SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

2011 Alumni Newsletter

Department of Geology and Geological Engineering

Department of Geology and Geological Engineering – Fall 2011: Left to right: (back row) – Kurt Katzenstein, Larry Stetler, Darrin Pagnac, Nuri Uzunlar, Maribeth Price, Arden Davis; (front row) Colin Paterson, Foster Sawyer, Laurie Anderson (Head), Mike Terry and Perry Rahn; Absent: Alvis Lisenbee, Bill Roggenthen, Jim Fox, Jack Redden, Jim Martin, Ed Duke and Sally Shelton

From the Editor – Nuri Uzunlar

Greetings Alumni and friends! I hope your year was as fun and productive as mine and wish each and every one of you good health and happiness in 2012. The 2011 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 – Laurie Anderson

Dear Alumni and Friends,

Perhaps the best way to kick off this newsletter is to introduce myself as the new Head of Geology and Geological Engineering. I am a west-central Minnesota native and received my B.A. from the University of Minnesota-Morris in 1985 (in biology, geology and music), a M.S. from Bowling Green State University (Ohio) in 1987 (in geology), and a Ph.D. from the University of Wisconsin-Madison in 1991 (in geology).

In 1991, I followed the Mississippi down to Baton Rouge, LA and became faculty member in the Department of Geology & Geophysics at Louisiana State University. During my time at LSU I served as Faculty Senate President (2001-2002) and as department chair from 2003-2007.

This year, SDSM&T offered me the opportunity to lead both the Department of Geology & Geological Engineering and the Museum of Geology. I am thrilled to be back in the Midwest and very much enjoying working with a great group of faculty, staff and students.

The primary foci of my research are the paleobiology, paleoecology, taphonomy, and phylogeny of mollusks, particularly the Bivalvia. My work combines field research in both modern and ancient settings, museum studies, and laboratory analyses. My teaching focuses on the biological history of Earth/geologic history of Life, and I find teaching field courses especially rewarding.

I look forward to meeting more Geol/GeoE/Pale alumni and friends in the next few months.

All the best,

Laurie C. Anderson
Head and Professor, Geology & Geological Engineering
Director, Museum of Geology
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From Our Emeritus Professors

Geology and Geological engineering 1986

Back Row L-R: James E. Martin, William M. Roggenthen, Fredrick, J. Rich, Perry H. Rahn, Jack A. Redden, Fred V. Steece. Front Row Nancy Scofield, Huseyin I. Bilgesu, Marilyn Lundquist, Colin J. Paterson, Philip R. Bjork.

Perry Rahn

Perry Rahn is busy cutting down trees infected with the "Mountain Pine Beetle". This year the SD Forestry department marked over 1,400 trees on his property along Slate Creek. The overall long term predictions for bark beetles in the Black Hills is rather dismal, actually. Other than that, Perry keeps some research going and is writing a paper about ground water recharge in metamorphic rock terrain.

Jim Fox

Jim is Emeritus Professor of Geology and Geological Engineering, and Emeritus Curator of Invertebrate Paleontology. Jim continues research on the subsurface geology of South Dakota as related to petroleum in the Williston Basin. He is also assisting with the curation of invertebrate fossils in the Museum of Geology.

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 spends winters in Arizona with his daughter.

Alvis Lisenbee

The professional side of my life continued this year with a bit of teaching, with research projects with graduate students and with geologic mapping in the Black Hills.

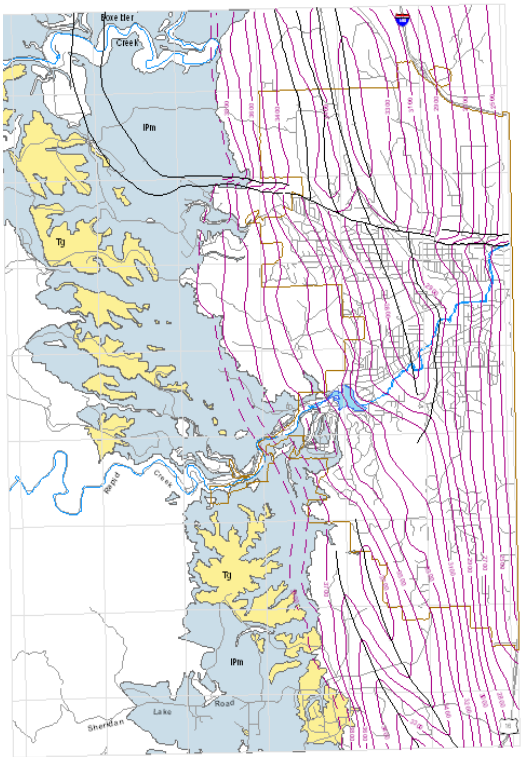
Nuri Uzunlar continues to include me in the teaching of summer field camp at our location in Taskesti, Turkey, a fact for which I am most grateful. The students are from universities across the U.S. and their preparation for field work varies from excellent to "we've-got-a-ways-to-go-here." They are all enthusiastic about the challenges of mapping in five differing terrains and geologic styles across a subduction zone, however. By the end of the five weeks they are field-capable and have a great appreciation for things Turkish – food, history, the friendliness of the average Turk and the beauty of the countryside.

In September, I returned to Turkey with Umit Yildiz, a master's candidate in geology. We visited his field area in the northwestern portion of Asiatic Turkey where he is examining a small, but very interesting part of one strand of the Tethys subduction zone. Being there was doubly interesting to me as the area was in my Ph.D. dissertation area at Orhaneli. Things have changed in 40 years!! Banks, supermarkets, restaurants – who would have thought it possible that the small, countryside town of 3,000 that we knew long ago would become so modern as to have a branch campus of a university??

The photograph shows Umit Yildiz using our sophisticated section-measuring device as we examine the contact between high-pressure blueschist rocks (at my feet) and a zone of highly sheared serpentine forming the base of a section of mélange, a part of the accretionary complex formed during subduction.

In the Black Hills, studies of vulnerability and susceptibility of aquifers continues, centered on a portion of Pennington County in the area surrounding Rapid City. Maribeth Price added greatly to this effort this year by bringing organization and leadership to the GIS aspects of the study and Arden Davis continues to guide our understanding of what is most significant in regard to the aquifer characterization. A total of seven graduate students participated, and funding was by the West Dakota Water Development District.

Our work includes preparation of five types of maps utilizing 1:24,000-scale maps. First is preparation of a geologic map. For each of the sedimentary aquifers, e.g., the Pahasapa Limestone (Madison aquifer) shown on the following map of the Rapid City West Quadrangle, we prepare structure contour maps on the upper surface and a derivative depth-to-aquifer map. The recharge area is then shown in two additional versions, one for aquifer susceptibility and one for aquifer vulnerability. The results for three quadrangles are viewable on the web site "aquifers.sdsmt.edu" and additional quadrangles are nearing readiness for posting in January.



Other efforts in the Black Hills include mapping the Hayward Quadrangle, which I had hoped to complete, but didn't and several consulting efforts regarding mineral resources. Interest in gold, rare earths, uranium and non-metallic ore deposits is strong now, with some large companies and others quite small involved. Life is enjoyable in retirement

Jim Martin

I retired after over 30 years in service to the SD School of Mines and Technology, both in the department and Museum of Geology. I decided to retire in order to spend more time in the research of the fossils I collected over many years before "Martinheimers" takes over completely. In that regard, I published three papers, one concerning faulting in southern South Dakota as an outgrowth of our work on the South Dakota geological map we published in 2005, another addressing the Tertiary stratigraphy of south-central South Dakota, and a third concerning late Miocene vertebrates from central Washington. I named two new vertebrates in the latter contribution, a new gopher species and a new turtle genus and species named for long-time Museum supporters, the George and Yvonne Wilbur family. I am just finishing another paper concerning an unusual shark occurrence in the Late Cretaceous epicontinental seaway; I also have papers being prepared on carnivores from Oregon with Jeff Person, invertebrates associated with a mosasaur from the 777 Ranch with Jim Fox and Rod Feldman, a beaver skeleton with Shawna Johnson, the gophers from Fossil Lake with Randy Moses, the westernmost occurrence of prairie dogs, and a Pleistocene assemblage from the Graves Ranch with Jennifer Cavin. I'm very happy to be publishing with colleagues and former students. As professor/curator emeritus, I also managed to secure two grants to support field work in Oregon and South Dakota.

