



## The Dickin-stone-ian

### Department of Earth Sciences Participates in Coal Mine Trip

by Marcus Key



On 4 October 2011, Ben Edwards and I took 8 Earth Sciences students to Patriot Coal's Federal No. 2 mine in Fairview, West Virginia. The group of ten was mostly made up of students from Ben's Earth Materials class and my Sedimentology and Stratigraphy class. The students included Melanie Campbell ('15), Will Seward ('12), Leslie Milliman ('14), David Cruz ('13), Julia Rasamny ('13), Rebecca Rossi ('12), Paige Hollenbeck ('12), and Jeremiah Feldstein ('15).

We began with a lengthy safety training session where we learned how to use emergency breathing apparatus. Then we suited up in coveralls, heavy boots, hard hats, eye protection and hearing protection. We went down 100 feet in an industrial-sized elevator, loaded into an electric train car, and headed 4.5 miles back to the working face. The tour was led by an Australian mining engineer and an American geologist of Patriot Coal. The mine is producing bituminous coal from the 8 ft thick Pittsburgh #8 seam. This is the thickest of the Pennsylvanian cyclothems coal deposits in the area.

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# A Letter from the Chair

Hi All. As I sit down to write this note at the beginning 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. Ben Edwards has finished his three-year term and I've taken over the reins. We've graduated another cohort of fine students with a diverse range of interests and accomplishments. Visiting faculty continue to enliven and enrich our ranks. Mitch Scharman (PhD UTEP) joined us for the year and taught introductory courses and structural geology. We will miss him and wish him the best as he moves onto a visiting position at Bates College. We've also had an adjunct, Chris Ackley, teaching introductory courses each semester. We've taken several exciting extended field trips, developed some new courses, and expanded the rock prep and wet labs. 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 Geographic Society to support additional research into subglacial volcanism in Iceland, last summer Marcus was asked to organize a summer sustainability program in Israel, and Jeff was elected a fellow of Geological Society of America. 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 Bre Hashman's Organic-poor Neoproterozoic Banded Iron Formations from the Slave and North China Cratons, Paige Hollenbeck's Test of a methodology to quantify paleoseasonality using extant bryozoans from both sides of the Isthmus of Panama, Natalie Kormushoff's "Using a wave tank to compare landslide generated tsunamis to point source tsunamis and its implications for the east coast of the United States", Will Seward's "Growth of rye in Icelandic volcanic ash", and Claire Persichetti's "Soil Fertility: A Comparison between Organic and Conventional Agriculture". 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. Most recently in the spring of 2011 Marcus and Ben were able to take 13 students along with alumnus John Pohl ('78) to Mt. Etna! 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 8<sup>th</sup> Annual Potter Lecturer: Frank Pazzaglia from the Lehigh University. His main public lecture was, "The Fall Zone; steep rivers and erosion: How Appalachian geomorphology has shaped our nation."

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, 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



# Construction on New Interdisciplinary Greenhouse to Begin this Summer

Funded by a \$1 million gift from alumni John '59 and Inge Paul Stafford '58, a new research-quality greenhouse will be erected on the grounds of Kaufman Hall this summer with an estimated completion in fall 2012.

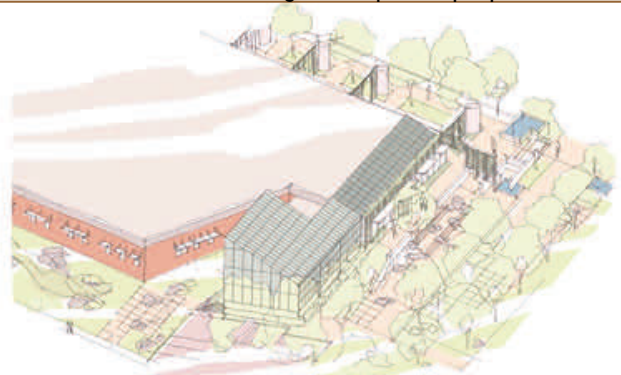
The 1,400-square-foot state-of-the-art facility will include:

- three independent research zones
- a general-use greenhouse area
- solar panels, which will help to offset the electrical consumption
- an adjacent classroom-lab that will allow students to move conveniently from the greenhouse into the classroom and
- a preparation potting area and climate-controlled laboratory, which are critical to experiments and research on marine ecosystems, seasonally dependent plants and air quality.

When completed, the greenhouse is expected to greatly enrich student research resources, while also providing faculty with an invaluable hands on teaching tool for classroom instruction. While beneficial to the departments of biology and environmental studies, the building design will also include enhancements that will entice use by other science departments as well.

The project will also include significant landscaping on the south side of Kaufman Hall, which will give a distinctive new look to not only the building but the campus. The greenhouse will frame the science campus from the north and spotlight the location of the Center for Sustainability Education, a significant interdisciplinary undertaking that is bringing national attention to Dickinson for its leadership role in sustainability education and stewardship.

