The Champlain Thrust

News from the Department of Geology, UVM

2018-2019

Greetings from the Chair:
Greetings from UVM Geology. Another year has passed and the Department is still standing!

As always, it has been an engaging and successful year. As you will see in this newsletter, faculty and graduate students have been busily pursuing research and churning out an impressive number of new publications. More information on the faculty's many exciting activities can be found on our website (http://www.uvm.edu/geology). Many kudos to Robin for all the energy and hours she spends keeping the site up to date!!

This past March the annual meeting of the Northeastern Section of the Geological Society of America (NEGSA) returned to Burlington after a 17 year-long hiatus. We spent a very busy year preparing for it, and I am happy to report that we survived without major nervous breakdowns. Results from the post-meeting survey and anecdotal information indicate that the meeting was a scientific and social success. Technical sessions were well organized and well attended and covered a wide variety of disciplines. There was a lot of traffic around the posters and exhibits, and special events were popular. The strong technical program drew a large crowd of 1114

attendees, well surpassing our expectations. (See announcement poster below). We are not sure when the meeting will be held in Burlington again, but I have a feeling that many of us will be retired by then!

Once again Jack has managed to collect all the information needed to put this newsletter together. As usual, not an easy feat! And, as always, we have Gabriela, Robin and Srebrenka to thank for keeping our small, but buzzing Department running smoothly. There is really never a chance for our support trio to get bored, and without them the place would fall apart pretty quickly!

On the financial side of Chairing, our budget was especially tight this year (but what's new about that?). Every donation helps, so please consider making a donation to support the UVM Geology Department. Simply click on "Give to UVM Geology" at the bottom of our Department home web page.

Select *"Make a secure online Gift"* and click on *"view other funds"* followed by "*other*" to write in "Geology Department" for donations directly to the department. If you would like your donation used for a specific purpose, then please indicate. All of your funds go directly to students. This really IS a case of "every dollar helps." On behalf of everyone in the Department, "thank you" for all your support!

Announcement for what was a successful and well-attended Spring 2018 North Eastern GSA meeting that was held in Burlington, VT.

Geologic Map of Vermont on display in the Geology Museum, Delehanty Hall

Department Faculty

Andrea Lini, Associate Professor (Stable isotopes, Limnogeology and Climate Change): Greetings from the world of stable isotopes and lake mud!

As always, chairing the Dept. has been quite a distraction (I am in year 9…), but fortunately I still managed to get some non-administrative work done. A manuscript that a very good colleague of mine, Prof. Suzanne Levine from the Rubenstein School of the Environment and Natural Resources, and I have resubmitted a few times finally made it to the presses earlier this year. The paper examines the roles of point and nonpoint phosphorus sources in the eutrophication of Lake Champlain as recorded in sediment cores we collected several years ago. Our study suggests that for Lake Champlain, eutrophication was driven initially by point sources of P, principally domestic sewage, but towards the end of the 20th century also by runoff from agriculture. The role of eroded soil in providing P for eutrophication remains uncertain, although the observation that sediment accumulation rate has generally peaked decades before the productivity maximum, suggests that this P is at best partially exploited. Unfortunately, sediment travel through the catchment might prove long enough to temper expectations that urban and agricultural BMPs focused on soil conservation, streambank stabilization, and the trapping of sediment in suspension will improve lake trophic status quickly. Not exactly good news!
On a more positive note, I am happy to report that my graduate student Matthew Kraft has

successfully completed his MS thesis on the Holocene history of St. Albans Bay, which is located in the Northeast Arm of Lake Champlain. The sediment cores Matthew collected along a transect in this bay, record the transition from Champlain Sea to Lake Champlain. In this area of the lake, this transition is represented by an unconformity overlain by an up to 85 cm thick peat horizon. In each of the cores there is evidence of sediment reworking in the uppermost Champlain Sea sediments, indicated by the presence of coarse-grained sediment, which is suggestive of a low stand at the end of the Champlain Sea period before the inception of Lake Champlain. This coarse-grained interval is immediately overlain by the peat horizon. The widespread occurrence of the peat layer points to a large wetland that occupied the entire inner portion of Saint Albans Bay, and lake level ~ 9 m lower than at present during the Early Holocene.
Based on radiocarbon dating, this paleo-wetland existed in Saint Albans Bay from ~ 9,600-8,400 yr BP. The shift from peat deposition to fine- grained, low organic content Lake Champlain sediments is believed to have occurred at ~8.6- 8.4 ka and is likely the result of continued isostatically driven lake level rise coupled with a changing climate.

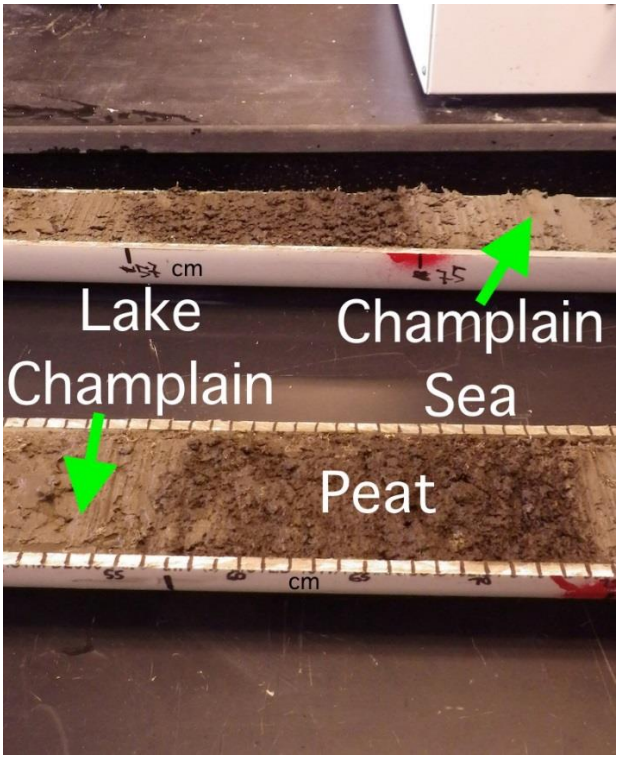
What's next? It appears that the isotope lab will soon be processing tree ring samples collected by my colleague in the Geography Dept., Prof. Shelly Rayback. It has been a few years since we last "played" with wood samples to study plant-climate ecological relationships and reconstruct environmental changes that have occurred during the past couple of centuries. I bet it will be fun!

Recent Publications and Graduate Student theses:

Kraft, Matthew, "From Sea to Lake: The Depositional History of Saint Albans Bay, Vt, USA" (2018). *Graduate College Dissertations and Theses*. 857.

Suzanne N. Levine, Andrea Lini, Milton L. Ostrofsky, Heather Burgess-Grant, Andrea Lami, Elizabeth Collyer-Gilles, Daun Reuter, Lindsay Schwarting-Miller, Neil Kamman, 2018, The relative roles of point and nonpoint phosphorus sources in the eutrophication of Lake Champlain as recorded in sediment cores, Journal of Great Lakes Research, Volume 44, Issue 5, Pages 1043-1056

Joseph A. Graly, Lee B. Corbett, Paul R. Bierman, Andrea Lini, Thomas A. Neumann, 2018, Meteoric 10Be as a tracer of subglacial processes and interglacial surface exposure in Greenland, Quaternary Science Reviews, Volume 191, Pages 118-131



Peat layer sandwiched between Champlain Sea and Lake Champlain sediments in one of the St Albans Bay cores

Paul Bierman, Professor, (Geomorphology, Geohydrology, Isotope Geology Applied to Landscape Change). Life continues to be busy here in Vermont. We sent Marika off to college (Williams) in August so we are half empty nesters although Quincy is expanding to fill the void for sure. I'm back to traveling more. Did a week of field work in Cuba (with Marika) in August and then a week in Denmark scoping the next IODP coring leg for Baffin Bay (anyone want to spend 8 weeks of summer in the Arctic on a ship drilling million year old mud for science?). Meanwhile, we have gotten NSF funding for the cosmolab and are now national sample processing facility with Lee Corbett leading the charge as facility manager so theoretically I get to write and mentor and teach more and do less lab work. In reality in less than a year, we've had 20+ visitors and are doing all kinds of cool science with people from all over the world visiting. Hope to get back to South Africa for more fieldwork this coming year and I am on leave this spring to revise our geomorph textbook - it's been 5 years.