Another reason for retirement was the accomplishment of my pledge to provide an adequate facility for the "care and feeding" of the fossil and mineral specimens that form the major portion of the Museum's collections. In June, I was very humbled by the dedication of the James E. Martin Paleontological Research Laboratory, a 33,000 square foot facility for the curation and reposition of natural history specimens and by the pledge of $2 million dollars from the Leroy and Charlene Foster family for continuation of paleontological research and education at the JEMPRL. Since the dedication, all has been relatively quiet; it is like I walked off the end of the earth after striving for the betterment of programs at SD School of Mines for so long.

Photo: Jim Martin with his first student, Craig DeTample, at the dedication of the James E. Martin Paleontological Research Laboratory

From the Faculty:

Arden Davis

In 2011 our research team continued to develop limestone-based technology for removal of arsenic from drinking water. The group includes Dr. David Dixon (Chemical Engineering), Dr. Cathleen Webb (Head, Department of Chemistry, Western Kentucky University), and Dr. Jenifer Sorensen (RESPEC, Inc.). The technology received a U.S. patent in 2010. Recent work shows that iron treatment of limestone increases its

efficiency dramatically, while preserving the buffering capacity of the limestone base. During the past year we also filed a provisional patent for removal of heavy metals from water. In laboratory tests with mine drainage water, the method has removed more than 99% of cadmium and lead.

Dr. Alvis Lisenbee, Dr. Maribeth Price, and I are supervising several graduate students through funded projects involving aquifer vulnerability in the 1:24,000-scale quadrangles west of Rapid City in the Black Hills. We're also starting a project on water quality and quantity in Precambrian aquifers of the Black Hills.

In May and June of 2011 I taught a three-week environmental field course to students from various schools, including the University of California at Berkeley, Rutgers University, Rice University, and others. The cold, wet spring weather in May gradually warmed up by early June, and the students, who had never seen the Black Hills, enjoyed their stay. After the course was over, some of the students went back to their homes, and others continued on westward to see more of the Rocky Mountains.

My service on the ABET Board of Directors normally requires two trips to board meetings each year. I enjoy seeing colleagues in the engineering accreditation field. In work related to engineering accreditation and professional registration, I'm serving on the P.E. Exam Committee of SME. If you have any ideas for sample exam questions, please send them along to me.

During the past year it was a pleasure to visit with colleagues and alumni at the SME annual meeting. We also enjoyed visits from alumni who stopped by to say hello, including Kendra Kungu, Colton Clark, Adam Hoffman, Cliff Kling, Darren Dyk, and many others.

Larry Stetler

Another year has passed speedily by and as I look back, it has been filled with a myriad of activities ranging from family, classroom, field research, and writing. Currently, I work directly with 3 GeoE MS students and 3 GeoE PhD students that are investigating a variety of topics that are mostly related to my active research projects.

In 2011, my teaching duties have been relatively well-balanced between spring (and summer) and fall semesters. The most significant academic change that occurred this past year was the merging of four previously independent courses into two new courses. Each of these new courses are team-taught with another of the GeoE faculty. In this way, the students are exposed to a broader perspective of technique and method regarding the subject matter. This new instructional method provides greater flexibility in time management during the course of a semester. The first combined course is GeoE 466 Environmental and Engineering Geology that was combined with GeoE 468 Geological Hazards. This new course is taught with Dr. Kurt Katzenstein. The second new course is GeoE 461 Petroleum Drilling and Production Engineering which combined GeoE 461 Petroleum Production with GeoE 462 Drilling Engineering. This course is taught with Dr. Foster Sawyer.

The Geological Engineering program was also modified in fall 2011 to meet new SD Board of Regents criteria for number of credits required by engineering programs. We reduced the curriculum by six credit hours from 136 down to 130 credit hours.

In 2011, my funded research was limited to an ongoing project at Badlands National Park (see Figures below). Previous research at the former DUSEL site in the former Homestake gold mine at Lead, SD are no longer being advanced.

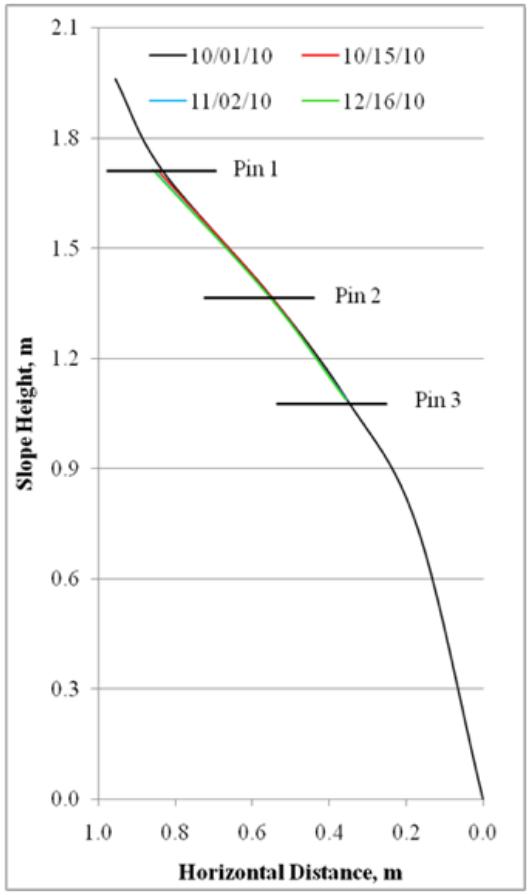
At Badlands, my research is directed toward establishing an erosion model for Park management to use for fossil resource management. I have established six measurement and monitoring sites throughout the fossil-bearing strata in the Park and collect monthly (and more frequent) data at each site.

Preliminary results from this project suggest that erosion rates at the Park can be very high in short time intervals. Table 1 contains data from two opposing slopes at one erosion site. These data indicate that high erosion rates > 10 mm do occur and conversely, at the lower portion of the slope, high deposition rates > 12 mm also occur.

Table 1. Erosion pin data from a research site at Badlands National Park. Values are in mm from original baseline measurements on 10/01/10. Positive values represent slope retreat (erosion), negative values represent slope advance (deposition).

Slope	Pin	10/01/10	10/15/10	11/02/10	12/16/10
O2P	1	0.00	10.60	9.31	1.97
	2	0.00	0.69	3.09	0.66
	3	0.00	1.40	-0.31	2.23
O3P	1	0.00	7.03	3.54	7.05
	2	0.00	-0.37	3.35	0.48
	3	0.00	1.15	3.73	-12.32

A vertical profiles of slopes O2P and O3P are shown in figure's 1 and 2 showing the changes that occurred during the 2 month measurement period.



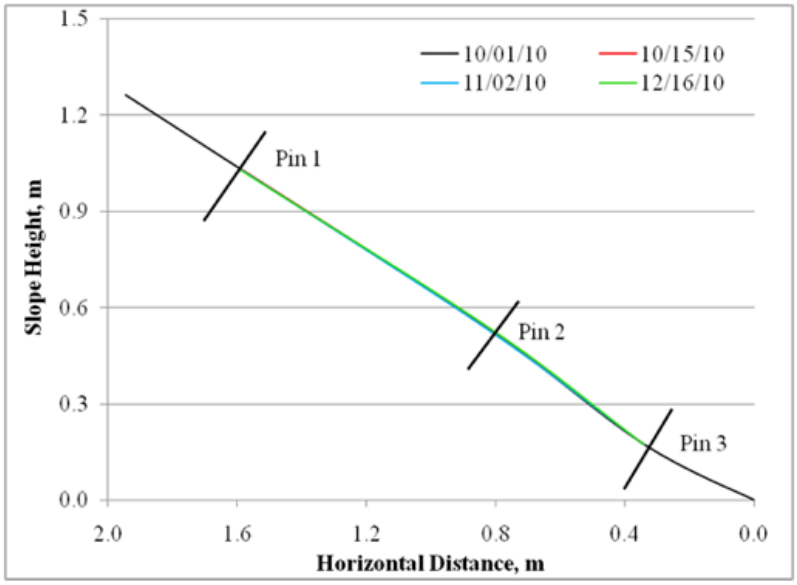


Figure 1 (left): Profile for slope O2P showing original surface and subsequent surfaces after pin measurement events.

