PROfile

a CROSS SECTION of PEOPLE and EVENTS at the UNIVERSITY OF WYOMING

SPRING 2007

Inside

FROM THE DEPARTMENT HEAD

Art Snoke

In less than a week, we will complete another spring semester with the 117th Commencement at the University of Wyoming. The Department of Geology and Geophysics will have a large group of undergraduate and graduate students finishing their studies at UW. This is also a time to honor several of our faculty members. **Scott Smithson** will complete his 43rd year as a faculty member in the Department. Scott joined the faculty of the Department of Geology in 1964 as an Assistant Professor, but his association with UW began in the mid-1950s when he became a graduate student under the direction of R.S. Houston. Scott graduated from UW with a M.S. in 1959 and continued his graduate studies as a National Science Foundation Graduate Fellow at the University of Oslo, Norway, where he received his Ph.D. in 1963.

When Scott joined the faculty of the Department of Geology in 1964 his research interests were in the petrology of granitic rocks, and many of his early papers were focused on various aspects of these rocks. However, early in Scott's career at UW, he realized that seismic-reflection profiling was an important key to understanding the structure of continental crust, and he began to employ this research technique in deciphering the evolution of deep crust. Scott created courses in the processing and interpretation of seismic-reflection data at UW, and he developed a graduate-research program in active-source seismology based on student data acquisition, processing, and interpretation. This program was unique in the U.S. and led to high national and international visibility of the geophysics program at UW. At the end of the spring semester Scott will become a Distinguished Emeritus Professor.

Another outstanding faculty member who will be honored at the Arts and Sciences spring 2007 Commencement is **Carol Frost**. Carol was selected this year by the graduating Class of 2007 as a "Top Teacher" in the College.

During spring break, a group of undergraduate students organized a trip to southern Nevada and Death Valley, California (including the compilation of a field-trip guidebook). **Ken Dueker** and **Mark Clementz** graciously served as faculty supervisors on this trip.

The Department has successfully recruited another new tenure-track faculty member: **Dr. Bryan Shuman** in Quaternary studies and paleoclimatology. Bryan and his wife, Cynthia Weinig (also a new faculty member–Department of Botany and Molecular Biology), will join the UW faculty in late summer. The UW and the Department are still in the midst of recruiting a Director for the new School of Energy Resources (SER) as well as a SER Distinguished Professor in Geophysics, respectively. **Carol Frost**, the present Interim Director of the SER, is looking forward to returning to her large and growing research program in isotope geochemistry as well as continuing her excellent teaching in the classroom. While **Ron Frost** and **Steve Holbrook** will return from sabbatical leave for the AY07–08, **Bobbie John** and **Mike Cheadle** will be leaving for a full-year sabbatical leave first at Stanford University and later at the Lamont-Doherty Earth Observatory (see details on awards regarding their sabbatical leave on pages 2–3 of this newsletter).

Finally, we at the Department of Geology & Geophysics wish you happy, healthy, and productive summer months, and hope that you can visit the University and Department in the near future. There is a lot happening here, especially in regard to the addition of new faculty members. ❖

Department of GEOLOGY & GEOPHYSICS
home.gg.uwyo.edu

Faculty News

Associate Professor **Mike Cheadle** and Ph.D. student **Craig Grimes** joined Jeff Gee (Scripps Institute of Oceanography), Bill Meurer (Exxon) and Brian McCullogh (mountaineer from Talkeetna, Alaska), for a geologic expedition of a lifetime. In early December 2006, the five headed to the Antarctic for eight weeks of research—and camping on the ice in the Dufek intrusion of the Trans-Antarctic Mountains. They initially flew to the U.S. base at McMurdo Sound via New Zealand, where they spent a week organizing their trip. They were then were taken by C130 to the South Pole and then onto the field site in a 60-year-old, but modernized, DC3. The research area is a slowly cooled layered mafic intrusion where they can document both geomagnetic and petrologic details of this massive igneous body. The team collected over 900 samples, and Craig Grimes and new master's student Matt Lusk will be working on the samples, hoping to better understand how magma chambers work.

A special issue on the Wyoming Province has appeared in the publication *Canadian Journal of Earth Sciences* in October 2006. "The Wyoming Province: a distinctive Archean craton in Laurentian North America" features papers on various aspects of the geologic history of the province, which is one of the oldest areas of continental crust in the world. Eight of the papers are authored by members of the Department of Geology and Geophysics, including Professor **B. Ronald Frost**, Professor **Carol D. Frost** and Research Professor **Kevin R. Chamberlain** and graduate students Kate Souders, Benjamin Fruchey, Robert Kirkwood, Rashmi Grace, Mary Cornia, and Nancy Bowers. The volume was edited by Carol Frost and Paul Mueller.

Last November, Professor **Carrick Eggleston** was selected to receive one of nine College of Arts and Sciences' Extraordinary Merit in Research Awards for 2006.

Eggleston will be giving a special invited presentation from June 26–28 at the Frontiers in Mineral Sciences 2007 meeting in Cambridge, UK. The joint meeting will also be attended by the Mineralogical Society of Great Britain and Ireland, the Mineralogical Society of America, the Mineralogical Association of Canada, and the Societe Francaise de Mineralogie et de Cristallographie.

In addition, Eggleston took delivery of an Optical Waveguide Lightmode Spectroscopy (OWLS) instrument, only the fourth installation in the United States—the first three being Yale, UC Berkeley, and University of Georgia. This instrument serves as a highly sensitive way to quantify adsorption of proteins and other molecules to mineral surfaces and is part of an initiative on life-mineral interaction shared by Eggleston and Zoology and Physiology Associate Professor Patricia J.S. Colberg.

