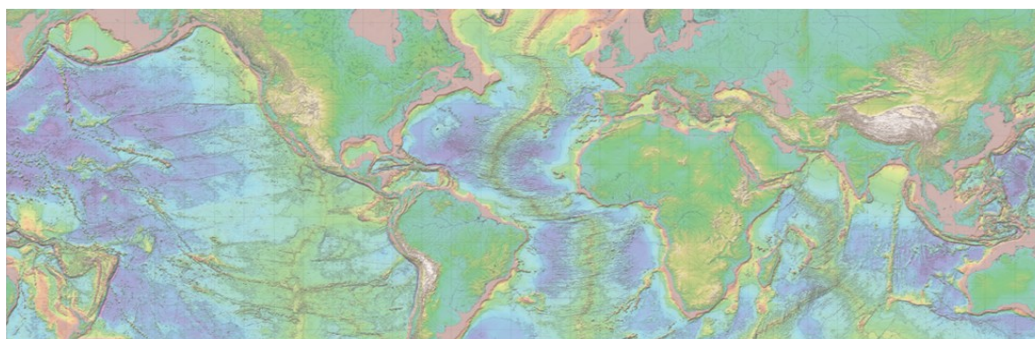


Fall 2010
UMD
Geological
Sciences

Geological Sciences Newsletter for Alumni & Friends



News from the Department Head - Ron Morton



You really need to come and see the first floor of Heller Hall. Displayed are two large floor maps that provide different views of planet earth. One is a 20 x 12 foot Landsat image of our cloud-free planet; the second, see above picture, is a whopping 40 x 18 foot map that shows, in vibrant colors, different levels of elevation (land) and bathymetry (ocean floors). Plate tectonic features never looked so prominent and spectacular! Even better, these images can be viewed in 3D with special glasses. The maps have attracted lots of interest from students, parents, classes, and field trips, to Risk and Clue players (Mr. Green did it in Indonesia with a volcano), to hopscotch skippers! In addition to these we have also installed a large, 3D wall map of the surface of the planet Venus. Thanks to Vicki Hansen, we get to see our sister planet in a way few people ever have.

I am pretty sure that on your many trips down Heller Hall you passed by the display with the woodland bison skeleton in it. Well, after 35 years of residence, the bison has gone to a new home, the Duluth Children's Museum. In its place is a display on the Sudbury meteorite impact and its deposits/effects on what would become Minnesota. The centerpiece of the display is a 4 x 4 foot painting by the acclaimed artist Carl Gawboy depicting the impact. The display is being put together by Mark Jirsa of the Minnesota Geological Survey, Deb Rausch, and graduate student Megan Rubesch.

Finally, the geology computer lab has been totally renovated with new carpet, furniture, and computers; the curtains were also cleaned for the first time in many, many years and they did not fall apart. All of these renovations were possible because of student tech fee funds.

I am very pleased to tell you that our outstanding alumnus for this year was Dr. Stephen Brand. Stephen is a 1971 graduate from the department and is currently the senior vice president of technology for ConocoPhillips. With the establishment of the emeriti scholarship fund (started by Penny Morton) and the Margaret and Harry Walker graduate student research fund, the department was able to give out more than \$30,000 in scholarships and awards to our undergraduates and graduate students; as usual field camp was a prime recipient of the awards. And, as you all know, we could not do this without your support and generosity, so I thank all of you who have given to one or more of our scholarship funds and can assure you that your donations *DO* make a big difference to our program. As far as our graduate students are concerned, we now have 26 active MS and PhD students in the department—a record thanks to research grants from our faculty; in particular Penny Morton, who's GK-12 grant has supported three to four students per year for the past four years.

Thanks to the generosity of consulting geologist Jack Everett, the department is in the beginning stages of trying to establish the Ralph Marsden endowed chair of economic geology. For those of you who did not know Ralph, he was the economic geologist here until 1979 and, before coming to UMD, the chief geologist for U.S Steel. Known as "Ironman Marsden" by his students, Ralph was also the treasurer of the Society of Economic Geologists for many years. There is more information on Ralph and the endowed chair inside this newsletter.

Finally, it was really nice to see many of you over the year. It is always a joy to have you stop in the department on your trips to Duluth and share your news with us. After all the department is, in many ways, a reflection of you all, and you are always welcome. In fact, we have 3-D glasses reserved just for you!

On a personal note, Penny and I spent two wonderful weeks in Iceland. The weather was superb (it did not rain) and yes, we did go and see the volcano (the rent-a-car people were not happy with a car coated in volcanic ash!). Both Megan (a senior engineer with Enbridge) and Chris (a computer programmer in a health start-up company) are still in Duluth, and I spend one afternoon a week with our Brittany Spaniel at agility training. As the trainer says, "the dog is great, it's the handler who could benefit from learning his left from his right!"

I hope this finds you all in good humor and enjoying life.

Fall 2010 UMD Geological Sciences

To Our Donors:

The Department of Geological Sciences would like to warmly thank the following alumni and friends who supported our students and programs with a charitable gift in the past year. Listed below are the names of individuals and organizations who donated to the Geological Sciences Department funds, and includes those donations that the University has posted to our department accounts at press time. Thank you for your generous contributions.

Anderson, Roger	Gasser, Michael M.	Matsch, Charlie	Sandberg, Brian S.	Wiethoff, William S.
Cartwright, Alyson	Geniusz, Annmarie	McManus, Jeffrey	Sellner, Linda Ross	Wonson-Liukkonen, Barbara
Christensen, Odin	Graham, Richard C.	Miller, James D., Jr.	Severson, Lori & Mark	York-Feirn, William
Connolly, Marc	Gravel, Louis P., III	Mooers, Howard	Sher, Laura	
Crain, William	Green, John C.	Morton, Penelope	Simonet, James	
Dincau, Anthony R.	Hankins, Rev. Jerry P.	Munter, James & Elizabeth	Spiering, Mary & Michael	
Dunn, Richard & Gretchen	Hedenquist, Jeffrey	Niendorf, Christopher	Strand, David V.	3M Foundation, Inc.
Englebert, Jayne	Hjerpe, John (family fund)	Noyes, Harold J.	Swor, Terrance E.	Chevron Texaco
Everett, Jack V.	Hoag, David	Ojakangas, Dennis & Eileen	Syverson, Kent & Lila	Cleveland Cliffs Foundation
Everett, Karl	Holman, John & Cathy	Ojakangas, Richard & Beatrice	Syverson, Timothy	El Paso Corporation
Fashbaugh, Earl	Jones, Jeffrey	Olson, Jean	Tarback, Edward	ExxonMobil Foundation
Felger, Tracey	Karberg, Susan	Owens, Richard T.	Thole, Jeffrey T.	Minnesota Section SME
Fitz, Thomas J., III	Kraus, Keith	Peterson, Dean M.	Tieberg, James E.	Sigma Xi
Flammang, Julie	Kyllonen, David	Rapp, Rip	Wahlstrom, Robert J.	Shell Oil Co. Foundation
Frantes, Thomas J.	Larson, Phillip & Katie	Ripley, Edward & Kathleen	Welsh, James	Walker Trust Fund

Student Scholarships, Awards and other Mentions for 2010-2011

Ralph & Ellen Marsden and Randy Seeling Outstanding Graduate Student Award: Susan Karberg