Figure 2 (above): Profile for slope O3P showing original surface and subsequent surfaces after pin measurement events. Slope retreat/advance values for each pin and measurement event are shown in Table 1.

I am also utilizing photogrammetry and LiDAR scanning techniques to collect slope data for erosion calculations. Figure 3 shows a slope at an erosion site that has been projected using Red-Blue stereo viewing. To see the 3D rendering, you will need to utilize a pair a paper glasses having a Red and Blue plastic lens. By performing digital analyses of images acquired at different time periods, a net slope change (analogous to slope retreat/advance) is obtained. Figure 4 shows a fossil turtle shell being monitored from May 2011 (left) to October 2011 (right). This is also in the Red-Blue stereo mode. An increase in distance from the shell to the ground surface is observed on the left side the images between the two dates, indicating a net erosion of material surrounding this shell.

This type of information will be valuable to Park personnel in making decisions on management of these fossil resources.

In summer 2011, the Department of Geology and Geological Engineering and the Department of Mining Engineering received a donation of an I-Site 4400 Laser Scanning camera. I have been utilizing the new scanner at Badlands national Park and at several other project sites in the area. The advantages of a scanner over a photogrammetry system include: 1) acquisition of xyz data as part of the scan, 2) ability to scan up to 360° in one operation, and 3) data acquisition in any light situation, since the data are collected via a laser pulse.

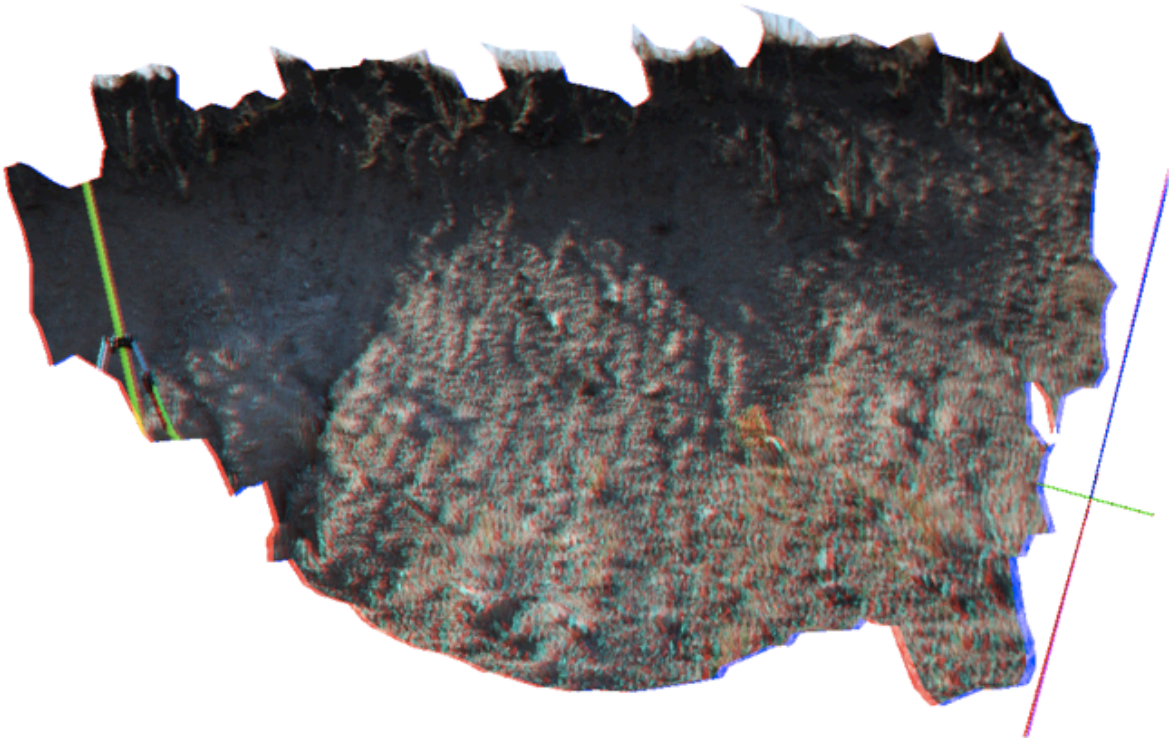


Figure 3. 3D image of a fossil-bearing slope at Badland National Park. Red-Blue stereo glasses are required to observe the 3D image.

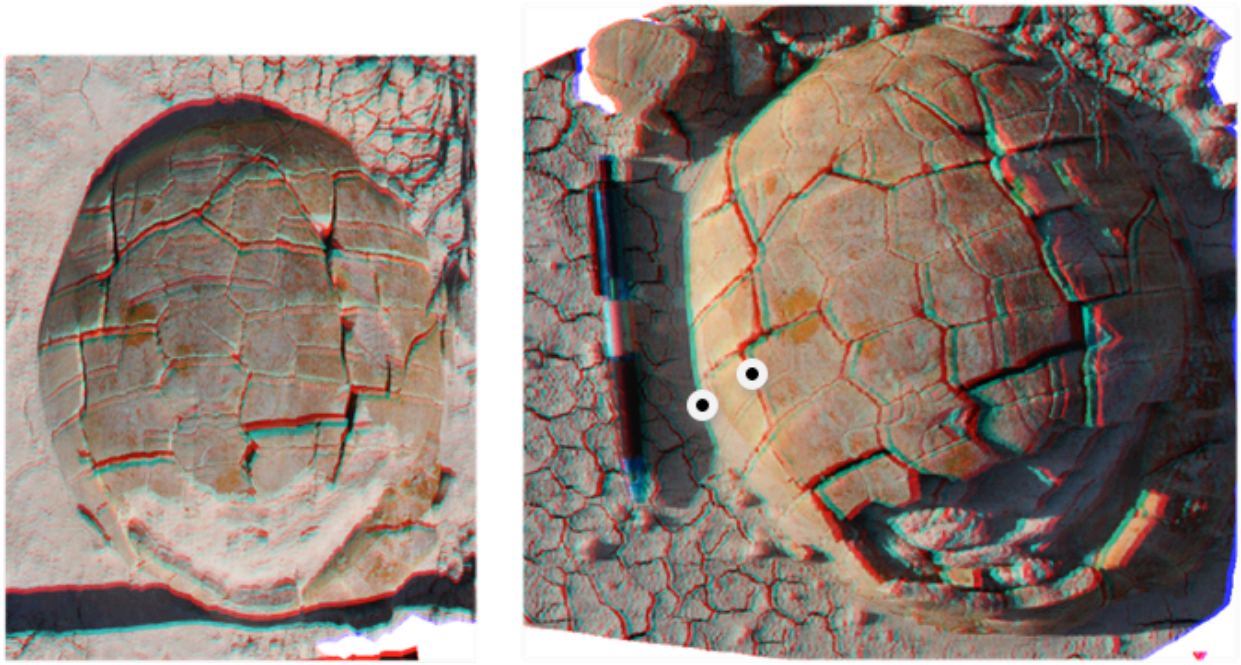


Figure 4. 3D images of a turtle shell at Badlands National Park in May (left) and in October (right) 2011. Using the black dots as a reference, the distance to the ground surface has increased over the measurement period indicating net erosion has occurred. Red-Blue stereo glasses are required to observe the 3D image.