Eggleston has also been invited to give a talk at the American Vacuum Society (AVS) conference in Seattle, Washington, this year, at a special symposium on "ambient surface analysis."

In addition, Eggleston is leading the creation of a renewable energy center as part of the new School of Energy Resources.

Professor **B. Ronald Frost** is spending sabbatical at the Australian National University Research School of Earth Sciences studying the sulfide melts that formed when the world-class Pb-Zn-Ag Broken Hill ore body melted. He is conducting experiments to determine how the composition of these sulfide melts changed during cooling. The experiments indicate that the texturally late metal-rich, sulfur poor ore minerals, such as dyscrasite (Ag_3Sb) at Broken Hill, formed from metallic melts that unmixed from the sulfide melt during cooling. This may be a key to explaining the occurrence of metal-rich, sulfur-poor minerals that occur in metamorphosed sulfide ore deposits worldwide.

Professor **Carol Frost**, along with graduate students **Elizabeth Brinck**, **Shaun Carter**, **Jason Mailloux**, and Academic Professional Researcher **Mike Meredith** will be presenting talks at the National Meeting of the American Society of Mining and Reclamation in Gillette, Wyoming, on June 5th.

Frost also delivered the overview presentation on "CO_2 sequestration: opportunities for Wyoming" at the School of Energy Resources symposium on CO_2 sequestration in Cheyenne, Wyoming, on April 4th. One hundred attendees heard talks by speakers from the University of Wyoming, Montana State University, Department of Energy, Enhanced Oil Recovery Institute, Texas Bureau of Economic Geology, Western Governor's Association, and other professionals in law and industry.

Professor **Barbara John** has been awarded a Marie Tharp Visiting Fellowship for 2007–08 at the Earth Institute at Columbia University (New York). The fellowship is named after Marie Tharp, who has been called "the mother of modern oceanography." Tharp was the first to map details of the ocean floor on a global scale, and she published the pivotal interpretation of mid-ocean ridges that was crucial to the eventual acceptance of the theories of continental drift and plate tectonics. John will take up the fellowship in the second half of her sabbatical, during spring 2008, at the Lamont–Doherty Earth Observatory in New York.

Professor **Barbara John** and Associate Professor **Mike Cheadle** were each awarded fellowships from Stanford University for their forthcoming six-month sabbatical. John and Cheadle received the Allan Cox Visiting Fellowship and Blaustein

Visiting Fellowship respectively. Allan Cox played a major role in the plate tectonics revolution in the 1960s.

In addition, John and Cheadle will be jointly leading (with Professors Elizabeth Miller and Simon Klemperer, from Stanford University) a summer field trip for graduate students at Stanford University entitled "A Geological and Geophysical Transect of the Northern Basin & Range." The trip will examine all aspects of how the continents are stretched. It will start at the Wasatch Front, Utah-Idaho, traverse the high lava plains of northern Nevada, and end at the western boundary of the Basin and Range in the Sierra Nevada, California.

Adjunct Professor **Peter Hennings** recently taught a five-day short course titled "Seismic Structural Analysis." The short course was designed to teach the fundamentals of seismic interpretation of complex structural systems using petroleum industry seismic data, with application to exploration and production. Nineteen students and several faculty members attended the short course. While at the department, Hennings, who also works for ConocoPhillips, met with faculty and graduate students to discuss various aspects of their research.

Academic Professional Lecturer **Erin Campbell-Stone** and Professor **Barbara John** received funding from the Wyoming NASA Space Grant Consortium for their research on "Seismic vs. Aseismic Slip on Low-Angle Normal Faults." This work will incorporate field, laboratory, and experimental study of fault rocks to determine the mechanisms by which movement on low-angle normal faults is accommodated. The grant was matched by funds from the School of Energy Resources for research on "Fault Seal on Low-Angle Normal Faults," which will allow them to extend their work to experimental study of sealing properties of fault rocks formed under various conditions.

Department Creates Interactive Seismic Display

Associate Professor **Ken Dueker**, Ph.D. student **Josh Stachnik**, and Systems Programmer **Jeff Lang** recently assembled an interactive real-time seismic display in the atrium of the Earth Sciences Building. The display, which is funded by the UW School of Energy Resources, includes four flat-screen monitors that display more than 1,000 channels of real-time seismic data recording by the National Science Foundation EarthScope project (for more information visit www.earthscope.org). This national scale project will continue to systematically investigate the seismic structure of the entire United States over the next decade. The flow of data across the Internet is processed to detect and locate earthquakes and seismic anomalies in the western United States within about 20 seconds of real time. In addition, global earthquakes higher than magnitude five are located and displayed. As a complement to this display, this summer Dueker will employ numerous undergraduates to find seismic sites for the 50 EarthScope seismic stations to be deployed in Wyoming starting in fall 2007. Thus, soon we can all watch how the ground in Wyoming wiggles in real time.

Dueker also recently received funding from the Nantional Science Foundation EarthScope program to employ six undergraduates this summer to locate 50 seismic sites within Wyoming. ❖

Picture of the seismic display located in the atrium of the Earth Sciences Building at the University of Wyoming. Funded by the UW School of Energy Resources.