Outstanding Graduate Teaching Assistant Award: Miao Du

Ralph & Ellen Marsden and Minnesota Section SME Outstanding Senior Award: Kathleen Grigg

Hugh Roberts Scholarship, Outstanding Junior Award: Julia Halbur

Minnesota Section SME Tools-Of-The-Trade Award: Angela Hawkins, Gavin Wagoner

Roderick Syck Field Camp Scholarship: Jeremy Mellow

James R. Frantes Graduate Fellowship: Tanya Dreyer

FIELD CAMP SCHOLARSHIPS:

R.C. Bright Field Camp: Ryan Birkemeier, Joe Buchanan, Kirsti Hakala, Todd Marks

Robert L. Heller Field Camp: Bridgette Eischens, Grace Johnson, Courtney Laney, Hannah McIntyre-Talbot

"Rip" Rapp Field Camp: Joe Buchanan

Charlie Matsch Field Camp: Sara Chlebeck, Kathleen Grigg, Julia Halbur, Adam Johnson

Ralph & Ellen Marsden: Teddy Berg, Todd Marks, Adam Salzer

Lempi M. & John W. Pagnucco: Andrew Bettilyon, Ehren Inkel, Todd Marks

Millennium: Kirsti Hakala

Faculty Emeriti: Andrew Bettilyon

Estwing Geology Field Methods Award: Ryan Birkemeier

Roderick Syck Outstanding Field Camp Award: Todd Marks

Sigma Xi Research Awards: Joshua Allen, Jason Aronson, Avery Cota

Harry & Margaret Walker Research Award: Josh Allen, Ryan Birkemeier, Avery Cota, Robert Rush, Daniel Gustafson, Stephanie Theriault, Miao Du

Undergraduate Student Presenters & Contributors

2010 Spring UMD UROP Showcase

University of Minnesota Duluth 2010

Birkemeier, R., "Characterizing organic matter in sediment of a tropical rift lake"

Johnson, G., "Global Map of shield terrain on Venus"

Graduate Student Presenters & Contributors

American Geophysical Union 2010

San Francisco, California

Berke, M.A., "Holocene vegetation changes using molecular isotopes from the Lake Victoria region, East Africa"

Dunn, E., Gran, K., Tal, M., "Incipient vegetation recovery in the braidplain nearly two decades after the eruption of Mount Pinatubo, Philippines"

Wartman, J., Kirby, S., Choy, G., "Global outer-rise/outer trench-slope (OR/OTS) earthquake study"

Geological Society of American 2010

Portland, Oregon

Berke, M.A., Johnson, T., "A Mid-Holocene Thermal Maximum at the end of the African Humid Period"

Rubesch, M.P., "A high resolution paleoclimate record for Lake Chalco near present-day Mexico City"

Gordon Research Conference 2010

Holderness, New Hampshire

Berke, M.A., "Temperature Reconstruction of Lake Victoria, East Africa"

American Quaternary Association Meeting 2010

Laramie, Wyoming

Berke, M.A., "Temperature reconstruction of Lake Victoria, East Africa since the latest Pleistocene"

Liu, X., Colman, S.M., Brown, E.T., Henderson, A.C.G., and Holmes, J.A., "The history of the Westerlies and the Asian monsoon; lacustrine record from Qinghai Lake basin on the northeastern Tibetan Plateau"

Current Faculty News

Erik Brown

Research - I'm continuing to develop new projects using our x-ray fluorescence core scanner (still one of two instruments of this type in the US). Basically, you can put a 1.5 m sediment core section into the device and after a few hours have mm-scale measurements of a suite of a dozen or more elements (for example, Al, Si, S, Ca, K, Ti, Mn, Fe, Rb, Sr, Zr, Pb). I received support from the National Science Foundation to operate the instrument as a National Facility, so I have been able to hire a lab manager who is kept pretty busy by outside visitors.

Travel - I traveled to Sweden for a week in late August to get some advanced training on the XRF core scanner. I also spent a few days in Mexico City with Nigel Wattrus in September to spin up a seismic survey on Lake Chalco (see map of Aztec capital, Tenochtilan, in the November 2010 National Geographic). We hope that this will become the site of a major lake drilling program. Finally, I have upcoming fieldwork in Tasmania (Australia) so the whole family will be going down under in February!

Family - We try to get to the cabin with the kids (Andrew, 14; Lianna, 12; and Matthew, 8) most weekends from June through August. The fishing was pretty lousy this year, but we had fun with a new little sailboat.

I had one MS student complete his degree this year: Robert Rush, "High-resolution geochemical XRF data from Elk Lake, Minnesota: A Holocene paleoclimatic record from varved lacustrine sediments".

Steve Colman

Another year has flown by, despite the fact that, for the first time in decades, I had no major field program. The highlight of travel this year was a trip to Nagoya, Japan to attend the Scientific Steering Committee meeting of the IGBP-PAGES (the Past Global Changes project of the International Geosphere-Biosphere Programme), with a few days of sight-seeing in Kyoto and at Mount Fuji. No National Geographic trip this year due to budget difficulties, but we are going to India in January. This fall has been busy with teaching Field Limnology, yet another course taught for the first time for me.

I am busy trying to finish up my two major research projects, one on Lake Agassiz discharge into the Lake Superior basin (with Nigel Wattrus) and the other a paleoclimate study of cores from Lake Qinghai, China (with Erik Brown). MS student Emily Voytek successfully finished her thesis on the Agassiz project, and with former MS student Jessica Gary, we have several papers in preparation. PhD student Xiuju Liu and MS student Miao Du are making progress on their work on Qinghai and related projects. In my spare time, I try to keep LLO solvent and steady. The group as a whole is doing really well, and we have been extraordinarily successful with grant applications recently. As much as I love administration, some of the tedium has worn thin, and I have begun to consider a sabbatical for next year.

Christina Gallup

My twins are now 17 months old and I feel like I am just starting to emerge from a baby-induced cocoon. Max and Sophie are talking (when Sophie says okey-dokey, it just melts my heart) and running around and waking us up at night. Chris is staying home with the kids while I go to work; it is a nice break to be at work in the quiet.

I am very excited that Kristin Riker-Coleman, who finished her PhD with me several years ago, started a tenure track position at University of Wisconsin Superior this fall along with another alum of UMD, Andy Breckenridge. It will be great to continue our research together.

My activities have been relatively quiet on the research front since the babies came along, but I went to a PAGES workshop on past interglacials at Lamont last month and it felt like a small zap of electricity running through my veins to get back in the fray. I also get a little zap from working with students, and I now have a UROP student, Autumn Stivers-Biscuso, who is working on Barbados fossil corals.

My work with Tom Johnson on dating the Lake Malawi sediment cores took an interesting turn this summer when we met with a group in mechanical engineering on the Twin Cities campus. It may be possible to enrich the carbonate fraction, where the age information resides, from the rest of the sediment with devices designed to sort atmospheric dust. It was Tom's idea to look into this and it is a good one. I hope it pays off!

John Goodge

I had a great spring teaching Petrology and Tectonics. Students in Tectonics used the new floor maps installed by Vicki Hansen to create posters explaining the tectonic setting and history of different areas around the world. Areas included the Caribbean basin, the East Africa rift, New Zealand, and the Himalayas. Their posters will be on display next to the floor maps this fall.