2018 publications

Moon, S., Merritts, D., Snyder, N. P., Bierman, P. R., Fosdick, J., Sanquini, A. and Hilley, G. E. (2018) Erosion of coastal drainages in the Mendocino Triple Junction region (MTJ), northern California. Earth and Planetary Science Letters. v. 502, p. 156-165. https://doi.org/10.1016/j.epsl.2018.09.006

Shakun, J. D., Corbett, L. B., Bierman, P. R., Underwood, K., Rizzo, D. M., Zimmerman, S. R., Caffee, M. and Naish, T. (2018) Minimal East Antarctic Ice Sheet retreat onto land during the past 8 Myr. Nature. v. 558, p. 284-287. doi:10.1038/s41586-018-0155-6
(see press coverage)

Bender, A. M., Lease, R. O., Corbett, L. B., Bierman, P. R. and Caffee, M. W. (2018) Ongoing transient bedrock incision of the Fortymile River driven by Late Pliocene Yukon River headwater capture, eastern Alaska and Yukon, Canada. Geology. Published online: 7 June 2018. doi:10.1016/j.quascirev.2018.05.009

Graly, G., Corbett, L. B., Bierman, P. R., Lini, A. and Neumann, T. (2018) Meteoric ^{10}Be as a tracer of subglacial processes and interglacial surface exposure in Greenland. Quaternary Science Reviews. v. 191, p. 118-131. doi:10.1016/j.quascirev.2018.05.009

Del Vecchio, J., DiBiase,, R. A., Denn, A. R., Bierman, P. R., Caffee, M.W., and Zimmerman, S. R. (2018) Record of coupled hillslope and channel response to Pleistocene erosion and deposition in a sandstone headwater valley, central Pennsylvania. Geological Society of America Bulletin. Published online: 14 May 2018. doi:10.1130/B31912.1

Bierman, P. R., Shakun, J., Portenga, E., Rood, D, and Corbett, L. B. (2018). Directly dating post-glacial Greenlandic emergence at high resolution using in situ ^{10}Be. Quaternary Research. Published online: 12 April 2018. doi:10.1017/qua.2018.6

Denn, A., Bierman, P. R.R., Caffee, M., Zimmerman, S., Corbett, L. B., and Kirby, E. (2018) Cosmogenic nuclides indicate that boulder fields are dynamic, ancient, multigenerational features. GSA Today. v. 28(3-4), p.4-10.

Collaborative field research with U.S and Cuban scientists

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Discussing project with Cuban colleagues

Field work in Cuba

The cooperative U.S. - Cuban research group

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John M. Hughes, Professor (Mineralogy, Crystallography, Crystal Chemistry): This annual report is a good opportunity to let people know what has been going on and to be in touch with our alumni. It has been a busy year, and both X-ray labs are chugging along with minor down time. A lot of new papers are forthcoming on apatite, and this fall I am humbled to have a special session in my honor at the GSA Annual Meeting. There will be twelve papers given on apatite, and I greatly look forward to it and the associated reception (read party). Such sessions are one of the benefits of being around a long time! It will be wonderful to see old friends, colleagues and students.

Below I list the 2017 papers that came out of my lab with students, and it has been a lot of fun. One of the papers, on minerals in cheese, won the Hawley Medal for Best Paper of 2017 in *Canadian Mineralogist*, and it was a pleasure to travel to Vancouver, BC with Gil Tansman to accept the medal.

The family is doing well, and we had a wonderful time at our getaway home in Charleston, SC with the whole crew this summer; days on Folly Beach, and nights of good food and family. After putting the grandchildren to bed each night everyone collapsed and got ready to do it again the next day. As I write this I have been checking the National Hurricane Center website for the past week to see how badly Charleston will be hit by hurricane Florence, and I hope that next year I can write again about family times in Charleston!
As my time in the Department increases, I seem to know more and more alumni, and I urge all former students to stop by if you are in the Burlington area. It is always great to see you.

Publications 2017-2018

Vaughn, J.S., Lindlsely, D.H., Nekvasil, H., Hughes, J.M., and Phillips, B.L. (2017) Complex F,Cl apatite solid solution investigated using multinuclear solid-state NMR methods, *The Journal of Physical Chemistry C.* ms jp-2017-09912x.R1

Tansman*, G., Kindstedt, P., and Hughes, J.M. (2017) Crystallization and demineralization phenomena in washed-rind cheese. *Journal of Dairy Science JDS-17-13067*, 8694-8704.

Lupulescu, M.V., Hughes, J.M., Chiarenzelli, J.R., and Bailey, D.G. (2017) Texture, crystal structure, and composition of fluorapatites from the magnetite-fluorapatite deposits, Eastern Adirondack Mountains, New York. *Canadian Mineralogist*, 55, 399-417.

Kampf, A.R., Nash, B.P., Hughes, J.M., and Marty, J. (2017) Burroite, $Ca_2(NH_4)_2(V_{10}O_{28})\cdot 15H_2O$, a new decavanadate mineral from the Burro mine, San Miguel County, Colorado. *The Canadian Mineralogist*, 55, 473-481.

Tansman*, G.F., Kindstedt, P.S., and Hughes, J.M. (2017) Crystallization and demineralization phenomena in stabilized paste white mold cheese. *Journal of Dairy Science JDS-16-12259*.

Kampf, A.R., Nash, B.P., Marty, J., Hughes, J.M., and Rose, T.P. (2017) Hydropascoite, $Ca_3(V_{10}O_{28})\cdot 24H_2O$, a new decavanadate mineral from the packrat mine, Mesa County, Colorado. *Canadian Mineralogist*, 55, 207-217.

Kelly*, S.R., Rakovan, J.F., and Hughes, J.M. (2017) Column anion arrangements in chemically oned ternary chlorapatite and hydroxylapatite from Kurokura, Japan. *American Mineralogist*, 102, 720-727.

Tansman*, G.F., Kindstedt, P.S., and Hughes, J.M. (2017) Minerals in food: Crystal structures of ikaite and struvite from bacterial smears on washed-rind cheese. *Canadian Mineralogist*, 55, 89-100.

Kampf, A.R., Hughes, J.M., Nash, B.P. and Marty, J. (2017) Kegginite, $Pb_3Ca_3[AsV_{12}O_{40}(VO)]\cdot 20H_2O$, a new mineral with an ε-isomer of the Keggin anion. *American Mineralogist*, 102, 461-465.

Kampf, A.R., Nash, B.P., Marty, J., and Hughes, J.M. (2017) Mesaite, $CaMn^{2+}{}_5(V_2O_7)_3\cdot 12H_2O$, a new vanadate mineral from the Packrat mine, near Gateway, Mesa County, Colorado, USA. *Mineralogical Magazine*, 81, 319-327.

Best to everyone,
John

A serendipitous meeting: My daughter, Rebecca (Hughes) Behrmann and UVM alumna Abby O'Donnell met at a knitting class in San Francisco

Keith Klepeis, Professor, Structural Geology, Tectonics & Field Geology: Greetings, This year started with a 5-week trip to New Zealand in January with two of my graduate students, ***Griffin Moyer*** and ***Christopher Eddy (Photos 1 & 2)***, along with colleagues from New Zealand, California, and Alabama. We spent several weeks cruising the fjords of southwest New Zealand on a large boat gathering samples and data for their Griffin's and Chris' MS theses. During field work, we found a whole host of new geological features, including shear zones up to 10 kilometers wide, lots of granulite, and previously unexplored fault zones. Chris and Griffin are sorting out the area's geological history, including the behavior of deep crustal faults and shear zones. In between mapping, we had plenty of time to see albatross, seals, and the occasional lost weka (a large native flightless bird).

UVM geology also had a great presence at the Northeastern section of GSA in March, which was in Burlington in 2018. ***Matthew Merson*** (***Photo 3***) presented the results of his MS thesis on the structural and kinematic evolution of the Champlain Thrust fault. Matthew worked with undergraduate ***Erin Dundas*** to produce new 3-D maps of the Champlain fault zone core and damage zone. They made a host of new discoveries, including evidence that the Champlain Thrust fault moved multiple times, most recently in a top-to-the-south direction. This movement history is strikingly different than previously reported and has changed the way local Universities teach using the famous Lone Rock Point exposure. I am also proud to report that Matthew accepted a job as a professional geologist with the Bureau of Reclamation in Sacramento, California.

Over the summer, both graduate and undergraduate students were immersed in a variety of research projects. Undergrad ***Jesse Lee*** worked closely with Griffin Moyer to unravel the 3-D geometry and vorticity of shear zones. Both will be presenting a research poster of their work at the upcoming annual meeting of GSA in Indiana. ***Erin Dundas*** has begun a project mapping rock quarries and outcrops in 3-D using aerial drone surveys and some sophisticated data processing software. ***Samantha Portnoy*** also worked with Jon Kim and Marjorie Gale and at the Vermont Geological Survey, mapping fracture patterns in central and Southern Vermont.

With all this new activity, it's been a great year for geology at UVM.

I hope to see many of you during the coming year.

With best wishes,
Keith

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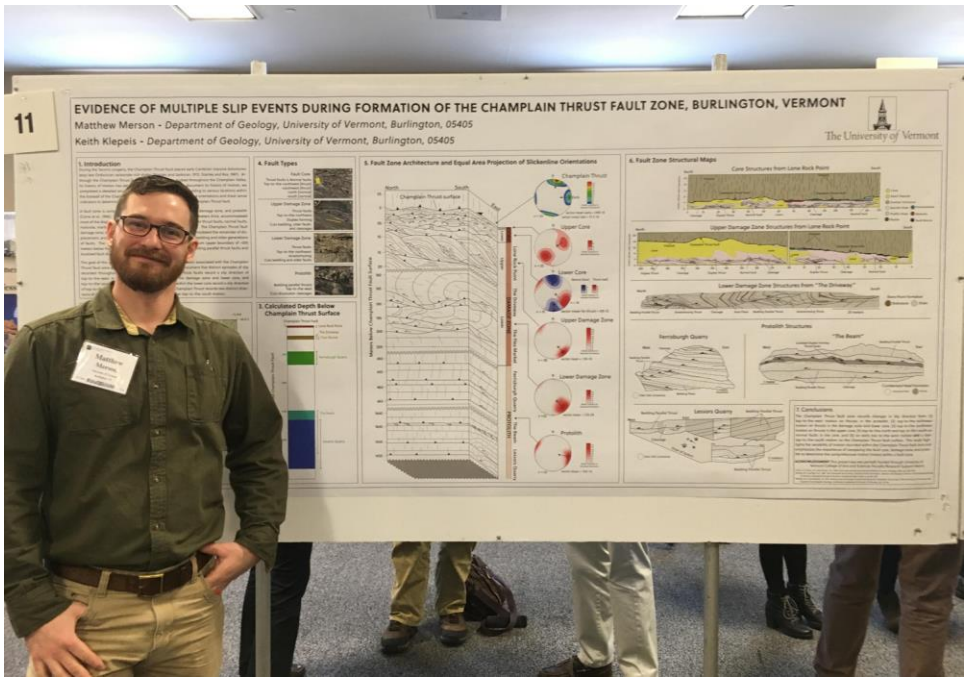
UVM Graduate student Griffin Moyer doing field work in Fiordland National Park, New Zealand.