Scanned images are also in 3D and can be merged to create a full-surround view of an object. Figure 5 shows captured scenes from the scanner as it has been used locally in recent months.

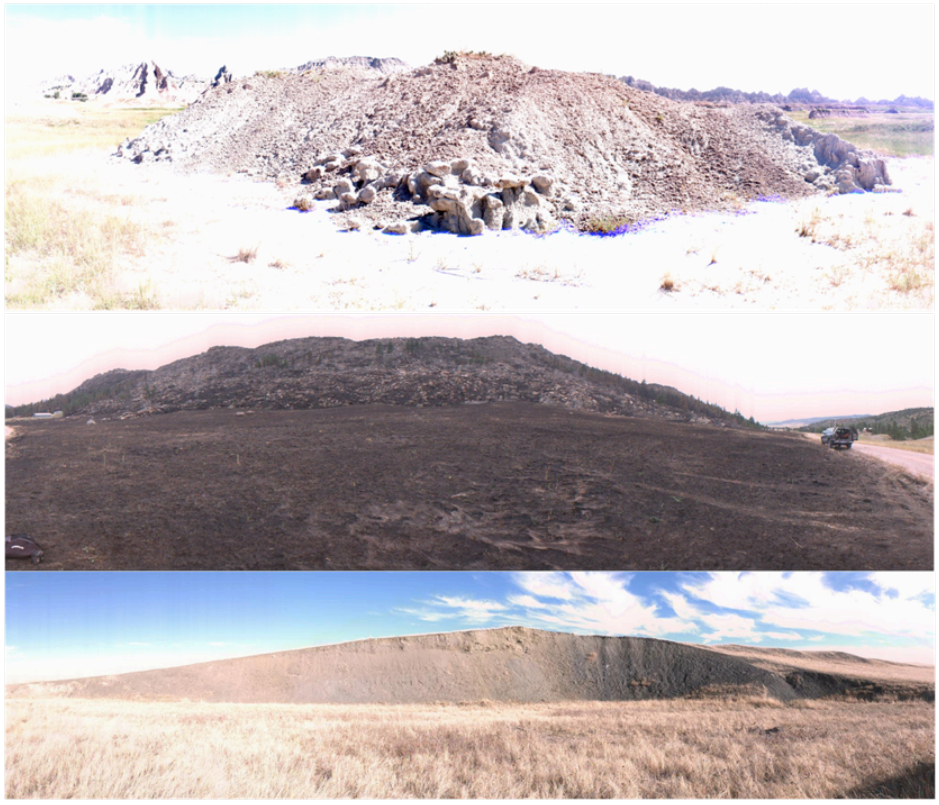


Figure 5. Images acquired with the laser scanner A) Badlands National Park, B) Whoopup Fire site in Wyoming, and C) methane seep in Cretaceous Pierre Shale, western SD. These images span 180° and have an associated point-data file for analysis.

In 2011, I remained active in publishing research results. The following list details these works.

Manuscripts in Review:

1. Stetler, L.D., J.J. Stone, and A. Schwalm. 2011. *Field Sampling Protocol for Abandoned Uranium Mine Site Characterization: Part 1—Soil Cores and Water*. In Review, Environmental & Engineering Geoscience.
2. Stetler, L.D., J.J. Stone, and A. Schwalm. 2011. *Field Sampling Protocol for Abandoned Uranium Mine Site Characterization: Part 2—Surface Soil and Aerosol Dust*. In Review, Environmental & Engineering Geoscience.
3. Stetler, L.D., J.J. Stone, and A. Schwalm. 2011. *Offsite Impacts From Abandoned Uranium Mine Sites: Part 3—A Case Study.* In Review, Environmental & Engineering Geoscience.

Manuscripts Published:

1. Meyer, F.D., S. Bang, S. Min, L.D. Stetler, and S.S. Bang. 2011. Microbiologically-Induced Soil Stabilization: Application of *Sporosarcina pasteurii* for Fugitive Dust Control. Proc. Geo-Frontiers, Advances in Geotechnical Engineering, Dallas, TX, March 13-16. Paper 1189, 10p.
2. Stone, J.J., C.M. McCutcheon, L.D. Stetler, and S.R. Chipps. 2011. Interrelationships between fish tissue mercury concentrations and water quality for South Dakota natural lakes and impoundments. Water, Air, and Soil Pollution, 222:337-349. Pub online 17 May, 2011, DOI 10.1007/s11270-011-0828-3. 13p.
3. Murdoch, L.C., L.N. Germanovich, H. Wang, T.C. Onstott, D. Elsworth, L.D. Stetler, and D. Boutt. 2011. Hydrogeology of the vicionity of Homestake mine, South Dakota, USA. Hydrogeology Journal, pub online 11 October, 2011, DOI 10.1007/s10040-011-0773-7. 17p.
4. Stetler, L.D., R. Benton, and M. Weiler. 2011. Erosion rates from Badlands National Park. International Symposium on Erosion and Landscape Evolution CD-Rom Proceedings (18-21 September 2011, Hilton Anchorage, Anchorage Alaska) St. Joseph, Michigan ASABE. Paper No. 11026, 9p.
5. Stetler, L.D., and J.J. Stone. 2011. International Symposium on Erosion and Landscape Evolution CD-Rom Proceedings (18-21 September 2011, Hilton Anchorage, Anchorage Alaska) St. Joseph, Michigan ASABE. Paper No. 11036, 9p.

Manuscripts In Press:

1. Volk, J., S. Hansena, T. Johnsona, H. Jostleina, T. Kipera, V. Shiltseva, A. Chupyrab, M. Kondaurovb , A. Medvedkob, V. Parkhomchukb, S. Singatulinb, L. Stetler, J. Van Beek, D. Fratta, J. Roberts , and H. Wang. 2011. Hydrostatic level sensors as high precision ground motion instrumentation for Tevatron and other energy frontier accelerators. Jour. Instrumentation. 30p.

Kurt Katzenstein

I hope all is well with you and your family this holiday season. 2011 was a very busy year for me both personally and professionally. My wife Lisa and I welcomed our second daughter Hannah Elise Katzenstein to the world on June 29. She is a very mellow kiddo and is our older daughter Brianne's favorite person in the world!

This August I began my new appointment as a Tenure-Track Assistant Professor of Geological Engineering. I had previously been at SDSM&T on an extended two year contract and am excited to have a more permanent position where I can continue to implement my expertise into the Geological Engineering curriculum. This past year I taught four and a half classes; Geology for Engineers, Earth Systems Engineering Analysis, Introduction to

Geological and Mining Engineering, Environmental and Engineering Geology (team taught with Larry Stetler), and again was the lead professor for the Engineering Field Geology course over the summer. The group of students we for field camp this past summer was the best group yet and was a very enjoyable experience. I was also lucky to attend the department spring field trip to New Zealand that was led by Colin Paterson. It was an amazing once in a lifetime trip, thanks Colin!

I am currently working to build a Geomechanics/Slope Stability laboratory that will be used for both instruction and research. This fall I was able to purchase a computer-controlled Trautwein soil shear box and will purchase a rock-joint shear box in the spring. I also plan to apply for an NSF CAREER grant this summer to explore the mechanics of rockfall triggering mechanisms through micro-scale strain measurements. If this

proposal is funded it will bring more state of the art equipment to the laboratory.

