Washington University in St. Louis

Department of Earth and Planetary Sciences

Newsletter

Fall 2012 Issue 12

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Department of Earth and Planetary Sciences
Washington University in St. Louis
St. Louis, MO 63130

Scott Rudolph Hall Dedication

The Earth and Planetary Sciences (EPS) building was dedicated with a new name on May 4, 2012. Washington University held a ribbon cutting ceremony outside the newly named Scott Rudolph Hall and a dedication ceremony in Whitaker Hall Auditorium. The ceremony was highlighted by special remarks by the Emmy Award-winning science television show host Bill Nye of "Science Guy" fame. The festivities included a welcome by the Chairman of the Board of Trustees, Stephen F. Brauer, and remarks by Chancellor Wrighton, Dean of Faculty, Gary Wihl, Department Chairman, Doug Wiens and EPS senior, Hannah Rabinowitz. Following the ribbon cutting ceremony there was a reception and self-guided tour of Scott Rudolph Hall which included displays in the museum on the first floor, the luminescent mineral display, the electron, microprobe lab, the Fossett Virtual Reality lab, the rock deformation lab, the stable isotope geochemistry lab and the Rettner EPS library. Graduate students were on hand to explain what research was being accomplished in each of these areas. According to Chairman Doug Wiens, "This was a great day for the Earth and Planetary Sciences Department. We were able to show off our building and some of our exhibits and research to the whole campus community, and also thank Mr. Rudolph and his family for making it possible."After the reception, the Chancellor hosted a dinner for Scott and Pyong Rudolph and members of the Washington University community. Included in the guest list were their sons, Michael Rudolph, a junior in Olin Business School and Ian Rudolph, currently a freshman at Washington University.

Joe Angeles/WUSTL

Ribbon sutting ceremony for Scott Rudolph Hall, from left, Doug Wiens, Bill Nye, Stephen Brauer, Scott Rudolph, Pyong Rudolph, Mark Wrighton, Gary Wihl, Ray Arvison and Ed Macias.

Scott and Pyong Rudolph are members of the Parents Council and Scott contributes his leadership on the Board of Trustees. The Rudolphs are sustaining charter members of the Danforth Circle. In 2011 the Rudolphs received Washington University's Brookings Award, a prestigious honor awarded by the Board of Trustees to recognize outstanding dedication to the institution. His connection to the Earth & Planetary Sciences department relates to his avocation mineral collecting. Mr. Rudolph generously contributed some of his mineral collection to the department museum on display in the first floor. Chancellor Mark S. Wrighton said, "Rudolph Hall is a fitting tribute to Scott, a highly accomplished entrepreneur whose personal interest in geology and mineral collecting inspired him to learn more about the important work being done in Earth & Planetary Sciences. We are honored and deeply grateful for Scott and Pyong's overwhelming generosity and infectious enthusiasm."

Content for this article was gathered from a story by Barbara Rea of *the Record*

Overview

Douglas Wiens

It's a pleasure to update you again on developments in the Department of Earth & Planetary Sciences. I think you will see it has been a great year and we are moving forward on many fronts. The Rudolph Hall dedication, highlighted by "Bill Nye the Science Guy" was a great success, and allowed us to showcase our building and activities to the university community.

I am really excited about our undergraduate programs. Both Jen Smith, our previous director of undergraduate studies (now Dean of the College), and Phil Skemer, the current director, have worked hard to revitalize our programs. It now looks like the number of majors is going through a doubling phase, in part due to our new "Environmental Earth Sciences" major, but also due to more students in our traditional major. An increased student awareness of the importance of geosciences to societal issues such as natural hazards, energy and the environment also plays a role. Many of the undergraduate students have become involved in research and are publishing their studies in research journals. One of the most enjoyable aspects as faculty members is to work with such ambitious and intelligent young people at the beginning of their careers.