McKinsey Ranch Dinosaurs

: : : Alumni Discover Large Collection of Dinosaur Fossils Just South of Laramie : : :

by Brendon Orr, editor, Department of Geology and Geophysics

Last fall, paleontologists and UW alumni **Kelli Trujillo** (M.S. '99, Ph.D. '03, Department of Geology and Geophysics) and Dave DeMar (B.S. '06, Department of Zoology and Physiology) discovered a large collection of dinosaur fossils on the McKinsey Ranch just south of Laramie, Wyoming. Their discovery came while they were examining a pipeline trench that was part of the Rocky Mountain Express Pipeline presently being constructed through the Rocky Mountain area. When completed, the proposed 1,663-mile pipeline system will stretch from Rio Blanco County, Colorado, to Monroe County, Ohio, thus making it one of the largest natural gas pipelines ever constructed in North America.

The company Trujillo and DeMar work for, Uinta Paleontological Associates, Inc. (Uinta Paleo), is a paleontological consulting company headquartered in Vernal, Utah, which was contracted by Kinder Morgan, Inc. for purposes of pre-construction surveying and salvaging of any invertebrate, vertebrate, or plant fossils discovered along the pipeline's right-of-way. Federal and Wyoming state laws also require gas pipeline builders to hire paleontologists for projects that cross public land.

On September 20, 2006, while carefully inspecting a section of the trench where the Late Jurassic Morrison Formation was impacted, Trujillo spotted what appeared to be dinosaur fossil fragments in the wall of the trench, as well as on the spoil pile. Upon closer inspection, the fossil fragments were revealed to be caudal (tail) vertebrae of a sauropod dinosaur (e.g. *Apatosaurus* or *Camarasaurus*). Trujillo recalls what took place when she first found the fossils.

"I was walking along the open trench and there was nobody else there. The [digging] crews were already gone. All of the equipment was gone. They were pretty much done with the area. I really wasn't expecting to find fossils—I was more interested in the fact that here was an exposed part of the Morrison [Formation] that no one had ever seen before. But then I saw big chunks of pink [fossils] of what looked like the cross section of a very large bone and I knew exactly what it was. I then looked over at the spoil pile and there were more huge chunks of the same types of fossils. I then thought to myself, 'Oh boy, this is a big deal, we have an issue now.'"

Understanding the gravity of the situation, Trujillo acted quickly to get the ball rolling on the excavation of the fossils. The excavation itself involved roughly 15-20 people putting in 60-70 hour weeks of meticulous work for approximately five weeks. By the time the excavation wrapped up at the end of October, fossils from a wide variety of different species had been unearthed. In addition to a plethora of sauropod fossils, several theropod remains were also exhumed, such as tail vertebrae and teeth from the well-known Jurassic-period carnivorous dinosaur *Allosaurus*. Fossils from other taxa were also discovered, such as those of crocodiles and turtles.

After the excavation, all of the fossil material was moved to a storage facility south of Laramie. Through an agreement between Uinta Paleo and the University of Wyoming (UW) Geological Museum, the fossil material is being prepared in the museum, where visitors can watch paleontologists (including DeMar and Trujillo) and perhaps eventually paleontology students, clean, assemble, and catalogue the fossilized bones.

Above: Trujillo (R) and Dwaine Waggoner, Tate Museum (L) excavate a sauropod femur and rib from the McKinsey Ranch Dinosaur Site.

This custom-made screening box was constructed on-site specifically to screen large amounts of sediment for this project. Here, DeMar looks through the spoils for broken bones.

As DeMar restores what appears to be a theropod vertebra, he explains that his favorite fossil that he has worked on so far is a vertebra from a juvenile *Allosaurus*.

"Theropod [meat-eating] dinosaurs were always my favorite when I was a kid and to actually work on a juvenile theropod specimen is really intriguing, because you get to look at an earlier stage of development of the animal."

When talking with DeMar, one cannot help but notice the youthful enthusiasm in his eyes as he describes how one of his childhood dreams has been realized. When asked about what it was like to participate in his first dinosaur dig, he explains, "It was awesome! Ever since I was 12 or 13 years old, I've always wanted to go on a dinosaur dig…it took me 20 years to do that, but it was worth the wait."

Although Trujillo does not have a favorite fossil of her own, she is very excited about the fact that the majority of the recovered samples still remain in storage and have yet to be closely examined at the lab in the Geological Museum. In fact, it is estimated that less than 10 percent of the entire material has been examined so far. Trujillo also describes the find as rather large, given that the entire sample collection is estimated to weigh in at approximately 14,000 pounds. She is also excited about the mysteries or stories that may be contained within the fossils themselves. So far, in addition to finding elements from several species, Trujillo and her team have come across samples that evoke some interesting questions, such as a sauropod rib fossil that was apparently marked by the teeth from an *Allosaurus* and another sauropod rib that is curiously twisted. According to Trujillo, the McKinsey Ranch Dinosaur find is really interesting from a taphonomic perspective.

"Taphonomy is essentially the science of looking at everything that happens between the death of an animal and the time that its fossil remnants are discovered," she explains.

"What is interesting about this particular find is that there are bones of many different individuals in one place, and they were impacted by many different things after death including predation during the Jurassic [Period] and frost action during the Pleistocene [Epoch]."

When asked to offer any theories or speculations on the state of the fossils or the reason for their close proximity, Trujillo politely declines while laughingly saying, "No, not really, that's dangerous." However, UW Geological Museum Curator and Director **Brent Breithaupt** is happy to share some ideas for those of us who crave a good dinosaur yarn.

