SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

2010 Alumni Newsletter

Department of Geology and Geological Engineering

Department of Geology and Geological Engineering – Fall 2009: Left to right: (back row) – Colin Paterson, Foster Sawyer, Jim Martin, Ed Duke, Maribeth Price (chair) and Mike Terry; Front row) – Larry Stetler, Perry Rahn, Kurt Katzenstein, Arden Davis and Nuri Uzunlar; Absent: Alvis Lisenbee, Bill Roggenthen, Jim Fox, Jack Redden, Darrin Pagnac and Sally Shelton.

Department of Geology and Geological Engineering - Spring 1984: From left to right (back row): James Martin, Fred Rich, Bill Roberts, Marilyn Lundquist, Fred Steece, Colin Paterson, Jack Redden, Paul Gries, Caner Zanbak (front row) Perry Rahn, Nancy Scofield, Randy Arthur, Jim Fox Jim Papike, Bill Roggenthen (not in the picture Alvis Lisenbee, John Mickelson).

From the Editor – Nuri Uzunlar

It was twenty five years ago when I came to this department as a graduate student from Turkey and met the wonderful people in this picture. Because of the warm and welcoming faculty in the department I kept my ties during my years in the industry. Today, I am very proud to be part of this fine group of people who work very hard to offer one of the best earth science and engineering education. The 2010 newsletter is being produced as PDF and DOC and posted on the department's website http://geology.sdsmt.edu. Alumni with emails will be notified that it is on the web page. Please pass this newsletter to other alums you may know without emails. Have a blessed holiday season and a fantastic new year!

From the Chair - Maribeth Price

Greetings to all and best wishes for a blessed holiday season and a happy new year!

This year has been one of change. Most significant, the university is moving to a system of department heads, rather than chairs, who will report directly to the provost and take on a significant portion of duties previously assigned to the college deans. This year we are conducting a national search for a department head, who will have a light teaching load and a charge to help the department grow in enrollments, research, and industry relations. We seek the help of all alumni to help us find good candidates for this important position.

Other staffing changes are in the works. We are searching for a vertebrate paleontologist to fill the position vacated by Dr. Grellet-Tinner. Dr. William Roggenthen has accepted a position as a research scientist at the Sanford Underground Science and Engineering Laboratory (SUSEL) at Homestake, and although we are fortunate that he is still on campus, he will no longer be a professor in the department. We anticipate searching next year to fill his open position.

I'm pleased to report that student associations are on the upswing. The Tech Geological Association (TGA) has been resurrected after a hiatus of several years, and the students are busy with events and service projects. Student numbers are slightly up, with strong gains in geological engineering and a modest increase in paleontology students.

We are excited to see the new building for the Paleontology Research Center growing day by day, through warm fall days and frigid winter weather (often in the same week). We anticipate moving in over the summer. Students and faculty are hard at work inventorying and preparing specimens, maps, and other materials for the move.

Once the new head arrives, I am looking forward to spending more time promoting our new Minor in Geospatial Technology which was approved last spring, providing enhanced opportunities for our students to become proficient in GIS and remote sensing.

Thanks to all who have contributed to the department and scholarships this year. Your generosity helps our students and becomes a part of all the exciting events and initiatives that are leading us into the future. We appreciate your support very much!

Senior Research Projects 2008-2009

These research projects have been proposed by the seniors this year and they will be working to complete them by May. The students would like to thank the alumni who have donated to the department in recent years. Some of these funds are used to help these students pay for costs associated with their research projects.

Becci Rowe, *Miocene Flora of Alvord Creek, Oregon*

Darin Beckstrom, *Timing of Igneous-Related Structures of the Sugarloaf Diatreme, Sundance, Wyoming*

Daniel Lye, *Analysis of Deadwood Formation Graptolites from the Wharf Mine, South Dakota*

Jamie Bartling, *Deformational Fabrics in the Poorman Formation of the Homestake Mine*

Jason Carr, *Dental Microwear Analysis of the Moschid Genus Longirostromeryx*

Kathleen Schwabe, *Depositional Environments of Dinosaur Egg Bearing Strata of Central Mongolia*

Melissa Jetson, *A detailed analysis of petrology, structures and microstructures in Precambrian metamorphic rocks*

Scot Dannenbring, *Influence of Lithology on Deformational Structures in Country Rock of the Harney Peak Granite*

Thomas Linn, *Biostratigraphic zonation of fossil cephalopods in the upper Pierre Shale on the northern portion of the Cedar Creek Anticline*

From Our Emeritus Professors:

Perry Rahn

This past year I have been thinning trees on my 160 acres near Hill City. There is a growing problem with Mountain Pine Beetles in the Black Hills and elsewhere in the Rocky Mountains. This fall I had 200 big trees logged off. I cut down the smaller infected ones and burn them up. It looks like eventually the Ponderosa Pine trees in the entire Black Hills are doomed. Right now the Harney Peak area looks all brown due to the dead trees. As a positive note, once this epidemic is gone, and a tragic forest fire erupts through the dead trees, it should make spectacular geology visible, unseen since the days of Darton.

Jim Fox

Jim retired after the spring 2008 semester. We see him periodically in the department.

Jack Redden

Jack is still active in research on various issues relating to Precambrian geology of the Black Hills. Jack is often found working in his office in the department. He has decided to spend winters in Arizona with his daughter.

Alvis Lisenbee

Another busy year! I was blessed to once again participate in the Geology field camp in Turkey – a great experience of superb geology and full cultural immersion. The 20 students, from universities across the U.S., were enthusiastic and wonderful to work with.

Equally interesting was consulting work with Mike Terry to aid initial phases of the DUSEL project at Homestake. The work entails outlining the geological aspects of the large underground cavities (200 feet in diameter at the 4850-5000 level) where neutron receptors are to be placed. Utilizing old drift maps and logs from new horizontal drilling, we are preparing maps and cross sections attempting to show the relationships of the Tertiary dikes to the host rock in the cavity area. Each new drill hole simply increases the apparent complexity of this system which looks so simple in the Open Cut above.