Artist's rendering of completed project



## 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](mailto:key@dickinson.edu)

## Potter Lectureship Going Strong

In the spring we welcomed Professor Frank Pazzaglia (Lehigh University) as the 8<sup>th</sup> Annual Potter Lecturer. It was a real honor for the department to host Professor Pazzaglia. Frank has devoted much of his research efforts to unraveling the Miocene to recent evolution of the Susquehanna River and gave a stimulating public lecture entitled "The Fall Zone; steep rivers and erosion: How appalachian geomorphology has shaped our nation" to an overflow crowd. The following day Frank spent time interacting the majors and gave a technical talk ("Broadband geodesy and the growth of the northern Apennines, Italy"). As in past years (see chart for listing of past speakers and their affiliations) our students have enjoyed the opportunity to speak with established scientists about their career paths and research and career opportunities beyond the limestone walls. We are grateful to all the alumni and friends of the Earth Science department who continue to support the Potter Lectureship Endowment.

	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 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 Left: Man Made Eruption in all her glory!!

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





# 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.

In 2011, the prize was given to Everett Lasher. Everett was an excellent student and spent much time in service to the college in the student government and as an Admissions tour Guide. With much appreciation he was quite biased toward the department in talking up the major to prospective students. Working with Jeff Niemitz his senior research was on climate change effects on peak stream flow magnitude and frequency and potential legacy sediment remobilization. Part of that work has been accepted for publication in the GSA journal *Geology*.

Everett became hooked on GIS in his senior year and now works in the School of Sustainability at Arizona State University overseeing many of their GIS projects. He plans to go to graduate school next year.

The 2012 recipient was Breanna Hashman. Bre had a very full four years at Dickinson. She was involved in the Geological Society and other campus activities while maintaining an active research agenda and a full year of study at the Dickinson Science Program in Norwich, England. Her sophomore summer she worked at the Carnegie Institution Labs in Washington, DC doing isotopic studies on Pre-Cambrian rocks looking for signs of life. It was there that she found her passion for early life studies in banded-iron formations (BIFs). After her junior year abroad she worked with Dominic Papineau at Boston College learning about the organic and inorganic origins of BIFs. She traveled to the Northwest Territories to collect samples which she used in her senior honors thesis on the potential organic origins of BIFs in the Slave (Canada) and Anshun (China) provinces. Bre has been accepted to the University of Wisconsin to continue her work on BIFs and will begin there in fall 2013. In the mean time she will be learning more analytical skills at the University of Manitoba in their ion microprobe lab.



**Photo Above:**

**Year End Picnic with faculty and graduating seniors**

**Front Row (L to R): Robert Dean (Earth Sciences Technician), Marcus Key**

**Back Row (L to R): Ben Edwards, Bre Hashman, Jeff Niemitz, Paige Hollenbeck, Claire Persichetti, Rebecca Rossi, Natalie Kornushoff, William Seward, Chris Ackley (adjunct faculty), Mitch Scharman (visiting faculty)**

# 2011-2012

## Senior Student Research Projects

Breana Marquette Hashman

### Organic-poor Neoproterozoic Banded Iron Formations from the Slave and North China Cratons

#### Abstract:

Geochemical data suggest that Banded Iron Formations (BIFs) preserve a record of both abiological and biological processes. Klein (2005) suggests that BIFs are hydrothermally--influenced chemical precipitates, while many other studies suggest a biogenic component to the formation of BIFs through the oxidation of Fe (II) and the conversion of iron oxides to magnetite (Heimann et al. 2010, Widdel et al. 1993, Planavsky et al. 2009, Lovley D.R., 1991). In order to further understand the genesis of these rocks, a study was performed on ca. 2.85 Ga BIFs from the Slave Craton in Canada and on ca. 2.53 Ga BIFs from the Anshan province of the North China Craton. Mineral occurrences of possible biological relevance like apatite, sulfides, and carbonates were mapped in petrographic thin sections from both localities and found typically to occur in bands parallel to bedding. This is consistent with an authigenic origin within a diagenetic environment. No apatite-graphite associations were found in BIFs from either location, although these mineral-pairs were found interbedded in Neoproterozoic turbidites from the Slave Craton. Only BIFs from Anshan province contained minor amounts of carbonates, typically occurring in bands, with isotopically light  $\delta^{13}\text{C}_{\text{carb}}$  values around -9‰. Diagenetic oxidation of organic matter from Dissimilatory Iron Reduction likely accounts for these carbonate isotopic values as well as for the low amount of organic carbon in the samples. Only one BIF sample from the Slave had detectable levels of organic carbon with only about 0.02 wt% TOC and a  $\delta^{13}\text{C}_{\text{org}}$  value of -25.7‰.

Paige Hollenbeck

### Test of a methodology to quantify paleoseasonality using extant bryozoans from both sides of the Isthmus of Panama

#### Abstract:

Quantifying seasonality is important for understanding past, current and future climatic and geologic changes. Techniques have been used to calculate mean annual range in temperature, however these methods have not incorporated seasonality (range in temperatures from winter to summer) experienced within an annual cycle. The ability to detect and distinguish among seasons can have many environmental, climatic and geologic applications. This study aims to develop a methodology to quantify seasonality in extant bryozoans from both sides of the Isthmus of Panama, the Pacific Ocean side that experiences seasonal upwelling and the Caribbean Sea side that experiences relatively constant sea temperature conditions. The methods tested in this study include MART (Mean Annual Range in Temperature) analysis (i.e. comparing zooid area across generations of zooids) and  $\delta^{18}\text{O}$  profiling (i.e. oxygen  $^{18}\text{O}/^{16}\text{O}$  isotopic ratio analysis to determine temperature across generations of zooids). The MART method was not able to detect seasonal upwelling trends and the MART temperatures were not consistent with literature values. The  $\delta^{18}\text{O}$  profiling method was able to detect seasonal periods of upwelling on the Pacific Ocean side of the Isthmus. The  $\delta^{18}\text{O}$  profiling method is therefore favored over the MART method in detecting paleoseasonality.