I am now the Director of Graduate Studies, as UMD begins a new chapter of relative autonomy with respect to graduate education. We have a delightful cohort of new graduate students this year, so the future looks bright for our program. In 2011, I will begin a four-year stint as co-editor of the GSA journal *Lithosphere*, which I am anticipating with both enthusiasm and trepidation!

We have just completed construction of a new analytical facilities lab! Bryan Bandli and I designed, planned and oversaw renovation of a suite of rooms for the lab in the MVAH building, funded by the Swenson College of Science and Engineering. The lab will jointly house instruments from Geological Sciences, Chemistry and Pharmacy to be used for analysis of a wide variety of materials. Major equipment includes the SEM, two XRD units, XRF, ICP-MS and a confocal microscope. The lab is open to UMD and the outside community.

I will return to Antarctica in November for the 11th deep-field season. I have a newly-funded NSF project to study the age, character and origin of the Precambrian East Antarctic shield by using glacial moraine clasts and early Paleozoic granites that have interacted chemically with crust during emplacement. The project focuses on U-Pb, Hf- and O-isotope analysis of zircon in these proxy materials to construct a picture of continental crust along 2000 km of the ice-covered East Antarctic margin. It will be a logistically demanding field expedition, with travel to numerous sites by a combination of aircraft, helicopter and snowmobile. This year's team of five includes a new PhD student, Tanya Dreyer, recently arrived from Cape Town, South Africa, and Jeff Vervoort, a former UMD grad student now teaching at Washington State University.

Karen Gran

I feel like this year has been one of the busiest on record. I was able to take two trips back to Mount Pinatubo in the Philippines, one in August and one in January, to collect more data on channel evolution and start up a new project examining the interactions between the braided channels and newly recovering vegetation. Five UMD students (four undergraduates and one MS student) came with me and were a great help in the field. I've been presenting the results from this research at conferences this fall and just got a paper accepted into *Geology* summarizing 20 years of sedimentation following the eruption. My project in the Minnesota River valley continues. Our research area was hit by record floods this fall, and the amount of sand transported (and subsequently deposited all over the place) was immense. This summer I also had the opportunity to help teach field camp for the first time out at the Wasatch-Uinta camp in Park City, Utah. After years of working in rivers it was fun to get back to mapping bedrock again. We had almost 60 students at the camp, with 19 from UMD – quite a crowd! On the home front, my kids keep growing. Peter started preschool, Alex is enjoying second grade, and they both had fun hanging out in Park City this summer.

Vicki Hansen

2009-2010 has been a great year with highlights being publication of the long-in-coming Venus ribbon-tessera terrain story in *Geology* in April, with a second paper in May, also in *Geology*, outlining evidence for Venus' Artemis as covering almost one third of the planet's surface. Venus 1:5 million scale *Geology* Maps by Nick Lang and Roger Bannister were also published by USGS. But perhaps the most fun this past year has been the installation of the Heller Hall Floor Maps and the Venus Wall Mural, both on first floor in Heller Hall. See the Department website for a view, and then plan a trip to the department to walk around the world. Stop by the Department office first to borrow some 3D glasses. The maps add a wonderful splash of color (bathymetry and topography map adds 18 x 40 feet of splash—the LANDSAT map a modest 12 x 20 feet of splash—plus the polar views for both data sets), and introduce all who walk the halls of Heller to our fantastic planet. If one planet is not enough, Venus dons the wall in a 7 x 18 foot mural viewed in 3D through red-blue glasses. We hope to bring Mars and the Moon to the hallways in the future, so stay tuned.

Tom Johnson

While we have already had our first significant snow of the year, the only annual event that looms more forebodingly in my daily existence these days is the persistent plea from Laura for the annual input to the departmental newsletter. Retirement begins to appeal – for then I will be able to respond with, “nevermore!” Ah, but that day is not yet here, so here goes my annual reverie on the months gone by. They have been good months! Kelly Wendt (of Brazilian prison fame) successfully defended his MS thesis at the end of the summer, which entailed scanning XRF analyses of sediment cores from three lakes in Minnesota, demonstrating that Erik Brown's magical XRF scanning machine can rapidly capture the signal of Holocene climate change in very high resolution – a major advance over the tedious bulk sediment geochemical analyses by ICP-MS or AA that we had to employ in the past. PhD student Melissa Berke has submitted a paper to the Proceedings of the National Academy of Sciences on the unexplained warming of tropical East Africa in the mid-Holocene, at the end of the so-called African Humid Period, based on her organic geochemical analyses of a core from Lake Turkana, Kenya, that is also evident in cores from Lakes Tanganyika and Malawi, as well as in an ice core from Mount Kilimanjaro. MS student April Abbott is currently spending two weeks at the Netherlands Royal Institute for Sea Research, analyzing our Malawi drill core for a temperature record that extends back some 600,000 years in time. And my new MS student, Ben Chorn, will travel to Oxford University in January to learn techniques for extracting trace quantities of tephra from our Lake Malawi sediments and establish new stratigraphic ties to the Rungwe volcano field in Tanzania. Kate and I are doing fine, daughter Heidi and her family moved back from China this summer to settle in St. Paul, so we now have two beautiful grandchildren to spoil and coddle, just hours from home. Son Ryan is halfway through a year's tour in Iraq, and is doing well. We can't wait for his return.

Jim Miller

2010 has been another busy and rewarding year in my third year as a faculty member of the department and director of the Precambrian Research Center. In the spring term, I taught Geologic Maps (GEOL 3000) again, and co-taught a new course in Engineering Geology (CE 3425) with Civil Engineering associate professor, Carlos Carranza-Torres. It was great to work with Carlos, with whom I hope to develop some collaborations in the realm of mining geology in the future.

Graduate students continue to keep me busy and engaged in research. I was glad that three of our grad students, Chris White, Dan Costello, and Steve Hoaglund, defended their MS theses this past spring. All three have jobs - Dan and Steve in oil and gas, Chris in minerals exploration. Brian Goldner expects to complete his MS thesis on Rio Tinto's Tamarack Ni-Cu-PGE deposit by the end of the year - Ryan Dayton, currently with the North Dakota Geological Survey, should defend his isotope study of the Sonju Lake intrusion sometime in the spring semester. My current second year students are well on their way to completing their theses by the end of the spring term – Steph Theriault (S-isotope study of the Biwabik Fe-Fm), Dan Foley (petrology and Cu-Ni-PGE mineralization of the BIC intrusion, UP Michigan), and Dan Cervin (PGM occurrences in Polymet's Northmet deposit).

(continued on next page)

Fall 2010 UMD Geological Sciences

(Miller continued from previous page)

The three MS students out the door earlier this year have been replaced by three first year MS students – Ben Brooker (mapping project on the Sawbill Lake intrusion, NE Minnesota), Matt Chaffee (petrology of intrusions spatially associated with Cu-Ni-PGE mineralized intrusions near Thunder Bay, Ontario), and Aaron Rowland (starts in spring semester to work on the petrology and mineralization of an Archean layered intrusion north of Fort Francis, Ontario). All these students projects are completely funded by various sources, particularly from minerals exploration companies.

