



The Dickin-stone-ian

Department of Earth Sciences Participates in Baffin Island Field Trip

by Marcus Key



Thanks to the generosity of John (GEOL '78) and Susan Pohl ('80), Professor Marcus Key, Liz Plascencia (ERSC '16), Melanie Campbell (ERSC '15), Leslie Milliman (ERSC '14) and Aleks Perpalaj (ERSC '14) were able to participate in an 11 day trip to Baffin Island to experience the geologic wonders of the Canadian high Arctic.

In early August 2013, we set up two base camps by boat from Pond Inlet on Baffin Island at 73 degrees North latitude. The

first was on Bylot Island where we did day hikes to Cretaceous sandstone outcrops (DSCN2094) and the Sirmilik glacier. The second was on Curry Island where we sea kayaked in a fjord carved into Precambrian metamorphics (DSCN2332) with narwhals. There were many firsts for us: first 24 hour daylight, first fresh polar bear tracks, first narwhals, first time sea kayaking in a fjord, and first time sea Kayaking around an iceberg. For additional photos of the trip visit our website. http://www.dickinson.edu/galleries/gallery/167/baffin_island_field_trip

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Great geology, great people, and decent weather = GREAT trip



Greenland Expedition 2014

By Ben Edwards

Thanks to the ongoing generosity of John (GEOL '78) and Susan Pohl ('80), the Earth Sciences department sent another five member team (Ben Edwards, Ariana Auerbach '16, Katie Mattern '16, Amanda Santilla '17, Will Kochtitzky '16) to explore geology and climate change, this time near the second largest ice sheet on earth in Greenland. The group spent 10 days in Greenland (via Iceland) during August 2014 to examine Paleoproterozoic metamorphic rocks, glacial erosional features, and icebergs.

The trip included hiking to see an active, retreating glacier on Ammassalik Island, examining cm-size garnets in granulite facies gneisses, kayaking with icebergs, close-up (but unplanned) observations of polar bears, distant views of Fin and Minke whales, examination of stone-peat huts and burial sites, and a visit to an active tide-water glacier.



NSF-sponsored Iceland 2013 and British Columbia 2014

Research by Ben Edwards

As part of an ongoing NSF-sponsored research program, two groups of students over the past two summers have worked on a study to understand the formation of pillow lavas erupted beneath glaciers.

In 2013, Ellie Was ('14), Aleks Perpalaj ('14), and Liz Plascencia ('15) spent three weeks in southern Iceland working in locations where pillow lavas are quarried for use as building material. The experience also included an overview of divergent plate magmatism, and a visit to Solemheimjokull glacier on the south side of Katla volcano.

The research project shifted to northern British Columbia Canada in 2014, with Liz and Will Kochtitzky ('16) experiencing helicopter flycamping at Mount Edziza Provincial Park, where they helped sample, measure and map sequences of glaciovolcanic pillow lavas. They also saw black and grizzly bears, moose, wolves and stone sheep. This ongoing research is part of a collaborative project with College of Wooster professor Meagen Pollock (former Visiting Professor at Dickinson College).



Iceland 2013



British Columbia 2014

Letter from the Chair

From the Chair

Hi All. As I sit down to write this note at the end of July (I should have done this earlier in the summer but...), we have lots of news to share from the department and from alums. The biggest piece of news to report is that Jeff has announced that he will be retiring at the end of the coming academic year. After 38 years on the faculty it is difficult to envision the department without Jeff. Fortunately we will have one final year to collect stories and reminisce before Jeff transitions to retirement. In addition to preparing for Jeff's retirement, we need to look forward, and I am very excited to report that we have been granted permission to search for two new tenure-track faculty members to start during the 2015-2016 academic year. One position will be a low temperature geochemist and the other position will be in environmental geophysics. As I have been told, this will represent the first expansion in the departmental faculty since 1971.

We've taken several exciting extended field trips, developed some new courses including an Introduction to Soils that Ben will be teaching in the fall and revamping our introductory offerings. Our students have been garnering well deserved recognition as well. Ellie Was' poster "Thermal Evolution of Subglacial Pillow Lava at Undirhlioar Quarry, Southwest Iceland" was recognized as one of two outstanding posters at the Dickinson Science Symposium in April. Mariah Murphy's proposal to study weathering in Guadeloupe was awarded one of the six Stephen Pollock undergraduate research grants from the Geological Society of America and although my colleagues may be too humble to toot their own horns, we have much to celebrate too. Ben recently received a grant from the National Science Foundation to study the 2013 eruption of Tolbachik volcano in Kamchatka, and this summer Marcus and Jeff both participated in a three week LUCE foundation funded field trip to study sustainability in China. This sampling of accomplishments highlights the defining attributes of the department. We have, and remain committed to providing our students with opportunities to engage in fieldwork around the globe and to do innovative teaching. The department remains committed to global education and many of our majors study abroad. We are active in the College's Sustainability and Environmental Science efforts. After all, it is hard to study either sustainability or environmental issues without an understanding of how the Earth works.

Many of the exciting things happening in the department are directly related to your past support of student research and field experiences. For example, the William Vernon Research Prize in Geology and the Henry Hanson Research Prize in Geology have supported many of our senior theses including Lesile Milliman's "Determining the Provenance of a Stone Paver from a Maryland Colonial Plantation", Geo Nikolov's "Groundwater-Surface Water Interactions in the Yellow Breeches Creek Watershed", Aleksander Perpalaj's "Overview of the Mineralogy and Geochemistry of Pillow Lavas and Dikes Exposed at Vatnsskaro, Iceland", and Ellie Was' "Thermal Evolution of Subglacial Pillow Lava at Undirhlioar Quarry, Southwestern Iceland". The Cassa Extended Field Trip Fund subsidizes fieldtrip costs for students allowing us to take them to diverse field areas including: Iceland, England, Scotland, and Wales, Sicily, Southern California, Hawaii, Death Valley, Grand Canyon, Zion, Yellowstone, Glacier, Acadia, and Sicily. Plans are in the works for a Cassa Fund subsidized trip to Costa Rica in January.