Work with graduate students and Dr. Davis and Dr. Price continues on the aquifer vulnerability study which we are conducting with the West Dakota Development District for the Rapid City area. We look forward to presenting results at the sectional Geological Society of America meeting here in Rapid City, new April. And have them on-line soon as well.

Bill Roggenthen

Dr. Roggenthen is the Co-PI for the NSF DUSEL proposal. He is either in his office here, at Homestake or traveling to Berkeley for various meetings. He also has a funded research project in the mine looking at micro seismic events and ground motion. Three-axis accelerometers were cemented in sand holes on the 2000-ft level and are used for seismic monitoring.

From the Faculty:

Arden Davis

Last spring our Geological Engineering Professional Advisory Board met on campus. Jeanne Goodman, Bill Gates, Creties Jenkins, and Ray Wuolo have always been willing to generously share their time and expertise in helping us improve the program, and we are grateful for their continued support. It has also been enjoyable to visit with many other alumni recently, including Richard Arnold, Janet Carter, Andy Long, Richard Hudson, Micah Sheldon, Michelle Jones, Kendra Kungu, Mike DeFea, Chris Johnson, Pradeep Chintalapati, Greg Kipp, Crystal Hocking, Ken Nelson, Grant wenker, Dennis Riding, Bruce Peterman, Halim Mutlu, and Joe Peterlin.

During the past year I've continued to develop research on removal of arsenic and heavy metals from drinking water. Collaborators include Dr. Kate Webb, Dr. David Dixon, and Dr. M.R. Hansen. Recent testing indicates removal rates of greater than 99% for lead and cadmium. We hope to start a pilot project to treat acidic mine water at the Gilt Edge Superfund Site in the Black Hills, south of Deadwood. I'm also looking forward to upcoming research with Dr. Sookie Bang that will investigate arsenic removal by microbiologically induced calcite precipitation.

Dr. Alvis Lisenbee and I, along with Dr. Maribeth Price and Dr. Foster Sawyer continue to develop aquifer vulnerability maps at the scale of 1:24,000 quadrangle maps in Rapid City area and the eastern Black Hills.

After serving on the Engineering Accreditation Commission of ABET from 2002 to 2007, I was appointed the ABET Board of Directors. The board meets twice each year. I also look forward to the SME Annual Meeting, which provides the opportunity to interact with other geological engineers and to participate in ABET-related activities of our professional organization. SME has a Professional Engineer Exam Committee, which I recently joined, and we have been reviewing test questions for next year's exam.

My consulting work during the past year has involved springs in the southern Black Hills and, recently, a new water well in the Madison aquifer near Spearfish.

My wife and I had a pleasant summer at our farmstead in Minnesota. We were able to pick all the asparagus we cared to eat during the late spring, and in August the sweet corn was delicious. The weather was mostly cool and dry, and we enjoyed many days with low humidity and sparkling clear air. To our pleasant surprise, rainfall in the Black Hills was above average during that same time, and whenever we came back to Rapid City during the summer, the grass on the hillsides was green.

If you're in the Rapid City area, please stop by to visit. It's always gratifying to see alumni and to hear how your careers are developing.

Larry Stetler

Teaching

Another busy year has passed. I remain busy in Department activities and research. During the spring 2009 semester I was fortunate to have had one class due to Dr. Katzenstein's taking my course GeoE 221 Geology for Engineers. I did teach GeoE 465 Geological Engineering

Design II where we undertook an enterprise project working with the SD Department of Game, Fish, and Parks. The study area was Rapid Creek below Pactola Dam to Rapid Valley at the Regional Airport. In the past several years a bacterial mass has begun to grow in the creek and has been attributed to the constant low flow from the dam. Ron Koth, senior fisheries biologist at GFP, and I have been working together for a number of years on various surface water issues around the Black Hills. We began looking at this section of the creek in 2004 to design a _flushing flow' that would theoretically consist of enough volume and capacity to mobilize bottom sediment and clean the channel or silt and the bacteria. Last spring the class divided into two teams and between them, measured cross sections at a total of 16 locations (Fig. 1) along this reach of river and characterized multiple stream parameters such as width, depth, velocity, cross section, bankfull, flood prone width, and bed and bank materials (Fig. 2). Using USGS gage records for stations in this reach, the students generated.a flow model based on Manning's relations to convey a flushing flow down the channel. The primary purpose was to determine if this flow, by the time it reached Rapid Valley, would be transporting silt and other debris that would potentially clog irrigation intakes. The students were significantly challenged by this project, especially considering the amount of field work and analysis required. Most projects were submitted on CD or in a large 3-ring binder due to its size. Several of these reports are currently being studied by the GFP to determine the next step in the process of designing a flushing flow.