## Senior Student Research Projects (cont'd)

Natalie Kormushoff

### Using a Wave Tank to Compare Landslide Generated Tsunamis to Point Source Tsunamis and its Implications for the East Coast of the United States

#### Abstract:

This study models and compares the wave attributes of landslide generated tsunamis and earthquake generated tsunamis. The study region for landslide generated tsunamis is the Canary Islands off the coast of western Africa. Although landslides large enough to generate tsunamis can happen all over the world, this study focuses on the Canary Islands archipelago due to the potential threat of a landslide generated tsunami impacting the eastern coast of the United States (Grilli et al., 2009). A physical model analysis of wave height, wavelength, and run-up heights along the coast is used to determine the potential hazard of landslide generated tsunamis as compared to earthquake generated tsunamis (Masson et al., 2006). Experimental results suggest that landslide generated tsunamis were determined to have greater wave heights at the propagation source and shorter wavelengths than the earthquake generated tsunamis. However, run-up heights at the coast were found to be similar with only a 0.108 cm difference between the average run-up heights. These results have important implications for coastal areas of the United States, which low lying coastal areas might be at risk from a landslide generated tsunami. Two regions along the northern east coast of the U.S. that would be most at risk are the Hudson River estuary and Long Island, and the New Jersey coastline (Grilli et al., 2009). Florida was also determined to be another region of elevated hazard (Pararas-Cayanias, 2003).

William Seward

### Growth of rye in Icelandic volcanic ash

#### Abstract:

The purpose of this study was to determine the effect on the early stages of plant growth from adding volcanic ash to soil. An experiment was conducted in order to compare the growth of rye plants in substrates composed of basaltic and trachyandesitic ash and peat moss to the growth of rye plants in substrates composed of quartz sand and peat moss. The results of the experiment showed that rye plants grew to significantly greater heights, weights, and root depths in the volcanic ash substrate. The average plant mass was 284.13 mg in basaltic ash and 348.48 mg in trachyandesitic ash, compared to 87.89 mg in poorly sorted quartz sand and 84.97 mg in well sorted quartz sand. The average root depth was 126.33 mm in basaltic ash and 163.33 mm in trachyandesitic ash, compared to 30.67 mm in poorly sorted quartz sand and 32.00 mm in well sorted quartz sand. Potential explanations for these results were investigated by examining the physical and chemical characteristics of the ash with the SEM microscope and XRF spectrometer. The XRF analysis showed significant leaching in certain trace elements, but it could not be interpreted as having a definitive effect on the plant growth experiment. The SEM analysis showed that the ash was significantly more vesicular than the quartz, but did not reveal any physical evidence of chemical leaching. The conclusion of this study was that the vesicular texture of the ash gives it greater surface area, facilitating the rye plants' access to water and soil moisture retention, and was responsible for increasing the growth of the plants during the experiment.

# Senior Student Research Projects (cont'd)

Claire Persichetti

## Soil Fertility: A Comparison between Organic and Conventional Agriculture

### Abstract:

The objective of this paper is two-fold. The first objective is to conduct a meta-analysis of the current understanding of the influence that organic and conventional farming systems have on soil fertility within the context of inherent soil processes and characteristics. Overall, organically managed farms were found to have equal or higher levels of organic matter and essential nutrients relative to conventionally farmed soils. Organic management was also found to result in improved soil structure and aggregate stability. The case study found little significant difference between the organic and conventionally managed farms in terms of soil chemical fertility, however, organic matter and phosphorus levels were found to be significantly increased on the organic farm. The lack of a statistically significant difference between soil nutrient levels between the two farms suggests that, though the mechanism by which soil fertility is produced differs, both systems produce comparable soil chemical fertility.

## Faculty Published Abstracts

(underlined name indicates student co-author)

2009

- ◆ Haynes, Courtney E. (Dickinson College, Department of Geology, Carlisle, PA, United States); **Niemitz, Jeffrey W.**, *Using 'legacy sediments' to determine past land use changes and future sediment release impacts on downstream ecosystems; Yellow Breeches Creek watershed, Cumberland County, PA. Geological Society of America, February, 2009, Vol. 41, Issue 3, pp. 110..*