In addition, this year we recognize Liz Plascencia as the inaugural Robert Jansen (Dickinson Class of '11) Scholar. Liz is a rising junior and member of the LA Posse and NSF-STEP Scholars program. Last summer Liz worked with Ben conducting research in Iceland, and this summer she will be accompanying him to British Columbia where they will be examining subglacial eruptions in the same general region where Rob had worked with Ben. The Robert Allan Jansen Student-Faculty Research Fund was established by Robert's parents and sister to honor his memory.

Letter from the Chair (cont'd)

Finally, the Potter Lectureship Fund supports bringing a distinguished earth scientist to campus each year to interact with our students. This past spring we were delighted to have our 10th Annual Potter Lecturer: Rudy Slingerland (Dickinson Class of '69) from Penn State University. His main public lecture was, "Black Diamond, Black Gold, and Black Shale: Pennsylvania's Geological Heritage".

If you are able to contribute to any of these funds, please send a check payable to Dickinson College to Peter Sak, Dept. of Earth Sciences, Dickinson College, P.O. Box 1773, Carlisle, PA 17013-2896. Please indicate on the memo line which fund you would like to contribute to (i.e., William Vernon Research Prize, Robert Allan Jansen Student-Faculty Research Fund, Henry Hanson Research Prize, the Cassa Extended Field Trip Fund and/or Potter Lectureship Fund). Our goal is to build the research funds to the point where we can provide some funding to all our seniors and offer Cassa-funded trips annually.

Keep in touch and come see us, Peter Sak

WE WANT YOU!!!

- ◆ Has your Dickinson education landed you the perfect career?
- ◆ Are you excited to tell people about projects you are currently working on?
- ◆ Are you involved in cutting edge work?

If you answered "yes" to any of these questions, the Earth Sciences department would love to have you back to campus to speak with our current majors.

If you would like to share your wisdom, knowledge and experiences with our students, please contact Marcus Key at key@dickinson.edu

Potter Lectureship Going Strong

	Name	Affiliation
2005	Richard Alley	Pennsylvania State University
2006	Bruce Marsh	Johns Hopkins
2007	Rob Thieler '87	USGS-Woods Hole
2008	Jeremy Jackson	Scripps Inst. Oceanography-UC San Diego
2009	Mark Brandon	Yale University
2010	John Eichelberger	USGS-Reston
2011	Katie Huntington	Univ. of Washington
2012	Frank Pazzaglia	Lehigh Univeristy
2012	David Bottjer	University of Southern California
2014	Rudy Slingerland '69	Pennsylvania State University

Department Outreach to Area Schools

The Department, in an initiative to promote Earth Sciences in education, has invited area schools to campus to participate in labs and exercises that we feel would interest them. Below is a photo of our volcano simulation that was enjoyed by local grade schoolers of the Carlisle Area School District. I thought it was cool to watch too!



Picture Right: Grade Schooler looking on as the "volcano" erupts.

Picture Left: Man Made Eruption in all her glory!!



William Vernon Prize for Excellence in the Earth Sciences

Each year the faculty has the difficult task of deciding which graduating senior will receive the Vernon Prize for Excellence in the Earth Sciences. The prize is based on grade point average, service to the department and the college, and promise for the future.

Rebecca Rossi '13, a double major in Earth Sciences and Archeology, received the 2013 Vernon Prize for Excellence in Geology. Becca's senior thesis "Petrology and Geoarchaeology of the Catoclin Metarhyolites of South Mountain, Pennsylvania" was supervised by Ben Edwards. After graduating Becca spent a summer in Mt Rainer National Park working for the GeoCorps where she investigated the relationship between tree falls and landscape evolution. After a summer with the GeoCorps, Becca volunteered for the USGS in Hawaii mapping lava flows. She returned to Mt Rainer National Park in the summer of 2014 to continue working on the tree fall project. In fall 2014, Becca will begin a MS at Utah State University in fluvial geomorphology.

Ellen Was '14, a double major in Earth Sciences and Physics was awarded the 2014 Vernon Prize for Excellence in Geology. Ellie's senior thesis "Thermal Evolution of Subglacial Pillow Lava at Undirhlíðar Quarry, Southwestern Iceland" built upon the summer that Ellie spent working with Ben Edwards in Iceland. This project was the basis of her award-winning poster at the annual Science Symposium where she was recognized for the Best Poster. Upon graduating Ellie spent the summer as a GeoCorps volunteer in West Virginia. In the fall Ellie will begin a MS at Syracuse University.



Photo Above:
At Year End Picnic with Dr. William Vernon and graduating senior and prize recipient, Ellen Was

2013-2014 Senior Student Research Projects

Marc W. Baumann '13

Volumetric Analysis of the Upper Freeport Coal Seam in the Saxonburg Quadrangle, western Pennsylvania

Abstract: My goal was to do a volumetric analysis of the Upper Freeport bituminous coal seam in the Saxonburg Quadrangle of Pennsylvania. The Upper Freeport coal was deposited in the Pennsylvanian age Allegheny Fm. by climatic cyclothems. The data consisted of logs from 67 boreholes provided by Rosebud Mining Co. I determined the amount of coal in place of the seam then constructed a 3D model using GIS. The seam averaged 0.83 m yielding an in-place volume of 1.2×10^8 m³. Taking into account the depth below the surface, the coal rank, and the % recoverable allowed an analysis of the economic recoverability of the coal.