Precambrian Research Center programs were very successful this year. We had another full Precambrian Field Camp in this our fourth year. We had 22 students from 17 different schools attend. Two of these students are new MS students in the department (Ben Brooker and Amy Radakovich). If you would like see some photos and the maps produced from the past three years of the field camp, visit: <http://www.d.umn.edu/prc/fieldcamp/>. The PRC's third Professional Workshop was held in October and was by far the most successful yet. The workshop dealt with the geology, mineralogy, and genesis of Precambrian iron formations. It was attended by 47 international participants and involved 20 instructors and field trip leaders. Check out the workshop website at: <http://www.d.umn.edu/prc/workshops/F10workshop.html>.

I filled in the other “gaps” in my year by being involved with the 11th International Platinum Symposium last June in Sudbury. There I gave a workshop and led a six-day field trip around Lake Superior. After field camp, I participated in a “Teaching in the Field” workshop in Bozeman, Montana. The year has also been filled with meetings related to planning for the 2011 national GSA meeting to be held in Minneapolis. I am the field trip chair for that meeting.

Hope to see you there next October.

Howard Mooers

Hi, everyone. I arrived at UMD in 1991. At that time my good friend, Charlie Matsch, was beginning his 22nd year as a professor in our department. So here it is 2010 and I am beginning my 20th year at UMD. In some ways things are the same; the building has not evolved much and I still see the original group of faculty on a regular basis. In other ways, however, things are very different. I spend a great deal of my time directing the UMD Honors Program and the Marshall W. Alworth Planetarium, and I teach more astronomy than geology. The constant over the years has been the quality of the students. I currently have three grad students and several undergrads working on projects. Over the past several years I have participated in several international studies courses including Geology and Culture of Iceland, Coral Reef Studies taught in the Bahamas, and I am working on two three-week modules, one in England looking at environmental impacts of the industrial revolution and another in Morocco studying landscape, history, and culture. So, if you are in the neighborhood, stop by and see me.

Happy holidays.

Penny Morton

For the last year I have been half-time in the department and half-time in the dean's office as associate dean. It seems that I have done three-quarters-time in each! I have just come back from GSA in Denver. It was a good meeting and we had glorious weather. However, I didn't manage to hook up with many of you. Next year it is in Minneapolis, and we hope to see a lot of you then. We plan to have our own alumni event, rather than co-hosting with the Twin Cities department.

Presently I am teaching mineralogy - I love it. Monday we start the uniaxial indicatrix, and as you can imagine, the students probably won't like it very much, but they will persevere. During the summer I went back to field camp for three weeks to teach. I forgot what a great experience that is. We had 16 of our own students as well as three from Morris in our group. They were lots of fun, and I think they enjoyed their stay at the Chateau. Yes, we still stay at the Chateau. You would think that it would have fallen down by now. I will be heading back out next summer. If you are in the Park City area, plan to stop by.

From Ron's letter you will see that the two of us went to Iceland for a true vacation. I took him to many of the places I had visited in the previous year, and found a few more besides. He wants to go back again, but I would like to go somewhere different.

John Swenson

I hope this note finds everyone in good spirits. Another year has come and gone and, to paraphrase David Gilmore's witty *memento mori*, I am indeed "shorter of breath and one year closer to death." Overall, the last year was good, if typically frenetic: I am settling in to my teaching regimen of Sedimentology and Stratigraphy, Earth's Resources (Penny's liberal-education creation), Physical Hydrogeology, and Well Hydraulics (with Howard). Things will change a bit this year and next, because—in a moment of profound weakness—I let Ron convince me that teaching 250 introductory geology students would be a noble task! I will warm up this spring with the smaller night class before taking over for Ron in the large daytime course next fall. Karen Gran and I will then be covering the daytime introductory classes, she in the spring, and I in the fall. I am anxiously awaiting this new teaching challenge in the hope that I can uphold the high teaching standard set by Ron and, in the process, convince a decent number of 'Intro' students to pursue a full degree in this fascinating science of ours.

On the home front, after helping my parents move into a new apartment, Sarah and I completed our move into my childhood home on Lake Superior. 'Completed' might be a bit of an overstatement; if personal history provides any clue, then in all likelihood we will spend the next decade trying to sort through all of our boxed possessions (i.e., junk) that now completely fills our garage. (In my entire adult life, I am fairly certain I never used a garage for its intended purpose!) All joking aside, we are overjoyed with our 'new' house, particularly the stunning views and the adjoining beach. Kayaking was fantastic this summer. Much like their parents, our furry 'kids'—Steffi the Standard Poodle and Fozzie the Labradoodle—love the new yard and beach. And, with our southern orientation and full sun exposure, I am finally realizing my lifelong dream of establishing a modest home orchard and not-so-modest garden. My life is good! I hope the same is true for all of you.

Nigel Wattrus

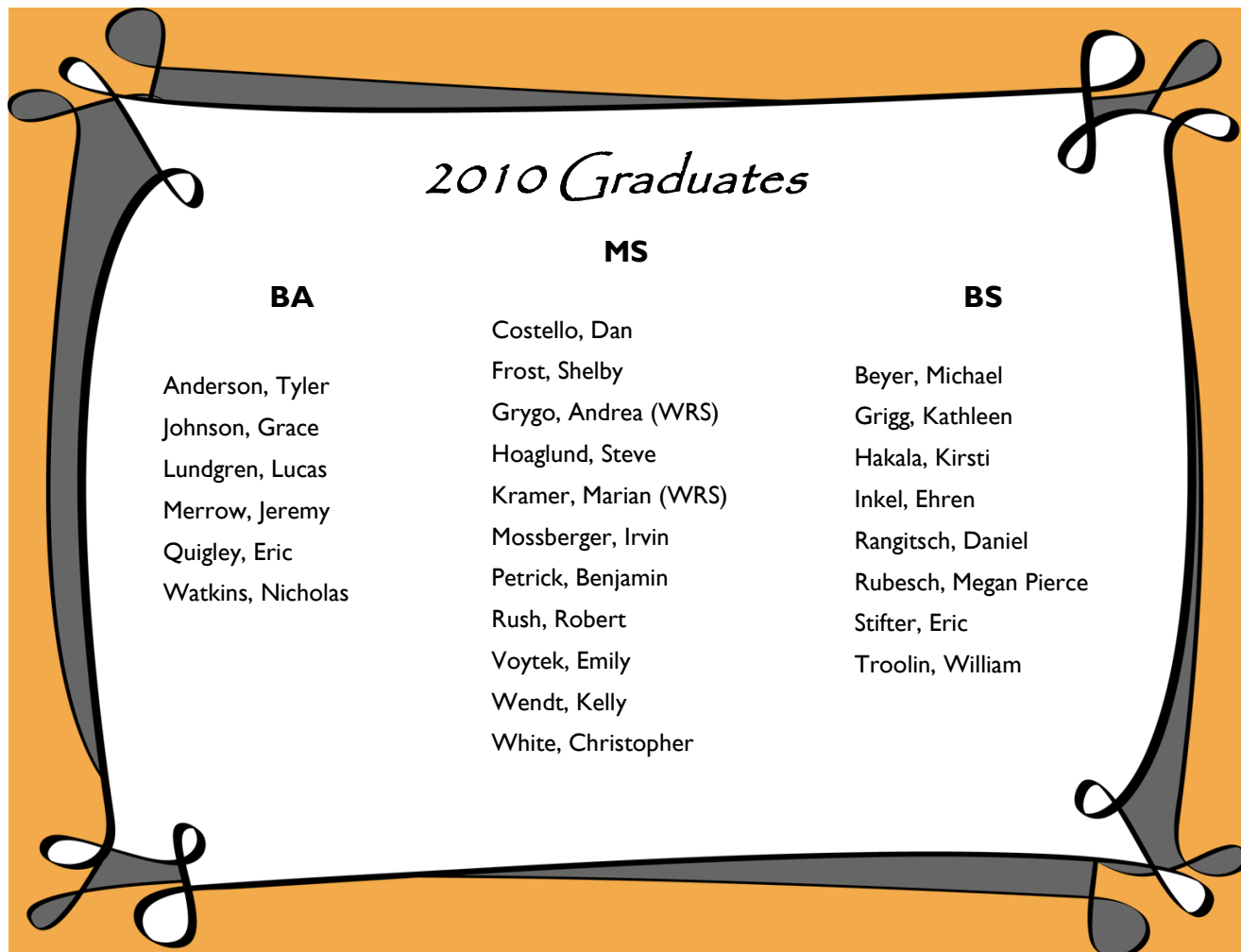
This past summer Emily Voytek defended her thesis on the evidence for pre-Marquette overflow events from glacial Lake Agassiz into Lake Superior. An event such as this has long been proposed as a "trigger" for initiating a return to cool conditions in northern Europe 12800 years ago. The location of the overflow was assumed to lie in Thunder Bay. Emily's work shows quite conclusively that there is no physical evidence preserved in the sediments of Thunder Bay, or adjacent parts of Lake Superior, that these overflows occurred in this area. This lends support to an alternate routing for the water from Lake Agassiz that takes it northwest to the Mackenzie River. Emily is now employed by the USGS in Connecticut where she is involved with their hydrogeophysics group working on a variety of geophysical projects.