UVM Graduate student Chris Eddy doing a balancing act to get a strike and dip measurement in Fiordland.



UVM Graduate student Matthew Merson presents a poster of his work at the North Eastern section of GSA in Burlington during the March, 2018 meeting.

Publications

Webb, L.E. and Klepeis, K.A., 2019, $^{40}Ar/^{39}Ar$ constraints on the Tectonic evolution of the Late Paleozoic and Early Mesozoic accretionary complex of coastal Central Chile, in Horton, B. and Folguera, A. (eds.), *Andean Tectonics*, Elsevier, pp.,

Huntington, K.W., and Klepeis, K.A., with 66 community contributors, 2018, Challenges and opportunities for research in tectonics: Understanding deformation and the processes that link Earth systems, from geologic time to human time. A community vision document submitted to the U.S. National Science Foundation. University of Washington, 84 pp., https://doi.org/10.6069/H52R3PQ5.

Char Mehrtens, Professor (Stratigraphy, Sedimentation, Carbonate Petrology): Annual greetings! I hope that this edition of the newsletter finds everyone well and happy. I'm on a teaching leave this semester so I can focus on getting some of the research we've done on the Monkton over the past few years written up. I also had the opportunity to do take a few weeks in the autumn and do some field work out west in the Dakotas. I visited some classic localities in the Badlands but also spent time looking at the Phanerozoic sequence on the flanks of the Black Hills. In particular, the Cambrian Deadwood Formation was interesting to compare to our Vermont sequence. Since the Deadwood is not dolomitized, it's possible to see carbonate-clastic relationships clearly and I had a few "eureka" moments. It was a great trip and I recommend the Badlands (in both North and South Dakota) and the Black Hills for awesome geo-tourism. I took the "long way 'round" on the way out, across the top of Lake Superior. I wanted to see Sudbury as well as the Keweenawan strata along the Lake Superior coastline. This is great geology, great scenery and the Canadian Provincial Parks are wonderful.

Other geo news: my last grad student, Henry Maguire, finished up a wonderful piece of work on cyclicity in the Monkton based on gamma ray logs. Henry is off pursuing a career in the oil patch. There are two Vermont State Geological Survey open file reports available with the data from his research. On the teaching front, I'll be doing Regional to Iceland in July, 2019 with Barb Tewksbury (Hamilton College).

Other than work news, the major events of the past year include wiping out on black ice in January and breaking my wrist (dominant hand, of course!) and as soon as that got better, fracturing a kneecap in a bicycle fall. Between the two it was not the best of winters for outdoor recreation. The accidents kept me out of curling, skiing and all the other ways to play in the winter. Fortunately, all seems well and back in working order again.

Please keep sending news of your activities. It is ALWAYS great to hear from everyone.

In the North Dakota Badlands during this fall's western sojourn

Publications:

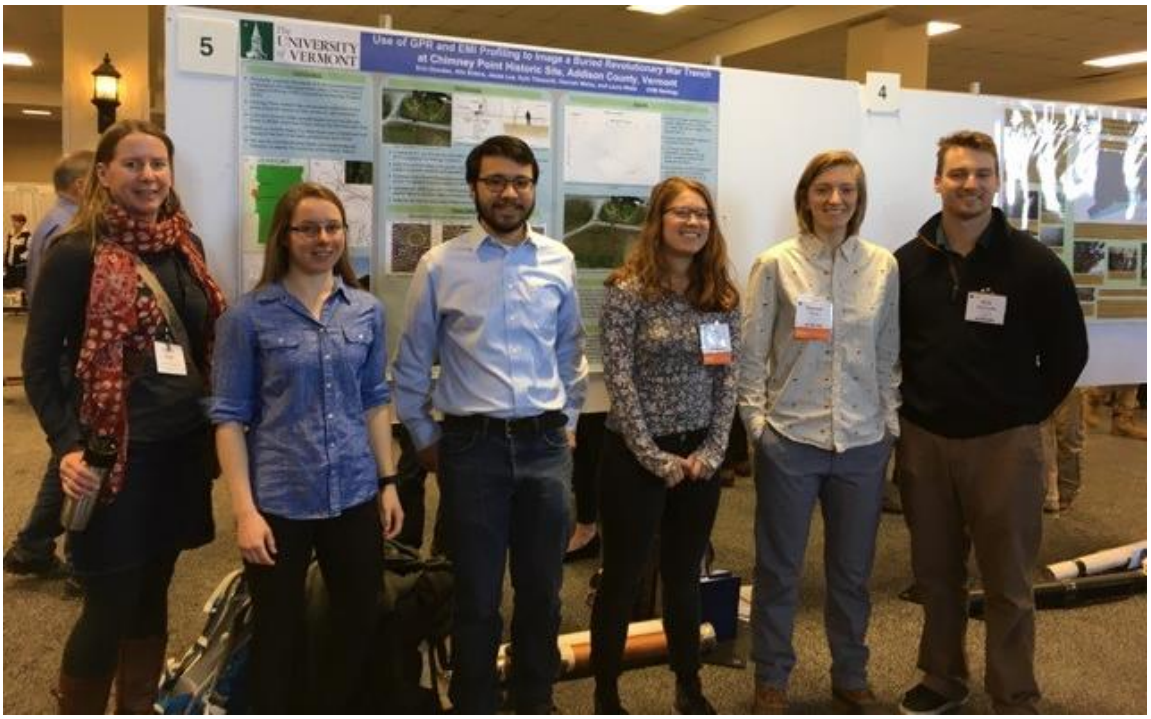
Maguire, H., C. Mehrtens, J. Kim, E. Romanowicz, 2018, Lower Cambrian Gamma Log Data from Wells in Western Vermont and Northeastern New York, Vermont Geologic Survey Open File Report VG2018-7

Maguire, H, C. Mehrtens, J. Chiarenzelli, L. Webb, 2018, Detrital zircon ages for the Cambrian Monkton and Danby Formations, Champlain Valley, Vermont, Vermont Geologic Survey Open File Report VG2018

Brink, R. C. Mehrtens, and H. Maguire, submitted, Sedimentology and Petrography of a Late Lower Cambrian Transgressive Sequence: Altona Formation (Potsdam Group) in Northwestern New York, Bulletin of Geosciences

Laura Webb, Assistant Professor (Igneous petrology and Geochronology: Greetings Alumni and Friends, Another year has vaporized. One of the big events in the interim since our last newsletter was the Northeastern Geological Society of America section meeting held here in Burlington in March. I want to commend all of my colleagues who put so much time and effort into organizing a very successful meeting. There was a great turn out from UVM students presenting quite an array of impressive research results. In last year's newsletter, I included a picture of the students in the GEOL 161 Field Geophysics course engaged in a service-learning project with the UVM Consulting Archaeology Program (CAP). In that photo they were preparing for ground penetrating radar surveys to map out the location of a Revolutionary War trench at the Chimney Point historical site in Addison, Vermont. Well, they found it! They also presented the results of their project at the NEGSA meeting (see photo below) and provided a well-received report on their findings to UVM CAP.

My students and I continue to refine the timing of events and tease apart polyphase tectonic histories in Vermont. Cheyne Aiken and Evan Tam successfully finished their MS thesis projects working with me on $^{40}Ar/^{39}Ar$ geochronology of the Tillotson Peak Complex and footwall of the Prospect Rock Fault, respectively. They both did fantastic work and presented their results at NEGSA, as well. They handed off the 'argon baton' up to Kristin Schnalzer, who joined our Geology MS program this fall and is working with me on a project on the Chester Dome. Kristin's project focuses on the timing of deformation in the mylonitic shear zone at the interface of the Precambrian core and the Paleozoic cover rocks.



The Fall 2017 GEOL 161 Field Geophysics class presented the results of their service-learning project for UVM's Consulting Archaeology Program at the 2018 Northeastern GSA section meeting held in Burlington last March. From left to right: Laura Webb, Erin Dundas, Jesse Lee, Alix Ehlers, Hannah Weiss, and Kyle Titsworth.

Kristin Schnalzer, Geology MS student, sampling mylonites in the Moretown Formation on the eastern flank of the Chester Dome.

In past newsletters, I have noted little adventures traveling with my mom. This past summer I was able to join her on a fantastic jaunt. We visited Prague for a few days, and then took the train to Bavaria where we embarked on a cruise down the Danube River, which took us ultimately to Budapest. No, the Danube isn't blue, but neither were we while we visited new sites each day along the way and enjoyed fantastic cuisine. There were even some tantalizing views of rocks of the Bohemian massif draped by vineyards along the way that combine forces to produce some very gneiss sparkling wines.

Well, with that bad pun I will end my blurb. I wish you all a wonderful year!

Elaine "Ma" Webb and Laura Elaine Webb on the Danube River in Budapest, Hungary.