David Cruz '13

Agricultural versus Urban Influence on legacy sediments of the Letort Spring Run Watershed

Abstract: Chemical analysis of 17th to 19th century Legacy Sediments were taken from two locations in the Letort Watershed to determine both the agricultural and urban land-use influences over the natural background soil chemistry. With the removal of milldams in recent years it is shown that the contaminants and nutrients held within these soils are now being remobilized back into the watershed ecosystem. It is hypothesized that the chemistry of the legacy sediment deposits in the core extracted at Letort Park (upper reach of the Letort Spring Run) has a greater agricultural land use affinity whereas the legacy sediment deposit and core near Jacob's Rest (downstream from the Carlisle Borough) has a greater influence from the agricultural and urban sources combined. If the cores record these land-use differences then it is possible to discern the degree to which the urban environment of Carlisle is contributing to the Letort Spring pollution from paved surfaces through to storm water runoff and fertilized green spaces. Conclusions from this experiment shows that overall there is a higher concentration of nutrients (P) and trace metals (Cu, Ni, Zn, Pb) within the core representing both urban and agricultural land use versus the core representing agricultural land use only. The magnitude of the geochemical differences between the two cores indicates which source(s) was responsible for certain trace and majors element concentrations increases.

Senior Student Research Projects (cont'd)

Julia Rasamny '13

Skeletal dissolution caused by ocean acidification

Abstract: Since the beginning of the industrial revolution in the mid-eighteenth century, the release of CO₂ from both industrial and agricultural activities has resulted in an increase in atmospheric CO₂ concentrations. This increase in anthropogenic production of CO₂ is causing pH in surface waters to lower. The purpose of this experiment was to test the experimental methodology for showing that with increased CO₂, a decreased ocean pH could be achieved, and skeletal dissolution of calcifying organisms would occur. It involved a simultaneous control and acidified week long experiment. The mean pH of the control reservoir was 7.83, and by pumping CO₂ into the acidified reservoir, the mean pH was 5.52. Seven marine invertebrate species including *Crassostrea virginica*, *Mercenaria mercenaria*, *Mytilus edulis*, *Boeuvia pulchella*, *Fissurella numbosa*, *Cryptopecten pallium*, and *Acropora prolifera*, were split between the two experiments. Each sample was dried and weighed four different times throughout the experiment. The mean weight % loss of all the samples in the control reservoir was 0.03%, and the mean weight % loss for all samples in the acidified reservoir was 22.75%. Though ocean pH is not expected to reach this level due to anthropogenic CO₂, the experiment shows the methodology works and can be easily refined in the future to measure skeletal dissolution at a more realistic pH.

Joseph R. Stahley '13

A Comparison of Black Shale: The Marcellus and Utica Formations

Abstract: The Marcellus Shale Formation and the Utica Shale formation have been topics of great interest for their potential natural resources. The purpose of this study is to find out whether or not the Utica shale, an Ordovician organic rich shale which lies directly below the Marcellus, is also potentially productive based on depositional environments and geochemical analyses. In our findings, the Utica and Marcellus are both high in silicon dioxide (SiO₂), and calcium oxide (CaO). Both the Marcellus and Utica have similar depositional processes. Based on our findings, we concluded that the Utica shale was deposited in a deep anoxic bottom marine environment where it was able to preserve some organic matter making it a good reservoir for natural gas drilling.

Senior Student Research Projects (cont'd)

Ellie Was '14

Thermal Evolution of Subglacial Pillow Lava at Undirhlíðar Quarry, Southwestern Iceland

Abstract: Subaqueous and subglacial lava forms by unique processes that distinguish its cooling history from that of subaerial lava, including the formation of an insulating glassy rim and steam envelope around the lava. A thorough understanding of these processes is required to infer lava flow dynamics, including eruption rates within a local volcanic system and diffusion of heat through a molten, non-steady state body. In this study, heat diffusion through subglacial pillow lavas is investigated using Crystal Size Distribution (CSD), which is a technique that infers growth and nucleation rates of crystals in lava when crystal aspect ratios and residence time—the amount of time the crystals are suspended in liquid lava—are known. The technique is applied to three edges of a pillow by at its contact with adjacent pillows in Undirhlíðar Quarry, Southwestern Iceland, where Sample A is at the base, Sample B at the top, and Sample C opposite Sample B at the top. Data reflect the cooling rate of the pillow itself, possible interference from surrounding pillows, and even the eruption and cooling rate of the volcanic ridge formed by emplacement of many pillow lavas. For all samples, plagioclase crystal growth rates decrease toward the center of the pillow (to in Sample A, to in Sample B, and to in Sample C), a pattern attributable to increasing insulation with increasing pillow thickness. Growth rates for Samples B and C decrease at a similar rate (and , respectively), but Sample A reveals a shallower decrease, suggesting more insulation at that contact and the possibility that the pillows at the other contacts were emplaced much later. A 2D finite volume model is created which uses the heat equation in cylindrical coordinates, and can be used to simulate pillow formation with varying boundary conditions corresponding to contiguous pillows, a steam envelope, or other boundary conditions. It has been used to find the residence times required for the growth rate calculations in this study. These techniques promote a deep understanding of lava flow dynamics, and may be useful in interpreting conditions of ancient lava flows and the formation of subaqueous and subglacial pillow ridges.