"One has to wonder why those [theropod] teeth are there," says Breithaupt. "Were they washed in by the river and stream sediments millions of years ago or was the *Allosaurus* there, perhaps feeding on this sauropod?

DeMar works on his "favorite fossil," a juvenile *Allosaurus* vertebra.

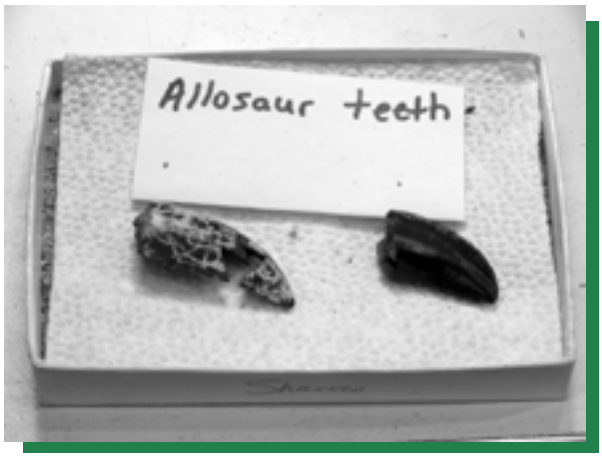
One can only speculate. What is exciting, is that with every new dinosaur discovery, we get a new

Trujillo works to restore what is believed to be a Camarasaurus scapula (shoulder blade).

page in our book of understanding past life, which relates to the focus of the museum—to help the public understand the prehistoric past of Wyoming."

Breithaupt is also excited about the level of public interest in the area and the prospects of essentially having a dynamic and interactive display in the museum where visitors can observe the fossil preparation that usually is done behind the scenes in many museums. Visitors can also hear stories or have their questions answered by the paleontologists that happen to be working in the lab on the day that they visit.

"The idea for having these fossils prepared at the museum was so that people could see these fossils that they had heard about and learn about the process of fossil preparation and curation in a fun and interactive way," explains Breithaupt. "We have people working in the lab for 40 or more hours a week and this is a tremendous resource for the museum."



Two fossil teeth from a juvinile *Alosaurus* recovered from the McKinsey Ranch site.

According to Breithaupt, the museum has never had this level of public interaction throughout its 100-year history and he encourages interested members of the public to stop by the museum and take a look at these local dinosaur fossils.

"This is a rare and unique opportunity for us [the museum]," says Breithaupt. "New discoveries are being made, new stories are being written, every time someone comes in, they can hear something new and something different—it's just exciting to be a part of."

Breithaupt and Trujillo hope that the new dinosaur bones found near Laramie will teach scientists and curious members of the public more about how these animals lived and died. Each of them has also seen the benefits of a collaborative effort between private land owners, energy companies, paleontological consulting firms, and the UW Geological Museum.

"I really see this as an example of a positive relationship between a variety of entities," explains Breithaupt. "We are seeing how when these entities come together, they can have a critical role to play in dealing with one of Wyoming's most important geological resources."

Trujillo echoes Breithaupt's sentiments by saying, "This really showcases the opportunities that are available when industry and science work hand in hand. These fossils would have never been uncovered if it wasn't for this pipeline project. And the existence of firms like Uinta Paleo, allows these fossils to be collected and studied.

The UW Geological Museum is open Monday through Friday, 8 a.m. to 5 p.m. and Saturday and Sunday from 10 a.m. to 3 p.m. There is no cost for admission. For more information, please contact the museum at (307) 766-2646 or via e-mail at uwgeoms@uwyo.edu. Also, visit the museum's website at www.uwyo.edu/geomuseum for regular updates on this project. ❖

Alumni News

On September 28th, 2006, Dr. **Jack Deibert** (Ph.D. '96), gave a lecture on pioneer Wyoming geologist Ferdinand V. Hayden as part of a celebration in which Deibert received the 2006 Majewski Fellowship.

The Bernard L. Majewski Research Fellowship is funded by an endowment provided through the generosity of Thelma Majewski. It is intended to provide research support for a recognized scholar in the history of economic geology and to facilitate the Fellow's use of archival collections in UW's American Heritage Center.

Deibert's lecture, titled "Tracts, Trails, and Thieves: The Adventures and Discoveries of Ferdinand V. Hayden's 1868 Geologic Expedition of the Wyoming Territory," focused on one of many geological expeditions by Hayden.

"Hayden was one of the big four surveyors, who is most famous for his surveys of the Wyoming and Colorado area," said Deibert. "During this survey Hayden discovered what he described as 'mule tracks, giant bird tracks, and four-toed elephant-like tracks,' which were later assumed to be the first dinosaur fossils found in Wyoming."

Those tracks were never found nor confirmed by anyone else until two years ago when Deibert and UW Geological Museum Director Brent Breithaupt rediscovered the tracks by following Hayden's notes.

Another major accomplishment and contribution to Wyoming made by Hayden was the first scientific expedition into Yellowstone.

"This was instrumental to influence congress to make Yellowstone the world's first national park," Deibert said.

Deibert is presently an associate professor of geology at Austin Peay State University in Clarksville, TN.

Beverly DeJarnett (B.S. '83) traveled to Laramie from her home in Houston, Texas, for a one-day consulting assignment with the Enhanced Oil Recovery Institute. The visit proved more leisurely than planned since her arrival coincided with that of a travel-stopping March snowstorm. The good news? An unexpected day for reminiscing with old friends.