2010

- ◆ Bhatt, M.P., Liermann, L.J., **Sak, P.B.**, Brantley, S.L., 2010, Basalt weathering rates vary with time and scale of measurement. *Geochim. Cosmochim. Acta* 74, A86 (abstr.).
- ◆ Buss, H.L., Dessert, C., White, A.F., Vivit, D., Blum, A.E., **Sak, P.B.**, Gaillardet, J., 2010, Mineral nutrient profiles and differing lithologies at three tropical critical zone sites. *Geochim. Cosmochim. Acta* 74, A133 (abstr.).
- ◆ **Key, M. M., Jr.**, G. A. Schumacher, and L. E. Babcock, 2010. Palaeoecology of commensal episkeletozoans fouling *Flexicalymene* (*Trilobita*) from the Late Ordovician Cincinnati Arch region. Pp. 227-228. In: *Programme & Abstracts, International Palaeontological Congress 3, London.*
- ◆ **Key, M. M., Jr.**, J. B. Knauff, and D. K. A. Barnes. 2010. "If you can't beat them, join them": epizoic bryozoans on predatory pycnogonids from the South Orkney Islands, Antarctica. *Terra Nostra*. 2010/4: 57-58.
- ◆ Lasher, G. Everett (Dickinson College, Department of Earth Sciences, Carlisle, PA, United States); **Niemitz, Jeffrey W.**, *The implications of climate change on stream flow and legacy sediment remobilization; Yellow Breeches Creek, Cumberland County, PA, Geological Society of America, November, 2010, Vol. 42, Issue 5, pp. 289*
- ◆ Ma, L., Chabaux, F., Granet, M., Pelt, E., **Sak P.**, Gaillardet, J., and Brantley, S., 2010, Quantifying weathering advance rates in basaltic andesite rinds with uranium-series isotopes: a case study from Basse-Terre Island, Guadeloupe: *Eos Trans. AGU*, v. 91, Fall Meet. Suppl. Abs.
- ◆ Miller, S.R., **Sak, P.B.**, Kirby, E., 2010, Relationship between fluvial geomorphology and erosion in the Pennsylvania Appalachians: Implications for landscape evolution: *Geological Society of America Abstracts with Programs*, v. 42.
- ◆ **Sak, P.B.**, Miller, S.R., Kirby, E., 2010, Hack vs. Davis: revisiting landscape evolution in an ancient orogen: 5<sup>th</sup> Annual Susquehanna River Symposium, Lewisburg, PA. [INVITED].
- ◆ Watson, Maunette (Dickinson College, Department of Environmental Studies, Carlisle, PA, United States); **Niemitz, Jeffrey W.**; Haynes, Courtney E., *Metals from legacy sediments and their impact on macroinvertebrates in Yellow Breeches Creek watershed, Cumberland County, PA. Geological Society of America, February, 2010, Vol. 42, Issue 1, pp. 180*



## 2010 Continued

- ♦ Wills, M.A., and **Sak, P.B.**, 2010, A Study of progressive deformation in the southern Valley and Ridge, Perry County, Pennsylvania: Geological Society of America Abstracts with Programs, v. 42.
- ♦ Witter, A.E., Baider, S., and **Sak, P.B.**, 2010, Distribution of PAHs in sediments along a rural-urban gradient in central PA: Assessing input sources and transport pathways using compositional analysis, GIS and multivariate methods: 5<sup>th</sup> Annual Susquehanna River Symposium, Lewisburg, PA. [INVITED].