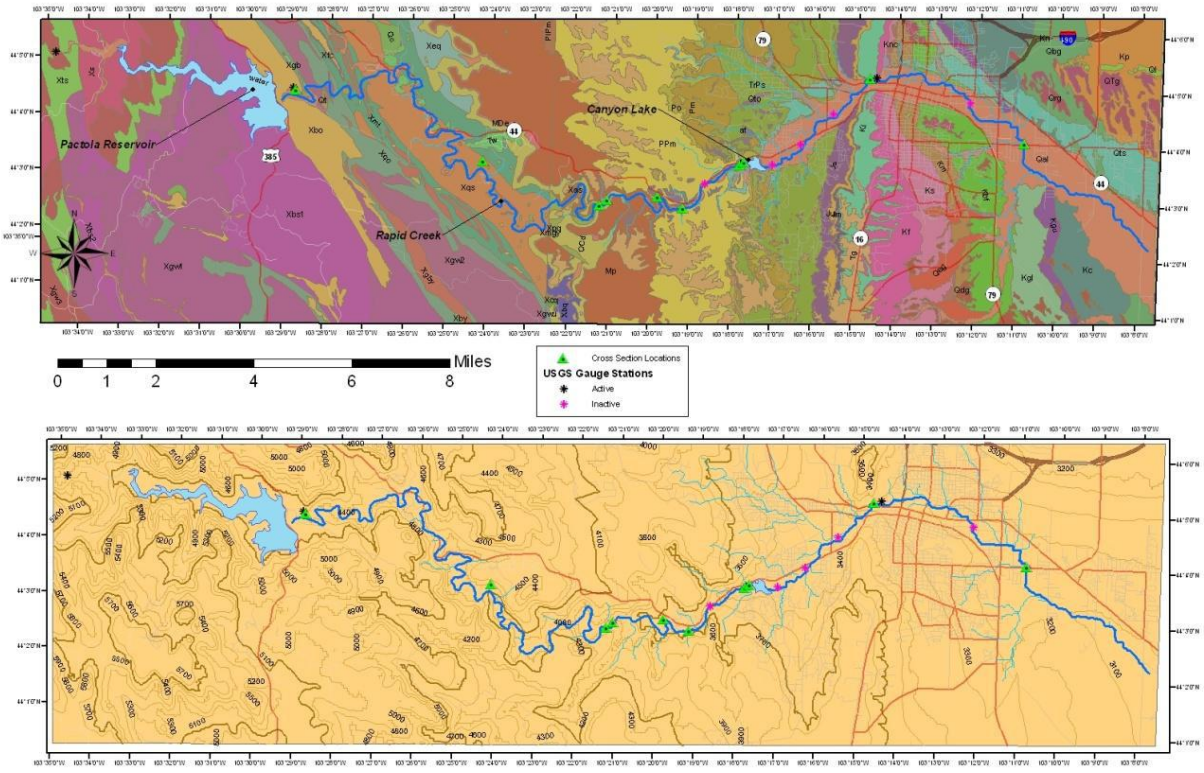


Figure 1. Geologic and topographic maps of the study area generated by the students using GIS.

Figure 2. Student working in Rapid Creek below Pactola Dam in spring 2009 measuring various stream channel and bed/bank properties.

I once again led the instruction of the summer field camp GeoE 410 Engineering Field Geology. We have operated out of SDSMT for the past two years and last summer there were 33 students. Kurt Katzenstein was with me the entire five weeks and in addition there were four U Miss professors and one UND professor rotating over the course. We had a great time and used many new projects that were highly successful. I have included some photos of the camp below.

Students working along Sand Creek south of Ranch A to prepare an engineering stratigraphic column. For several of the students, especially those from southern Mississippi, this was their first real exposure to outcrop.

Students collecting scanline data at a rock outcrop for assessment of slope stability (below left). This was a landslide in Sturgis, SD (right) that we were able to access and make measurements of the

geomorphology. Collected data were input into Rockware software programs to perform slope stability calculations.

During the Fall 2010 semester I am teaching two courses, GeoE 466 Engineering and Environmental Geology and GeoE 682 Fluvial Processes.

Research

During 2009 I submitted three large external proposals, one to the National Science Foundation and one to the National Institutes for Health. Two are still pending (#3 has been declined), so I remain hopeful. These are:

1. Collaborative Research: Using the Mobile Underground Laboratory for Experimentation (MULE) to Define Fracture Fluid and Rock Geobiological Interactions. National Science Foundation, EAR – Geobiology and Low Temperature Geochemistry, SF 09-552. PI: L.D. Stetler, co-PI: C.M. Anderson – Black Hills State University, S.M. Pfiffner, J. Biggerstaff, and Q. He, University of Tennessee Knoxville. Submitted July 2009. $1,835,651.
2. Environmental monitoring and measurement on American Indian reservations in South Dakota for documenting health disparities. National Institutes for Health, PI: L.D. Stetler. Submitted May 2009. $2,209,192.

3. Cross-disciplinary collaborative research in the subsurface environment at the Sanford/DUSEL laboratory in Lead, South Dakota. National Science Foundation EPSCoR. PI: M. MacLaughlin Montana Tech, co-PI: L.D. Stetler. Submitted March 2009. $800,000.

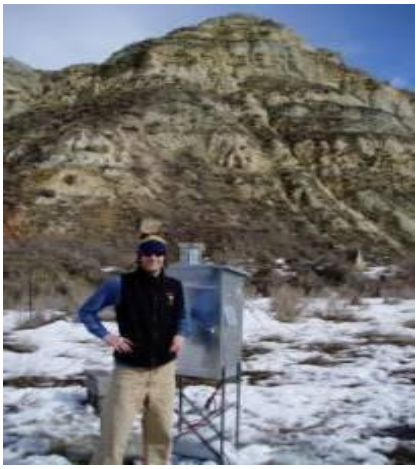
Ongoing research includes offsite characterization of abandoned uranium mines, a project that I am Co-PI on. Funding has been from the US EPA/USFS through CERCLA (superfund) at ~$600,000 since 2006. The research site has been in NW South Dakota, in Harding County. I currently have one MS GeoE student who is wrapping up the study by integrating the three specific regions that were studied into a regional picture utilizing GIS and satellite images. His thesis will be primarily focused on spatial relations in the distribution of uranium form the mined areas. This student was just awarded, in mid-November 2009, a $2500 scholarship form the SD Space Grant Consortium/NASA. The funds will be used to complete his thesis.

Results from the uranium study are located on our website. The final report is due to the Forest Service by December 31, 2010. http://uranium.sdsmt.edu. Several research papers have been published and are in preparation describing this project (see publications list below)

I am also Co-PI on a TMDL study in SD for mercury transport and occurrence. This program is funded through the SD DENR at $265,000 for one year. Over the past year we sampled sediment in lakes across SD using a core sampler deployed through ice. We also built 12 Hg samplers and have deployed them across the state and in four regional National Parks. These four units in the Parks were funded through a NPS award after they became aware of the other project. Monitors are in Teddy Roosevelt Park in North Dakota, Devil Tower National Monument in Wyoming, and in Badlands and Wind Cave National Parks in South Dakota.

Below Left: mercury monitors we built for the study. These are wet deposition monitors. Monthly samples are sent to a lab in Seattle for analysis. Below Right: Dr. Jim Stone at Hg monitoring site in Badlands National Park.