My other graduate students are busily working on their research projects. Dan Gustafson, is working with the pseudo-3D seismic reflection data set that we collected on Lake Superior last summer. He is attempting to image the sub-surface "plumbing" of the lake floor rings that are so well developed in Superior. Jessica Gary, my second-year PhD student, is setting up an acoustic interferometry experiment that she hopes to use to image the acoustic structure of lacustrine systems. Lisa Marlow (whom I co-advise with John Swenson) recently took an exploration position with Shell Oil in Houston.

This past summer I spent three weeks in Indonesia collecting a high resolution seismic reflection survey on Lake Towuti on Sulawesi. This work is part of a paleoclimate study that I am working on with colleagues from Brown University and UM-TC. I took Dan Gustafson and a geology undergraduate (Ryan Birkemeier) along to help collect the data. As is often the case, we had some difficult days getting the survey boat configured and working properly, but once surveying began everything worked flawlessly, thanks in large part to the students' efforts. We expect to spend most of the next year processing and interpreting the data.

Most of the rest of my summer was spent on Lake Huron conducting a high resolution bathymetry survey of the lake floor off Drummond Island. The Great Lakes Fishery Commission (GLFC), who sponsored this work, are installing hydrophone array on the lake floor to track spawning lake trout fitted with tracking tags. In order to design the array, the GLFC needs an accurate map of the lake floor bathymetry. Shallow water surveying takes a lot of time and takes you into some stressfully shallow parts of the lake!

2011 looks like being another busy year. In January, Erik Brown and I will be travelling to Mexico City to collect a high resolution multichannel seismic reflection survey on the old dried up lake bed upon which the city is built. January seems like a nice time to get out of Minnesota!



EMERITUS FACULTY

Jim Grant

Since last I wrote, we had our annual trip to Los Cabos, said “hi” to our favorite whales – both humpback and grey, snorkeled and savored and, as always, relaxed. Then off to the rigors of Park City for a spot of spring skiing. Spring was spent in DC visiting Lisa Gindy, who is lively as ever, and Wally Parham, a friend from Minneapolis days. Wally and Melissa took us out to Harpers Ferry, Appomattox and Madison’s mansion, and I learned more about the Civil War than I did for my citizenship test. Finally, we spent three weeks in Italy in September. The hill towns were beautiful and interesting, the people were very friendly, the Etruscans lived it up, and the traffic in Rome is horrendous.

I’m back working on isocon analysis in the Matchless belt of Namibia, and intend to see if I can use Thermocalc on the lower Bushveld, following on an REU with Sally (Drews) Armitage in 1990.

(continued on next page)

Fall 2010 UMD Geological Sciences

(Grant continued from previous page)

Christabel is well recovered from her surgeries of last year, Fiona is spending more time on her communications work now that Tara is in all-day school (and loving it), Ian's business is looking up again, and his TV career is still alive. He gave the commencement address at Marshall School this spring (major advice: savor diversity, follow your dream and don't chew with your mouth open).

Wishing you all a happy Christmas and a prosperous and healthy New Year, which we shall start once again in Los Cabos!

John Green

This year I've continued to help advise Terry Boerboom as he maps bedrock quads for the Minnesota Geological Survey up the North Shore. The Grand Marais quad was published this year. I taught short-courses on North Shore geology twice for the North House Folk School in Grand Marais, and have completed two more "Geological Evaluations" for North Shore landowners as nonprofit fundraisers. In July I gave a program and field trip for the Appalachian Forest School on local Canadian Shield geology at Snowbank Lake east of Ely. And I seem to be the 'go to' guy for people with funny rocks to diagnose (sorry, folks, no meteorites yet!), with local help, of course, including the great resources of our growing Analytical Lab. Now I'm beginning to prepare for a North Shore Volcanics field trip for the annual GSA meeting next October.

In July, Jan was presented with the Environmental Stewardship Award by the Lake Superior Binational Program, "For outstanding life-long contributions that led to the protection of the environment in the Lake Superior basin."

Jan and I took our usual August family trip to New England, which included a few days on Monhegan Island, about ten miles off mid-coast Maine. Lots of hiking trails and rugged cliffs of – surprise – gabbro! Almost like home. On the way back we drove around the east and north shores of Lake Superior - wild and impressive. And in late September we explored NE North Dakota, especially the Devil's Lake area where they're in panic mode, building up dikes and highways as decadal increase in precipitation inexorably raises the lake level in its enclosed basin. And nobody downstream in the eventual overflow rivers wants its saline water or organisms.

Charlie Matsch

I'm into my tenth year of retirement, and I am still staying close to Duluth and the North Shore. I continue to enjoy hiking and birding and periodically leading field trips focused on the geologic history of the area. Trips away from Duluth began with my first visit ever to Florida, based in Key West. Wow, what a town! Two highlights included a boat trip to the outermost keys, the Dry Tortugas, and a day in Everglades National Park at Flamingo (I did not see one, but a Purple Gallinule and lots of alligators made up for that). Later in the spring I flew to Tucson, Arizona, for a week of hiking with Rip Rapp in the mountains near Tucson. Summer was beautiful in Duluth, and on my birthday in June I changed from a septuagenarian to an octogenarian. Look it up. I don't believe it either. In mid-September, to recover from that, I returned to the solace of the coast of Maine. I'm OK about it now. Last year's newsletter announced the publication of OJ's new book, *Roadside Geology of Minnesota*. I just want to tell you that I think it is terrific. (There's a photo of me on page 235.) Have a great holiday season.