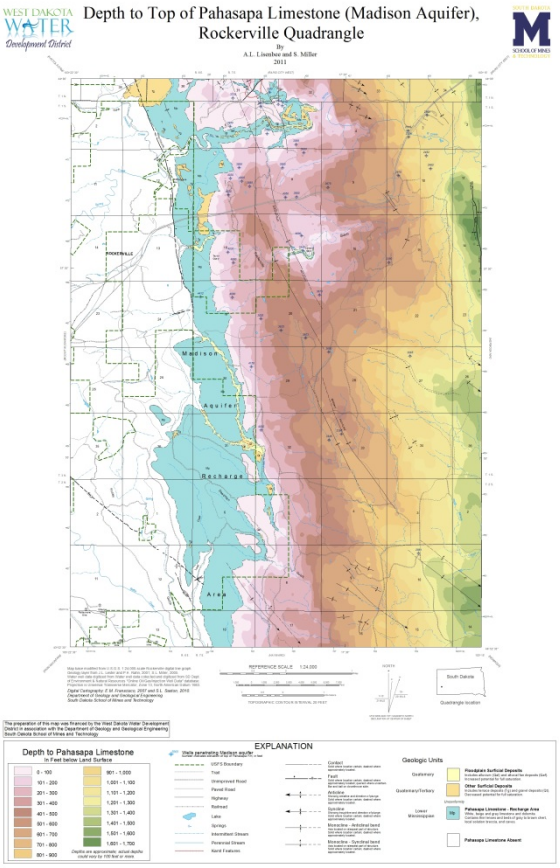
My Interferometric Synthetic Aperture Radar (InSAR) research is still ongoing. I am currently working on a grant funded by the Utah Geological Survey to investigate the source of ground fissuring in Cedar Valley near Cedar City, UT. I am also currently writing manuscripts detailing previous work looking and dewatering-induced subsidence at large mines and subsidence resulting from Coal Bed Methane production in the Wyoming and New Mexico/Colorado.

It was another successful year for the Tech Geological Association (TGA) as well. Activities this year included climbing Harney Peak, Bowling night vs. other student organizations (TGA won of course!), ice fishing, a visit to RESPEC, a trip to the Mammoth Site in Hot Springs, an overnight camping trip to Badlands National Park (which included a brisk 50 mph windstorm overnight, see the tent carnage in the image below) and outreach activities including teaching students at Corral Drive Elementary about the geosciences (see image below). We hope to continue fun outings (including our first attempt at curling this spring!) and outreach activities in the coming year.

Maribeth Price

Hello alumni! This had been a year of great change for me, and many of the changes are great as well! Most significantly, I am pleased to step down as chair and yield the floor to our new department head, Dr. Laurie Anderson. We have been working together to make the transition as smooth as possible. I think it is very positive that the administration has committed to hiring full time heads with light teaching duties, and that will really help the department to grow and expand in many ways. Welcome, Laurie!

With new time on my hands, I am looking forward to ramping up on research activities. I am expanding efforts with Alvis Lisenbee , Arden Davis, and many students to develop the Black Hills Aquifer Atlas, a 1:24,000-scale collection of maps characterizing Black Hills aquifers. The West Dakota Water Development District has been funding students on this project. Three quadrangles are complete; we currently have five students at work on five additional quadrangles and they are doing a great job (Henok Tiruneh, Kathleen Grigg, Jen Bednar, Samantha Nichols, and Michael Tekle. (See http://aquifers.sdsmt.edu for more information and to download the maps).



I also plan to expand in a new direction and work with the Museum of Geology in their initiative to migrate their collections database into the digital world and integrate them with geographic information systems (GIS). We have been working on writing proposals to support this work, and I am excited to see it start happening. I have volunteered to serve as the Map Curator for the Museum, and look forward to putting the map archives in order and making them more accessible.

I am also busy fostering our recently established Minor in Geospatial Technology. New minors are trickling in, and enrollment in the advanced GIS courses is up as well. This fall we purchased an educational package of 10 mapping-grade Trimble GPS units for use in GIS classes and research to give students advanced practical experience.

Finally, I am beginning work on the next (6th) edition of my GIS text, Mastering ArcGIS. Adapting the text to the demands of ArcGIS Version 10 and was a massive effort. The 6th edition revisions will not need to be quite so extensive, fortunately, and the new edition should be available in January 2013

Foster Sawyer

Greetings to all of our alumni and friends! Another exciting year has come and gone filled with enjoyable activities involving our awesome students, faculty, alumni, and friends and supporters of the department. Highlights of the past year include hosting a team of Russian scientists and engineers from the St. Petersburg Mining Institute here at SDSM&T, a truly fantastic spring break trip to New Zealand, an interesting summer working with Native American students at Oglala Lakota College, organizing another successful oil and gas conference on campus, serving as the National Vice President of the American Institute of Professional Geologists, teaching and advising students, receiving funding for an environmental education grant through the U.S. Environmental Protection Agency, and submitting a number of new grant proposals. However, the most significant occurrence of the year among all these activities was watching another group of talented students reach their goals here at SDSM&T and embark on new adventures and challenges as they begin their exciting careers.

1) Russian scientists and engineers from the St. Petersburg Mining Institute at Crazy Horse monument, and 2) Students in the PEEC program conduct water quality investigations on the Pine Ridge Indian Reservation.

Teaching classes and advising students is central to our mission in the Department, and in 2011 I taught and/or co-taught Geophysics, Petroleum Geology, Invertebrate Paleontology, Field Geology, Petroleum Production, Sedimentation (undergraduate and graduate), and Introduction to Geological Engineering (through Oglala Lakota College). I served as faculty advisor for both the Tech Geological Association (TGA) and the student chapter of the Society of Petroleum Engineers (SPE) this year, and we sponsored a number of activities for these organizations including outreach to local elementary schools, field trips, and many other fun and educational outings. I also served on numerous thesis committees, and was major advisor for Mr. Bobby Hendricks who completed a ground-breaking (pun intended) thesis in conjunction with the U.S. Geological Survey using optically stimulated luminescence to investigate the timing of major terrace formation and abandonment and classic stream capture events of Black Hills fluvial systems.

The summer months were spent building the Pre-Engineering Educational Collaborative (PEEC) program with students and faculty from SDSM&T, Oglala Lakota College (OLC), and SDSU. We had sixteen students working on twelve different projects, and culminated the summer with poster sessions and presentations on all of the projects. The PEEC program has continued into the academic year with a team-taught Introduction to Geological Engineering course this Fall and a Construction Materials course will be offered to program participants in the Spring. The goal of the program is to prepare students from OLC to transfer into engineering programs at SDSM&T and SDSU for completion of their engineering degrees. I also taught four weeks of Field Geology at our beautiful facility in northeastern Wyoming which is always a pleasure.

One other topic on which I would like to touch is my year as National Vice President of the American Institute of Professional Geologists (AIPG). This has been a wonderful opportunity to become involved in geological issues at the national level, and I have learned and benefitted tremendously from my association with this professional organization. I am pleased to announce that South Dakota and SDSM&T have been selected to host the 2012 National Annual Conference of AIPG in September, 2012, and I am honored to co-chair this national conference with colleagues Larry Stetler and Tom Durkin. Eight outstanding field trips already are being organized for the conference, and we also plan to co-host our 2012 New Horizons in Oil and Gas Conference with the AIPG conference (conference flyer). I encourage all of our alumni to seriously consider paying us a visit next September to revisit your Black Hills roots through participation in the 2012 AIPG National Conference. It promises to be a fantastic meeting!

As always, there are more activities than time and space to describe them. Some additional items, events, and publications are given in the list below. Thank you for your interest in the Department of Geology and Geological Engineering and for your support as we move forward to meet the challenges of the future!

- Program Director: Oglala Lakota College-South Dakota State University-South Dakota School of Mines & Technology: Pre-Engineering Educational Collaborative (OSSPEEC)
- National Vice President and 2012 Annual Conference Co-Chair: American Institute of Professional Geologists (AIPG)
- Board of Directors: West Dakota Water Development District
- Board Member: Black Hills Digital Mapping Association, Inc.
- Vice President: Inyan Kara Group, LLC
- Stamm, J.F., Hendricks, R.R., Sawyer, J.F., Mahan, S.A., Zaprowski, B.J., Geibel, N.M., and Azzolini, D.C., in prep., Late Quaternary stream piracy and fluvial terrace formation along the Belle Fourche and lower Cheyenne Rivers, South Dakota and Wyoming.
- Fahrenbach, M.D., Sawyer, J.F., and Martin, J.E., in press, Geologic Map of the Lemmon 1° x 2° Quadrangle: South Dakota Geological Survey, scale 1:250,000.
- Hendricks, R., Stamm, J., Mahan, S.A., Sawyer, J.F., 2011, Geochronology of terrace deposits of the Belle Fourche and Cheyenne rivers, western South Dakota, based on optically stimulated luminescence [abs]: 2011 Western South Dakota Hydrology Conference, April 28th, 2011, Rapid City, South Dakota.