## 2011

- ♦ Alcorn, R., Pollock, M, **Edwards, BR**, 2011, Construction of subglacial pillow ridges: insights from compositional variations in a 3-D exposure, Undirhlithar quarry, southwest Iceland. Northeastern (46<sup>th</sup> Annual) and North-Central (45<sup>th</sup> Annual) Joint Meeting (20–22 March 2011), Paper 24-32.
- ♦ Bowman, L., Pollock, M, **Edwards, BR**, \*Alcorn, R., 2011, Geochemical and field relationships of pillow and dike units in a subglacial pillow ridge, Undirhlithar quarry, southwest Iceland, GSA Abstracts with Program, Minneapolis, 9 Oct.
- ♦ **Edwards, BR**, Karson, J, Wysocki, R, Gregg, T, 2011, Direct observations of lava-ice interactions: the Syracuse University Lava Project. IUGG 2011 Melbourne, IAVCEI Symposium V16: Subglacial and Subaqueous Volcanism.
- ♦ **Edwards, BR**, Pollock, M, Gudmundsson, MT, Russell, JK, Skilling, I, 2011, Petrology, Lithofacies and Structure of Glaciovolcanic Pillow Ridges: Iceland and British Columbia comparisons. IUGG 2011 Melbourne, IAVCEI Symposium V16: Subglacial and Subaqueous Volcanism.
- ♦ **Edwards, BR**, Russell, JK, 2011, Thermodynamic Constraints on Explosive vs. Effusive Onset of Glaciovolcanic Eruptions, *Eos Trans. AGU*, V31E-2578, Fall Meet. Suppl., Fall 2011.
- ♦ **Edwards, BR**, Ryane, C, Russell, JK, \*Jansen, R., \*Dunnington, G., 2011, Overview of glaciovolcanism in the Kawdy-Tuya volcanic fields, northern British Columbia and its implications for Pleistocene paleoclimate. IUGG 2011 Melbourne, IAVCEI Symposium V16: Subglacial and Subaqueous Volcanism.
- ♦ Jansen, R., **Edwards, BR**, Ryane, C, 2011, Origins of polymitic diamict at Kima'Kho, northern British Columbia, Canada. Northeastern (46<sup>th</sup> Annual) and North-Central (45<sup>th</sup> Annual) Joint Meeting (20–22 March 2011), Paper 24-2.
- ♦ Ma, L., Chabaux, F., Pelt, E., Granet, M., **Sak, P.B.**, Gaillardet, J., Lebedeva, M., and Brantley, S.L., 2011, Quantifying rind formation and chemical weathering rates in basaltic/andesitic weathering clasts with uranium-series isotopes: a case study from Basse-Terre Island, Guadeloupe: *Eos Trans. AGU*, v. 92, Fall Meet. Suppl. Abs. [INVITED].
- ♦ Miller, S.R., Kirby E., **Sak, P.B.**, and Bierman, P., 2011, Late Cenozoic fluvial incision through the Susquehanna River drainage basin: A response to dynamic topography?: Earthscope – GeoPRISMS Science Workshop for Eastern North America, Lehigh, PA. [INVITED HOT TOPICS TALK].
- ♦ Miller, S.R., **Sak, P.B.**, Kirby, E., and Bierman, P.R., 2011, Bumps in the long road to flat: *Eos Trans. AGU*, v. 92, Fall Meet. Suppl. Abs.
- ♦ **Niemitz, Jeffrey W.** (Dickinson College, Carlisle, PA, United States); Haynes, Courtney E.; Lasher, G. Everett, *Legacy sediment chemistry and land use: using small catchment basins to determine potentially harmful inputs to downstream environments*, *Geological Society of America*, October, 2011, Vol. 43, Issue 5, pp. 564.
- ♦ Rossi, R. K., and **M. M. Key, Jr.** 2011. Sourcing black limestone gravestones in late 17<sup>th</sup> century colonial Virginia. *Geological Society of America Abstracts with Programs*. 43(5): 294.
- ♦ Ryane, C, **Edwards, BR**, Russell, JK, 2011, Volcanic stratigraphy of Kima'Kho Mountain: a Pleistocene tuya, northern British Columbia, Canada. IUGG 2011 Melbourne, IAVCEI Symposium V16: Subglacial and Subaqueous Volcanism.
- ♦ Ryane, C, Russell, JK, **Edwards, BR**, Porritt, L, 2011, Armoured lapilli in glaciovolcanic deposits: origins and implications, *Eos Trans. AGU*, V51C-2531, Fall Meet. Suppl., Fall 2011.
- ♦ Ryane, C, Russell, JK, **Edwards, BR**, Porritt, L, 2011, Volcaniclastic deposits at Kima'Kho Mountain, northern British Columbia, Canada: A record of explosive glaciovolcanism. IUGG 2011 Melbourne, IAVCEI Symposium V16: Subglacial and Subaqueous Volcanism.
- ♦ **Sak, P.B.** and McQuarrie, N., 2011, Sequential development of the central Appalachian fold-thrust belt, Pennsylvania: A testable kinematic framework for crustal architecture: Earthscope – GeoPRISMS Science Workshop for Eastern North America, Lehigh, PA.
- ♦ **Sak, P.B.**, Vannucchi, P., Ujiie, K., Ohkushi, K., and the IODP Expedition 334 Scientific Party, 2011, Accelerated subduction erosion opposite the Cocos Ridge: Implications for the initiation of ridge subduction: *Eos Trans. AGU*, v. 92, Fall Meet. Suppl. Abs.

## 2012

- ♦ **Edwards, B.**, Gudmundsson, MT, Oddsson, B, Hungerford, J, Skilling, I, 2012, Constraints on Emplacement of Lava Flows in Snow/ Ice-dominated Environments: comparisons of field and experimental observations to theory, 3<sup>rd</sup> IAVCEI Volcano-Ice Interactions on Earth and Mars Conference, 18-20 June, Anchorage, AK.
- ♦ **Edwards, B.**, Karson, J, Wysocki, B, Lev, E, 2012, Experimental Insights on Lava-ice-snow Interactions, 3<sup>rd</sup> IAVCEI Volcano-Ice Interactions on Earth and Mars Conference, 18-20 June, Anchorage, AK.
- ♦ **Edwards, B.**, Oddsson, B, Gudmundsson, MT, \*Rossi, R., 2012, Field constraints for modeling the emplacement of the 2010 Gigjokull lava flow, southern Iceland: interplay between subaqueous, ice contact and subaerial lava emplacement, 2012 European Geophysical Union Meeting, Vienna, April 2012.
- ♦ Oddsson, B, Gudmundsson, MT, **Edwards, B.** (2012) Interaction of lava and ice during the advance of a trachyandesitic lava flow in the 2010 Eyjafjallajökull eruption, Iceland, 3<sup>rd</sup> IAVCEI Volcano-Ice Interactions on Earth and Mars Conference, 18-20 June, Anchorage, AK.