Sampling lake sediment though ice in eastern SD during January 2009.



My DUSEL research is still active along several avenues and with several people. I have instruments deployed on the 800, 1250, 2000, 2650, and 4850-ft levels in the mine. In the next month, I will also be moving some equipment to the 5000-ft level. My NSF project, Characterization of the Precambrian Aquifer at the Homestake DUSEL, is in its last year, although the work will continue for at least another three years. Using funds from this award, I have established six climate stations underground and one on the surface. I have instruments suspended into the water table from the #6 winze on the 4850-ft level that measure the water reduction. A new vibrating wire transducer will soon be deployed all the way to the bottom from the 5000-ft level. With this deployment, we will also

run a single fiber optic distributed temperature cable in the shaft that will allow us to know temperature along the entire length of deployment. The fiber optic is part of a new network of strain measurement cabability that I am working with Dr. Herb Wang (U Wisc) and Dr. Mary MacLaughlin (M Tech). I am currently building a website for this work: http://www.hpcnet.org/dewatering.

No. 6 winze on the 4850-ft level one week after the level had been dewatered (left). The yellow strap is a safety strap. This winze goes to 8150 feet deep.

View down the #6 from the 4850-ft level. The light is shinning off the water surface.

Graduate student Jason VanBeek and myself deploying the instrument cables nto the #6 winze from the 4850-ft level (left).

The surface weather station was deployed in July 2009 on top of the SDSTA Administration Building roof. Data can be observed online at: http://204.114.27.11.

Surface weather station at DUSEL looking southwest. The Ross headframe can be seen in the right center of the image.

Working on deployment of tiltmeters on the 2000-ft level in January 2009 (right).

Two tiltmeter Arrays were deployed on the 2000-ft level in January 2009. This project is a cooperative effort between myself and Dr. James T. Volk, an applications physicist from Fermi National Accelerator Laboratory (Fermilab). Sensors and data acquisition equipment were designed and built at Fermilab. Ultimately, sensors will be located at several levels at the Lab providing a 3-D

view of slow ground motion at the site. I am building a website for this research that is at: http://www.hpcnet.org/HLS.

A small vacuum was used to pull water through the tubing in an effort to eliminate bubbles. All bubbles that were in the tube had to be chased out through a lot of bending and walking in a bent position. This is graduate student work from now on!

Single-jacking a hole through a bulkhead for placement of the upper tubing line for the tiltmeters (right).

Publications

1. Kipp, G., J.J. Stone, and L.D. Stetler. 2009. Metal transport in sediments near abandoned uranium mines in Harding County, South Dakota. *Journal of Applied Geochemistry*, 24(12):2246-2255.
2. Rastogi, G, S. Osman, P. Vaishampayan, G. Andersen, L.D. Stetler, and R. Sani. 2009. Microbial diversity associated with abandoned uranium mines as revealed by high-density 16S microarray and clone library. *Microbial Ecology*, Online First, DOI 10.1007/s00248-009-9598-5.
3. Rastogi, G., L.D. Stetler, B.M. Peyton, and R.K. Sani. 2009. Molecular analysis of Prokaryotic diversity in the deep subsurface of the former Homestake Gold Mine, Lead, South Dakota, USA. *Journal of Microbiology*, 47(4):371-384.
4. Davis, A.D., Roggenthen, W.M., Stetler, L.D., Hladysz, Z.J., and Johnson, C.S., 2009, Post-closure flooding of the Homestake Mine at Lead, South Dakota. *Mining Engineering*, 61(3):43-47.
5. Davis, A.D., L.D. Stetler, W.M. Roggenthen, Z.J. Hladysz, and R. Salve. 2009. Instrumentation of the Homestake underground laboratory for drawdown measurements during dewatering. *Mining Engineering, In press*. Preprint 08-051.

In Preparation

1. Stetler, L.D., J.J. Stone, A. Schwalm. 2010. Field Sampling Protocol for Abandoned Uranium Mine Site Characterization: Part 1—Soil Cores and Water. *Environmental and Engineering Geologists.* In Preparation for 12-2009 submission.
2. Stetler, L.D., J.J. Stone, A. Schwalm. 2010. Field Sampling Protocol for Abandoned Uranium Mine Site Characterization: Part 2—Surface Soil and Aerosol Dust. *Environmental and Engineering Geologists.* In Preparation for 12-2009 submission.
3. Stetler, L.D., J.J. Stone, A. Schwalm. 2010. Environmental impacts from Abandoned Uranium Mine Sites: Part 3—A case study of the North Cave Hills, Harding County, South Dakota. *Environmental and Engineering Geologists.* In Preparation for 12-2009 submission.

Kurt Katzenstein

This fall marks my third semester as a faculty member in the Department of Geology and Geological Engineering here at SDSM&T. The courses I taught during 2009 include Geology for Engineers, Earth Systems Engineering Analysis, Stratigraphy and Sedimentation, and a new course that I proposed called Geohazards. I also taught all five weeks of the Geological Engineering field camp here in the Black Hills along with Dr. Larry Stetler.

In late 2008 I was awarded a Project Initiation Grant (PIG) by the South Dakota Space Grant Consortium as well as a Nelson Research Grant to establish an Interferometric Synthetic Aperture Radar (InSAR) processing laboratory here at SDSM&T. InSAR is a geophysical method that allows for sub-centimeter surface deformation to be measured using radar satellite imagery acquired from space. The lab was operational by late August and I have preliminary results from a few sites around the Black Hills and elsewhere including the delineation of subsidence resulting from coalbed methane production in the Powder River Basin, monitoring surface deformation resulting from dewatering of the Deep Underground Science and Engineering Laboratory (DUSEL), surface deformation in Harding County, SD resulting from petroleum production, and a study investigating regional slope stability in the area of the Nile Valley, WA landslide which occurred in October of 2009.