Charles R. Deland (M.A. '54), now retired in Arizona, visited the department this spring seeking information on some of the Cambrian trilobite genera he studied as a graduate student. Names such as *Crepicephalus* and *Arapahoia* rolled easily off his tongue, demonstrating that an addiction to trilobites early in life is incurable.

The Department regrets to announce that alumnus **Gale W. Cleven** (B.S. '46; M.S. '56) passed away on November 17, 2006. His wife, Lee, sends her best wishes to one and all.

Ed Durkee, (B.S. '52; M.A. '53) writes from Manila, The Philippines, that despite some recent health problems, he is still an oil and gas consultant in the western Pacific Rim region. We wish Ed a rapid recovery from his most recent health setback, so that he can continue his active lifestyle as a consulting geologist.

Desui Miao (Ph.D. '87) is co-author of an article describing an extremely rare fossil found in Cretaceous strata of China. The article in the June 22, 2006 issue of *Nature* reports the third-known fossil species of the lampreys, jawless vertebrates lacking a bony skeleton.

Gene Pearson (Ph.D. '72), Professor of geology at the University of the Pacific in Stockton, California, is in the first year of a three-year term as secretary/treasurer of the National Association of Geoscience Teachers.

Curtis Talbot (M.S. '67) and his fossil-collecting family now have a fossil named for them. *Dimorphosiphon talbotorum*, a calcareous alga from the Bighorn Dolomite, was described by Don Boyd in the January, 2007 issue of the *Journal of Paleontology*. The Talbots discovered the first specimens of the new species.

Henrich Toots (M.S. '62; Ph.D. '65) writes in a Christmas card that he is in pretty decent working condition and making every attempt to visit as many outcrops as possible while he is able. At the Philadelphia GSA meeting last fall he participated in a field trip to the K/T boundary and sank ankle-deep into Cretaceous mud. ❖

Coming up!

AAPG ROCKY MOUNTAIN RENDEZVOUS
Sept. 29–Oct. 2, 2007
aapg.gg.uwyo.edu/rockymtnrendezvous/index.htm

GSA
2007 Annual Meeting & Exhibition
Beginning of the International Year of Planet Earth
October 28–31
Denver, Colorado
www.geosociety.org

AGU
2007 Fall Meeting
December 10–14
San Francisco, California
www.agu.org

Gathering news!

Please take a minute to fill out the Alumni News Form insert and let your fellow UW Geology and Geophysics grads know what you're up to. Where you are. Who you've become.

Student News

Associate Professor **Ken Dueker** and graduate students **Steve Hansen** (M.S.), **John Jasbinsek** (Ph.D.), **Jeanette Peck** (M.S.), **Josh Stachnik** (Ph.D.), and **Huaiyu Yuan** (Ph.D.) spent the end of September 2006, removing 43 broadband seismometers from the coast of British Columbia. After 16 months of collecting data, and many trips to the land of mutant-white-spirit bears, the students now have a great seismic dataset with which to constrain how the Eocene Coast Mountain granodiorite batholith was distilled.

The project's fundamental question is whether the batholith was 'deep-distilled'—because deep distillation would produce a heavy garnet pyroxenite residuum that could have subsequently foundered into the mantle. For more information about the project, visit www.geo.arizona.edu/tectonics/ducea/batholiths/index.html.

The students are just beginning their analysis of this new seismic dataset. Huaiyu Yuan continues to be the data 'wolf' in the group—producing several new results with respect to the deep structure of the Yellowstone hot spot and its mantle plume. In particular, Yuan has produced a synoptic scale crustal thickness and velocity map of the Yellowstone region that requires large-scale lower crustal outflow from beneath the eastern Snake River Plain.

John Jasbinsek has research in review that provides very good seismic evidence for a low-velocity layer of melt residing atop the olivine-wadslyeite phase transformation that occurs at about a 410 km depth. This new seismic finding is consistent with the seismic predictions of the provocative new 'water-filter' model, which dynamically creates MORB and OIB chemical signatures.

Josh Stachnik has been writing a processing package that uses the ambient seismic noise that is present throughout the planet as data to constrain lateral velocity variations in the crust. In particular, Stachnik's ambient noise processing seeks to constrain the volume of the 'mid-crustal sill' beneath the Yellowstone hot spot track whose excess-mass has probably driven the lower crustal outflow required by Yuan's results.

Steve Hansen has been coding new seismic deconvolution techniques that are being applied to a seismic dataset that Dueker's group collected across the Laramie Basin to study crustal imbrication and wedging across the Cheyenne suture. His results show that the Proterozoic Green Mountain terrane was thrust under the Wyoming Archean craton. This finding suggests that the 1.78 Ga terrane collision with an outboard-directed subduction zone is an overly simplified kinematic model.

Jennette Peck is measuring arrival times from earthquake waves recorded by the seismic array we just removed from British Columbia. The measured arrival times are used to create a sub-surface image of velocity variations down to a few hundred kilometers beneath our seismic array. This research will provide information with which to constrain whether the Coast Mountain batholith was (or was not) deep-distilled.

Dueker's group expects to remain plenty busy in the future, as they just received funding from the National Science Foundation (NSF) Continental Dynamics Program to deploy a large seismic array in the Colorado Rockies in 2008. This interdisciplinary project has nine principle investigators who seek to constrain the deep processes that have driven the rock-uplift and exhumation history of the Colorado Rockies. For more information about this project, visit www.ees.nmt.edu/geop/crest.

At last year's annual Geological Society of American meeting in Philadelphia, graduate student **Lars Hansen** received the 2006 GSA Structural Geology & Tectonics Division Award for his student proposal titled, "Deformation associated with the evolution of an oceanic core complex."