Dick Ojakangas

I have been busy doing book signings for *Roadside Geology of Minnesota*, which came out a year ago. I do a PowerPoint on the Geology of Minnesota, with emphasis on the area where the signing occurs. (Educating the masses!)

In February I was a lecturer on two two-week cruises from Buenos Aires to Antarctica. I could have a guest, but Peaches said, "Been there - done that!"; so daughters Cathy and Susanna came along.

In July I was part of a National Park Service team doing a Great Lakes Network Geological Resources Inventory in Minnesota and Wisconsin. Prior to that, we were in Greece for Cathy's wedding on a small, white limestone island in the blue Aegean Sea. Picturesque—much like "My Big Fat Greek Wedding". Cathy & Nicho, whose parents emigrated to Boston, are neuroscientists at UChicago. In October I was a speaker at UMD and field trip leader for a workshop on Precambrian Iron Formations. About 75 geologists from around the world were there. It is difficult for retired faculty to get grants. Fortunately, the University of Minnesota has a new program of "Development Grants for Retirees". I received one, a whopping \$3,930, to go to India in January: "Ancient (2.7 billion-year-old) Glaciation in Southern India: An Uncommon 'Mega-event' of Possible Value in Intracontinental and Intercontinental Correlations".

(continued on next page)

(Ojakangas continued from previous page)

Miscellanea: Peach's 28th cookbook, *Weeknight Desserts*, was published in October. Susanna is at the University of Minnesota Twin Cities, studying to be an Earth Science teacher. Went to ILSG at International Falls. Led geologists from Brazil and India on field trips. Presented "Southern India: Rocks and People" as a UMD seminar. Lectured at UChicago on "Antarctica: The White Continent", to the 8th grade at the lab school. (I was judged "a real bad ass", the ultimate compliment!)

P.S. Totaled our Honda SUV, without injury.

Rip Rapp

This has been a productive year for me: four papers in press, working on three books, made my 18th [and I hope last] trip to China on my long-running project at Anyang (the largest Bronze Age site in the world), successfully survived my 80th birthday and, thereby, achieved octogenarian status, started getting ready for rocking chair status in perhaps five years.

I get back to Duluth and UMD a couple of times a year but for a total of only a month or less. It is hard to leave southern Arizona, the land of perpetual sunshine, great biking and hiking, etc. With the resources of the WEB it is not hard to keep up with important goings-on in the department, at UMD and northeastern Minnesota, and the University in general. This newsletter also is a great help.



Update on the Precambrian Research Center at UMD

"The rocks are the final court of appeal" Francis Pettijohn

Now in our fifth year, the Precambrian Research Center at UMD is hitting its stride. Principally formed as a field mapping institute, the centerpiece of the PRC is a six-week, summer Precambrian field camp. Last year's camp, our fourth, was at capacity with 22 students from 17 different schools from across the US. I will let Ryan Birkemeier, one of our UMD undergraduates who attended the camp last summer, fill you in on the details elsewhere in this newsletter. What has made the camp a pleasure to teach, for me, is the diversity and enthusiasm of the students, who attend this camp by choice. We believe that a good measure of the success of the PRC camp is the high percentage of our students who have found jobs in the minerals exploration industry, many locally, or have gone on to pursue graduate degrees researching Precambrian topics, many here at UMD. We are looking forward to another full and diverse camp next summer.

The other major program of the PRC is a professional workshop series that provides continuing education to professional geologists and advanced students on various topics related to Precambrian geology. The week-long workshops, which have been held in October for the past three years, may involve short course lectures, laboratory sessions, and field trips. The workshops are taught by local and international experts and attract participants from industry, government and academia. The first PRC workshop was held in 2008 on the topic of the physical volcanology, structure, and alteration of Archean greenstone belts and associated VMS and lode gold mineralization. It was principally taught by George Hudak, Harold Gibson, Ron Morton, and Dean Peterson, and had 16 participants. The 2009 workshop focused on field, petrographic and mineralization characteristics of mafic layered intrusions. It involved nine instructors and attracted 21 participants. Because both of these first two workshops involved petrography lab sessions, the maximum attendance was limited by the number of microscopes. The most recent workshop was held this past October on the geology, mineralogy and genesis of Precambrian iron formations. Being limited only by the number of people who could fit onto a coach bus, this workshop attracted 47 participants. Two days of short course lectures involved 16 instructors that included Kase Kline (U New Mexico), Nic Beukes (U Johannesburg), Bruce Simonson (Oberlin), as well as other prominent iron formation scientists. The workshop also included four days of field trips to the Gogebic, Mesabi, and Gunflint ranges, led by local experts. We are not planning a 2011 workshop since the national Geological Society of America meeting will be held next October, and we will all be busy leading field trips and hosting special sessions about northern Minnesota geology. Tentatively, we are planning our next workshop for 2012 on the Cu-Ni-PGE deposits of the Lake Superior region.

(Precambrian Research continued from previous page)

Finally, one new endeavor for the PRC is to serve as principal organizer for the annual Minnesota Minerals Education Workshop over the next three years. The MMEW is a popular three-day workshop for K-12 earth science teachers, which includes a day of short courses and two days of field trips. The goal of the workshop is to provide current information to teachers on the geology and mineral resources of the state. Next June, the 14th annual workshop will be held at the Mesabi Range Community College in Eveleth.

For more info on these and other programs and on how to become a supporting member, please visit the PRC website:
<http://www.d.umn.edu/prc>

Announcing the Ralph W. Marsden Fund



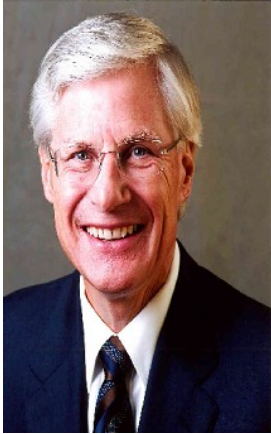
Ralph W. Marsden

The Department is in the beginning stages of trying to establish an endowed chair in economic geology in honor of Dr. Ralph W. Marsden. This position is expected to add significantly to UMD's existing education and research programs in economic geology, both within the Department of Geological Sciences and with affiliated departments including the Natural Resources Research Institute, Civil Engineering, and Chemical Engineering.

Called Iron-Man Marsden by his students, Ralph Marsden spent most of his professional career working on Lake Superior iron ore deposits and iron formations worldwide. After receiving his PhD from the University of Wisconsin in 1939, he served five years as chief of the geological division of the Philippine Bureau of Mines (including teaching geology courses during his internment as a prisoner of war). Upon returning to the US in 1946, Ralph joined Jones and Laughlin Steel Corporation as a geologist. He served in this position for five years, with one year's leave to teach geology at the University of Oklahoma. He joined US Steel in 1951 where he worked until 1967 as manager of geological investigations for the Oliver Iron Mining Division; and then as manager, geological investigations for iron ore for all of US Steel. In 1967, Ralph was recruited to join the Department of Geology faculty at the University of Minnesota Duluth, where he was a professor of economic geology for thirteen years, and department head for seven of those. Even in retirement, Ralph continued his mentoring of students and work on iron formations until his unexpected death in 1986.