Recent publications:

Cordova, J.L., Mulcahy, S.R., Schermer, E.R., and Webb, L.E., in press, Subduction initiation and early evolution of the Easton Metamorphic Suite, Northwest Cascades, Washington. Lithosphere.

Webb, L.E., Klepeis, K.A., and Kim, J.J., 2018. New Insights on Acadian Deformation and Reactivation in Northern Vermont from Integrated Structural and Geochronological Studies. Geological Society of America Abstracts with Programs. Vol. 50, No. 2, doi: 10.1130/abs/2018NE-311032.

Klepeis, K., Webb, L.E., Merson, M.Q., and Kim, J.J., 2018. Unraveling Fault Reactivations and Their Tectonic Significance Using Integrated Structural Data and 40Ar/39Ar Geochronology, Examples from N. Vermont and S.W. New Zealand. Geological Society of America Abstracts with Programs. Vol. 50, No. 2, doi: 10.1130/abs/2018NE-311301.

Best regards,

Laura Webb

Stephen Wright, Senior Lecturer (Glacial geology, Geomorphology, Environmental Geology): I hope all of you have had a good year and are looking forward to the cooler fall weather. I took on another mapping project for the Vermont Geological Survey this last summer and recruited 4 undergraduate students to work with me in the Richmond Quadrangle. We spent the month of June working together mapping from the Winooski River valley north to the Mill Brook valley in the Towns of Richmond, Bolton, and Jericho. We met many wonderful people including more than a handful of UVM grads some of whom had even taken one or more geology classes! We also had to inform several landowners that the rocks they had found on their property were not meteorites! The students had the opportunity to discover several previously unmapped eskers as well as sediments deposited in several different glacial lakes. They will spend the fall semester making geologic maps from their data as well as drawing cross-sections that they will present at the Northeast GSA meeting in Portland this coming March.

Later in the summer I had the opportunity to map in parts of the Jericho Firing Range, a large military reservation used for all kinds of training exercises ranging from biathlon to large-calibre gun testing by General Dynamics. The people running the range are very careful, but also very friendly and helpful. Some parts of the Range have been intensely modified, but much of the area hasn't been altered significantly since the farms were abandoned there at the turn of the last century. The glacial geology is stunning with eskers, deltas, and abandoned channels providing the underpinnings for wetlands and surrounding woods that haven't been cut in over 100 years.

I took a vacation in July to hike in England. During the first half of the trip my wife and I hiked along parts of the Southwest Coastal Path in both Devon (not the type-section, but still home to the "Devonian" system name) and northern Cornwall. The rocks exposed in the cliffs are beautifully folded and in places at low tide you can easily walk (clamber/climb) across or sit on numerous fold hinges. Everything is built out of stone in this part of England; gorgeous old bridges, barns, houses, and pubs—of course! During the last half of my trip I did a week-long point-to-point hike across the Lake District. While wet (as usual), this is a very steep mountainous landscape, but largely treeless and consequently the views are stunning even though the mountains aren't any higher than the Green or White Mountains of New England.

Complexly folded and faulted Devonian sandstones along the coast of Devon, England.

Clouds lifting from a ridge in the Lake District of England. I could see the ridge that afternoon!

Julia Perdrial, Assistant Professor of Geochemistry. ***Julia Perdrial, Assistant Professor of Geochemistry*** This has been another fun and busy year: The Geology Department, most notably Andrea and Char, organized that Northeastern GSA meeting in Burlington and many of our students presented. It was also a fun year for travels: funded through a VT-NASA EPSCoR Faculty Research Award ("Expanding the concept of the Critical Zone from Terrestrial to Planetary Systems: What can we learn about weathering on Mars?") my lab group visited the Johnson Space Center in Houston to begin collaborations with researchers from "Astromaterials Research and Exploration Science" or ARES. We toured the lunar lab, which was fantastic.

We also began our work on a collaborative, NSF-funded project, where my collaborators from PennState and the University of Reno and I combine different modelling techniques and experiments to tackle the question why dissolved organic matter fluxes in streams increase in many forested systems. Our interdisciplinary team of biogeochemists, hydrologists, Big Data scientists and data miners came together for a 3 day project kick-off meeting in May. We also toured the Shale Hills Critical Zone Observatory, which is where Critical Zone science found its beginning and we will do some fieldwork this fall.

We also got one of my favourite papers published this year: In "*A net ecosystem carbon budget for snow dominated forested headwater catchments: linking water and carbon fluxes to critical zone carbon storage"* we describe how timing of water availability might be more important than total water amount when trying to sequester carbon in forested ecosystems. We also had a great summer working again with amazingly talented interns through the BREE EPSCoR internship program. Max is making progress with his thesis research and Thomas just joined our group as MS student. Lastly, Malayika and Jesse both successfully defended their theses in August and are off to new adventures! Thanks for fantastic work to both of them!

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The environmental Biogeochemistry team is visiting the Lunar Lab at JSC (from left to right: Julia Perdrial, Nicolas Perdrial, Grant Reeder, Jesse Armfield, Liz Rampe).

Project kick-off meeting and workshop at Penn State, vitamin C helped with staying focussed (left to right: Li Li, Hang Wen, Kristen Underwood, Donna Rizzo, Thomas Adler, Gary Sterle).

Our group in the Shale Hills watershed.

Papers in 2018:

- *Cincotta, M.,* **Perdrial, J.N.**, *Shavitz, A., Libenson, A., Landsman, M.,* Perdrial, N., *Armfield, J., Adler, T.*, Shanley, J (in review). Soil aggregates as a source of dissolved organic carbon to streams: an experimental study on the effect of solution chemistry on water extractable carbon, Frontiers in Earth Science: Biogeosciences.
- *Armfield, J.*, **Perdrial, J.N.**, *Gagnon, A., Ehrenkranz, J.*, Perdrial, N., *Cincotta, M.*, Ross, D., Shanley, J., Underwood, K., Ryan, P (in review). Does stream water composition at Sleepers River in Vermont reflect dynamic changes in soils during recovery from acidification? Frontiers in Earth Science: Biogeosciences.
- Hernandez-Ruiz, S., **Perdrial, J.N**., Segraves, D. (in review). Evaluation of Corrosion Control Products on a Distribution System through Crowdsourcing. Environmental Science and Pollution Research.
- Radke, A., Godsey, S., Lohse, K., McCorkle, E., **Perdrial, J.N**., Seyfried, M.S., Holbrook, S (in review). Spatiotemporal Heterogeneity of Water Flowpaths Controls Dissolved Organic Carbon Sourcing in a Snow-dominated, Headwater Catchment. Frontiers in Earth Science: Biogeosciences.
- **Perdrial J.N**., Brooks P.D., Swetnam T., Rasmussen C., Lohse K.A., Litvak, M., Harpold, A.A., Broxton, P., Mitra, B., Meixner, T., Condon, K., Huckle, D., Stielstra, C., Vazquez-Ortega, A., Lybrand, R., Holleran, M., Orem, C., Chorover, J. (2018). A net ecosystem carbon budget for snow dominated forested headwater catchments: linking water and carbon fluxes to critical zone carbon storage. Biogeochemistry. 138(3):225-243. (Effort 70%, Impact factor 3.43).

<u>Conferences in 2017:</u>

National and international meetings:

- Perdrial, N., ***Armfield, J., Reeder, G.,*** *Gagnon, A.*, Rampe, E., **Perdrial, J.N.** (2018). The Martian Critical Zone: Concept and Experimental Example. Goldschmidt Conference, Boston, MA August 12-17. (peer reviewed).
- ***Juice, S.M.,*** Adair, C., Schaberg, P., Hawley, G., Kosiba, A., Waite, C., Wang, D., **Perdrial, J.N**. (2018). Interacting effects of climate change and soil characteristics on carbon and nitrogen loss from northern hardwood forests. Ecological Society of America Meeting, New Orleans, August 5-10 (peer reviewed talk).
- ***MacNeille, R. B.,*** Lohse, K., Godsey, S., Derryberry, D., McCorkle, E., Parson, S., Baxter, C., **Perdrial, J.N.** (2018). Stream structure at low flow: biogeochemical patterns of intermittent streams over space and time. Society of Freshwater Sciences Annual Meeting, Detroit, MI, May 20-25 (peer reviewed poster).
- ***Cincotta, M.,*** **Perdrial, J.N.,** *Shavitz, A.,* ***Landsman, M****. Liebenson, A.,* Shanley, J. (2018). The soil aggregates play in the generation of dissolved organic carbon: a case study at Sleepers River watershed. GSA meeting Northeastern section, Burlington, March 18-20 (peer reviewed talk).
- *Shavitz, A.,* **Perdrial, J.N.,** ***Cincotta, M., Armfield, J.***, Shanley, J. (2018). Influence of soil chemistry on carbon and nutrient liberation in the Sleepers River watershed. GSA meeting Northeastern section, Burlington, March 18-20 (peer reviewed poster).
- ***Armfield, J.,*** *Gagnon, A.,* **Perdrial, J.,** *Ehrenkranz, J.,* Perdrial, N., ***Cincotta, M.,*** Ross, D., Shanley, J., Bailey, S., Ryan, P. (2018). Weathering dynamics in the acid impacted Sleepers River watershed: combining observations of stream and soil data. GSA meeting Northeastern section, Burlington, March 18-20 (peer reviewed poster).
- ***Landsman-Gerjoi, M., Lancellotti, B.,*** *Beisel, C.,* ***Cincotta, M.,*** Adair, C., Schroth, A., **Perdrial, J.N.** (2018). Incubations vs. fluorescence spectroscopy: a field and lab study on DOM bioavailability. GSA meeting Northeastern section, Burlington, March 18-20 (peer reviewed poster).
- ***Ryan, K.,*** Shanley, J., Stubbins, A., **Perdrial, J.,** Raymond, P., Hosen, J. (2018). In-situ optical sensors reveal hot moments of dissolved organic matter exports in Sleepers River Research Watershed, Vermont. GSA meeting Northeastern section, Burlington, March 18-20 (peer reviewed talk).