Geo Nikolov '14

Groundwater-Surface Water Interactions in the Yellow Breeches Creek Watershed, South Middleton Township, PA

Abstract: The objective of this study was to characterize Groundwater-Surface water (GW-SW) interactions in the Yellow Breeches Creek Watershed (YBCW), South Middleton Twp., PA over various time scales during a water year (October 1 to September 30). The elevation (above sea level, ASL) of the groundwater table in the regolith-mantled karst aquifer of the Elbrook formation at the Dickinson College well field (DWF) was compared to the elevation (ASL) of the water level in the Yellow Breeches Creek at South Middleton Park (SMP) from January to November, 1997 and January 2001 to January 2002. Precipitation data from rain gauges at Pine Grove Furnace (PGF) State Park and Harrisburg International Airport (HIA), and the well field as well as regional temperature data were used to reconstruct the climate during these time interval. High discharge in the YBC during storm events was observed to be closely followed by a rapid rise in the groundwater table elevation at the DWF. It was hypothesized that the dominant mode of recharge to the DWF was either by rapid infiltration through preferential pathways in the unsaturated zone of the DWF, or by direct influent recharge from the YBC during high-rainfall events. To test these alternative hypotheses, recession rates for the DWF and YBC during base flow and storm events, as well as lag times between water level rise in both locations were calculated and compared. We found that during periods of low precipitation, the YBC water level exceeded that in the DWF for up to weeks, indicating an influent exchange regime. This may imply extensive drainage to the YBC from karst bedrock and regolith storage in the DWF and close connectivity between the two reservoirs.

Senior Student Research Projects (cont'd)

Aleksander Perpalaj '14

Overview of the mineralogy and geochemistry of pillow lavas and dikes exposed at Vatnsskarð, Iceland: insights on physical and chemical processes at tindar ridges

Abstract: A quarry at Vatnsskarð, which is part of the Krisuvik fissure system in southwestern Iceland, provides exceptional exposures of the stratigraphy and insights into the formation processes of a glaciovolcanic, pillow-dominated tindar. The active part of the quarry is ~0.5 km wide, and 0.7 km long, while the overall width of the ridge at this location is ~1.2 km. The Vatnsskarð sections comprise a variety of extrusive and intrusive lithofacies, including packages of the two predominant units, pillow lava and vitric tuff-breccia. Locally tuff and lapilli tuff lenses are also present. Intrusions vary from conformable with existing contacts to cross-cutting. Dikes are exposed immediately south of the quarry and are subparallel to the overall ridge orientation. Gabbroic inclusions are also present in multiple units, although they are most abundant within the intrusions. The upper sections of the ridge are covered by multiple packages of glaciogenic diamictons, comprising predominantly rounded and locally striated basaltic cobbles.

All of the coherent units at Vatnsskarð appear to have the same phenocryst assemblage of $Pl \gg Ol > Cpx$, with a similar mineralogy in the groundmass. Preliminary mineral compositions (SEM-EDS) show a limited range of compositions for Pl (An76-81; average ~ An78), Ol (Fo73-81; average ~ Fo78) and Cpx (Diop61-70; average Diop ~66). Locally Pl phenocrysts show oscillatory zoning, and Ol has small inclusions of Cr-spinel. Comparison to the geochemistry of samples from another quarry along the same ridge but ~2 km north, at Undirhliður, show that samples on the north side of Vatnsskarð have compositions similar to the first (older) compositional group at Undirhliður. The occurrence of the same magma composition in both quarries is consistent with the fissure segment having been active at multiple points over length scales of km during ridge construction. Furthermore, because of this particular magma batch was identified in dikes at Undirhliður, it may also indicate that dikes distributed magma along-axis during the formation of the ridge. This geochemical information is consistent with ridge-parallel orientations of dikes, as well as orientations of magma distributary channels.

Leslie Milliman '14

Determining the Provenance of a Stone Paver from a Maryland Colonial Plantation

Abstract: The goal of this study is to constrain the provenance of a stone paver excavated from the colonial (late 1600s-early 1700s) Jesuit plantation of St. Inigoes Manor in St. Mary's County, Maryland. Given the lithology of the paver, it is unlikely that the stone was locally sourced from the Maryland Coastal Plain Physiographic Province. Lithological, chemical, mineralogical, and paleontological analysis was conducted on samples from the paver to determine provenance. Stone fragments excavated from the dismantled St. Mary's Brick Chapel in St. Mary's City were also analyzed for a comparative study to determine if the samples shared the same provenance as the paver. Due to diagenetic alteration, the fossils were too poorly preserved to determine the exact source, though we were able to rule out the Florida Platform, Hampshire (England), Belgium, and Paris (France) basins. The paver was almost identical to the fragments from the chapel, suggesting the pavers were reused from or had the same source as the stone in the chapel, which was closed in 1704 and torn down in 1705.

Faculty Published Abstracts

(underlined name indicates student co-author)