Ed Duke

Ed Duke spent much of 2011 in activities related to the Engineering and Mining Experiment Station (EMES) and the South Dakota Space Grant and NASA EPSCoR programs.

EMES is in the process of adding over $800,000 of new instrumental capabilities. These include (1) a high resolution 3D x-ray microscope (x-ray microCT), (2) a handheld (field portable) x-ray fluorescence (XRF) spectrometer, and (3) a new combined x-ray microanalysis and electron backscatter diffraction (EBSD) system for the scanning electron microscope. All three instruments have potential applications in geology and geological engineering as well as campus-wide applications.

Ed ended a two-year term as secretary of the National Council of Space Grant Directors. This fall, he helped coordinate a workshop in Rapid City focusing on Carbon Nanomaterials and Applications (e.g., carbon nanotubes, nanfluids, graphene). These materials feature extraordinary properties (e.g., strength, electrical and thermal conductivity), but also are challenging to develop because of their extremely small dimensions. The workshop featured representatives from NASA Ames Research Center, NSF's Thermal Transport Program,

the Army Research Lab, universities, and industry. Speakers included two members of the National Academy of Engineering and one member of the National Science Board. The participants plan to continue working together to develop a comprehensive roadmap for future carbon nanomaterials research and collaboration.

On earth science activities, Ed along with Mike Terry, continued to try to secure funding from NSF's EarthScope program to support geophysical imaging of the Precambrian basement in South Dakota, Wyoming, and Nebraska (buried suture zones of the Trans-Hudson and Yavapai orogenies). Together with five other universities they developed a $1.8 million proposal; despite very favorable reviews, it fell just short of receiving funding.

Darrin Pagnac

The past year has been an extremely busy one for me. I entered my second year as an Assistant Professor with an increased workload, but also with increased accomplishments. I spent a great deal of time on evolving collaborations with universities and museums in Taiwan. In March, Jim Martin (retired Museum of Geology Executive Curator) and I returned to Taiwan to investigate the Pleistocene fossils found quite abundantly in that nation. Jim and I spent an whirlwind and inspiring week in Taiwan observing diverse geology and paleontology, much of which is unknown to scientists outside this small island nation.

I was extremely honored to welcome my Taiwanese colleague, Dr. Ming-Chee Wu, to South Dakota this November. Dr. Wu, who is head of the Department of Earth Science at National Cheng Kung University in Tainan, Taiwan, spent a week with us. The weather was mostly cooperative, and Dr. Wu was able to see some of the local geology, including Badlands National Park, Spearfish Canyon, and the open cut at Homestake. The week ended with Dr. Wu and Dr. Ronald White signing a memorandum of understanding between our universities, officially opening the door for collaborative research and education.

Field paleontology was very successful this summer. We had another successful season at Little Houston Quarry, our Jurassic Morrison Formation quarry near Sundance, WY. We spent an entire month at the quarry this year, taught one graduate field paleontology camp, and welcomed visitors from all over the United States. The season culminated with the excavation of a 1000 pound jacket containing several neck vertebrae of the long-necked herbivorous dinosaur *Camarasaurus*. Plans to return to the Little Houston Quarry next summer are in play.

I look forward to new academic and research ventures next year. My doctoral student, Huai-Pin Hu, and I are busy describing much of the data we've accumulated on our trips to Taiwan. I will be visiting the site of my dissertation research in the Mojave Desert, near Barstow, CA, in March to reinstate some preexisting projects that have been on the back burner for awhile. Finally, I am extremely excited to be initiating a new field camp to be held in May. Collaborating

with Agate Fossil Beds National Monument in western Nebraska, we will hold a two week camp in March led by me and assisted by Miocene mammal specialist Dr. Robert Hunt, recently retired from University of Nebraska, Lincoln. New opportunities abound, the work never ends, and I consider myself extremely lucky to be able to come to work every day and do what I love.

Michael Terry

It was another very busy year of research and teaching. Two of my students Patrick Morton and Ashley Evenson completed their theses this year. With co-authors, high-precision ages on eclogite facies metamorphism in west Norway were also reported in the Special volume of the Canadian Journal of Science. Leah Koch was invited to present her undergraduate research at the national Geological Society of America Meeting (GSA) in Minneapolis. Professional presentations were given a the GSA meeting and the International Lithosphere Project Meeting in Piemonte, Italy. Teaching included Advanced Field, Structural geology, Advanced Structural Geology and Igneous/Metamorphic Petrology. I also spent nine weeks teaching Field Camp In Turkey. It was a cooler summer in Turkey and the flowers were spectacular. Best wishes and happy New Year to all alumni.

Publications:

Krogh, T. E., Kamo, S. L., Robinson, P., Terry, M. P., and Kwok, K., 2011, U-Pb zircon geochronology of eclogites from the Scandian Orogen, northern Western Gneiss Region, Norway: 14-20 million years between eclogite crystallization and return to amphibolite-facies conditions: Canadian Journal of Earth Sciences, v. 48, no. 2, p. 441-472.

Theses Supervised:

Evenson, A., 2011, Late Laramide paleostresses in basement rocks determined from calcite twinning using electron backscatter diffraction, Lead-Deadwood Dome, South Dakota 106 p.

Morton, P., 2011, Deformation mechanisms in quartz and their implications for deformation at the Deep Underground Science and Engineering Lab (Homestake Mine), Lead, South Dakota, M.S. Thesis: South Dakota School of mines and Technology, 69p.

Presentations:

Terry, M.P., Garaffa, A., Yildiz, U., Lisenbee, A.L., and Uzunlar, N., 2011, Petrologic and structural observations at a HP-LP contact along the Cretaceous Izmir-Ankara suture zone near Orhaneli, West- Central Turkey, Volume, ILP meeting, Nature of the plate interface in subduction zones, Piedmonte Italia, Programme & Abstracts, International Lithosphere Program, p. 70-71.

Terry, M.P., 2011, An example of heterogeneous deformation and strain partitioning applied to crustal flow and exhumation of HP and UHP rocks, Black Hills SD, USA, Geological Society of America Abstracts with Programs, Vol. 43, No. 5, p. 649.

Colin Paterson

Colin Paterson led the spring break field trip to New Zealand during March 3-15. The party of 25 included 4 other faculty (Katzenstein, Sawyer, Uzunlar, Gilcrease (ChemE), 5 alumni, and 15 students. We arrived in Auckland in rain that continued on and off for a couple of days before it was generally dry weather. We drove in 3 vans (on the left side of the road mostly) from Auckland through the volcanic and geothermal area of the central North Island. Notable stops were made at Hot Water Beach to dig our own hot pool, Martha Hills epithermal gold mine at Waihi, the Whakarewarewa Maori village in Rotorua, the Waiotapu geothermal area, and a one-day hike across the active volcanoes of Mt. Tongariro and Mt. Ngauruhoe.