2012 Continued

- ◆ **Seward, W., Edwards, B.** 2012, Testing hypotheses for the use of volcano ash as low cost, natural fertilizer, 2012 European Geophysical Union Meeting, Vienna, April 2012.
- ◆ **Jeffrey Niemitz, Courtney Haynes, and Gregory Lasher.** *Legacy Sediments and historic land-use: Chemostratigraphic evidence for excess nutrient and heavy metal sources and remobilization.* Accepted to GSA Geology

## Faculty Published Articles/Manuscripts

2009

- ◆ **Key, M. M., Jr.,** S. Vaughn, T. H. Davis, and W. Parr. 2009.  $^{14}\text{C}$  age control on a Rappahannock Native American site on Totuskey Creek (44RD0206) in Richmond County, Virginia. *Quarterly Bulletin of the Archeological Society of Virginia*. 64: 163-176

2010

- ◆ **Key, M. M., Jr.,** G. A. Schumacher, L. E. Babcock, R. C. Frey, W. P. Heimbrock, S. H. Felton, D. L. Cooper, W. B. Gibson, D. G. Scheid, and S. A. Schumacher. 2010. Paleoeecology of commensal epizoans S. A. Schumacher. 2010. Paleoeecology of commensal epizoans fouling *Flexicalymene (Trilobita)* from the Upper Ordovician, Cincinnati Arch region, USA. *Journal of Paleontology*. 84: 1121-1134.
- ◆ **Key, M. M., Jr.,** R. Teagle, and T. Haysom. 2010. Provenance of the stone pavers in Christ Church, Lancaster Co., Virginia. *Quarterly Bulletin of the Archeological Society of Virginia*. 65: 1-15.
- ◆ **Sak, P.B.,** Navarre-Sitchler, A.K., Miller, C.E., Daniel, C.C., Gaillardet, J., Lebedeva, M.I., and Brantley, S.L., 2010, Rates of formation of basaltic weathering rinds vary with clast curvature: *Chemical Geology*, v. 276, p.129-143.

2011

- ◆ Hausrath, E.M., Navarre-Sitchler, A.K., **Sak, P.B.,** Williams, J.Z., and Brantley, S.L., 2011, Soil profiles as indicators of mineral weathering rates and organic interactions on a Pennsylvania diabase: *Chemical Geology*, v. 290, p. 89-100.
- ◆ **Key, M. M., Jr.,** P. N. Wyse Jackson, and L. J. Vitiello. 2011. Stream channel network analysis applied to colony-wide feeding structures in a Permian bryozoan from Greenland. *Paleobiology*. 37: 287-302.
- ◆ Navarre-Sitchler, A., Steefel, C.I., **Sak, P.B.,** and Brantley, S.L., 2011, A predictive model for weathering rind formation on basalt: *Geochemica et Cosmochemica Acta*, v. 75, p. 7644-7667.
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## Faculty Awarded External Grants

- ◆ **EDWARDS: National Geographic Committee for Research and Exploration Grant:** Field documentation of water-ice-lava interactions in the 2010 Gigjökull lava flow (awarded \$19,870 for summer 2012)
- ◆ **SAK: Consortium for Ocean Leadership.** Constraining the rates, timing, and magnitude of subduction erosion along the Middle America Trench: IODP Expedition 334, \$14,823.

**Professor Noel Potter**



I am still happily “somewhat” retired. I continue to work on some local projects. Lidar has given a new view of the landscape, particularly in the forests on South Mountain where all sorts of periglacial features such as solifluction lobes and sheets left over from the Pleistocene abound. I also continue to serve GSA as “Section Meetings Senior Adviser,” a volunteer position in which I help section meeting chairs deal with budgets and hotel logistics. Helen still works at the PA Geological Survey, and our son Noel Lewis is now a Junior in high school. We are beginning to look at colleges, and of course he is totally contaminated by his parents so that he is looking at liberal arts colleges. It is interesting having been involved in admissions recruiting for Dickinson to see the college hunt from the side of a parent and son. I enjoy hearing from Department alums.

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**FACULTY UPDATES**

**Professor Mitchell Scharman**

I joined the Earth Sciences department at Dickinson College for the 2011-2012 academic year to cover the Planet Earth and Structural Geology courses while Pete Sak was on sabbatical. Coming to Dickinson from Idaho by way of El Paso, Texas, I have greatly enjoyed learning about and exploring the structural geology and tectonic history preserved in the rocks of the eastern U.S. which has provided a chance to view and learn about geology that is new to me. It has also given me a chance to use my knowledge and experience in the North American Cordillera – especially from my field and research experience in southern Alaska and the American southwest - to introduce different and new ideas of geology to both introductory students and Earth Science majors.



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 also greatly valued the numerous talks about the local geology and fieldtrips with Noel Potter throughout the year. I look forward to maintaining these excellent collaborative relationships and the experience gained in this excellent program to use as I move on to Bates College in Maine for the next academic year.



**Professor Jeffrey Niemitz**

Hello to all alumni graduating since the class of 1978. Wow, it doesn't seem possible that I am just finishing up year 35 at Dickinson. Lots has changed at the College not the least of which has been the students. Yes, I know I'M getting older and they are staying the same. It has been an interesting last two years so let's take it in chronological order.

Spring of 2010 I was on sabbatical and working on Legacy Sediments in the local watersheds. Legacy Sediments for those out of the loop are sediments trapped behind late 18<sup>th</sup> to early 20<sup>th</sup> century mill dams. They contain the runoff from 150 years of development (mostly agricultural and urban) in the eastern US. The best estimate is that there are ~65,000 of these dams many of which have been removed with the sediment being remobilized to downstream environments. I have had students working on these deposits in various ways for the last 3 years. Some of that work was just submitted to the journal *Geology* for publication and more is coming. My fourth student will be working on these again this summer; an interesting combination of natural and human historical geochemistry.