Local meetings:

- *Follansbee, B.,* Pinder, G., **Perdrial, J.N.** (2018). A Geochemical Analysis on Lake Iroquois Groundwater Seepage: Is There a Relationship between Cations and Phosphorus? UVM Student Research Conference, Burlington VT, April 17th (not peer reviewed).
- *Beisel, C.,* ***Landsman, M.,*** **Perdrial, J.N.** (2018). The Impact of Clay Structure on Carbon Bioavailability. UVM Student Research Conference, Burlington VT, April 17th (not peer reviewed).
- *Mecca, S.,* **Perdrial, J.N.,** ***Cincotta, M.,*** Seybold, E., ***Lancellotti, B.,*** Schroth, A., Adair, C. (2018). Effect of ionic strength on soil water extracts from BREE wetlands. EPSCoR CWDD symposium, Burlington, VT, March 20th (not peer reviewed).
- *Adler, T.,* **Perdrial, J.N.,** Schroth, A., Adair, C. (2018). Optimizing Fluorescence Spectroscopy Methods in DOC Analysis. EPSCoR CWDD symposium, Burlington, VT, March 20th (not peer reviewed).

- **Perdrial, J.N.,** ***Lancellotti, B.,*** Seybold, E., ***Landsman-Gerjoi M.,*** *Anderson, B., Beisel, Blum, E., C., Collins, A., Couderc, A., Czyzyk, K., Libenson, A., May, N., McCarthy, K., Quesnell, T., Quock, M., Reilly, M., Ryan, S.,* ***Cincotta, M.,*** Adair, C., Schroth, A. (2018). EPSCoR soil monitoring network as classroom: preliminary data on the biogeochemistry of soils and streams. Lake Champlain Research Conference, January 8-9, Burlington VT (not peer reviewed).

Funding in 2018:

In preparation:

- **NSF-EAR**, **$500,000.** *"Acquisition of a research-grade powder X-ray diffractometer for research and education in geological, environmental and material sciences",* **co-PI, effort 35%.**

Funded:

- **CAS-FRSA** (The College of Arts and Sciences Faculty Research Support Awards, FY 2018-2019), **$4954.** *"Will you become a greenhouse gas? Testing fluorescence spectroscopy as tool to predict the fate of carbon in natural waters",* **lead-PI, effort 100%.**

Nico Perdrial: Hi there, 2017-2018 has been another full year. New research projects and collaborations, a trip to NASA Johnson Space Center and the NanoEarth center at Virginia Tech, organization of NEGSA and frequent hikes around Burlington are some of the highlights of the year.

My group is still working on deciphering nanoscale soil sorption processes, in particular Pb in soils and Grant Reeder successfully defended his MS in 2017 and is working on 2 papers. He presented his work at NEGSA here in Burlington. On the same project undergraduate students Amanda Rossi, Katelyn Czyzyk and Landon Williamson presented a poster at NEGSA too. An undergraduate student (Lily Zanta) is continuing the project adding the final touches for a successful submission of the papers. My new MS student, Adele Conde and I are working on a very cool new project in collaboration with Roland Hellman (University of Grenoble, France) and researchers at the Johnson Space Center. Adele is looking at the atomic scale weathering mechanisms of apatite. She received funding from NASA to support her second year of research. We have spent some fruitful time together at Virginia tech to acquire high-resolution transmission electron microscope images and she presented her results at the Goldschmidt conference in Boston last summer. She will also present another aspect of her research at the Geological Society Meeting in November this year. Julia and I started a study of the weathering of Mars material upon modification of the environment. We received funding from the NASA-EPSCOR program and visited with two MS students (Jesse Armfield and Grant Reeder) the Johnson Space Center, including the Lunar lab. This was a great experience and the people there are amazing. We also invited Dr Liz Rampe from the curiosity rover science team to give a seminar and she visited my "planetology" class for great discussions with first year students. I presented our concept of planetary critical zone at the Goldschmidt conference in Boston in August.

Last year I taught Planetology for the first time. This is a Teacher Advisor Program class designed for first-year, first-semester students. Aside from learning about the planets of the solar system, the students built an exhibition on that theme for the Perkins Geology Museum. This year I teach Geol001 and Planetology in the fall and will continue teaching Environmental Geology and Geocomputing next spring. I am also working on a new class with a physicist, an English professor and a philosopher about extraterrestrial life, to be offered next year.

Publications in 2017/2018:

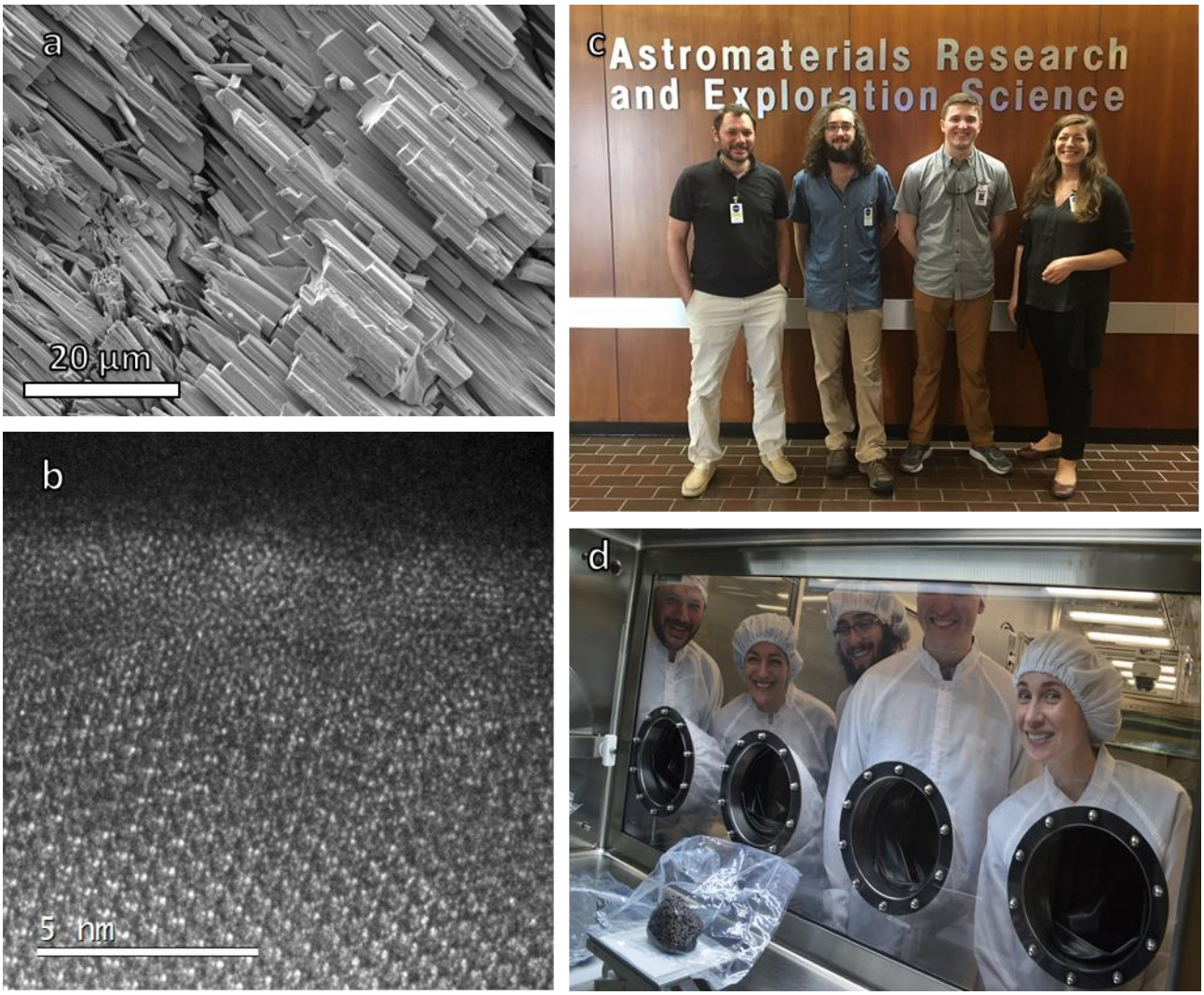
1. Kamali-Asl A.*, Ghazanfari E., **Perdrial N.**, and Bredice N. (2018) - Experimental study of fracture response in granite specimens subjected to hydrothermal conditions relevant for enhanced geothermal systems. *Geothermics*, **72**, 205-224.
2. **Perdrial N.**, Vazquez-Ortega A., Wang G., Kanematsu M., Mueller K.T., Steefel C.I., O'Day P., and Chorover J. (2018) - Uranium speciation in acid waste-weathered sediments: The role of aging and phosphate amendments. *Applied Geochemistry*, **89**, 109-120.
3. Singer D.M., Jefferson A.J., Traub E.L. and **Perdrial N.** (2018) - Mineralogical and geochemical variation in stream sediments impacted by acid mine drainage is related to hydro-geomorphic setting. *Elementa*, **6**, 31.
4. Wang G., Um W., Wang Z.M., Reinoso-Maset E., Washton N.M., Mueller K.T., **Perdrial N.**, O'Day P.A. and Chorover J. (2017) - Uranium Release from Acidic Weathered Hanford Sediments: Single-Pass Flow-Through and Column Experiments. *Environmental Science & Technology*, **51**, 11011-11019.
5. Bower J.A.*, Lister S.*, Hazebrouck G*. and **Perdrial N.** (2017) - Geospatial evaluation of lead bioaccessibility and distribution for site-specific prediction of threshold limit. *Environmental Pollution*, **229**, 290-299
6. Clark K.E., Shanley J.B., Scholl M.A., **Perdrial N.**, Perdrial J.N., Plante A.F., McDowell W.H. (2017) - Tropical river suspended sediment and solute dynamics in storms during an extreme drought. *Water Resource Research, 53*.

