Brent Aigler | Shemin Ge | Hydrogeological analysis of a mountainous groundwater system: Fraser River watershed, Grand County, Colorado |
| Katy Barnhart | Kevin Mahan | Deep crustal xenoliths from the Great Falls Tectonic Zone, Montana: Investigating the timing and mechanisms of high-velocity lower crust formation |
| Kevin Befus | Anne Sheehan | Applied Geophyscial Characterization of the shallow subsurface: Towards quantifying recent landscape evolution and current processes in the Boulder Creek Watershed, CO |
| Eugenia Bribiesca | David Budd | Lateral Variations in Petrophysical, Geochemical and Petrographic Properties of an Avon Park (Middle Eocene) Dolograinstone, Gulf Hammock Quarry, Florida |
| Renee Foster | Paul Weimer | Sequence Stratigraphy of the Upper Cretaceous Middle Williams Fork Formation, Piceance Basin, Northwestern Colorado: Implications for Reservoir Sandstones |
| Kasira Laitrakull | Paul Weimer | Sequence Stratigraphic Interpretation of Jurassic through Oligocene Strata, Browse Sub-Basin, Northwest Shelf, Australia |
| Michael Leibovitz | Paul Weimer | Sequence Stratigraphy of the Upper Cretaceous Upper Williams Fork Formation, Piceance Basin, Northwest Colorado, and its Contribution to the Basin-Centered Gas Accumulation |
| Ben Schupack | Giff Miller | Cryptotephra Detection and Geochemical Analysis in Distal, Arctic Lacustrine Archives |
| Kris Schwendeman | Paul Weimer | Sequence Stratigraphy of the Campanian, Lower Mesaverde Group, in the Piceance Basin, Northwestern Colorado, Through Well Log Analysis |
| Humberto Torres-Sastre | Paul Weimer | Sequence Stratigraphy and Reservoir Architecture of the Blasillo Field (Miocene-Pliocene), Salina del Itsmo Basin, Southeastern Mexico |

## Ph.D. Candidates Graduating with Degrees

| | | |
|---|---|---|
| Treasure Bailley | Lang Farmer | A re-evaluation of the origin of Late Cretaceous and Younger magmatism in the Southern Rocky Mountain Region using space-time-composition patterns in volcanic rocks and geochemical studies of mantle xenoliths |
| Nate Bradley | Greg Tucker | Modeling Sediment Transport with Random Walks |
| Nicole Cates | Stephen Mojzsis | Petrogenetic Histories of pre-3750 Ma Supracrustal Rocks (Alkilia association, West Greenland and Nuvvuagittuq Supracrustal Belt, Quebec, Canada) |
| Katherine Dayem | Peter Molnar | Tectonics and climate of the Tibetan Plateau, China, and the Western Pacific |
| Damhnait Gleeson | Alexis Templeton | Microbial life in cold, sulfur-rich environments: Investigations of an Arctic ecosystem and implications for life detection at Europa |
| Zane Selvans | Karl Mueller | Time, Tides and Tectonics on Icy Satellites |
| Dylan Ward | Bob Anderson | The effects of lithology on glacial landscape evolution paced using terrestrial cosmogenic nuclides: examples from the Colorado Rocky Mountains and the Kichatna Mountains, Alaska Range, Alaska |

## Fundraising Updates

As pointed out in the News from the Advisory Board, our endowments, like those at other academic institutions, have suffered over the past two years. The Department recognizes that this continues to be a difficult financial time for all of us, but we encourage you to consider a gift because your donation is an essential supplement that enables us to provide a variety of special activities for our students.

At this point, the Braddock In-the-Field Fund is sufficiently large enough that it is meeting our various field trip needs. The major funding need is the Curtis Graduate Fellowship. The quality of students applying to the graduate program continues to increase, and more funding would allow us to admit additional, highly qualified students. As well as the Curtis Graduate Fellowship fund, the Department is always in need of general gifts funding. General gifts support a number of important departmental programs including student travel to conferences, activities of the undergraduate Geology Club, and the undergraduate mentor program. The article on p. 14-15 describes the activities of the undergraduate students involved in the mentor program and highlights the value of this experience to their education as geologists. Please consider a gift to the department to allow us to continue providing a high quality education to current undergraduate and graduate students.

**Submit your alumni news @**
**www.cugeology.org**
**click on "Alumni Resources"**
**"Alumni Database"**
**"Submit News..."**

## Alumni Receptions

The 6th Annual CU at the Brown Alumni Reception for the Department of Geological Sciences was held on February 18, 2010 at the Brown Palace Hotel. Anna M.R. Wells, who is a member of the Advisory Board, and Michael Zakroff of St Anselm Exploration Company generously sponsored this elegant reception. Despite snowy weather, a number of alumni, faculty, and campus administrators enjoyed the event.