We continue to add outstanding young scientists to our faculty. Alex Bradley joined us this fall as a new assistant professor in the field of geobiology. We currently have two faculty searches being advertised. We are looking for a geoscientist doing research on climate change at the associate professor level as part of the campus-wide ICARES (International Center for Advanced Renewable Energy and Sustainability) program, supported by funds from the Chancellor's office. We are also searching for a junior level person in high temperature geochemistry or experimental petrology. If you know of somebody qualified for these positions please tell them what a wonderful place Washington University is.

In closing, I remind you that we will once again be hosting a reception at the December AGU meeting so please stop by and have a drink on us. I am staying home from Antarctica this year so I will be able to attend and hope to meet you there. I would also like to thank those who have donated money during this past year. Alumni donations to the department allow us to improve our educational activities and do more to educate our students. One example is that we have now initiated a "Fossett Postdoctoral Fellowship" program, which brings in a young researcher for a two year research post in one of our laboratories. The first Fossett Postdoc, Catherine Rose, has recently arrived and in addition to her research, she will be assisting David Fike with the undergraduate geological field trip of Scotland in March.

Jennifer Smith named College of Arts and Sciences Dean

Associate Professor of Earth and Planetary Sciences Jennifer Smith was announced as the new Dean of the College of Arts & Sciences effective July 1, 2012. Smith, a geoarcheologist, received her bachelor's degree in Earth and Planetary Sciences from Harvard College and her master's and PhD in Earth and Environmental Science in 2002 from the University of Pennsylvania. Her research used tools from sedimentology, geomorphology and geochemistry to reconstruct the landscapes and environments occupied by prehistoric people. She was the director of undergraduate studies for the department since 2003 and the recipient of a Faculty Mentor award from the Graduate Student Senate in 2005. She has served on more than 20 department and university committees since joining the WUSTL faculty in 2002. Doug Wiens, Chairman of the Department of Earth and Planetary Sciences, said he was terribly sorry to see Jen leave as faculty but delighted in her new position and knows she will be excellent at leading the university's largest undergraduate school, and following in Dean Jim McLeod's tradition.

As dean of the College of Arts and Sciences, Smith is responsible for the university's liberal arts curriculum as well as every phase of student life, from admission through graduation. She leads the undergraduate four-year advising program with its 17 deans in the college and six in other schools, manages the annual budget, works with the Undergraduate Council to address student governance issues and works with the office of the Dean of Students, Campus Life and Residential Life, the first year center and other academic support units that deal with the undergraduate experience. She became a member of WUSTL University Council which comprises the chief administrative officers and deans of the university.

Rudolph Collection *by Jill Pasteris*

As we were preparing for the dedication of Rudolph Hall last May, Mr. Rudolph, an avid mineral collector, sent an unexpected surprise to the department. His "mineral consultant" arrived with 31 boxes of mineral specimens. These specimens were selected to enhance our existing mineral displays and our teaching collection. Laboratory Administrator, Bob Osburn, explained that for him it felt like Christmas morning as he opened the boxes and eventually revealed about 120 specimens. Several are now on display in the museum in Rudolph Hall, and a larger display is under development. Bob has begun to carefully photo-document all the minerals, examples of which you may have noticed in the "photo of the week" images on the departmental web page. The specimens are of very high quality, well suited to display both in our museum and in the portable displays that the department frequently loans to local mineral shows.

These specimens represent a wide variety of mineral groups, selected to be both beautiful to the eye and excellent examples of their species. Particularly well represented are zeolites, which are known for their attractive shapes and intergrowths, and evaporite minerals, which precipitate from sea water or saline lakes. There are also unusual crystal forms and mineral associations for research by our students. Department members and visitors to our displays will benefit from this collection for years to come.

Arvidson is MSL Curiosity participating scientist

In November of 2011 Ray Arvidson was selected to be a Participating Scientist on the NASA Mars Science Laboratory Curiosity Rover Mission. He commuted back and forth between the NASA Jet Propulsion Laboratory and our department during August through October, 2012, helping in operations and doing scientific analyses after the rover successfully landed on August 5, 2012. He has used the telemetry and imaging data returned during drives to simulate the rover as a virtual instrument, retrieving soil and other terrain properties. Ray has also provided analyses of expected mineral exposures along traverse paths, working on analysis of orbital CRISM hyperspectral data with graduate student, Abby Fraeman. Besides Abby there are seven former students from our department who are working on the Curiosity Mission.