Talks

1. **Perdrial N.**, Armfield J*., Reeder G*., Gagnon A*., Rampe E. & Perdrial J. (2018) - The Martian Critical Zone: Concept and Experimental Example. Goldschmidt Conference, August 12-17, Boston, MA, USA.
2. Conde A*., Hellmann R., Wurzburger C*. & **Perdrial N.** (2018) - Mechanism of Apatite Dissolution. Goldschmidt Conference, August 12-17, Boston, MA, USA.
3. Reeder G., Rossi A., Czyzyk K., Williamson L. & **Perdrial N.** (2018) – Bioaccessible Pb in Burlington (VT) soils: Field and microscale controls. NE Geological Society of America, 18-20 March, Burlington, VT, USA.

4. Armfield J.*, Gagnon A., Perdrial J., Ehrenkranz J., **Perdrial N**., Cincotta M., Ross D.S., Shanley J.B., Bailey S. & Ryan P. (2018) – Weathering dynamics in the acid impacted Sleepers River: Combining observations of stream and soil data. NE Geological Society of America, 18-20 March, Burlington, VT, USA.
5. Rossi A.*, Reeder G.*, Czyzyk K.*, Williamson L.* & **Perdrial N**. (2018) Soil Pb bioavailability and distribution in Burlington, Vermont: Testing and assessment of a geospatial model. NE Geological Society of America, 18-20 March, Burlington, VT, USA.

Email: Nicolas.Perdrial@uvm.eduW Website: http://nicolasperdrial.weebly.com/



a) Scanning electron microscope image of the surface of a weathered apatite acquired on the Middlebury SEM. b) The same surface seen transversally (the top of the picture is outside the crystal, the dot at the bottom are atomic cluster in the structure) using the high-resolution transmission electron microscope on a focused ion beam cut at the NanoEarth Center at Virginia Tech. c) Our UVM group at the Johnson Space Center during our 2-days workshop/visit (from left to right: Nico, Jesse, Grant & Julia) and in bunny suits during the visit of the lunar lab with our friend and collaborator Dr. Liz Rampe (right). Liz is Exploration Mission Scientist at ARES and co-investigator on the CheMin instrument currently on Mars. Can you recognize the other members of our team?

Some of the effects of Hurricane Maria (September 20, 2017) on Puerto Rico. a) El Junque forest in January during the Chapman conference (credit: KC Clark). b) The same forest after the hurricane (note: this is a tropical forest, trees do not lose their leaves like deciduous forests - credit: Miguel Leon). c) and d) Some landslide impacts on the island. Red dots identify the location of roads and buildings impacted by the landslides. (https://landslides.usgs.gov/research/featured/2017-maria-pr/)

Andrew Schroth, Research Assistant Professor (Low Temperature Geochemistry, Limnology and Oceanography: Hello Alumni,
I hope that all is well. 2017-18 has been active year for my research group. Geology MS students Meagan Leduc and Austin Wilkes continue to make exciting progress towards completion of their respective theses. Their collective work constitutes major progress in understanding how fluctuating redox conditions around the sediment-water interface impact the chemical partitioning/speciation of phosphorus and its mobility (or lack thereof). Meg's focus is on analysis of seasonal time -series of surface sediment cores collected from Missisquoi Bay and Shelburne Pond, VT; whereas Austin's work is focused on experimental manipulation of fluctuations in redox front position in sediment cores collected from Missisquoi Bay. Meagan and I recently traveled to Indiana to collaborate with former UVM faculty member, Greg Druschel's group, for what constituted a brief writing retreat that was highly productive. Austin and I are planning a similar visit this coming spring as part of our ongoing NSF-funded collaboration. Austin and I also traveled to the Stanford Synchrotron Lightsource on Beamlines 14-3 and 4-2, where we have been awarded beamtime to analyze and quantify the distribution of phosphorus and iron species in these manipulated lake sediments. We will be traveling to SSRL again in Dec of 2018 for further analysis of sediments and standards. Austin is also looking forward to sampling additional Californian burritos, as he developed a strong bond with California's taqueria fare on his first visit to the west coast. Additionally, we were awarded time at the Canadian Light Source, a facility that I have never utilized before, but home to what many consider to be the optimal beamline for synchrotron-based phosphorus analysis in the world, Beamline SXRMB. I am also currently co-advising 3 PhD students in RSENR working on our EPSCoR grant. Matthew Vaughan (watershed biogeochemistry and sensor technologies with Breck Bowden), Wilton Burns (chemical limnology with Jason Stockwell), and Brittany Lancellotti(soil geochemistry with Carol Adair and Julia Perdrial). Coincidentally, Matt is defending his dissertation this week, and has already has published two outstanding manuscripts in Water Resources Research and Limnology and Oceanography. He has also begun a full time position with the Lake Champlain Basin Program as their Technical Coordinator. Congrats Matt! I am also co-advising two wonderful postdoctoral scientists with Carol Adair, Dustin Kincaid and Erin Seybold, who are both watershed biogeochemists, with recent completion of PhD programs at MSU and Duke respectively. My research group in general has been quite productive with many conference presentations, and we have published 13 new manuscripts over 2017-18 time frame. Seven of these manuscripts were lead by our team, which in my mind, is a testament to the bright and motivated students and post docs that make this team run. Please let me know if any of these interest you, and I would be happy to pass along a pdf. The EPSCoR team also won a regional Emmy for a PBS documentary focused on documenting the complex water quality issues facing the Lake Champlain Basin under climate change to a diverse audience. You can check it out here https://www.vermontpbs.org/water/.

Collaborating with the cross disciplinary EPSCoR team is an ongoing highlight of my career here https://www.vermontpbs.org/water/. Collaborating with the cross disciplinary EPSCoR team is an ongoing highlight of my career.

UVM Faculty leaders associated with regional emmy award-winning PBS documentary (awkwardly posing with the award). From left to right, Arne Bomblies (CEMS), Donna Rizzo (CEMS), Andrew Schroth (Geology), Carol Adair (RSENR), Chris Koliba (CALS), Pat Clemins (on screen-EPSCoR). Although not included in the photo, it is important to acknowledge that BREE Ecological Team and Geology faculty member, Julia Perdrial, also contributed extensively to the program content.

2017-18 Publications from my group (* indicates that the effort was led by a student or postdoc member of our research group)

*Vaughan, M.C.H. et al. (2018) Using in situ UV-Visible spectrophotometer sensors to quantify riverine phosphorus partitioning and concentration at a high frequency. Limnology and Oceanography Methods.

Kaushal, S.S. et al. (2018) Watersheds as elemental sieves, filters, chromatographic columns, and reactors in the Anthropocene. (*Biogeochemstry)*
Addy, K. et al. (2018) Stream response to an extreme drought induced defoliation event. *Biogeochemistry*

Hamshaw, S.D. et al. (2018) A new machine-learning approach for classifying hysteresis in suspended-sediment discharge relationships using high-frequency monitoring data. *Water Resources Research*

Vidon et al. (2018) In the path of the Hurricane: impact of Hurricane Irene and Tropical Storm Lee on watershed hydrology and biogeochemistry from North Carolina to Maine, USA. *Biogeochemistry*

Underwood, K. L. et al. (2017). Evaluating spatial variability in sediment and phosphorus concentration-discharge relationships using Bayesian inference and self-organizing maps. *Water Resources Research*

*Isles P.D.F. et al. (2017) Modeling the drivers of interannual variability in cyanobacterial bloom severity using self-organizing maps and high-frequency data. *Inland Waters*

Schroth, A. W. et al. (2017), Atmospheric deposition of glacial iron in the Gulf of Alaska impacted by the position of the Aleutian Low, *Geophys. Res. Lett*.