In addition to teaching, supervising students, and research on iron ore deposits, Ralph believed strongly in service to his chosen profession. He served as treasurer of the Minnesota branch of the American Institute of Mining Engineers for twenty years. He served as treasurer of the Society of Economic Geologists for ten years, and was a member of the SEG Executive Committee. In recognition of Ralph's excellent stewardship and contributions to the society, the SEG established the Ralph W. Marsden Medal in 1987. The Institute on Lake Superior Geology, which he helped found in 1955, dedicated the 1980 proceedings volume to him and awarded him the Goldich Medal in 1982 for outstanding contributions to Lake Superior geology.

Dr. Stephan Brand named Outstanding Alumnus



Dr. Stephen Brand is currently the Senior Vice President of Technology for ConocoPhillips and is based in Houston, Texas. Dr. Brand received his Bachelor of Arts degree in Geology from UMD in 1971, then went on to earn his MS and PhD degrees at Purdue University. After receiving his PhD, Dr. Brand chose to pursue a career in the energy industry. Joining ConocoPhillips as an exploration geologist in 1976, Dr. Brand has gone on to hold numerous senior-level positions, which have involved research and development, exploration, business development, operations, and strategic planning in terms of petroleum, natural gas, and alternative energy resources.

Dr. Brand was the supervisor of development geology from 1982 to 1989 before being named manager of exploration and production for North American business development. In 1992, Dr. Brand became President of ConocoPhillips' Canadian Division where he managed exploration and production operations, which included the production of a major natural gas field in the BC foothills. In 1995 he took on the responsibility of exploration and production manager for international business development; and then, in 1998, became the President of ConocoPhillips' Australia Division. In a five year period he built the division from a two-person organization to a major gas producer with 356 personnel.

In 2005 Dr. Brand became the Vice President of ConocoPhillips for exploration and business development. Then, in 2007, he assumed the position of Senior Vice President, Technology. In this position Dr. Brand developed a global research and development organization with 600 total personnel, of which about 250 are PhD researchers. As Senior Vice President he directs ConocoPhillips' research and development of new technologies and applications that will enable the company to access and develop non-traditional hydrocarbon reservoirs such as shale oil, gas hydrates, stranded gas, and arctic resources. He also oversees research in a biofuels program that has a significant focus on algae. Finally, he has established a team of researchers to develop innovative technology solutions for existing assets and provide diversification in broader energy businesses, clean technology, and renewable/alternative energy.

Announcement - Alumni Event 2011

The Department of Geological Sciences will host an alumni event for graduates from our department next October in conjunction with the GSA meeting (October 9-12, 2010) in Minneapolis. As soon as the place, date and time are set, we will post it on our website at:

<http://www.d.umn.edu/geology/>

Alumni News

Dincau, Tony, BS 87, is a geophysicist at a private oil and natural gas company in Lafayette, Louisiana, called Marlin Energy, L.L.C. He and his family are doing well. If anyone would like to know more about the oil and natural gas business, don't hesitate to contact him.

Hoffman, Adam, MS 07, is proud to announce an addition to the family. Audrey Katherine Hoffman was born on December 27, 2009. Congratulations!

Leitheiser, Cara, BS 09, is currently employed with Duluth Metals in Ely and loving it!

Liukkonen, Barb, MS 87, had retired in June 2009, but decided to go back to work in grants and contracts for climate change and citizen involvement. She hopes to really retire and move back to Minnesota in 2011.

Muhich, Tom, MS 93, is a professional Geologist and Certified Hazardous Materials manager for Environmental Troubleshooters' in the Eveleth office. The corporate office for this environmental consulting and contracting firm is in Duluth.

Rachel, Reid, BS 07, started a flood risk consulting company in Minnesota, which he then moved to Denver. Business has been good; the company has grown and added a few employees.

Schneider, Robert, MS 85, is currently an instructor with Seismic Micro-Technology, which provides interpretation software for geological and geophysical exploration in the petroleum and environmental industries. Bob teaches software courses and develops curriculum in general

(continued on next page)

(Alumni continued from previous page)

exploration methods. He currently lives in Texas with his wife, Sue, and his two high school daughters.

Sellner, Linda Ross, BA, 96, enrolled at University of Wisconsin Superior for a certification in GIS in 2009. She continued with Advanced Principles of GIS and is currently conducting research with the watershed delineation of impervious surface impact to Duluth streams.

Washburn, Jeff, BS 79, is the Director of Sales for ME Global, which is based in Minneapolis, Minnesota. Jeff and Brenda celebrated their 30th wedding anniversary last year. Jeff also stopped by to visit with Charlie Matsch, who was a big inspiration to him during his UMD years and a good friend today.

Wolter, Scott, F., BA 92, is a forensic geologist in the Twin Cities area and President of American Petrographic Services, Inc. Scott has authored two books; "The Lake Superior Agate" and "The Lake Superior Agate: One Man's Journey", and he has just released his third book, "Amazing Agates: Lake Superior's Banded Gemstone".



The *new* Research Instrumentation Lab

This past spring and summer, Marshall W. Alworth Hall Room 55 was renovated to become the new Research Instrumentation Laboratory for the Swenson College of Science and Engineering. The lab will be the new home for several analytical and imaging instruments used by students and faculty of the Department of Geological Sciences including the scanning electron microscope and powder x-ray diffractometer. The laboratory will provide space and technical personnel for a wide range of research related equipment. In addition to consolidating instrument spaces from across the college into one location, the lab also has also been designed with future research instrument acquisitions in mind.

The laboratory will allow students and faculty easy access to instrumentation that had previously been separated into multiple lab spaces dispersed across campus. The instruments in the lab can provide analytical data on a wide range of sample scales. The x-ray fluorescence spectrometer and powder x-ray diffractometer can provide whole rock chemical and mineral phase analysis. The scanning electron microscope provides high resolution imaging and microanalytical chemical and structural analysis from micrometer sized areas. This kind of information allows students and faculty to better understand the nature of the rocks they are studying. The lab will also be used by researchers from Biology, Pharmacy, Chemical Engineering and Mechanical Engineering, and will be available to outside non-profit and industry groups.

For further information regarding the laboratory, please contact Bryan Bandli, Research Instrumentation Laboratory Manager at 218-726-7362, or by email at bbandli@d.umn.edu. A website detailing the capabilities of the new laboratory is currently under construction, but look for a link from the Geological Sciences Department website (www.d.umn.edu/geology) in the coming months. As part of the laboratory's outreach program, Bryan is also responsible for managing research projects for groups and companies external to the university.

Precambrian Field Camp 2010



Students standing on a bed of stromatolites in the Biwabik Iron Formation at the old LTV mine.

This past summer I attended the PRC field camp in Duluth and Ely, Minnesota, as one of two UMD undergraduate students. At first I was apprehensive about only knowing one other student, but after getting to know all the other young aspiring geologists, a total of twenty from around the country, I realized that every geology student pretty much

enjoys rocks as much as I do. It was also very easy to get to know everyone when you could spend the whole day talking about the daily quirks of the three instructors: Jim Miller, George Hudak, and Dean Peterson.