During the upcoming year I plan to continue to refine my curriculum as well as focus on research efforts, including expanding the InSAR research I mentioned above and pushing to acquire some geotechnical equipment which will support current and future geomechanical-based instruction and research within the department. This equipment will also allow for a mechanical based research focus on slope stability to be established within the department. I also look forward to leading this year‘s spring trip in March. We will be traveling to Death Valley, California, a place where I have spent a significant amount of time as it is only an hour and a half from my hometown. I hope all is well with you and yours this holiday season.

Foster Sawyer

Greetings to all of our alumni! It‘s been an exciting, action-packed year since the last newsletter, including a trip through the Gobi desert, preparing new courses, working with students and colleagues on research projects and publications, interacting with the Tech Geological Association and the Society of Petroleum Engineers student chapter, teaching field camp, and many other stimulating and enjoyable activities! The coming year promises to hold even more interesting and rewarding experiences as our Department continues to grow and evolve in response to new challenges and opportunities.

In the spring of 2009, I had the great pleasure of traveling to Mongolia with a team of faculty members from SDSM&T and Oglala Lakota College for the purpose of initiating new cooperative research projects and student exchange opportunities with Mongolian universities. We visited virtually every university in the entire nation of Mongolia and made huge strides in paving the way for future research in that country as well as in bringing Mongolian students here to SDSM&T. An exhilarating trip through the Gobi desert resulted in identification of potential research topics related to ground water recharge in extremely arid regions, ground water and surface water quality, ground water supply, and other environmental and ecological topics of study. Mining is the mainstay of the Mongolian economy, and we also had the opportunity to attend a conference on environmental issues associated with the Erdenet Copper Mine which is the largest mine in the country. At the conference, I presented a paper on source water protection approaches in Mongolia and was rewarded with an interview on Mongolian television the next day! Dr. Michael Terry and I also are working on publication of geologic information from a dinosaur egg locality that we visited on our route through the Gobi.

On another front, we are working to enhance our oil and gas curriculum in the Geology and Geological Engineering Department and to strengthen industry ties in that field. Progress has been made in reaching a cooperative agreement with Halliburton regarding use of their latest software packages in our classes, and efforts also have begun in developing petroleum related research projects

and approaches to market the resulting information. The Rocky Mountain Unconventional Gas Conference held at SDSM&T this fall brought many potential cooperators to campus, and interest in new opportunities for natural gas exploration is keen at present.

(a)

(b)

(a) Ulan Tsav dinosaur egg locality in the Gobi desert of southern Mongolia, and (b) Erdenet copper mine in north central Mongolia.

Other exciting opportunities exist in the field of ground water hydrology, and I enjoyed working both with colleagues in our Department and with representatives from Oglala Lakota College on several grant proposals related to water quality and land use issues this past year. Several of the Tribal colleges in South Dakota have expressed interest in cooperative hydrological projects with SDSM&T, and I look forward to exploring those avenues of research in the coming year. My position on the Board of Directors of the West Dakota Water Development District also has kept me in the thick of emerging water-related issues locally.

Another exciting event involving the Geology and Geological Engineering Department is the upcoming Geological Society of America Rocky Mountain Section Meeting that will convene in Rapid City in April, 2010. I am serving as Technical Committee Chair for the meeting, and Dr. Perry Rahn and I, along with colleagues from the U.S. Geological Survey, plan to lead a field trip focused on the hydrology of the central and eastern Black Hills. This GSA section meeting is shaping up to be fantastic, and I encourage all of our alumni to consider attending the meeting and paying us a visit next spring!

There are many other activities about which to write, however, I will limit myself to inclusion of some of the more noteworthy events and publications in the list below. Thank you for your interest in the Department of Geology and Geological Engineering and for your continued support as we prepare the Department to meet the challenges of the future!

- Election to the American Institute of Professional Geologists (AIPG) National Executive Advisory Board for 2010; current President of the South Dakota Section of AIPG; part of the team that is bringing the annual national meeting of AIPG to Rapid City in 2012
- West Dakota Water Development District Board of Directors
- Vice President of the Black Hills Digital Mapping Association, Inc.
- Vice President of the Inyan Kara Group, LLC
- Technical Committee Chair, 2010 GSA Rocky Mountain Section Meeting

- ❖ Faculty advisor for the Tech Geological Association and for the Society of Petroleum Engineers Student Chapter at SDSM&T
- ❖ Sawyer, J.F., and Tinant, C.J., 2009, Strategies for source water protection and assessment: Mining and the Environment, Erdenet, Mongolia, June 8-9, 2009, Conference Proceedings, p. 36-44.
- ❖ Martin, J.E., Di Pasquo, M., Case, J.A., and Sawyer, J.F., 2009, The age of a theropod dinosaur, based upon associated palynoassemblages, from the Snow Hill Island Formation (Maastrichtian) at the Naze, James Ross Island, Antarctica [poster]: Geological Society of America Annual Meeting, Portland, OR, Oct. 18-21, 2009
- ❖ Putnam, L.D., Hoogestraat, G.K., and Sawyer, J.F., 2008, Water-quality effects and characterization of indicators of onsite wastewater disposal systems in the east-central Black Hills area, South Dakota, 2006-08: U.S. Geological Survey, Scientific Investigations Report 2008-5232, 115 p.

Ed Duke

Ed Duke has been busy directing the South Dakota NASA Space Grant Consortium and the South Dakota NASA EPSCoR Program. The programs provide close to $2 million annually for research and education projects across the state. In addition, Ed runs the scanning electron microscopy lab, and he offered a new SEM class this fall that drew 35 students from a variety of disciplines. In his spare time, he is finishing a research project on metamorphic conditions in the Belt Supergroup using information derived from NIR spectra of over 1000 samples.

Darrin Pagnac

I have had an extremely busy year with burgeoning research projects and teaching classes. Last spring I finalized my manuscript on the biostratigraphy of the Barstow Formation (Miocene, California) which was accepted for publication in the journal Paleobios. It is currently in press. I am working on a number of other projects, both solo and with students, including a paper on additions to the Miocene vertebrate fauna of the Fort Randall Formation (South Dakota), a description of a dwarf Miocene horse from the Punchbowl Formation (California), and a collaborative project with a former undergraduate advisee comparing the Miocene horses from Ashfall Fossil Beds (Nebraska) and the Mission Pit (South Dakota).