Graduate students **Phil Bottrell**, **Cat Campbell**, **Liz Hajek**, **Jen McHarge**, and **Beth Wilson** participated in AAPG's Imperial Barrel Award Competition at the 2007 Annual meeting in Long Beach, California. The students competed against teams from eight other universities from around the world. The competition involved 20-minute talks given by each respective team. Cash prizes in the amounts of $20,000 (for 1st place), $10,000 (for 2nd), and $5,000 (for 3rd) were given out to the top three teams. AAPG covered the travel expenses for all teams and team advisers.

Undergraduate students **Dan Eakin** and **Lisa Humbert** of Professor **Steve Holbrook's** research group were each awarded EPSCoR undergraduate research fellowships for their work on seismic oceanography.

This past March, graduate students **Steve Hansen**, **John Jasbinsek**, **Josh Stachnik**, and **Huaiyu Yuan** were fully funded to go to the National EarthScope meeting in Monterey, California, to present new scientific results. The funding came from the National EarthScope program.

Later this year, graduate students **Steve Hansen**, **Jennette Peck**, **Josh Stacknik**, and **Huaiyu Yuan** will be finding and permitting 60 seismic sites in central Colorado as part of the NSF Continental Dynamics CREST project to constrain the origin of the modern-day Rocky Mountains

Graduate students **Liz Hajek** and **Heather Jones** each gave a talk at the annual AAPG meeting in Long Beach, California.

In April, eight graduate students from the Department of Geology and Geophysics participated in UW's annual Graduate Student Symposium. **John Jasbinsek**, **Ryan Morgan**, **Lars Hansen**, **Steve Hansen**, **Tim Tschetter**, **Josh Stachnik**, **Beth Wilson**, and **Huaiyu Yuan** each gave either oral or poster presentations. ❖

Sailing the mid-Atlantic

::: Graduate Student Kay Achenbach Aboard the RRS James Cook :::

Through March and April of 2007, a team of scientists, including Department of Geology and Geophysics graduate student **Kay Achenbach** [home.gg.uwyo.edu/Person.aspx?ID=165], sailed aboard the RRS *James Cook* to visit and study a special area of the Mid-Atlantic Ridge, which is referred to as the Fifteen-Twenty Fracture Zone. The area consists of what is referred to as a massive "open wound" on the Earth's surface where the Earth's mantle—the deep interior of the Earth, normally covered by crust many kilometers thick—is exposed on the seafloor, 3000 m below the surface. What scientists don't know is whether the ocean crust was first developed, and then ripped away by huge geological faults, or whether it never even developed in the first place.

During the course of the cruise, Achenbach and Department of Geology and Geophysics Editor **Brendon Orr** conducted an interview via e-mail in an effort to chronicle Achenbach's experience and get a glimpse into the world of marine geology.

[Fri 3/9/2007 4:48 PM] Editor: Hi Kay! How is life aboard the RRS *James Cook*? You've been at sea for about a week. Tell us about your experience so far. Where are you now?

[Fri 3/9/2007 5:40 PM] Achenbach:

Hi Brendon! Life aboard the ship is settling into a routine now—food, gym, and work. We left Tenerife on the afternoon of Monday, March 5th, and we've been sailing steadily southwestward ever since. As I type this, we're at about 20° N, 33° W, and we are projected to arrive at the Mid-Atlantic Ridge on the evening of Monday, March 12th. We started keeping watches on Tuesday, and I'm on the noon-to-midnight watch. Thus far, the only duties for watch keeping involve writing down the ship's position and other important navigational data every half hour, but I am sure it will become much busier as soon as we arrive on station and start recovering some rocks! We've also spent some time answering questions from the general public, which were sent to us via the official cruise website, www.soc.soton.ac.uk/gg/classroom@sea/jc007/index.html.

Even though this is not your first cruise, I believe this is your first cruise on a ship's maiden voyage is it not?

Yes, this is my first cruise on a ship's maiden voyage! There have been some kinks related to the fact that nobody has used this ship before. For example, there is a shortage of eye-bolts, which are often used to secure items such as computers to desks so that they do not fly around when the ship hits a large swell! However, it's nice to be on a ship that is so shiny and new. Just this morning I went to the gym on board and used some extremely nice new exercise equipment.

Tell me more about the team you are working with? They seem to be from a wide variety of backgrounds, i.e. students, professors, engineers, experts, etc.

The team consists of four professors, four graduate students, and a number of engineers from the British Geological Survey who are experts in using the BRIDGE rock drill, which we will be utilizing to collect samples from the seafloor. Furthermore, there are a few science technicians who run the ship's scientific equipment such as the sonar bathymetry mapper, and about 25 crewmen who are responsible for keeping the ship afloat. In my opinion, one of the most exciting things about going to sea is that you end up getting to know people that you don't typically run into in the ordinary course of events.

What are you anticipating to do during the next week or so?

In another three days or so, we'll arrive on station at about 13–15° N on the Mid-Atlantic Ridge, and we'll begin to collect some rocks! Aside from that, I imagine life will continue as usual. I'll go to the gym, work on my computer on the research that I have brought with me, and write down navigational information in the ship's log every half-hour! And learn a lot of new British slang, of course.

[Fri 3/16/2007 12:05 PM] So, Kay, catch us up on what you've been up to for the past week. How has the weather been?