The first two weeks of camp were spent in Duluth. This included field mapping of major folds in an around the Thomson Dam Area, a geophysics exercise with the University of Minnesota Duluth's esteemed geophysicist, Nigel Watrus, a trip up the north shore to Wolf Ridge Environmental Learning Center, and field mapping of the Spirit Mountain Area. The most memorable part of the mapping projects at Thomson Dam and Spirit Mountain had to be the abundance of strawberries, raspberries, thimbleberries, and blueberries throughout each area. Not to mention, the great geology I uncovered upon mapping these areas rather than just "visiting" them in previous classes. The trip up the shore to Wolf Ridge included roadside mapping and correlation of the roadside maps, by canoe, with the Lake Superior shoreline. Luckily, I only managed to roll my partner out of the canoe and into the lake once. I can't say much about the geophysics project other than it was definitely a good introduction to the science, and that crunching the numbers all day with Nigel had to be the highlight of his summer.

The weeks spent in Ely included trips to Hibbing, Minnesota, for core logging, mapping of glacial geology in the area, mapping of greenstone volcanics with George, a trip to a taconite pellet plant (a PRC first), a Duluth Complex mapping project with Dean, and a trip to Soudan Mine. In order not to bore you, I'll just say that the best part about Ely was the food and the late nights spent finishing mapping projects, with the trip to the Soudan Mine a close second. I can also say that glacial geology and core logging were probably not the "high" points of my camp experience, but they were indeed beneficial to me, to say the least.

At the end of the time in Ely, all of the students selected capstone-mapping projects and spent the next week completing them. My capstone project consisted of mapping the Ogishkemuncie Lake unconformity, with Mark Jirsa from the Minnesota Geological Survey, in the Boundary Waters Canoe Area Wilderness. This was an amazing trip! Waking up every morning to mist on the lake, mapping all day with a lunch of trail mix and crackers and honey, and finishing the day with a dinner prepared by our fearless leader and chef, only account for some of the high points. Not to mention, falling asleep every night to the call of the many loons who inhabited our lake.

After the capstone projects, students returned to the University of Minnesota Duluth and compiled the data into Arc Map and Illustrator for the creation of a final geologic map of each study area. This was no easy task I might add, and I can attest that all the students, myself included, spent the better part of a week working on the final maps. I should add, though, that we did in fact get to eat at the Dining Center for every meal during that week, and for those from Duluth, this is pure royalty. After the final maps were completed, they were presented to the instructors and also to various people from the mining industry at the PRC graduation ceremony. This provided students with a direct link to the industry and helped to provide the possibility of future employment opportunities.

Once all maps were presented, a feeling of relief passed through all the students and it was time for goodbyes. I can't begin to relate how lucky I am to have been able to work with the three fine instructors of the PRC field camp. I have gained an invaluable knowledge of mapping and have created great memories that I will carry with me for the rest of my life. On a final note, students did, in fact, participate in fun activities other than those related to geology on the weekends and at various times throughout the week during camp. However, I chose to omit these in order to provide an idealist view of how the PRC camp runs. Let's just say, instructors and students did, in fact, enjoy cold beers together on occasion and several students were, in fact, karaoke stars.

Undergrad Field Trip to Wasatch-Uinta Field Camp 2010



Ankareh Ridge, Northeastern Utah

The 2010 Wasatch-Uinta Field Camp in Park City, Utah saw a large contingent of UMD students in attendance, with sixteen students making the trip. We also had a group of three students from the Morris campus accompany us on the trip. The 2010 attendees were: Teddy Berg, Hannah McIntyre-Talbott, Andrew Bettilyon, Kathleen Grigg, Bridgette Eischens, Courtney Laney, Kirsti Hakala, Grace Johnson, Julia Halbur, Jeremy Mellow, Todd Marks, Joe Buchanan, Sara Chlebecek, Adam Salzer, Ehren Inkel, and Adam Johnson. The three students from Morris were Wyatt Nolan, David Torres, and Beth Novak.

Twelve of us, plus the three from Morris, left one week before camp began, and made three two-night stops in the Badlands of South Dakota, Rocky Mountain National Park in Colorado, and Dinosaur National Monument in Utah. It was a great time, and we had mostly good weather the whole way with exception of our last night in Dinosaur when it poured rain! I am pretty sure we broke an altitude record with the department's van at 12,183 feet on Trail Ridge Road in Rocky Mountain National Park!

Field Camp consisted of multiple mapping projects and working six days a week, nine hours a day. It was a lot of hard work and frustration, but ultimately, I think we all learned a lot and truly miss being out in the field. Aside from the field work, we took a few trips away from Park City as well. Our first trip was to the San Rafael Swell in southern Utah with past UMD professor Tim Demko. On this trip we learned a lot about sedimentary stratigraphy. We saw some spectacular scenery on this trip, but I think we all can agree that the gnats in the "Swell" were terrible, and probably one of the worst experiences of camp! Our second trip was over the Fourth of July weekend to Grand Teton National Park and Jackson Hole, Wyoming. We camped at Gros Ventre campground, where all 355 campsites were full for the weekend! The weekend was spent lazing in the Gros Ventre River, playing horseshoes, and enjoying beautiful Jackson Hole & Grand Teton National Park. We even had a bull moose graze through our campground one morning, eating grass just a few feet from some unsuspecting campers' heads! Our third and final trip was to Carlin, Nevada, and the Newmont gold mine. They treated us like kings and queens, and we got an awesome view at the day-to-day operations of a world class gold mine, both above ground and below. Some of us even took the opportunity to interview with the company in hopes of someday getting a job with them.

Although we were so ready to go home by the end of camp, many of us were already missing it before we got there! It definitely was a time that we will never forget, both for the memories we shared and for the tools that it gave us for our future as geologists.

Fall 2010 UMD Geological Sciences

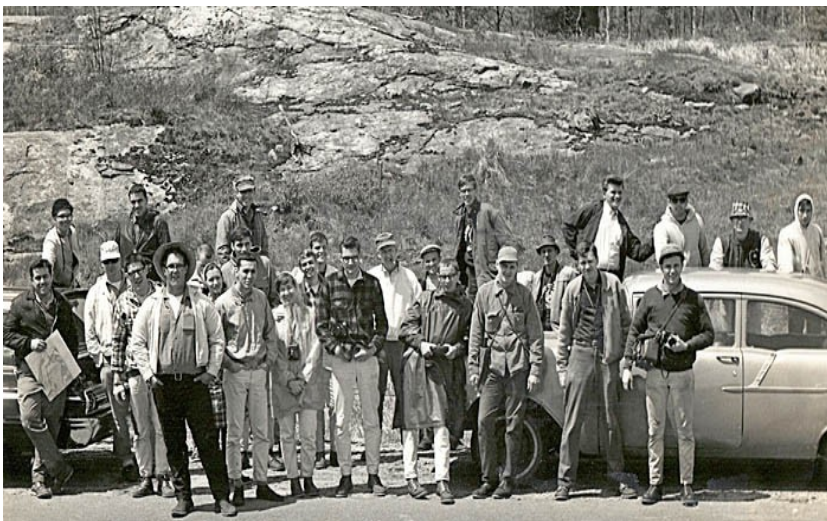
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1966 - Petrology Tweed, Ontario field trip, Kent State. Who's the guy in the plaid shirt?

What's New ??

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Name

Contact information

Degree earned and graduation year

A short paragraph with your news