The future looks extremely bright with brand new research projects underway. In August I submitted an NSF grant with a colleague from the New York State Museum. We will be combining stable isotope analyses of fossil mammals with detailed stratigraphy to provide an in-depth analysis of climate change and associated shifts in diet during the medial Miocene. As I write this, I am awaiting a call from colleagues at both the Oklahoma State University and the University of Oklahoma. We will be starting a collaborative venture examining the correlative biostratigraphy and phylogenetics of Miocene mammals in the Great Basin, including the Barstow Formation of California, and the Eastgate fauna of Nevada. Most excitingly, I have been invited to National Cheng Kung University in Tainan, Taiwan, to explore collaborative education and research options between the university, the national Taiwanese museum, and SDSMT. If all goes well I will be spending a week in January making new connections with our partners across the Pacific Rim.

July was a very fun and enjoyable month for me. I reopened the Jurassic Little Houston Quarry near Sundance, WY, for the first time in over ten years. Along with graduate students Natalie Toth and Josh Ratliff, I held a two week field paleontology course for undergraduates, graduate students, and several interested amateurs. The course was a huge success, with participants from all over the United States. The students had a fun time creating an –olde tyme" group photo reminiscent of Cope and Marsh days. Exceptional discoveries include a femur (thigh bone) of the sauropod dinosaur *Camarasaurus*, and several neck vertebrae of similar kinds of herbivorous dinosaurs.

I eagerly await professional developments in the coming year. With luck and hard work, I will report on continued success, new international connections, and exciting developments in the future.

Mike Terry

This past year my time was spent teaching structural geology, petrology, advanced structural geology, modeling metamorphism, Homestake Research seminar and field courses at Ranch A in Wyoming and in Taskesti Turkey. During the summer I traveled to Ulaanbaatar Mongolia with a team from SDSMT to explore develop collaborations with faculty at Mongolian University of Science and Technology. This was followed by trip to the Gobi desert to explore research potential and to become familiar with the environment and culture. Mongolia is truly a fantastic place with great people. There is great potential to develop collaborations on the geological engineering side.

After field camp, I did some geologic reconnaissance with Nuri Uzunlar and Alvis Lisenbee to identify potential research projects in Turkey. We will have two students beginning their M.S. research there in the summer of 2010.

Two graduate students, Lindsay Chasten and Patrick Morton, and one undergraduate student, Eric Hoffnagle, presented research at the National GSA meeting in Portland. The disciplines covered by their abstracts include, mineralogy, geochronology and structural geology. Lindsay Chasten also completed her thesis, which involved chemical dating of monazite at the Deep Underground Science and Engineering Lab. Currently, I am advising four students in undergraduate research and have graduate student working here in the Black Hills and abroad.

Colin Paterson

Colin Paterson continued to coordinate the course IS 110 Explorations for all entering students majoring in science at SDSM&T. The theme for Fall 2009 was –climate change". Eleven students came on the optional field trip to Glacier National Park and Yellowstone National Park in August to examine ecosystems and their response to fire and climate change. I spent a total of 6 weeks teaching field camp at Ranch A and in Turkey in the summer. I am involved with the Homestake underground lab, and am coordinating the PODS geoscience working group (Petrology, Ore Deposits, Structure) initiating research on a variety of aspects of the Homestake iron-formation gold deposit and its geological setting. Three graduate students are undertaking ore deposit theses on the Homestake deposit, and there is one dissertation on Namibia in progress. There are quite a few enquiries from students considering ore deposit research, but the challenge is finding resources to support them. Of particular difficulty is attracting funding for graduate student stipends – it is time for mining companies to look to the future and to invest in the new generation of potential employees. If you are in a position to help, or if you have potential research projects available, email colin.paterson@sdsmt.edu

The Society of Economic Geologists student chapter has been very active in the department with about 45 members involved in monthly meetings and field trips. The chapter sponsored the fall department picnic, and provides sodas and cookies for the department Friday seminars. As one of our fundraisers, the chapter has Homestake gold mine rock suites for sale, in beautifully crafted wooden display boxes, for $165 – check out the details and order form at http://seg.sdsmt.edu or email Colin.

James Martin

Excitement increased during 2009 concerning the new paleontology building. For over 20 years, our fossil and mineral collections have languished in the Old Gym, and most were unavailable to our students or faculty. But in the Spring of 2009, ground-breaking for the new 33,000 square-foot facility occurred, with Governor Mike Rounds officiating. Subsequently, the summer was very busy, and the construction noise is music to our ears. The building process is well ahead of schedule, and rather than being completed in the Fall of 2010, a more likely completion date will be in May, 2010. This means that our efforts to organize and inventory the collections prior to their move must be increased. I wish to thank all our students, volunteers, partners at various federal agencies, and hard-working personnel for their efforts. We appreciate the kindness of the SDSM administration for allowing us to use the Old Gym floor to organize the collections. Jim Martin's time has been consumed by the new building, particularly in raising funds. In that regard, we wish to sincerely thank Leroy (GeolE 71), Charlene, David, and April Foster for their gift of $100K to complete the Preparation Laboratory, which will be named in their honor. As this is going to press, we just received the exciting news that the Frank M. and Gertrude R. Doyle Foundation of Nevada will donate $450K to aid in funding the library and conservation laboratory. We are still soliciting funds for shelving, equipment, and to complete other laboratories. If you can help, please contact Jim (James.Martin@sdsmt.edu).

We received another fantastic donation from the Field Museum in Chicago, thanks to William Simpson, their head preparator and former School of Mines paleontology student. We received three life-size sculptures of brontotheres, the largest mammals to live in the Badlands. These sculptures include a very large bull, cow, and a baby. In October, we had a baby shower during which time we unveiled the juvenile, had a naming and coloring contest won by three local children, and solicited equipment through a gift registry. Instead of diapers and milk bottles, we asked for pallet jacks, cases, forklift, etc. for the new building. You are welcome to check out the Museum of Geology website to see the kinds of items we need. You may not be able to donate major funds for the new building, but a shovel or pack of scalpels are always needed.