**The Department will host an alumni reception at the Annual GSA meeting to be held in Denver this fall. The reception is scheduled for Monday November 1. We hope that many of you are planning to attend the GSA meeting and can also attend this party.**

**We would like to thank**
**ALL of our faithful and generous donors.**
**Words can hardly express our gratitude for your continued support and encouragement to the Department of Geological Sciences.**
**We would not be the first class program that we are without your support.**

**Our Sincerest Thanks**
**From the Faculty, Staff and Students**

## Alumni News


**Tim Grove (right)** is the current president of AGU. Here Tim is pictured with Giff Miller at the AGU Awards Ceremony honoring new fellows. Tim is a Geological Sciences graduate and current professor at MIT

**Carol Finn** (MS 1982, PhD 1988) is currently the General Secretary of AGU and is standing for president. Carol, who is at Senior Research Geophysicist at the USGS, also recently served on the departmental advisory board.

**Steven D. Jacobsen** (BA, 1996, MS, 1998, PhD, 2001) received a Presidential Early Career Award for Scientists and Engineers (PECASE) at the White House in January, 2010. He is one of 100 awardees in all fields and one of ten put forward by US National Science Foundation this year. Steve is now an Assistant Professor at Northwestern University.

Steven Jacobsen (PhD 2002) receives award from National Science Foundation officials

**David Pyles**, who completed his PhD with James Syvitski in 2004, won the J.C. "Cam" Sproule Award for the second year in a row. The award is given to an AAPG member, 35-years of age or younger, whose paper published in any publication of the Association or an affiliated society, division, or section, is judged to be the best contribution to petroleum geology during that year. Dave is only the second person in AAPG history to have won this award twice (2009 and 2010). The award went to Dave's paper titled on "Multiscale Stratigraphic Analysis of a Structurally Confined Submarine Fan: Carboniferous Ross Sandstone, Ireland."

In addition to the Sproule Award, Dave also received the 2010 Wallace E. Pratt Memorial Award from AAPG. This award honors the authors of original articles published in the AAPG Bulletin. Dave is currently research professor in the Department of Geology and Geological Engineering at the Colorado School of Mines.

David Pyles in Ireland

In October the Colorado Scientific Society, a Denver group consisting of USGS, university and industry geologists, honored the career work of **Glen Scott**. Glen graduated from our department in 1948 and then joined the USGS in Denver. Soon Glen was mapping the nearby Kassler Quadrangle which has a large area of Quaternary deposits that underly terraces at various levels. Using soils to estimate ages and correlate Quaternary deposits was a new approach used by USGS workers, one being Ph.D. student Gerry Richmond who used soils extensively in a Quaternary mapping project of the La Sal Mountains, Utah. Glen was one of the first to apply soils to estimate ages and correlate Quaternary alluviums in the Colorado Piedmont, and establish formal names for them. In places, he also related the deposits to archeological sites for dating. Pete Birkeland attended his first GSA soil-geomorphology field conference in 1960, run by Glen in the Kassler area, as well as one by Richmond in Rocky Mountain National Park. Later in his career, Glen mapped Quaternary deposits in the Arkansas Valley, and in other areas of the Colorado Piedmont. Glen also mapped the Tertiary erosion surfaces in the Front Range with Dick Taylor, and with Bill Cobban mapped biostratigraphic zones in the Pierre Shale.

To celebrate his career, the Society put on an evening of talks. Pete talked on the family tree of USGS soil-geomorphic workers mapping and doing research in the area east of the Continental Divide, which includes some former students (Berry, Machette, Muhs, Piety, Reheis, and Shroba). Rich Madole (formerly at INSTAAR) talked on the pitfalls of interpreting Quaternary geologic history from the local alluvial deposits. On the following Saturday former student Ralph Shroba joined Rich and Pete to put on a 70-participant field trip highlighting how Glen's work helped us better understand the local Quaternary history and Pierre Shale zonation. At 91 years of age, Glen was the senior geologist on the trip.

1948 Graduate Glen Scott

A photo taken in 1953 by Vance Kennedy of professors on a field trip. From Left: Larry Warner, Ernie Wahlstrom, Warren Thompson, and Ted Walker

## Calling All Alumni!!!!

Pete Birkeland, Rich Madole and Ralph Shroba are announcing that the Department of Geological Sciences would like to "**Go Green**" with our yearly newsletter.

You can help by providing us with your current email address so that we can notify you when our e-Newsletter is posted each year. You can email us at geolinfo@colorado.edu to give us your email address and we will update our database. Everyone who sends us an email will receive their copy of the Geology News by electronic copy.

**Note:** Donations to the department can be made by visiting http://www.cugeology.org and clicking on the "Alumni Resources link and then selecting an option under "Make a Gift Online"

## Obituaries

**Charles "Chuck" Iglehart**, aged 84, died September 26, 2008 in Georgetown TX. Chuck graduated from the University of Tulsa with a BS in Geological Engineering and from CU in 1948 with an MS in Geology. He was employed with Amoco Production Company for 35 years and with Penzoil for five. He worked in Casper, Tulsa, New Orleans and Houston. After forty years in the oil business, Chuck and his wife, Dee, retired to Evergreen CO after which they moved to Sun City, Georgetown, where he was active in the Nature and Astronomy Clubs.

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