Active gold-depositing system, Champagne Pool, Waiotapu geothermal field

In Wellington, we boarded a ferry to cross to Picton on the South Island, and drove to Reefton in Westland to visit the Globe-Progress orogenic gold mine. Following wet stops on the Alpine Fault plate boundary and at Fox Glacier on the West Coast, we traversed the Haast Pass and the Otago Schist to Wanaka and the historic Bendigo goldfield. En route to Queenstown, we looked at engineering issues associated with the Clyde HEP dam in the Cromwell Gorge, and toured the Kawarau Gold Mining Museum including gold panning (with a notable lack of success!). Using Queenstown as our base, we explored the scheelite district of Glenorchy at the head of Lake Wakatipu, and Lord of the Rings film sites at Paradise, before hiking up to the historic Invincible gold mine in the Rees Valley. A free day in Queenstown included a variety of activities – bungy jumping, luge, jet boating, tour of Kiwi House, sightseeing and shopping. The flight from Queenstown back to Auckland along the Southern Alps was disappointingly cloudy for the most part. Upon our return to the USA, we gave two powerpoint presentations (to the department and Darton Geological Society) including the performance of "Sweet As New Zealand", composed by Foster Sawyer, and sung by the group to the tune of "I Walk the Line".

Experiencing typical "liquid sunshine" at Fox Glacier! (above left)

The braided Dart River at Paradise, in vicinity of "Isengard" in Lord of the Rings (left)

With Mike Terry and grad student Joe Zeitler, I flew to Elko in April to visit the Cortez Hills gold mine, and plan Joe's thesis research on structural controls of the ore. I was lead instructor at the Ranch A geology field camp during the first half of the summer, and welcomed Dr Randy Kath (Ph.D. 1990, SDSM&T, and now Professor at West Georgia University) as fellow instructor. Later in the

summer, Andy Armstrong and I sampled the Homestake drill core archive for Andy's thesis research on hydrothermal alteration in the biotite zone rocks of the Homestake deposit.
Dr. Kelli McCormick (SD Geol. Survey) and I submitted a proposal to the USGS Strategic Minerals Program on "Metallogenic evolution of the southern margin of the Superior Craton, southeastern South Dakota: Potential for PGE mineralization in mafic intrusions north of the Spirit Lake Tectonic Zone". This study, intended to support a graduate student, will use core from two basement holes drilled by Western Mining Corp. in 2003 in SE South Dakota.

Bill Roggenthen
Bill is the Co-PI for the Underground Lab at Homestake. 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.

From the Museum

Sally shelton
Dr. Laurie Anderson joined us as Director in August, replacing Sally Shelton, who served as interim director from January through July. We are very excited by Laurie's presence on the museum team and the opportunities that exist for increased collaboration with the Department and other institutions.

Dr. Jim Martin retired at the end of 2010. In June 2011, he re-joined us for a ceremony re-naming the Museum's Paleontology Research Laboratory to the James E. Martin Paleontological Research Laboratory, a ceremony attended by over 100 friends, family and well-wishers. This was accompanied by the announcement of a $2 million gift from Leroy and Charlene Foster, who previously endowed the preparation laboratory at the PRL. The new gift, one of the largest in SDSM&T history, will be used in aid of the vertebrate paleontology program in particular and PRL needs in general.

Haslem Post-Doctoral Fellow Dr. Aaron Wood left the Museum at the end of July to accept a position with the University of Florida on a major paleontology project in Panama. Dr. Wood is serving as the lead paleontologist on site, working with the Smithsonian Tropical Research Institute. We miss Dr. Wood but are elated at his success in obtaining this position. A search for the next Haslem Fellow is underway.

The Museum of Geology is in the final stages of closing out its presence in the basement of the Old Gym and moving everything up to the new Paleontology Research Laboratory. Thanks to the tireless efforts of students, staff, faculty and volunteers, as well as assistance from Greens Moving and Storage, we have cleared thirty years' worth of collections storage in a year and a half. The PRL has separate collections rooms for invertebrate, vertebrate and plant fossils, as well as biology, mineralogy, the Bump-Mcdonald Library, the archives/map room and the type room. This has made good organization possible for the first time in many years.

We have received a number of significant donations in 2011. The largest was the invertebrate fossil collection from the University of South Dakota at Vermillion. Jim Fox, Gene Hess and Sally Shelton met Tim Heaton at USD and spent 2 days packing and loading a 26' moving van completely full. This firmly establishes the Museum and SDSM&T as the leading paleontological collection in the South Dakota Regental system. We also received a donation of the George Henderson Recent mollusk shells and related specimens and archives from the Springfield College Museum in Springfield, SD, also packed and moved by Jim Fox and Sally Shelton. The magnitude of these donations, as well as the size of the collections brought by Dr. Laurie Anderson, made a complete revision of the invertebrate collections room necessary. In November, thanks to funding from the Doyle Foundation and from Dr. Laurie Anderson, we were able to install collections compactors in this room to house all the invertebrate fossils and comparative biological materials. This was completed just in time for

specimens for next semester's micropaleontology course to be pulled out and organized in advance.

We have also received a number of large donations to the Bump-McDonald Library, including books and journals donated by Gary Haag of the USFS and Mr. Effington (an alumnus). Fred Steece presented us with several truckloads of archival and historical materials documenting his career with SDGS and DNR. In November, the Department of Invertebrate Zoology (National Museum of Natural History, Smithsonian Institution) and the National Marine Fisheries Services offices in Washington, DC, sent us 12 large boxes of journals and reprints from the offices of the late Austin Williams, decapod systematist and fossil collector, who collected in South Dakota for many years. The volume of our existing library and archives resources, combined with these large donations, made it necessary for us to set up the use of our rooms differently. The Bump-McDonald Library will continue to house books, reprints, and journals in frequent use. The archives room will be dedicated to the map collection and to field notes, locality files, GIS and other uses of this collection for mapping and locality work. Maribeth Price has joined us as our map curator, and with a few more flat files she will be able to start organizing this massive collection properly. The type room will now also house the photographic media and the archives related to Museum history. The Doyle Foundation funding also allowed us to compactorize the library and type room, so that they can be organized and used at top efficiency.

Other donations included the herbarium and insect collections formerly housed in McLaury; a donation of geological teaching materials from Donna Coppedge; a collection of agates from Pam Mahony in memory of her mother, Merilyn R. Harmon; and a large fossil coral specimen from Jim Parsons, whose family also donated a large ammonite last year in memory of his father, Quentin Parsons.

The most valuable donation monetarily was a collection of extraordinary zinc mine minerals (including calcite, fluorite, barite and sphalerite) from Tennessee, donated by Dr. Clark Scovel and Dr. Steve Neely of the Memphis area. Dr. Scovel grew up in Rapid City and decided during a visit in the summer that the Museum of Geology would be an appropriate place for this collection. The generosity of Drs. Scovel and Neely, combined with the work of students in the GEOL 473/573 museum exhibits course resulted in a new exhibit in the Museum, opening on Dec. 1. Another new exhibit by GEOL 473/573 student Julianne Ratliff provides a complete historical update on the Homestake mine saga. Julianne is taking the SDSMT museum courses as part of the new museums certificate program offered by the History Department at BHSU, a course-sharing arrangement worked out by Robb Campbell and Sally Shelton. The organization of the mineral collection continues with the dedicated volunteer team of Tom Loomis and Miranda Boenisch of Dakota Matrix Minerals.

Field work continued at Fossil Lake, the Little Houston Quarry, and Chamberlain over the summer months. Specimens from Badlands National Park were also brought in for preparation. Badlands NP, the U.S. Army Corps of Engineers, and the Bureau of Land Management supported field and lab work, and also purchased additional compactor shelves for the specimens from the lands. Plans for a new field program in 2012 at Agate Fossil Beds National Monument in western Nebraska were finalized. This will allow students to live and work at the Monument for two weeks, focusing on creating a paleontological resource inventory and management plan. This will be led by Dr. Darrin Pagnac, Dr. Bob Hunt of the University of Nebraska (emeritus), Dr. Rachel Benton (NPS regional paleontologist), and Sally Shelton. In other National Park Service news, Dr. Pagnac and Ms. Shelton received an award from the National Park Foundation Impact Grant program to set up a conservation monitoring study of the recently remodeled visitor center at Dinosaur National Monument in Utah.

The Museum was visited by Dr. Holly Witchey of Case Western Reserve University in August as part of an award from the Museum Assessment Program, American Association of Museums. This peer-review visit and report are part of the first steps toward AAM accreditation the major long-term goal of the Museum. Dr. Witchey wrote a glowing report with many practical suggestions for getting the Museum on the accreditation track.