The Midland Energy Center, Texas, donated a large geological library to the Museum of Geology for inclusion in the new building. Mr. Loren Toohey, a long-time friend of the Museum of Geology, arranged for the important donation that will provide resources for students and researchers, alike.

Among these hectic duties, Jim taught the graduate vertebrate paleontology class and two summer field paleontology excursions. He wrote $3.4 million dollars in grants and requests, and so far, has received funding to continue to research and systematic surveys of the Late Cretaceous deposits of the Missouri River. We found mosasaurs and plesiosaurs once again this summer, and as normally happens, found the best specimen the last day, a very small mosasaur skull. We collected that specimen, but we still have parts of the larger specimens to completely collect next summer.

October also saw the airing to two National Geographic Society documentaries in which Jim participated. Each program targeted two of the largest carnivores from the Badlands: *Hyaenodon*, a creature similar but much larger than a wolf, and the entelodonts, which were termed Hell Pigs in the documentary. He also starred in a South Dakota public television documentary concerning the amazing mosasaurs (sea lizards) that he and his colleagues and students have collected over the last 20 years.

Jim continued his advising role and was happy to see the completion of Master‘s theses by Matthew Sauter, who took a paleontology position with a private company, Huai-Pin Hu, from Taiwan who is staying at the School of Mines for his Ph.D., and Ms. Chloe Branciforte, who completed her degree in December. Their thesis topics ranged from Miocene mammals to Pleistocene horses.

Jim was inducted as a fellow into the Explorers Club after being nominated by School of Mines President, Robert Wharton, and Mr. Edward Bakewell, III, of St. Louis. Explorer Bakewell also arranged for Jim to give a lecture concerning his discoveries in Antarctica for the St. Louis Chapter of the Explorers Club. The lecture was well received, and Jim was treated like a king, thanks to the hospitality and kindness of the Bakewells.

Jim spent September in Europe visiting France, Northern Ireland, and England. Although some time was expended with wine and castles, Jim conducted field work and met with his colleagues at the Paris Museum of Natural History and the British Antarctic Survey. He also presented a scientific contribution at the international meeting of the Society of Vertebrate Paleontology in Bristol concerning the first evidence of salt glands in plesiosaurs with his colleague

Dr. Marta Fernandez from Argentina. The South Dakota specimen was originally described by former student, Dr. Bruce Schumacher, and the salt glands were discovered subsequently. Salt glands are found in many marine creatures to remove salt from the blood, which would otherwise be toxic. Marta had found these structures in fossil marine crocodilians before, but these were the first ones ever found in plesiosaurs (Loch Ness monsters).

Jim also hosted another Argentine colleague, Dr. Mercedes Di Pasquo, who was in the United States as a Fulbright Scholar. Her expertise is in fossil pollen, and she analyzed the plant pollen collected from the section with a theropod dinosaur we found in Antarctica in 2003. The results were presented at the national Geological Society of America meeting in Portland. She also sampled many areas in the Black Hills as part of her world wide study of the Devonian-Mississippian boundary. Dr. Mark Fahrenbach, another former student now with the SD Geological Survey, took us to many interesting outcrops as he had studied the sedimentology and paleontology of the Englewood Fm. for his doctorate.

Now, Jim is very busy engaged in organizing all the collections and Museum equipment for the move into the new building….a very exciting time for paleontology, geology, and the university!

From the Field Station:

Nuri Uzunlar, Director

The BHNSFS had a blessed year with 112 students and 22 summer faculty on three continents. Alvis Lisenbee, Colin Paterson, Larry Stetler, Mike Terry, Foster Sawyer, Kurt Katzenstein, Darrin Pagnac, Randy Moses were all spent part of their summer teaching the camps. Additional faculty members came mainly from the consortium schools. Thanks to faculty members here at SDSM&T and your support the Field Station now is one of the premiere field schools in the nation and offers camps in the **USA**, **Turkey**, **India** and **Nepal**. Black Hills State University joined the consortium to offer ecology and biology field courses. In addition to field courses offered, in 2009 BHNSFS will be offering a Geomorphology Field Camp in the Himalayas, Petroleum Geology Field Camp in Turkey, Geospatial Field Methods and Vertebrate Ecology Field Techniques courses in the Black Hills.

The dream of building a field station somewhere in the Black Hills is still at large. I am looking for a suitable land somewhere close to Nemo, Spearfish or Rochford. Please contact me if you can help or

you know someone who can. Ranch A is a great place as many of you know but with many summer courses and year around activities we need a field station that belongs to us.

Courses offered in the summer of 2010 are listed in the table below.

Field Courses 2010			
USA			
Course No / Session	Credit	Name	Date
GEOL 410 (Ranch A – 1)	6	Field Geology	May 17 – June 18
GEOL 410 (Ranch A - 2)	6	Field Geology	June 21 - July 23
GEOE 410 (Campus)	6	Engineering Field Geology	May 17 – June 18
GEOL/GEOE 412/512	3	Science and Engineering Field Applications	May 17 – June 3
GEOL/GEOE 492 -TOPICS	1	Freshmen Field Geology	May 24 – 28
GEOL 376	3	Geospatial Field Methods	July 31 – August 14
GEOL 412	3	Vertebrate Ecology and Field Techniques	TBD
GEOL 371	2	Undergraduate Field Paleontology	Multiple dates
PALE 671	2	Graduate Field Paleontology	Multiple dates
Turkey			
GEOL/GEOE 412/512	3	Science and Engineering Field Applications	May 24 – June 10
GEOL 410 (Session One)	6	Field Geology	June 14 – July 17
GEOL 410 (Session Two)	6	Field Geology	July 19 – August 21
Nepal			
GEOL/GEOE 412/512	3	Science and Engineering Field Applications	May 23 – June 9
India			
GEOL/GEOE 412/512	3	Science and Engineering Field Applications	May 24 – June 10