Credits

Editors

Margo Mueller • Doug Wiens

Contributors

Jill Pasteris • Doug Wiens
Frederic Moynier • Garrecht Metzger
Ryan Clegg

For more information about the department and a listing of our faculty go to eps.wustl.edu

New Advances in Isotope Geochemistry

by Frédéric Moynier

Isotope geochemistry is a discipline which combines the concepts and methods of chemistry and nuclear physics with geological sciences. Some of the most famous applications of isotope geochemistry are the use of radiogenic isotopes to determine the age of meteorites, rocks and minerals and the use of natural stable isotopes as paleothermometers. The recent development of new types of mass-spectrometer, the multi-collection inductively-coupled-plasma mass-spectrometers (MC-ICP-MS)(see Figure 1) has permitted the measurements of the isotopic composition of almost any elements with very high precision. This has increased new fields of applications, especially the development of the so-called heavy stable isotopes (e.g. Fe, Zn, Cu).

At the isotope geochemistry laboratory we use the measurements of nucleosynthetic anomalies of heavy elements (e.g. Sr, Cr, Ca) to understand the stellar environment at the origin of our Solar System. We use short-lived radioactive systems, like 53Mn-53Cr, or 182Hf-182W, and long-lived systems (e.g. Rb-Sr) to calculate the most precise ages of formation (e.g. accretion) and differentiation (e.g. core formation) of the Earth, the Moon, Mars and asteroids. We also use stable isotopes to understand the processes of exchanges and transports of the elements along the history of the Solar System and of the Earth (using the Zn isotopes to trace evaporation phenomena, or Fe isotopes for changes in redox conditions). More recently, we have started to apply these systems to biological problems in order to understand the transport of metals in plants/soils systems, animals, and in medical sciences to track diseases, in collaboration with the Washington University medical school.

Technically, we first have to purify the element of interest from the rest of the rock or mineral. This is a very important part of the work which is done in our clean laboratory to avoid any external contamination. The chemical purifications are different for each element and for the different types of samples. It usually involves ion-exchange chromatography and it requires a lot of time and effort.

Once the element has been purified, its isotopic composition is analyzed using our MC-ICP-MS, a Thermo Scientific Neptune Plus. The argon plasma source ionizes most elements and the different isotopes are separated in an electro-magnetic field. This instrument has 9 collectors which allow us to analyze up to 9 different isotopes at the same time.

A recent example of our research has been the application of the zinc isotopes as tracers of evaporation processes. Zinc is what we call a moderately volatile element. It is an element that would evaporate under moderate temperature

Figure 1: Graduate student Cheng Heng sitting at two-year old multi-collection inductively-coupled-plasma mass-spectrometer.

(<1000°C) as opposed to refractory elements (e.g. Ca, Ti) which evaporate at very high temperature. Volatile elements play a fundamental role in the evolution of planets. However, our understanding of how volatile budgets were set in planets, and how and to which extent planetary bodies became volatile-depleted during the earliest stages of our Solar System formation remain poorly understood. One typical example is the Moon (see Figure 2).

Because of the analysis of the first Apollo samples, it is well known that lunar samples are highly depleted in volatile elements compared to Earth. However the origin of this depletion was still not understood. Volatilization is known to fractionate isotopes, thus comparing the isotope compositions of volatile elements between samples is a very powerful tool to understand the origin of volatile element abundance variations. Evaporation enriches the residue in the heavier isotopes while the absence of condensation is expected to produce limited isotopic effects.

Graduate student Randy Paniello has found that lunar basalts are all enriched in the heavier isotopes of zinc compared to Earth. This effect is quite small (1.5 permil for the 66Zn/64Zn ratio) and these types of measurements require a lot of analytical development which were not technically possible 15 years ago. These isotopic variations are exactly what is expected if the Moon had lost its zinc by gas loss. In addition, the zinc isotopic composition is very homogeneous among many different lunar samples which imply that this evaporation event has affected the Moon as a whole. This is exactly what would be expected in the case of the origin of the Moon by a giant impact. However, until Randy's discoveries no chemical evidence of this wholesale evaporation had been found.