Darrin Pagnac, Aaron Wood and Sally Shelton received an award from the Paleontological Society for the creation of geoscience teaching kits for outreach education in the region. Preliminary versions were tested on National Fossil Day in October through the cooperation of science teacher Jennifer Fowler at South Middle School, who invited us in to work with her classes.

The Museum itself, under the guidance of Heidi Minkler, underwent a major facelift after the library and specimen holdings were moved to the PRL. The gift shop has been moved to the back room and expanded, and the library room is now Heidi's office. Storage areas have been converted to exhibits space, and the former gift shop is being turned into a children's education area and a storage room for teaching kits for outreach education. There is also a major initiative underway to provide Lakota labeling for the Museum. This is likely to be a two- to three-year project involving many tribal representatives and students.

Dr. Darrin Pagnac traveled to Taiwan with Ph.D. student Huai-Pin Hu for the second year in a row, a collaboration that has resulted in a formal Memorandum of Understand between SDSM&T and National Cheng Kung University for joint and exchange geology programs.

Sally Shelton and Darrin Pagnac, along with several students, attended the 9th Conference on Fossil Resources in Kemmerer, Utah, in April, and put in a successful bid to host the 10th CFR meeting in Rapid City in 2013. This will be held back to back with the 28th meeting of the international Society for the Preservation of Natural History Collections. The two conferences will overlap for a day with a shared workshop on repositories, using the PRL as a case study. A preliminary field trip to the White River Badlands of South Dakota and Nebraska has been proposed as a pre-visit trip.

Sally Shelton has started teaching paleontology resource management as part of the paraprofessional resource monitor training at the Cheyenne River Reservation, through the office of Donna Rae Petersen, Cultural Resource Officer.

The Museum will be ending its loan and visit moratorium at the end of 2011. Requests for loans and visits will be evaluated on a case-by-case basis. A new database system, Specify, has been evaluated and approved for use to bring all collections up to Federal standards for accountability and tracking, thanks to the work of Gene Hess and David Foster.

We helped with teaching and logistics for the GEAR-UP program and sponsored three high school students needing community service projects as part of their graduation requirements. We wish to thank everyone for all the help we have received in packing, moving and organizing collections in the PRL. We have had a lot of support from community and student volunteers, representing ~2500 hours of valuable help, as well as from faculty and staff.

From the Field Station:

Nuri Uzunlar, Director

The BHNSFS had another great year with 151 students and 23 summer faculty on three continents. Alvis Lisenbee, Colin Paterson, Larry Stetler, Mike Terry, Foster Sawyer, Kurt Katzenstein, Darrin Pagnac, spent part of their summer teaching the camps. Additional faculty members came from the consortium schools other universities. 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, Iceland** and **Nepal**. In addition to field courses offered, in 2012 BHNSFS will be offering a Volcanology Field Camp in Iceland and Petroleum Geology Field Camp in Turkey.

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 BHNSFS.

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

Field Camps 2012

USA			
Course No / Session No	Credit	Course Name	Date
GEOL 410 (Ranch A – S1)	6	Field Geology	May 14 – June 15
GEOL 410 (Ranch A - S2)	6	Field Geology	June 18 - July 20
GEOE 410 (Campus)	6	Engineering Field Geology	May 14 – June 15
GEOL/GEOE 412/512 Environmental Engineering	3	Science and Engineering Field Applications	May 21 – June 8
GEOL/GEOE 492 - TOPICS	1	Freshmen Field Geology	June 6-11
GEOL 371	2	Undergraduate Field Paleontology	Multiple dates - summer
PALE 671	2	Graduate Field Paleontology	Multiple dates - summer
Turkey			
GEOL 410 (Session One)	6	Field Geology	June 11 – July 14
GEOL 410 (Session Two)	6	Field Geology	July 16 – August 18
GEOE 410	6	Engineering Field Geology	July 16 – August 18
Nepal			
GEOL/GEOE 412/512 Geomorphology Field Camp	3	Science and Engineering Field Applications	May 20 – June 7
India			
GEOL/GEOE 412/512 Environmental Geology	3	Science and Engineering Field Applications	June 11-29
Iceland			
GEOL/GEOE 412/512 Volcanology Field Camp	3	Science and Engineering Field Applications	July 29 – August 17

Research Projects

My DUSEL project titled "**Coupled Thermal-Hydrological-Mechanical-Chemical-Biological** (THMCB) **Experimental Facility at DUSEL Homestake"** and funded by NSF is at its last year and will be ending this 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).

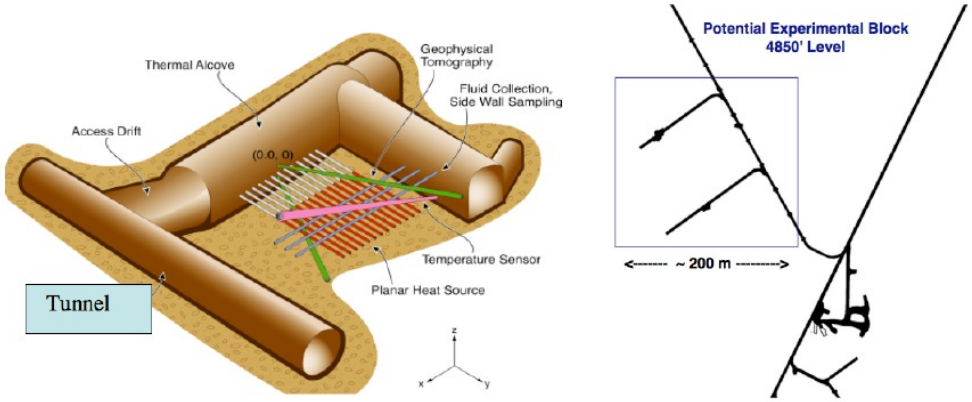


Figure 9. Left—preliminary experimental layout for the THMCB experimental facility based on a proposed thermal test at Yucca Mountain, Nevada. Borehole regions marked in red are heater elements. Right—plan view of a potential tunnel complex at the 4850' level for the proposed THMCB experimental block.

In addition to Homestake project I started to investigate geothermal energy potential of South Dakota. Many of you remember the thermal waters in Hot Springs. Similar types of hot (geothermal) waters are present within the subsurface aquifers in south central South Dakota where they have been partially utilized for direct heating of school houses and motels in Philip and White River. A large geothermal heat anomaly is the reason for these hot wells in SD and we are trying study the potential for electrical generation. We have submitted a proposal to DOE to study hot water reservoirs and their potential in electrical generation.

Once again I was honored with the John C. Mickelson Professorship Award in 2011. Funds from this award used to support research development in Turkey led by Alvis Lisenbee, Mike Terry and I. We supported two graduate students working in western Turkey. Umit Yildiz, one of the graduate students, is to complete his work in May 2012. We are submitting a full proposal to NFS for additional support for the project and new students.

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 have been serving on Counsel for Graduate Education and as the Cahir of International Recruiting Committee. I travelled to Turkey with the Dean of Graduate Education for recruiting and exchange programs with Istanbul Technical University in Istanbul and Middle East Technical University in Ankara. I attended GSA in Minneapolis, Minnesota, to host a booth on behalf of the BHNSFS and the department. I also attended to NSF workshop on geothermal energy in Salt Lake City and to AGU in San Francisco for research related presentations and energy related discussions.
For additional information about upcoming field station activities please visit:
http://geologyfieldcamp.sdsmt.edu, call me at (605) 394–2494 or write to
nuri.uzunlar@sdsmt.edu

Senior Research Projects 2011-2010
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; some of these funds are used to help these students pay for costs associated with their research projects.
Everett Brill, Origin and Composition of the Cobbles Found within Wind Cave
Stevie Holmes, Bite Forces in Durophagous Mosasaurs
Benjamin Zalneraitis, Determining the Bite Force of *Arctodus Simus*