Crusius, J. et al. (2017), Seasonal and spatial variabilities in northern Gulf of Alaska surface water iron concentrations driven by shelf sediment resuspension, glacial meltwater, a Yakutat eddy, and dust, *Global Biogeochem. Cycles*

*Vaughan, M.C.H. et al. (2017) High-resolution dissolved organic carbon and nitrate measurements reveal differences in storm hysteresis and loading based on land cover and seasonality. *Water Resources Research*

*Joung, D. et al. (2017) Winter weather and lake-watershed physical configuration drive phosphorus, iron and manganese dynamics in water and sediment of ice-covered lakes. *Limnology and Oceanography.* DOI: 10.1002/lno.10521

*Isles P.D.F. et al. (2017) Long-term climate-driven changes in energy and mass inputs systematically alter nutrient concentration and stoichiometry in deep and shallow segments of Lake Champlain. *Biogeochemistry.* doi.org/10.1007/s10533-017-0327-8

*Rosenberg, B. and Schroth A.W (2017) Coupling of reactive riverine iron and phosphorus species during hot transport moments: impacts of landcover and seasonality. *Biogeochemistry* DOI: 10.1007/s10533-016-0290-9

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STAFF

Robin Hopps, Office Administrator: While in the office, starting my 13th year here, I always enjoy working with other Geology Department staff members, faculty and, of course, students. At present, we have 10 Geology graduate students, plus 29 major, and 14 minor undergraduate students. I continue to landscape/garden during the summer months when I am out of the office (10-month UVM position). If you are in the area, please stop by the office to visit the Department and the Perkins Museum of Geology. The Museum's new website will be launched next year, and will be loaded with educational materials and resources.
http://www.uvm.edu/cas/geology/news-and-events/newsletters
Email: robin.hopps@uvm.edu Visit http://www.uvm.edu/perkins/

Srebrenka Mrsic: Administrative Coordinator: I have worked in the Geology Department since May 16, 2008 and been in US since 1997. I just celebrated my 10-yearanniversary working for the Geology Department. After these ten full years at UVM I can tell that this is the best job in my career of 34 years including my work experience in my home country of Bosnia. It is a real pleasure to work with every single person in the Department, all faculty, students and staff. I am so proud to be part of the Geology team and help our undergraduate and graduate students to grow educationally and professionally.

Email: srebrenka.mrsic @uvm.edu

Gabriela Mora-Klepeis, Senior Research Technician: Greetings from Delehanty Hall. It has been another busy but fulfilling year! Thanks to Andrea and Char for their efforts as hosts of the NE-GSA conference. The event took place in March and that gave me an opportunity to interact with colleagues, friends and former students. In May Keith and I went to Mexico and spent one week in Mexico City. We had the chance to see family and some friends from UNAM that I have not seen in years. One of my classmates is now department Chair! We also had the great opportunity of going Friday to Kahlo's house. She is my favorite artist! The house has been converted into a museum and we were happy to find a Geology book in the library room! During the summer months I took care of the teaching equipment and continued my efforts of documenting the mineral collection. Next on the list is the rock collection! We celebrated the end of the summer with another bike ride along the islands with Jack, followed by our traditional barbecue with Jack and Ruthie at their camp. It is a nice tradition! Hope everyone is doing well and if you are in the area please stop by, I'd love to show you around!

Email: gmora@uvm.edu
http://www.uvm.edu/~geology/?Page=faculty/moraklepeis.php

Frida Kahlo's house

Happy to find a geology book at Frida's house!

Dan Jones, Research Technician: Aside from what Laura has to say about the lab, my partner and I had a wonderful trip to Hawaii!

EMERITI FACULTY

Barry Doolan Hello to all UVM Geology alumni and friends. Another summer has bit the dust. Time to button up the gardens put up the wood and send the goats home to Does Leap Farm**.** Read a lot of books; some good, some not and played plenty of golf with good days and bad. But the most important events for the Doolans' include the move back to Vermont by daughter Katie and her family. If someone told me 50 years ago that my family would all live in Franklin County Vermont I would have said "Fat chance of that happening!"…but it's true. So the picture below for those who may have forgotten: Son in law George grands Zoe and Peter and daughter Kristan and on the right daughter Kate, husband Ian, grands Maddie and Leah. It's been a great summer for us and we look forward living through the seasons with all the families within 20 minutes of each other.

Two other milestones also occurred this year: Sandy and my 50th wedding anniversary AND our ten year anniversary since she gave me one of her kidneys in 2007!

We will return to Italy to celebrate this month this time to Sicily for two weeks. Last year we went to Sorrento Italy and a Lancia Fulvia similar to the one we owned in 1970's followed us home. (see pic below). Sandy is assured that no other cars will cross the Atlantic. I will close with a few pictures of my young granddaughters and a pic of a happy meeting of Sandy, me, **Laura Mallard,** and **Carey Hengstenberg** at the Waterbury Arts and Crafts fair this summer . Nice Surprise. Also I am very proud to congratulate our own **Craig Manning** for receiving this year's coveted **N L Bowen award in Petrology.**

That's all for this year. If any of you make it to Vermont, please come and visit us in Fletcher.

Three Generations of the Doolan Clan

Above Left: Barry and Sandy only a few years ago; Above Right: The new addition to our family, a Lancia Fulvia; Below Left and Right: Katie's kids enjoying life in Fletcher

M.S. Alums Carey Hengstenberg (L) and Laura Mallard (R) at the Waterbury Arts and Crafts Fair, Summer

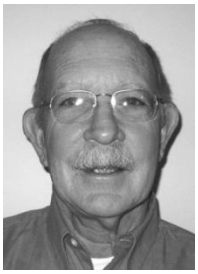
Jack Drake: Greetings to all. Another year, another newsletter. While I thoroughly enjoy staying in touch with you all. I think this will be my last newsletter "production". It is time to pass the "baton" to someone younger, more creative and artistically talented than I. But I will stay in touch!

Life for Ruthie and me has *almost* settled into a routine – 5 months in sunny southern California enjoying sun, surf, birding, golf, volunteer activities and our California friends followed/preceded by 7 months in Burlington enjoying spring, summer and fall activities. I say "*almost"* because last year was quite different in California. First there was the Thomas Fire (now the second largest in CA's history; at the time, the largest) in the hills behind our cottage. So, we had to evacuate because of the extremely bad air quality. Next came the mudslides/debris flows in Montecito (5 miles west of us) and threats of more to come. So, we evacuated two more times to a friend's house in LA. Finally, on a happy, positive note, Matt and Natalie (living in LA) has twins (a boy and a girl) in early April. They (the parents) are now sleep deprived trying to change, feed and entertain two six-month olds. Back here in Burlington it was the usual – golf with Barry and Char, sail boat racing, a canoe camping trip with Char as well as a weekend at her camp in the Adirondacks with Ruthie, a bike ride with Keith and Gaby, and our usual sojourn to Ruthie's family house on Mount Desert Island near Acadia Nat'l Park. So you can see, like is good and busy!

Best to you all, and make sure to contact me (or someone else in the department) if you are ever in town.

Stay in touch, Jack
Email: john.drake@uvm or jcdrakevt@gmail.com.

Cuba, November, 2017
With a 1965 Pontiac Bonneville



David Bucke: Donna and I continue to plug right along keeping busy doing things around "the ranch", mowing, gardening, and general outside upkeep. We lost at least 30 trees right near our house during last fall's wind storm -- a mess to clean up but no damage to buildings. Having Katy, our youngest daughter, and her family living with us in our much enlarged house has been a real blessing. They both love to cook so most of the time we can just come to the table when called and we can enjoy participating in the growing years of our 8 and 9 year old granddaughters. (Our oldest grand"child" is Kelly's son, Ben, who is 34!) Our great grandson, Bodhi, is now 1 year old, but since he's living in Florida, we rely on face time to keep up to date with his rapidly growing life.

We are no longer doing our annual long RV camping trips but we still do some travels. As I write this, we're on our way home from a Rocky Mountaineer train trip from Banff to Vancouver. What great geologic scenery! Early snowfall helped accentuate the beauty. We also spent 9 days last February in Granada (the West Indies one) to escape the cold. Every time we do these travels, fond memories of regional trips with Allen Hunt are stirred up. My closest thing to being back in the classroom was a recent Lessor's Quarry field trip with my granddaughter's 3rd grade class. It's hard to believe it's been 18 years since I abandoned my desk in Perkins. (I must admit that my body does notice the 18 years.)

Our best to you all out there in this great world -- all of which is underpinned by our favorite, geology.

Dave Bucke
Our new email address is: ddbucke@gmail.com
I think my UVM mail still works & flips into the gmail box -- but maybe not.

On the train in the Canadian Rockies

Department Awards

This year's outstanding Graduate Teaching Assistant Matthew Merson (with Andrea Lini)

RECENTLY COMPLETED M.S. THESES 2017

Gina Accorsi - Fingerprinting Wolframite: An Atomic/Crystallographic, Chemical and Spectroscopic Study Along the Solid Solution Series

Jennifer Bower - Speciation, Distribution, Prediction, and Mobility of Lead in Urban Soils: A Multiscale Study

Alison Denn - Detecting Landscape Response To Perturbations By Climate And Base Level In Central Pennsylvania Using In-Situ 10Be and 26Al

John Gilbert - Crustal Deformation During Arc-Flare Up Magmatism: Field And Microstructural Analysis Of A Mid-Crustal, Melt Enhanced Shear Zone

Michael Ingram - 4d Strain Path Recorded In The Lower Crust During The Transition From Convergence To Continental Rifting, Doubtful Sound, Fiordland, New Zealand

All Graduate student research listed at:
https://www.uvm.edu/cas/geology/research-student-opportunities/graduate-student-research

HURRAY FOR THE LIBERAL ARTS!!

Some graduating seniors with Char.
L to R: Elisabeth Pidgeon, Katelyn Czyzyk
Brandon Follansbee, Char

Sam Portnoy, recipient of the Charles G. Doll Award for outstanding graduating senior in Geology
and
Sigma Gamma Epsilon Honors Society TARR Award in Geology
pictured with
SGE Honor Society, Eta Kappa Chapter Director, Keith Klepeis

Amanda Rossi recipient of the award for outstanding senior in Environmental Science Concentration with Andrea Lini

Sarah Powers: 2018 Winner of both the David Bucke Award for Excellence in Introductory Geology and the American Mineralogist Undergraduate Award (presented by Julia Perdrial)

Go to the following website to learn more about undergraduate student opportunities
http://www.uvm.edu/cas/geology/research-student-opportunities/student-opportunities

COME SEE US AT THE FOLLOWING EVENTS:

2019 NATIONAL GSA Meeting: Phoenix, Arizona, 22-25 September

2019 NORTHEAST SECTIONAL GSA Meeting*: Portland, Maine*
17-19 March

NATIONAL AGU Meeting: Check the following website for up to date information:
http://www.agu.org/meetings

NEIGC: Check for information, dates and specific location at http://www.salemstate.edu/~lhanson/NEIGC/

2019 Alumni/Reunion Weekend at UVM!!!! (Note that this coming year it is in the fall!) *check http://alumni.uvm.edu/reunion for more information*
Make sure that you get in touch with us so we can show you around!!