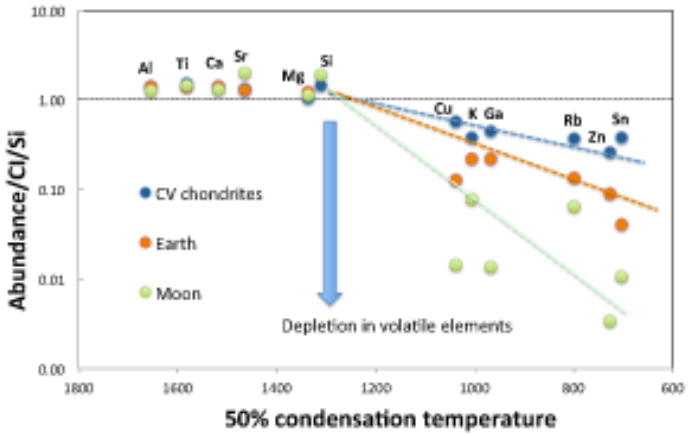


Figure 2: Abundance of several elements relevant to this proposal normalized to CI chondrites and to Si in function of the 50% condensation temperature. CV chondrites, the Earth and the Moon are depleted in volatile elements compare to CI, and the depletion is correlated with the relative volatility between the elements. The dashed lines indicate the depletion patterns.

PHD's Awarded 2012

Erica Emry
Shallow thrust and outer rise earthquakes in northwestern Pacific subduction zones and their role in subduction zone water budgets with special focus on the Mariana Islands.

Andrew Frierdich
Trace element cycling during iron(II)-activated recrystallization of iron(III) oxide minerals.

Christopher Orth
Geodynamic interpretations of global topography and gravity on Venus and Mars.

Amy Shaw
Characterization of Martian surfaces using mechanical and spectrophotometric models.

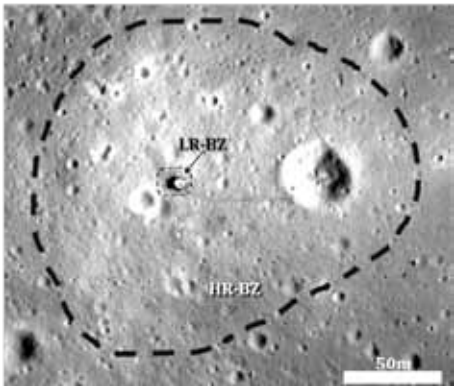
Graduate Student Research

Photometric Analysis of Lunar Landing Sites: Using LROC to Understand the Effects of Rocket Exhaust on Lunar Soil

by Ryan Clegg

Understanding the behavior of lunar soil is critical to the safety and planning of future manned and robotic missions. Blowing dust during descent has always been a major concern for lunar missions. For example, Apollo 12 landed 155 m from the Surveyor 3 spacecraft, and analysis of pieces returned by the astronauts revealed that Surveyor 3 had been sandblasted and pitted by the Apollo 12 descent exhaust spray. Apollo astronauts also remarked that dust obscured their visibility during landing, so future missions must take this hazard into account in order to land and operate safely.

In the Planetary Materials Research Group, Brad Jolliff and I have been using Lunar Reconnaissance Orbiter Camera (LROC) Narrow Angle Camera (NAC) images to study the Surveyor, Luna, and Apollo landing sites. High-resolution (50 cm/pixel) NAC images of the landing sites show regions of both increased and decreased reflectivity around the landers. These regions are interpreted as disturbance of the regolith by rocket exhaust during descent of the spacecraft and are referred to as "blast zones" (BZs), or specifically high-reflectance blast zones (HR-BZs), extending tens to hundreds of meters from the landers, and low-reflectance blast zones (LR-BZs), extending a few meters from the landers. The goals of this research project are to determine the effects of rocket exhaust in terms of erosion and particle redistribution, and the cause(s) of the reflectance variations and how they are related to changes in grain size, soil maturity, and surface texture.