2012

- Long, K., and **Niemitz, J.**, Assessing the impact of land-use change from late 18th to early 20th century mill dam sediment geochemistry and its potential effects on the Chesapeake Bay: Geol. Soc. America Annual meeting, Abstr. w. Programs, v. 44, no 7, p 393
- Rossi, R. K., **M. M. Key, Jr.**, A. M. Smith, S. Hageman, and W. P. Patterson. 2012. Reconstructing annual seawater temperature cycles using stable isotope profiles in modern bryozoans from the Snares Platform, New Zealand. Geological Society of America Abstracts with Programs. 44 (7): 120.
- Hageman, S. J., A. M. Smith, **M. M. Key, Jr.** 2012. Growth cycles in the temperate bryozoan *Melicerita chathamensis*, southern New Zealand: a new tool for paleoseasonality? Geological Society of America Abstracts with Programs. 44 (7): 119.
- **Key, M. M., Jr.**, P. M. Hollenbeck, A. O'Dea, and W. P. Patterson. 2012. Stable isotope profiling in modern marine bryozoan colonies across the Isthmus of Panama. Geological Society of America Abstracts with Programs. 44 (7): 164.
- Russell, K, **Edwards, B.R.**, Porritt, LA (2012) Pyroclastic passage zones (Invited), Eos Trans. AGU, Fall Meet. Suppl., Abstract V21A-2749.
- Pollock, M, **Edwards, B.R.**, Bowman, L, Was, E, Alcorn, R, Hauksdottir, S (2012) Candeetailed mapping of subglacial pillow lavas inform our understanding of pillow-dominated submarine eruptions? Eos Trans. AGU, Fall Meet. Suppl., Abstract V21A-2760.
- **Edwards, B.R.**, Karson, J, Wysocki, R, Lev, E, Bindeman, IN, Kueppers, U (2012) Experimental Insights on Lava-ice-snow Interactions, Eos Trans. AGU, Fall Meet. Suppl., Abstract V21A-2763.
- Skilling, I, **Edwards, B.R.** (2012) Ice-confined basaltic lava flows: review and discussion, Eos Trans. AGU, Fall Meet. Suppl., Abstract V21A-2764.
- **Sak, P.B.**, Gray, M.B., and Ismat, Z., 2012, The Juniata culmination and its significance in the deformation history of the Pennsylvania salient, Appalachian mountains: Geological Society of America Abstracts with Programs, v. 45.
- Greenberg, R., and **Sak, P.B.**, 2012, Ridges on ridges: Extensions of adjacent topography onto the flanks of European ridges. American Astronomical Society Division for Planetary Sciences Annual Meeting. [Abs].

2013

- Cruz, D. and **Niemitz, J.**, Using Legacy Sediments to "Quantify" Urban nutrient and trace metal contributions to streams within a dominantly agricultural land-use region, Cumberland County, PA; Geol. Soc. America Annual meeting, Abstr. w. Programs, v. 45, no 7.
- Hiatt, A., Pollock, M., **Edwards, B.**, Hauksdottir, S et al. (2013) Estimates of pressures from pillow lavas at Undirhlithur quarry, Iceland, Eos Trans. AGU, Fall Meet. Suppl., Abstract V41D-2840.

2013 (cont'd)

- Was, E, **Edwards, BR**, Pollock, M et al (2013) Constraints on the formation of pillow ridge in southwestern Iceland, Eos Trans. AGU, Fall Meet. Suppl., Abstract V41D-2839.
- **Edwards, BR**, Belousov, A, Belousova, M, E, Izbekov, P, Rossi, R, Haklar, J, Muraviev, Y, (2013) Is tephra stratigraphy in seasonal snow likely to be preserved? Observations from proximal deposits at Fimmvorduhals (2010) and Tolbachinsky Dol (2012-13), 2013 IAVCEI Meeting, Kagoshima, Japan
- Vannucchi, P, Morgan, J.P., **Sak, P.B.**, Balestrieri, M.L., 2013, Subduction erosion: The Cause of sediment-starved trenches and the birth of new forearc above the seismogenic interface? [presented at the 2013 American Geophysical Union Fall Meeting, San Francisco, CA].
- Wyse Jackson, P. N., **M. M. Key, Jr.**, and S. P. Coakley. 2013. Pp. 88. In: A. Rosso and S. Sanfilippo (eds.). Abstract Volume of the 16th International Conference of the International Bryozoology Association, Catania, Italy. University of Catania.
- **Key, M. M., Jr.**, and P. N. Wyse Jackson. 2013. Use of fossil bryozoans as provenance indicators. Pp. 38. In: A. Rosso and S. Sanfilippo (eds.). Abstract Volume of the 16th International Conference of the International Bryozoology Association, Catania, Italy. University of Catania.

2014

- Perpalaj, A, **Edwards, B**, Pollock, M, (2014) Overview of the mineralogy and geochemistry of pillow lavas and dikes exposed at Vatnsskarth, Iceland, EGU14_14XXX
- Garcia, S., L. Ma, **P. Sak**, H. Buss, S. Brantley, 2014, Using sequential extraction and mass spectrometer to determine U distribution in soils from Basse-Terre, Guadeloupe: Implications for understanding chemical weathering in a tropical climate. Annual Spring Symposium for Campus Office of Undergraduate Research Initiatives, April, 2014, El Paso, TX.
- Pereyra, Y., L. Ma, **P. Sak**, J. Gaillardet, H. Buss, and S. Brantley, 2014, Using uranium-series isotopes to quantify volcanic soil formation rates under a tropical climate: Basse-Terre, Guadeloupe. GES 10, Paris France.
- Ma, L., J. Engel, **P. Sak**, J. Gaillardet, and S. Brantley, 2014, Quantifying weathering advance rates in basaltic andesite rinds with uranium-series isotopes: Basse-Terre Island, Guadeloupe. GES 10, Paris France.
- Stinchcomb, G., Sullivan, P., Hasenmueller, E., **Sak, P.**, Brantley S, 2014, Quantitative links between biota, mass-balance geochemistry and the soil atmosphere in the piedmont uplands critical zone, USA: Goldschmidt 2014, Sacramento, CA June 2014.
- Witter, A.E., Nguyen, M.H., Baidar, S., and **Sak, P.B.**, 2014, Coal-tar-based sealcoated pavement: A major PAH source to urban stream sediments: Geological Society of America Abstracts with Programs, v. 46.
- Stinchcomb, G.E., Davis, R., **Sak, P.B.**, and Brantley, S.L., 2014, Relationships between soil gas and regolith geochemistry in the Appalachian Critical Zone: An example from the Cumberland Valley, PA: Geological Society of America Abstracts with Programs, v. 46.
- Ma, L., **Sak, P.B.**, Gaillardet, J., Buss, H., Chabaux, F., and Brantley, S.L., 2014, Application of U-series isotopes to quantify weathering rind formation rates along steep gradients of precipitation, bedrock ages, and topography in Guadeloupe Island. Uranium-series Symposium 2014: The Frontiers of U-series Research: Sydney, Australia