[Sun 3/18/2007 3:10 AM] Things have been going great for the past week. We dredged for a few days at the beginning of the week in order to decide if the region had enough lower crustal and mantle rocks to make further study worth our time. When the dredge recovered lots of peridotites (mantle rocks), we decided to go ahead with a side-scan sonar survey using a deep-towed instrument called the Towed Ocean Bottom Instrument (TOBI). We are now in day four of a 12-day survey, which will tell us the composition of the surface rocks in the area. Once this is done, we'll start drilling! Meanwhile, to pass the time between recording things in the ship's log—which we have to do every half hour when we're on watch—I've spent a lot of time answering e-mail questions that people have sent to the cruise website, and I've been conducting interviews with the ship's crew, (since a lot of people have written to the website asking what the crew are like).

The weather has been great! It's been about 80 degrees with a light breeze. Smooth sailing, as they say.

Tell us a little bit more about the ship (RRS *James Cook*) that you are on. What is the layout like on the different levels of the ship? Where do you spend most of your time? What are your living quarters like?

The ship is really nice, and quite large. There are eight decks. The bottom deck houses a lot of the machinery; the main deck has a lot of the living quarters (including my own)

and is about at water level—the porthole in my room is maybe four feet above the waves. Above that is the upper deck, which houses all the scientific labs; this is the level that the afterdeck is on, which is the deck from which the scientific equipment is deployed into the water. Above that is the mezzanine deck, where the galley, the crew bar, the library, and the video room are located. Above that is the boat deck, which is home to the ship's senior officers. The next level is the forecastle deck, which is the level with the forward deck, where lots of people like to sit out in the sun on nice days. Above that is the bridge deck, which is shorter than the rest and houses a lot of the electronic equipment used in running the ship, and finally above that, the navigational bridge deck, which is where the bridge is located.

I spend most of my time when I am on watch on the upper deck in the scientific labs, and when I am not on watch, I might be found on the mezzanine deck, relaxing in the galley or the bar. I also like to spend some time each day standing on the forward deck catching some sun and looking at the waves.

As to living quarters—we all get a cabin to ourselves, which is a big improvement over a lot of previous scientific vessels. I can't tell you how much of a difference it makes to have a private place to go when you're living and working in such close quarters with such a limited number of people. The cabin itself is pretty nice. I have a porthole, and a sink, and a desk, and a bunk with a rail all around it to keep me from falling out at night if the ship takes a big roll!

Last week you mentioned that the team would start collecting rocks upon arriving at the Mid-Atlantic Ridge. What does the rock collection process entail? How do the rocks get from the bottom of the ocean to the ship?

We are using two methods on this cruise. The first is dredging, in which a giant mesh basket is lowered down to the seafloor on a wire, dragged along for a kilometer or so, and then raised again. This is a good way to acquire lots of rocks that will give you an idea of the average composition of the place being dredged.

The second method that we will be using is drilling. The British Geological Survey has a rock drill that can be lowered to the seafloor on a fiber-optic cable, which transmits video in real time back to the ship. By looking at the screen, the scientists can find a suitable place to drill, where there is bare rock on the seafloor and no sediment cover. The drill can recover cores 1-meter long, and the huge advantage of this tool is that it marks a score along the recovered rock to mark where north is. With oriented cores, it's possible to get accurate information about the orientation of structural features in rocks such as deformational fabrics, and because the location of the sample is well controlled, you know exactly where your sample came from.

Care to share any new British slang you may have learned?

Well, I am basically getting at least one new vocabulary word every day. My favorite so far is "Gordon Bennet!", which is an exclamation of surprise. You might say, "Gordon Bennet, look at the size of that rock!" Another of my favorites is "muppet", which is a name you might call someone who has done something stupid. I'm also making a concerted effort to learn to distinguish among the various kinds of British accents, but I've discovered that this requires some delicacy, since it turns out a Liverpool man gets very insulted if you ask him if he has a Manchester accent.

[Thu 3/29/2007 11:01 AM] Howdy Kay! It's been nearly two weeks since our last round of questions. Mind catching us up on any recent activities? Seen any marine life so far?

[Mon 4/2/2007 11:21 AM]

Hi Brendon! Yeah, I saw some mahi-mahi fish a week or so ago—an entire school (maybe 20) swimming around near the ship. They are beautiful fish—bright blue and yellow and maybe 2-2.5 feet long! And they mate for life. As for the work, well, for the past week or so we've been collecting a LOT of rocks. Our TOBI survey is complete, so now we've got a very complete image of the seafloor in this region and we can better decide where we'd like to collect some rocks. For me, since I am a petrologist, this means that my life has suddenly gotten VERY busy!

Earlier you told us about the different processes involved with collecting rock samples off of the ocean floor (i.e. dredging and drilling). Specifically, how are you involved with either of these processes? Are you involved with the collection or the analyzing of the samples, or both?

There are a lot of people who have come on board specifically to run these operations. There are four guys who run the drill, and two guys who specialize in driving these huge shipboard winches to run the dredges. So I mostly just watch them do their thing, since they know more about it than I ever will! Once they bring the rocks back on board the ship, I and the other petrologists become responsible for figuring out what all the rocks are (not always an easy task!), describing them so that they can be identified as potential research targets back on shore, and curating them so that they are in some way organized! Practically, this means a WHOLE lot of tedious work, such as cutting rocks in half with a big saw to expose the interiors so that we can see what the rock is made of, and lots of labeling and bagging. Rocks might come on board at any hour of the day or night, and it's really quite fun to come on shift just as the previous shift has finished cutting and labeling, because it means you get tasked with making the descriptions of the rocks, and that reminds me of why I got involved in geology in the first place! Rocks are so cool! As for the research, we'll probably have a big meeting at the end of the cruise to decide who is going to do which analyses once we are back on shore.