Close-up of the Apollo 11 landing site, showing the LR-BZ close to the lander and the HR-BZ extending.

Spatial and Reflectance Measurements

In this research, we first measured the spatial extent and area of the BZs using NAC phase-ratio images. Because of the high resolution and repeat coverage with different illumination geometries, we were able to measure the BZs in ways that have not been done before. The average Apollo BZ elliptical area is ~29,000 m2 (~175 m by 200 m) which is 10x larger than the average Luna BZ, and over 100x larger than the aver-

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Pushing the limits of isotope chemostratigraphy

by Garrecht Metzger

Space and Time

It's been 343 years since Nicholas Steno published the law of superposition, laying the theoretical framework for the field of stratigraphy. Nearly three and half centuries later stratigraphers are still refining their understanding of how sedimentary rocks relate in space and time. To do this, stratigraphers studying marine deposits have increasingly utilized isotopic methods, giving rise to the field of "isotope chemostratigraphy". These methods utilize isotopic systems from elements such as C, O, S, and Sr as the ratio of different isotopes of a given element varies with time as a function of source, environmental conditions, and geologic phenomena. For example, the temperature dependence of oxygen isotope ratios has been used to understand atmospheric temperature fluctuations during the past 800,000 years.

Carbon isotopes are relatively homogenous in the modern ocean as a result of rapid mixing. Carbon isotope ratios vary with time and are thought to result largely from changes in the fluxes of 13C and 12C into and out of the ocean. These oscillations occur on the thousand to million year time scale and are recorded in carbonates (13Ccarb) synchronously across the ocean, allowing construction of a 'relative chronostratigraphy' at a resolution beyond that of radiometric or biostratigraphic methods. This is especially useful when trying to correlate areas that lack the fossils used for correlation and/or radiometrically dateable materials. When C-isotopes are paired with radiometric ages a robust correlation network can be constructed to understand the depositional, climatic, and tectonic histories across large areas at a temporal resolution not possible using other methods alone.

Figure 1. Late Ordovician outcrop showing the famously fossiliferous Decorah Formation near St. Louis. Lab and department alumnus Rachel Folkerts (B.A., 2012) for scale.

Figure 2. Millbrig K-bentonite (altered volcanic ash bed). Ash beds contain zircons which can be dated by measuring U-Pb ratios. This ash bed falls at the beginning of a 13Ccarb excursion (interval where 13Ccarb deviates from baseline values) correlated across North America.

The Late Ordovician: When, Where, and Why

The Fike Isotope Biogeochemistry group has been using these methods to study the Late Ordovician (444-461 Ma) of the central and eastern United States. The Ordovician should be a familiar geologic period for anyone who has resided in the St. Louis area as Ordovician sediments blanket much of the Midwest. These rocks formed during one of the largest sea level highstands of the past half billion years when warm, shallow seas left laterally extensive deposits of carbonates and marine siliciclastics that extended for thousands of miles across North America. The Late Ordovician is an important interval to Earth Historians because within it occurs the highest rate of increase in the number of marine invertebrates (e.g. brachiopods, crinoids, nautiloids) in Earth history; the epoch also ends with the first of the 'big five' mass extinctions, the Hirnantian. Economic geologists are interested in the argillaceous carbonates and black shales of the Trenton and Utica Formations which contain large oil and gas reserves.

The first goal of our work was to understand geologic variability in 13Ccarb at the cm and km scale to reduce signal "noise" and push the limits of identifying a resolvable 13Ccarb signal. Previous work in the Late Ordovician has argued that apparent 13Ccarb gradients from the open ocean to the interior of the continental sea were the result of poor connectivity between the two water bodies. In an upcoming paper we use new data to show that these

apparent gradients are better explained as having resulted from sample selection and poor preservation, which calls for reevaluation of oceanic circulation models built upon previous interpretations. The same data set, taken from two sections in Missouri, also shows two geologic formations units previously thought to be successive are actually time-equivalent northern and southern facies. This revises the erosional history of eastern Missouri that has stood for decades. These methods have also been used on subsurface samples (i.e. cores and cuttings) to show that the Utica Shale is time-transgressive across New York State, thereby revealing how the lithology (and therefore depositional environment that produced that lithology) migrated across the state over 0.5-1.5 Myrs.