My new DUSEL project titled **Collaborative Research: Coupled Thermal-Hydrological-Mechanical-Chemical-Biological** (THMCB) **Experimental Facility at DUSEL Homestake** was funded by NSF last summer. The proposed work focuses on developing a preliminary design for a large-scale subsurface experimental facility to investigate coupled Thermal-Hydrological-Mechanical-Chemical- Biological (THMCB) processes in fractured rock at depth. The experiment would be part of the proposed Deep Underground Science and Engineering Laboratory (DUSEL) in the Homestake Mine. My collaborators are Eric Sonnenthal (UC Berkeley and Lawrence Berkeley National Lab), Derek Elsworth (Pennsylvania State Univ.), Barry Freifeld (Lawrence Berkeley National Lab), Robert Lowell (Virginia Tech), Kate Maher (Stanford University), Brian Mailloux (Barnard College).

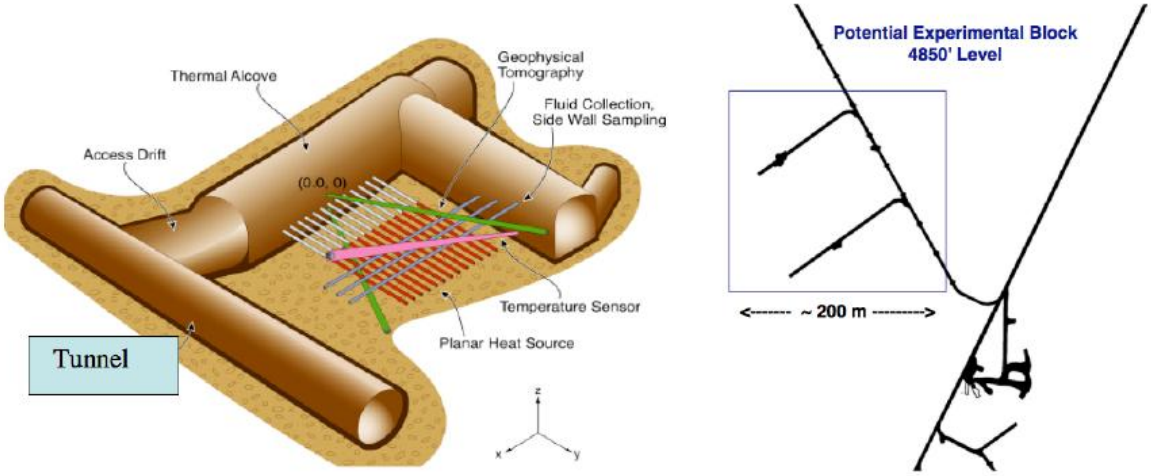


Figure 9. Left—preliminary experimental layout for the THMCB experimental facility based on a proposed thermal test at Yucca Mountain, Nevada. Borehole regions marked in red are heater elements. Right—plan view of a potential tunnel complex at the 4850' level for the proposed THMCB experimental block.

I also received the John C. Mickelson Professorship Award in 2009. Funds from this award will be used to support research development in Anatolia led by Alvis Lisenbee, Mike Terry and I

In addition to traveling from camp to camp I have been very active in departmental committees and the department's graduate and undergraduate recruiting efforts. I attended GSA in Portland, Oregon, to host a booth on behalf of the BHNSFS and the department and attended to AGU in mid December for DUSEL related research projects and discussions.

For additional information about upcoming field station activities please visit: http://geologyfieldcamp.sdsmt.edu , call me at (605) 394–2494 or write me at: nuri.uzunlar@sdsmt.edu

DUSEL News:

Bill Roggenthen, Co-PI

Activities in Lead in support of the preparations for a Deep Underground Science and Engineering Laboratory continued apace this year. The two major projects include the Early Science and Operations at the Sanford Laboratory, supported by local sources, and the work to prepare the Preliminary Design, supported by the National Science Foundation (NSF). The Sanford Laboratory currently is excavating drifts and a large room near the site of the former Ray Davis neutrino experiment that occupied space on the 4850 level since the mid-1960's. This will provide additional

space and access for the early neutrino and dark matter experiments schedule to be installed at the 4850 level in the middle of next year. Concurrent with the excavation work on that level is the geotechnical program being conducted to determine the rock quality and feasibility of building the large detectors on that level as well. These detectors involve the construction of extremely large volumes, probably cylinders with diameters of ~55m and heights of ~60m.

Approximately $47 million has been allocated to the preparation of the Preliminary Design, which is scheduled for completion in the spring of 2011. Project offices have been established at the University of California Berkeley (project prime contractor), at Lead (headquartered in the former Homestake Administration Building), and at SDSMT (responsible for most of the contracts for the project). Within the Department and SDSMT, Bill Roggenthen is the Co-Principal Investigator for the DUSEL Project and several members of the Department are involved. Larry Stetler has support from the NSF to characterize the water inflow, and he and his graduate students including Tessa Jones , are making good progress in measurements of the baseline conditions in the Homestake underground. Arden Davis authored a paper for the Society of Mining Engineering on the rate of water inflow. Mike Terry and Alvis Lisenbee have put together some interesting geology based upon the coring performed as part of the geotechnical characterization program investigating the suitability of the rock for construction (it's good). This model will help tremendously during the final site selection and construction phases.

Overall, the progress has been good. Funding is in place to complete the Preliminary Design. The Homestake underground situation is in good shape in that the water has been pumped down below the 4850, which will allow the early experiments and geotechnical characterization to proceed on the 4850 and for the new pumping system to be installed on the 5000-ft level. A water treatment is in place that appears to be operating very well. Coring and the determination of *in situ* stresses at the 4850 have been completed and geological studies and design of the excavations are well underway. Finally, graduate and undergraduate students are being involved in the project to both their benefit and that of the project.

Progress at the Lab can be followed by viewing the SDSTA and Lawrence Berkeley websites: http://sanfordlab.org and http://www.lbl.gov/nsd/homestake/