It is my understanding that the TOBI is used to scan the ocean floor for suitable drilling spots. Have you been involved with the use of TOBI? Or have you at least seen it in action?

I have seen TOBI in action! It's a great device. When I'm on watch while TOBI is in the water, my job is to figure out the ship's position and TOBI's position every half hour, and plot it on a bathymetric map of the seafloor so that the guys who are operating TOBI know if they are about to tow the vehicle into a giant underwater mountain. TOBI sends back data in real time and prints it out, so you get to see what you are sailing over as you do it! It's very fun to watch an image of the seafloor emerge, because usually we never know what the seafloor actually looks like! It's so hard to "see" through water that we actually know more about the surface of Venus than about the ocean floor of Earth, and the imagery that TOBI produces is as close as I've ever imagined to having an aerial photo of the seafloor. It isn't quite the same thing—sidescan sonar basically tells us the difference between smooth spots and rough spots—but things like undersea volcanoes or striated fault surfaces are very easy to identify in the images, and if you drape the images over the bathymetry so that you have a 3-D perspective, you can really get an amazingly detailed picture of the seafloor.

Looking at some of the pictures on the cruise's website [www.soc.soton.ac.uk/gg/classroom@sea/jc007/gallery/crew.html], it seems like you have a couple of ukulele players on board. Are there times where the crew can get together and just relax? I'm sure such opportunities are few and far between, but how does a group of scientists aboard a ship keep themselves entertained?

Let's just say that it's good that Bram and Chris are on different shifts so they can't play together very often; their instruments might have been tossed overboard by now if they brought them out more often.

Unlike American vessels, British vessels are allowed to have alcohol on board, so there is a lounge/bar for the crew and scientists to use, and I think this is a really great thing. It's very nice to have a public place where you can go and hang out and chat. For me, anyway, living in such close quarters in such an isolated environment can be stressful because every little event that happens feels a bit magnified without the background of your "real life" to give you perspective, and I think having a bit of relaxation and social time helps a person stay sane. So most days, if I'm not too tired from dealing with all the rocks, I'll go up to the lounge and hang out with people.

For a couple nights in a row we played some marathon games of *Trivial Pursuit*, and that was really fun. I lost quite badly because most of the questions in that game are really country-specific, and I don't know very much about British TV stars or cricket championships, but I concluded that watching a game of *Trivial Pursuit* might be one of the best ways to familiarize yourself with a foreign culture, because you can ask for explanations about every question you hear.

[Tue 4/10/2007 1:49 PM] Gordon Bennet, Kay! Your cruise is finishing up in a few days! Looking back, how does this experience compare to the cruise you went on in 2005?

[Wed 4/11/2007 6:50 PM] I can say that both cruises had their good points and their bad points, but overall I have probably gotten more out of this cruise than I did out of the previous one in 2005. This is because this time I'm nearly finished with the fourth year of my Ph.D. (the last cruise I was on was at the beginning of my second year), so I can contribute more to the science and I've been more involved in the entire process of "ocean fieldwork" than I was on the previous cruise.

Does anything stand out about this trip? Either from a recreational or scientific perspective? What new things did you learn? What will you remember?

As I said above, I've really felt like a part of the scientific team on this cruise because I was at a better level to participate this time. This really stands out for me—it's nice to feel like I'm actually turning into a scientist after all these years of effort! Along the same lines, I came on this cruise without knowing any of the participants ahead of time, so it has been very rewarding to interact with other scientists on a peer-like level and feel like I've made a success of it. It has boosted my confidence in myself as a researcher. Now, recreationally, it's been a blast to spend six weeks on a little floating piece of Great Britain. I've learned so much about British culture, and I've made some friends that I hope I'll keep for a lifetime.

How will the research that you conducted on the RRS *James Cook* relate to your Ph.D. work when you return to UW?

This cruise was designed to test different models of how the mantle might be upwelling beneath mid-ocean ridges—does it upwell like flat sheets that spread perpendicularly away from the ridge axis? Or does it upwell like focused bubbles and spread out radially from the center of a ridge segment? This is a question I've been trying to address with my own research for the past three and a half years, so it's exciting to think that I may get to work on some of the rocks collected during this cruise to try to shed more light on this problem. I may not get to this in time for my Ph.D.—finding things to work on is certainly not the problem; finding time is—but if I don't get to these rocks within the next year or so, I'll have a great direction to move in when I graduate.

Kay, we certainly wish you a safe trip back to Wyoming! Take care!

Thanks, Brendon! We've been working like crazy for the past four weeks, and we are all pretty cream-crackered now (this, I found out, is Cockney rhyming slang for "knackered", which means dead tired), so I'll be looking forward to getting home. See you soon! ❖

PROfile

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Graduate student **Craig Grimes** (L) and Associate Professor **Mike Cheadle** (R) at the South Pole, on Dec 20th, 2006, on their way to the Dufek Massif in the Trans-Antarctic Mountains. Cheadle and Grimes were part of an NSF-funded five-man geology team camping at the foot of the Dufek Massif for five weeks during Christmas and New Year to collect rocks to better understand how the Earth's magnetic field behaves when it undergoes a reversal (a topic which was 'Hollywood-ised' in the recent movie *The Core*), and how magma chambers work.

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