Faculty Published Articles/Manuscripts

2012

- Zhuang, K., Giardino, J. R., 2012. Ocean cooling pattern at the Last Glacial Maximum, *Advances in Meteorology*, Article ID 213743, vol. 2012. doi:10.1155/2012/213743.
- **Sak, P.B.**, McQuarrie, N., Oliver, B.P., Lavdovsky, N., and Jackson, M.S., 2012, Unraveling the central Appalachian fold-thrust belt, Pennsylvania: the power of sequentially restored balanced cross sections for a blind fold-thrust belt: *Geosphere*, v. 8, p. 685-702.
- Ma, L., Chabaux, F., Pelt, E., Mranet, M., **Sak, P.B.**, Gaillardet, J., Lebedeva, M., and Brantley, S.L., 2012, The effect of curvature on weathering rind formation: evidence from Uranium-series isotopes in basaltic andesite weathering clasts in Guadeloupe: *Geochimica et Cosmochimica Acta*, v. 80, p. 92-107.

2013

- **Niemitz, J.**, Haynes, C. ('09), Lasher, G. ('11), Legacy Sediments and Historic Land-Use: Chemostratigraphic evidence for excess nutrient and heavy metal sources and remobilization: *GSA Geology*, v. 41, no. 1, p. 47-50
- Hungerford, JDG, **Edwards, BR**, Skilling, IP, Cameron, B (2013) Evolution of a Subglacial Basaltic Lava Flow Field: Tennena Cone volcanic center, Mount Edziza Volcanic Complex, British Columbia, Canada, *J. Volc. Geotherm. Res.*, 272, 39-58. doi:10.1016/j.jvolgeores.2013.09.012.
- **Edwards, BR**, Belousov, A, Belousova, M, Volynets, A, Melnikov, D, Chirkov, S, Senyukov, S, Gordeev, E, Muraviev, Y, Izbakov, I (2013) Another 'Great Tolbachik' eruption?, *Eos, Transactions of the American Geophysical Union*, v. 94, 21, 189-91, 21 May 2013; doi: 10.1002/2013EO210002
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- Zhuang, K.**, North, G.R., Giardino, J.R., 2014, Hysteresis of glaciations in the Permo-Carboniferous, *Journal of Geophysical Research*, vol.119, p. 2147-2155.

Faculty Awarded External Grants

- Consortium for Ocean Leadership.** Constraining the rates, timing, and magnitude of subduction erosion along the Middle America Trench: IODP Expedition 334, \$14,823.
- National Geographic** Committee for Research and Exploration Grant: Lava-ice interaction at the ongoing Veniaminof eruption, Alaska (awarded \$11,800)
- NSF Petrology and Geochemistry** Division RAPID Collaborative RUI EAR 1321648: Rapid response to ongoing Tolbachik eruption, Russia (awarded for \$25,000 for 1 year)
- National Science Foundation.** Collaborative Research:/RUI Quantifying weathering rind formation rates using U-series isotopes along steep gradients of precipitation, bedrock ages and topography in Guadeloupe. Total Award: \$388,579; Dickinson Portion: \$86, 927.

Professor Noel Potter



I continue to enjoy retirement. I still go in to the Department most mornings. I continue to work on the geology of South Mountain, particularly as shown by Lidar. I serve GSA as "Section Meeting Senior Adviser." When NE GSA met for the society's 125th Anniversary at Bretton Woods, NH in 2013, I was asked to appear as a surprise special guest—Charles Hitchcock, author of the 19th century 3-volume "Geology of New Hampshire," and the person who arranged the first winter-over on top of Mount Washington in 1872. Hitchcock had a moustache, so I thought Charles should have one. For the first 2 days of the meeting I appeared with the usual beard, then for the banquet I wore a period frock coat and shaved for the first time in 38 years—see photo. Most people didn't know who I was until I opened my mouth. I was co-chair of NE GSA 2014 in Lancaster with attendance of 1317, largest single NE meeting since 1980. And this coming October I will be a co-organizer of the Field Conference of Pennsylvania Geologists based in Carlisle and with stops from Hammonds Rocks to

Waggoners Gap. Helen is well and still at the PA Survey, and our son Noel Lewis has finished his first year at Bates College in Maine. He came home over winter break and told us "I think I'm going to do geology!" I think it is the outdoors that does it. Mom and Dad are happy. I do not do Facebook and other "social media", but I'd be delighted to hear from alums by email at: pottern@dickinson.edu.

FACULTY UPDATES

LIASE Post-Doctoral Fellow in Earth Sciences and Environmental Studies

I joined the Earth Sciences department at Dickinson College for the 2013-2014. In the Fall I taught a course titled paleoclimatology in East Asia. This introductory-level course was focused on climate change in East Asia in the Quaternary period with special emphasis on the most recent 20,000 years.

In the spring semester, I taught another course titled environmental degradation of the Yellow River, China. This interdisciplinary introductory-level course was focused on the environmental degradation in the Yellow River beginning 5000 years ago, which had provided an interdisciplinary cohort of students with an integrated, process-based examination of environmental and societal issues focused upon a single river system. Through this course students have gained their understanding on the impacts of climate change and human interventions on a specific river system like the Yellow River since the historical time; environmental degradation in the Yellow River mainly caused by deforestation and human reclamation since the beginning of Chinese civilization.

I greatly enjoyed working and collaborating with Ben Edwards, Jeff Niemitz, Marcus Key, and Pete Sak on many different aspects of geoscience education both in lecture and lab settings, as well as in science outreach events. I look forward to maintaining these excellent collaborative relationships and the experience gained in this excellent program.