Visit our website for links to more department information and activities
http://www.uvm.edu/geology/ and http://www.uvm.edu/perkins

Regional Geology in "recent" years

On the next few pages are several pictures from past trips so you can relive the experience. We hope that those of you who went on Regional found it to be great educational experience.
Enjoy a trip down Memory Lane!!

Regional Geology, Colorado, 2012 enjoying a "warm" summer day at Mt Sopris, Carbondale.
Stewart Long, Beth Rutila, Ben DeJong, Eric Weber, Stephanie Drozd, Stefan Christie,
Jacob Vincent, Ruth Shafer. Front: 2 outdoor field labs (four-legged).
Missing: Stephen Wright, Mike Murray

Regional Geology, Colorado 2011 class stymied by snow in the South Lottis Creek Valley. From left to right: Sam Hellman, Sam Kleh, Parker Richmond, Doug MacLeod, Abi Ruksznis, Ryan Stredny, Jo Palmer (TA), Hank Ainley, Sandra Cronauer, Abby O'Donnell, Emily Siegel, and Elizabeth (Ollie) Olliver.

Regional Geology, Iceland, 2010

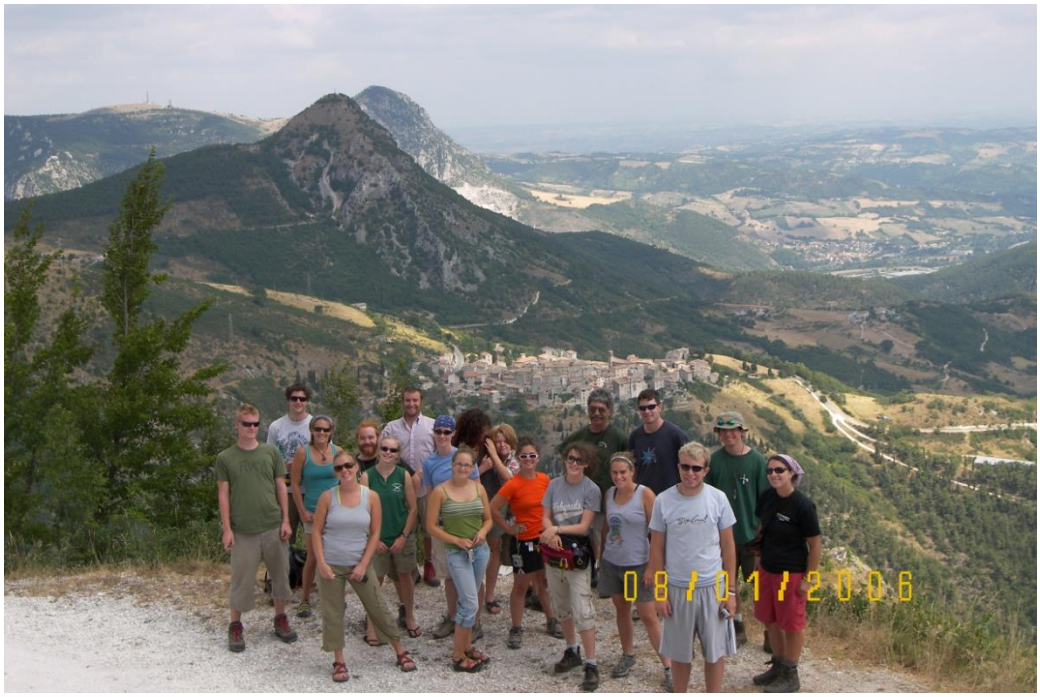
Front row kneeling: Char Mehrtens, Briana Birchman, Elizabeth Olliver, Abby O'Donnell, J. Nason, Carolyn Blum

Back row standing: Laura Wilson, Emily Siegel, Abby Ruksznis, Matt Bansak, Jeff Tinklepaugh, James Christenson, Don Hefferon, Doug Koopman, Marguerite McMillan, Middle on right standing: Gabriela Mora-Klepeis, Keith Klepeis.

Regional Geology, Colorado, 2009 students: Matt Bansak, Ben Henry, Greg Parrish, Will Hackett (TA), Maggie McMillan, Tyler Vendituoli, Holly Crimmins, Mary Snyder, Mike Ingram, and Shane Snyder at the base of a weathered Tertiary lava flow near Del Norte, Colorado.

Regional Geology, Italy, 2008

Regional Geology, Colorado, 2007: Pat Niggel, Gary Peters, Pat Tobin, Corey Coutu (TA, partially hidden), Jessica Schechter, and Kirsten Stokes studying the contact relationships between Paleozoic carbonate rocks and Laramide intrusive rocks near Cumberland Pass, Colorado



Regional Geology, Italy, 2006

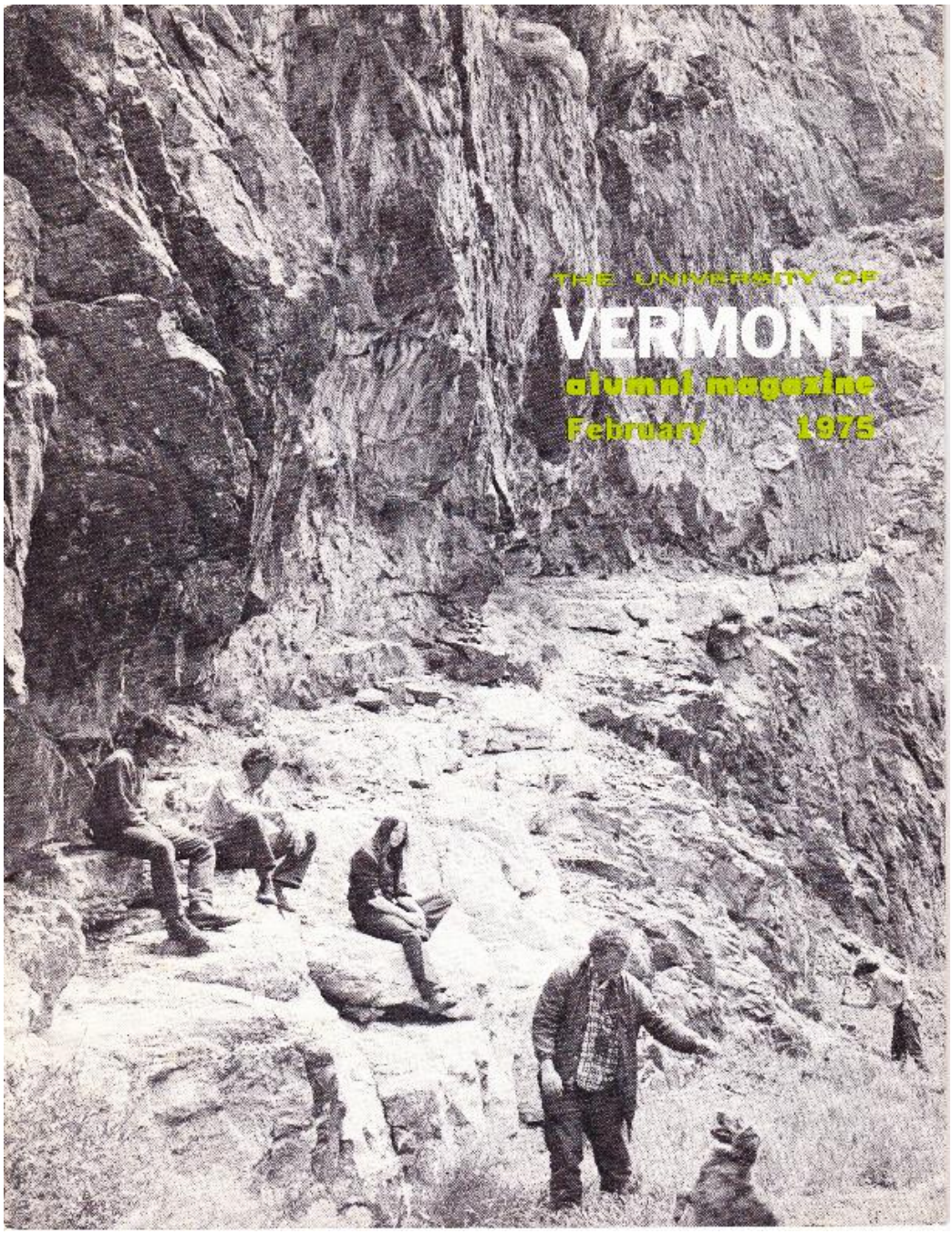
Regional Geology, Colorado, 2005 in front of the "Maroon Bells" near Aspen.

Regional Geology, Iceland, 2004
Crew enjoying August summer sun.

Regional Geology, Maine, 2003 enjoying the coast.

"A blast from the past"

Regional Geology from 1986! Can you identify these people??



And truly a blast from the distant past – check out the following photo from the very first Regional Geology trip in 1975!!!!