Last summer I had the opportunity to go to Africa (Zimbabwe) with a group called Forgotten Voices to do some water quality work on water supplies that affect kids with HIV AIDS or orphaned by the disease. We did a lot of test of wells and streams. As you might imagine the water quality in Africa is sketchy at best but fortunately most of the testing turned out to be acceptable. I also advised a bush (aka middle of nowhere) hospital on purification of their water drawn from a very nasty looking reservoir. We were there in the dry season so the water levels were particularly low and, of course, the cattle were grazing in the water as well. Makes you stop and think about what you have and how little we question our water and food supplies. The kids I met were just crazy cute and funny. You would never know they were orphans. Forgotten Voices helps orphans with all sorts of needs through local churches including farming, water, school fees, clothing, income generation for caregivers and so forth. It is a great model of how to help the African people directly and to help themselves.

The other big event last summer was the marriage of our son, Matt, to Mary Flynn Detlefs. The wedding was held in the Great Smokies of NC and was spectacular. They are living in NYC so we get to see them frequently. Two weeks later our second grandchild, Kate, arrived. She is, of course, perfect though her mother may beg to differ. We now have 2 grandchildren, Will (2.5) and Kate(0.75 yrs).

**Professor Jeffrey Niemitz (cont'd)**

In the fall, I was humbled to be elected a Fellow of the Geological Society of America at the annual meeting in Minneapolis. It was a great honor. This fall I taught in a mosaic; 4 thematic courses taught to the same students over one semester. The theme was African Climate Change. The new Director of the Sustainability Center, Neil Leary, taught an Environmental Change and Governance course centered on the UNFCCC Climate Conference in Durban, South Africa. Jeremy Ball in History taught an Ecological History of Africa course and I taught my Global Climate Change course with an emphasis on Africa. The fourth course was an independent study based on research at the conference.

In October, we spent time briefing US negotiators in Washington and between Thanksgiving and Christmas we spent 3 weeks in South Africa; two at the conference and one doing service work (AIDS orphanages) in the vicinity of Durban. It was quite an experience to be at the conference (20,000 people from 193 countries trying to agree on climate change mitigation and adaptation). I really never thought I would ever get to Africa and then I go twice in 6 months. If you are wondering it is 27,000+ km roundtrip and takes 17-19 hours one way depending on the season and winds. This summer looks like it will be positively boring compared to the last year and that is just fine with me.

Trish is also doing well. She started full time in school nursing this spring due to a personnel change at her school. She has decided to work for 2 more years and then retire. Hope all is well with you. We love hearing about your family and careers and, be assured, the light is always on at 230 Conway Street if you are coming through Carlisle. Please don't hesitate to stop and chat.



**Professor Marcus Key**

Greetings from Dickinson Earth Sciences! My knees turned 50 this last year, and I bought my first bifocals! I am on the long slippery slope of middle age. Maria's new 1987 Alfa Romeo Spider Veloce is helping me deal with that though. This past year we finished our first significant renovation to Kaufman, our new home since 2006. The Wet Lab off the Sedimentology-Stratigraphy-Paleontology lab was expanded to accommodate the giant wave tank that Jeff and Rob built. That lab is also the home of our new laser scattering grain size analyzer which helps us quantify grain size distributions at the finer end below what traditional sieving can handle. This year the paleontology teaching collection is getting a much needed curatorial overhaul to accommodate new donations from our alumni. Thank you Bill Berggren ('52), David Rilling ('62), Jim Turner ('67), and David Ellis ('83). Keep them coming!

On the teaching front, since the last newsletter I have taught Sedimentology and Stratigraphy for the 12<sup>th</sup> time, and I taught a new First Year Seminar on peak oil. The seminar was very timely, but last week the U.S. Energy Information Agency reported that U.S. petroleum product exports exceeded imports in 2011 for first time in over six decades. Hydraulic fracturing in North Dakota and Pennsylvania is temporarily ruining my peak oil predictions! The plus side is that the job market for our majors remains strong in the minerals and energy industries despite the global recession.

On the research front, I am on sabbatical this semester (spring 2012). My sabbatical project, conducted with senior major Paige Hollenbeck, is using C and O stable isotopes derived from bryozoan skeletons to quantify the onset of seasonal upwelling on the Pacific side of the Isthmus of Panama. This summer I will be working with senior major Rebecca Rossi applying the same isotope method to more temperate bryozoans from New Zealand. Our goal is to develop a way to quantify paleoseasonality that we can use in the fossil record. I am also wrapping up a few historical geoarcheology projects trying to determine the provenance of stones used in a colonial Virginia church on the coastal plain where there are no sources of stone. Using fossils, we have traced the floor stones to the Early Cretaceous Purbeck Limestone Group that outcrops along the Dorset coast of southern England and the tombstones to the Middle Mississippian black limestones in Belgium that outcrop along the Meuse River!

If you are ever in the Carlisle area, please let me know so I can rope you into giving a seminar to our students about what you are up to in your career (in exchange for a bevy or two of course).