Professor Peter Sak



Greetings All!

It is hard to believe that another two years have passed since I last sat down to write an update for the departmental newsletter. The past two years have been busy, fun and productive. Last summer I got to experience Global Ed first hand while co-teaching a course in Japan called “Seismic Japan”. The course examined Japan’s resiliency in the face of repeated earthquakes. I taught that course with Professor Alex Bates from East Asian Studies and it was remarkable to get see seismicity through the eyes of a social scientist.

It's hard to believe I've been at Dickinson for a decade now. Over this time, I've been expanding my research to explore Appalachian geology. My work in the Appalachians has been field based, with some projects focused on tectonic questions such as quantifying the amount of shortening across the Valley and Ridge and Appalachian Plateau and the magnitudes of incision throughout the upper Susquehanna River basin and other projects related to the geochemistry of weathering in the Great Valley. These local projects have been very rewarding and have allowed me to stay closer to home and engage more students and classes in the ongoing research projects. In addition to these local projects, I recently received a three year collaborative grant from the National Science Foundation to study weathering on the Caribbean island of Guadeloupe. This summer rising senior Mariah Murphy and I spent two weeks in the field working with colleagues from University of Texas, El Paso and Paris. The samples that we collected will be become the basis of Mariah’s thesis among other projects.

I continue to teach intro, structure, surface processes and field methods. It has been a few years since I last got to teach structure and field methods and am looking forward to offering both of those again this coming year. As always I am particularly excited to introduce a fresh crop of students to the geological wonders of Central Pennsylvania in intro courses. On the home front, Maya (6 ½) is growing like a weed and swimming, dancing, ice skating, skiing and doing gymnastics. Linda continues to teach at Bucknell. We continue enjoy hiking, biking and paddling the many local trails and waterways when we aren’t traveling to see the family and friends. I truly look forward to hearing from department alumni and friends through email updates, campus visits, or upcoming conferences – please do stay in touch. Or better yet, join us for a field trip.

Regards,
Pete

Professor Jeffrey Niemitz

Hello All –

This likely will be my last blurb for a department newsletter as I will be retiring next June after 38 years at Dickinson. I have to say I have very mixed feelings about it. Teaching the last installment of your classes as I have for Oceanography and Environmental Geology tells you that there is not much time left. There are lots of things I have planned for my “free time” but I think there will be a significant hole in my life for a while at least. Overall it has been an amazing E-ticket ride and you all, my students, have been a large part of that. Pete has asked me to think about a meaningful honorarium for my retirement similar to what we have put in place for Dr. V, Henry and Noel. I have some ideas but would covet your thoughts as well. Let me know what you think would be appropriate and meaningful to you.

Of course I am not out to pasture quite yet and actually have a lot on my plate for the next twelve months. Last year the Asian Studies faculty put together a successful grant to integrate Asia and the Environment. Part of the grant was to take faculty to southwestern China to experience the landscape and culture of some of the most diverse places on the planet. Ann Hill in anthropology is leading the effort. Last summer Ann, Matt Steiman (Assistant Farm Manager), and I travelled to Yunnan province to set up a three week trip for faculty this May. What an amazing place although it is a bit disconcerting to not be able to read or say much of anything. We are learning some “survival” Chinese for this next installment. The overall idea is to view this part of China in the same way we might view our own landscape but with a different culture and tradition of what it means to be sustainable in a country with a much longer environmental history than our own.

Many of you may recall that two years ago Neil Leary (Center for Sustainability Education Director) and I took students to the UN Climate Conference in Durban, South Africa as part of an Africa Climate Change Mosaic semester. This November we will be off again to the same conference in Peru to see if the world can finally get its act together and establish a binding climate treaty. We have 15 students going including three Earth Science majors. Should be a lot of fun as I know a little more Spanish (cerveza, margarita, burrito, cerveza, tamale, pollo, cerveza) than Mandarin – well at least I know the important Spanish words.

I continue to work on my Legacy Sediment projects with current students and have expanded to Lancaster and Baltimore (MD) counties. We seem to be seeing the same results with high nutrient and trace metal concentrations in the sediments that are being remobilized to ultimately find a home in Chesapeake Bay. We have also looked at strictly urban legacy sediment deposits which show quite high Pb concentrations (thanks Dave Cruz!)

On the home front my wife, Trish, will be retiring from the Carlisle School District next year as well so that we can spend more time with our three grandchildren now 4.5, 2.8 and 1 (I know, I’m a nerd). Our family is still spread far and wide so we will not be leaving Carlisle for the foreseeable future. All that to say, we have plenty of extra beds at 230 Conway St. if you are in town for reunions or just passing through. We always enjoy catching up with your busy lives and hearing how you are advancing your careers and establishing your own families.

Cheers and blessings to you all

Jeff

Professor Marcus Key

Maria's and my family is shrinking with Dylan out of college, Lily and Kevin away at college, and only John and Peter still at home. When not driving the boys to soccer, scouts, soccer, and choir (and did I mention soccer?), I am busy teaching Earth History, Sedimentology & Stratigraphy, Energy Resources, and Paleontology. As part of these classes, we have gone on lots of great local and more extended field trips. The last time I taught Paleontology (Fall 2012), it was part of a Natural History mosaic. There were three faculty (me, Ash Nichols in English, and Gene Wingert in Biology) and 10 students. We each taught a class as part of the mosaic, and that was our only teaching responsibility. The students only took our three classes plus an independent study/research. That meant that we "owned" the students' schedules and could organize multiday field trips without class conflicts. We went to Tangier Island in the Chesapeake Bay, to the fall elk rut in northwestern PA, to natural history museums in Harrisburg, DC, and Pittsburgh, and went kayaking down the Susquehanna. It was a great teaching

experience! That same semester and thanks to our generous alumni who contribute to the Potter Lectureship Fund we were able to bring the eminent paleontologist Dave Bottjer in from the University of Southern California to talk to our students about the Cambrian Explosion (a.k.a. the Biological Big Bang) and the Permo-Triassic mass extinction, the latter as a model for greenhouse-induced extinctions. In addition thanks to John (GEOL '78) and Susan Pohl ('80), I was able to take four students to Baffin Island to experience the geologic wonders of the Canadian high Arctic (see related article in newsletter).

Back on campus I run our weekly Earth Sciences Lunch and Learn seminar series. We have a rich schedule of speakers talking to our students about their industry and academic careers. So... if you are ever in the area, please let me know, and we would love to have you tell our students what you have been up to! I also keep busy as a the Faculty Advisor for first year students' in the Adams Hall Neighborhood Association on campus. There I am tasked with bringing academic programming into the residence hall. Pete and Ben have generously helped out with that.

On the research front, I am becoming schizophrenic balancing geoarcheology projects with more conventional paleontology. I am getting involved in lots of unsolicited but interesting geoarcheology projects from historical archeologist who want help sourcing sedimentary building- and tomb-stones from colonial sites around the Chesapeake Bay. My students and I have usually been successful with a combination of sedimentological, paleontological, and chemical approaches. On the more conventional paleontological side, I have been using C and O stable isotopes to document climate change in long-lived extant bryozoan colonies from the waters around New Zealand and Panama. Now that my students and I have figured out the methodology, we are trying to get funding to push the climate change signal back through time using fossil bryozoan. In particular we are focusing on the closing of the Isthmus of Panama which isolated the Pacific and Atlantic Oceans, initiated upwelling on the Pacific side (which we can detect with the isotopes) and has been attributed to the formation of the Gulf Stream and Northern Hemisphere Glaciation.

I'll be in China this summer with Jeff as part of a grant from the Luce Foundation. I am excited to see the famous karstic Stone Forest, Cambrian fossils in Chengjiang, and the Lufeng Dinosaur Park.

Keep in Touch!
Sincerely,
Marcus

Professor Ben Edwards

Life has been moving at a rapid pace over the past two years! We have continued to work extensively on revamping our Introductory course sequence, and are finally settling in on geohazards and climate as themes for each of the courses. This material seems most topical, is interesting to students (and faculty), and fits well with Dickinson's increasing sustainability profile. I've taught another round of Earth Materials, which is becoming more focused, but still packed with learning minerals, optical mineralogy and a quick go-round of ig-sed-met rocks. We had three great field trips: Frog Switch, Smithsonian behind-the-scenes (Mars meteorites, \$100k plus crystals), and NIST (THANKS to alumnus Jenn Marshall for an excellent tour, including meeting the robots!!). The students would still like a bit more time on rocks I think, so I have to find a way sort the timing to work in at least a 3 hour 'petrology' elective in the next few years. I am excited for this fall, when I am teaching a new course on Soils, which will utilize the Farm, possibly the greenhouse, and is giving me a chance to learn/review basic biology (as Darwin realized, worms are critical!).

We had another great crop graduate this spring, and it is always bitter sweet to send good students out the door! I was fortunate to supervise Ellie Was (pillow lavas and heat transfer) and Aleks Perpalaj this fall, both of whom worked in Iceland with me last summer (second Iceland experience for Ellie though - she got to land on the lava flow erupted in the infamous 2010 Eyjafjallajökull eruption two summers ago). I also watched my first set of POSSE scholars graduate this spring (including Aleks P), which was also exciting but a bit sad. We always love hearing what alums do when they leave! So hopefully everyone wants to keep us updated!!!

I was on sabbatical last spring (2013), and was very fortunate to plan my sabbatical to coincide with the large eruption of Tolbachik volcano, in Kamchatka. The stars were aligned, and I ended up getting a small NSF RAPID grant to go work on the eruption with Russia colleagues (Sasha and Marina Belousovs - who visited this past fall and gave a great talk on the eruption complete with lava-cam video!). I am continuing to write up results from our lava-snow observations, as well as continuing to work on large-scale experiments at the Syracuse Lava Lab (see URL for amazing videos including our pillow lava pours!).

This summer I'm staying busy with two students (Liz Plascencia, Will Kochtitzky) and collaborators at College of Wooster and University of British Columbia to return to Mt. Edziza Provincial Park to work on more glaciovolcanic pillow lavas, as well as a quick visit to the Tuya country. We'll cap the busy summer with another trip sponsored by John and Susan Pohl, this time to Greenland via Iceland. The Pohls, four ERSC students (Katie Mattern, Ariana Auerbach, Amanda Santilli, Will Kochtitzky) and I will be visiting the Kulusuk area of East Greenland to study the effects of climate change on Greenland's glaciers. On the return trip, the students and I will do a short field trip to see tectonic and volcanic features of southern Iceland (can't pass up if we are already there!).

I guess that's about it. We are sending Teagan to Carleton to start her college career in linguistics (at least for a start), and Kaelan will be busy at Carlisle High School with field hockey and musicals. Kim has kept busy with math teaching, but you are of course always welcome to stop by and visit 256 South Pitt Street if you happen to be in Carlisle!

Cheers!
Ben

DICKINSON COLLEGE

Department of Earth Sciences
P.O. Box 1773
Carlisle, PA 17013

Phone: 717-245-1355
Fax: 717-245-1971
E-mail: peters@dickinson.edu

We're on the web:

<http://www.dickinson.edu/academics/programs/earth-sciences/>