**Professor Pete Sak**

It's hard to believe I've been at Dickinson for eight years 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 sailed on an Ocean Drilling Program Expedition offshore of Costa Rica last spring (2011) and am using data from that cruise to document the timing, rates, and magnitudes of subduction erosion along the Pacific coast of Costa Rica.

This fall I'll return to teaching after a year on sabbatical leave. I am looking forward to returning to the classroom and am excited to introduce a fresh crop of students to the geological wonders of Central Pennsylvania in intro courses. On the home front, Maya (4 ½) is growing like a weed and swimming, dancing, singing, and doing gymnastics. Linda continues to teach at Bucknell. We enjoy hiking, biking and paddling the many local trails and waterways when we aren't traveling to see 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.



**Professor Benjamin Edwards**

Greetings after another very busy year in the Department of Earth Sciences! We're just finishing our second year with a new name and new course program, with lots of interesting preliminary successes. We have a great group of seniors graduating this year, who have traveled extensively during their four years at Dickinson (ALL five did at least a semester abroad!), and who have covered a broad range of interesting projects for their senior research (see abstracts and SR Bios), including growing plants in volcanic ash and characterizing soil on the college farm, using Bryozoans to study ocean circulation, creating tsunami in our large wave tank, and looking for clues of biological influences on the formation of Banded Iron Formation (BIFs). As Marcus and Pete are on sabbatical, Jeff and I have been hopping reading theses over the past few weeks! As of July 1 Pete takes over as department chair, so I am looking forward to being a bit (or maybe a lot) less of an administrator and focusing more on teaching and research for another 6 years (at least!).

This year I've learned a lot about our new curriculum, teaching for the first time a 6-hour version of combined mineralogy and petrology. We were uncertain as to how this would work, and the students did feel like they missed out on a few rocks – maybe this bodes well for my opportunities at teaching an 'advanced' petrology class! I also taught Earth History for the first time this spring, and have a much better idea of the sorts of information that we are delivering in the 'historical' part of the introductory sequence...I did have to cut ten out of Marcus's eleven bryozoan-based labs, but otherwise was very impressed with many of the hands-on lab activities that Marcus, Jeff, and Noel have developed over the years (including students making 'coal' from peat during lab). Finally I've been teaching a newly revised, non-lab Environmental Hazards course; we debated whether or not our new 200-level courses would be as successful without labs, and this first test suggests to me that we do need some sort of lab component in these courses. We are having larger discussions within the College's Physical and Natural Sciences Division (Div III) about teaching in general, and teaching load is an important part of the discussion. We earth scientists have one of the largest contact loads among any of the science departments, which, along with our research requirements and extra-curricular trips with students, means the college and students are getting great value for their dollars! We wouldn't want it any other way...



**Professor Benjamin Edwards (cont'd)**

Along with lots of new and interesting teaching insights, I've been relatively busy with a few different research projects. I'm finishing work now, including a paper just published in the *Journal of Geophysical Research*, on investigations of the two different lava flows effused during the 2010 Eyjafjallajökull eruption in Iceland (with field work help from James Haklar '11 and Rebecca Rossi '13). This research has added immensely to my insights about how lava flows interact with snow/ice, and that experience will give me a very different perspective as I continue to work on ancient glaciovolcanic deposits in British Columbia, Iceland, and likely other places TBD.

As part of this research, I was also invited to Syracuse University to pour basaltic lava flows (~1 m long, 0.3 m wide) onto ice using the unique, large volume lava production lab housed in the Syracuse Sculpture program – I'm not quite sure whether this is the start of a new career in experimental volcanology or just a brief interlude, but the experiments are fascinating and we're reproducing features that I've seen in BC and at the 2010 Eyja eruption sites. I've also very excited to begin writing up new constraints on Pleistocene ice-sheets and northern hemisphere climate change from Ar-Ar geochronology work in BC that is just now finishing. Finally, I've officially started both agricultural and archeological volcanology this year through the experiments of graduating senior William Seward and field work of rising senior Rebecca Rossi. Will used volcanic ash from Iceland to grow rye plants as a test of the benefits of fresh volcanic ash for agriculture. With the construction of the new greenhouse this summer at the south end of Kaufman, I am hoping to continue work on the use of volcanic rocks as soil additives. Becca is looking at the textures and geochemistry of our local south-central PA volcanic deposits, the Catoctin metarhyolite (probably familiar to all of you from various course field trips!), as it was quarried for thousands of years by early native American populations for tools, and apparently traded widely along the East Coast. So I'm following Jeff and Marcus in what is becoming a department speciality of doing geo-archeology.

For those of you who know my family, they are all healthy and very busy as well. This is the height of soccer season, so I'm generally running out of Kaufman at least a couple of afternoons each week to watch Teagan and the Carlisle High School girls soccer (I'm one of the unofficial game photographers and so can't miss too much of the action or my photos are a bit boring). Kaelan has decided to choose field hockey in the fall, and so is taking a bit of a sports break this spring and is instead occupied with a production of \*MASH\* by one of the Carlisle theater groups. Kim is a full-time substitute in Shippensburg, so we are up at 5.30 a.m. every morning to shower, breakfast, walk the dog, etc. So if you're in Carlisle and up for an early morning dog walk – be sure to stop by and help me practice Icelandic as I wander around the streets of Carlisle bright and early!



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