Stratigraphy in the Dark

In the past year the Late Ordovician carbon isotope chemostratigraphy project has been expanded to include subsurface studies of Kentucky, Ohio, Pennsylvania, and West Virginia. This is part of the 5-state Utica Shale Research Consortium that includes research teams from the state geologic surveys and Washington University. The work hopes to address longstanding questions and controversies over how to correlate through vastly different depositional environments with the goal of arriving at a cohesive regional stratigraphic network.

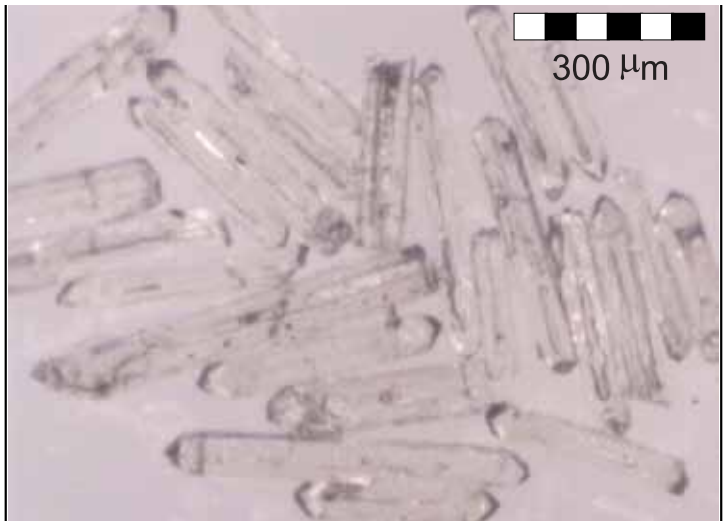

Figure 3. Reflected light photomicrograph of euhedral zircons isolated from the Deicke K-bentonite collected near St. Louis.

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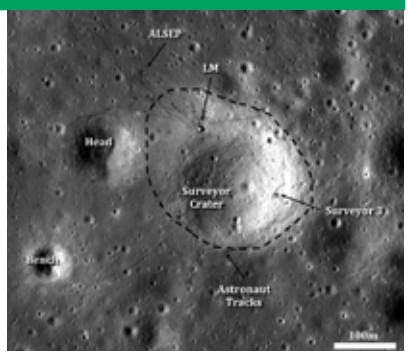
age Surveyor BZ. We have found a rough correspondence between the size of the blast zones and the descent thrust characteristics, which scale approximately with spacecraft mass.



LROC NAC image of the Apollo 12 landing site, with the blast zone outlined and important features labeled.

Phase-ratio images and reflectance profiles show that the HR-BZs are less backscattering than undisturbed regolith, and 2-16% more reflective at ~30° phase. The LR-BZs are most evident at the Apollo sites and are 2-14% less reflective than the background at ~30° phase. The LR-BZs at the Surveyor and Luna sites are less evident and are likely confined to the area immediately below the landers.

Investigating the Causes

Possible reasons for the reflectance differences include: 1) change in macroscopic roughness (cm to m scale), 2) redistribution of fine particles, 3) removal of a more mature surface layer and exposure of less mature soil beneath, 4) microscopic (nm to µm scale) modification of fine-scale structure (e.g., "fairy castle" structure), 5) compaction of the regolith within the more reflective area, 6) contamination from fuel, or 7) a combination of these effects.

We infer that smoothing of the surface and destruction of the fairy-castle structure caused the changes in HR-BZ reflectance. LR-BZs are created by pitting and clumping of the soil under the descent engines, as well as by astronaut bioturbation at the Apollo sites. These processes rough up the soil and create more shadows, causing the LR-BZs to have lower reflectance than the HR-BZs and undisturbed areas.

Modeling of particle velocities and trajectories indicate that it is unlikely that fine particles resettled at distances on the scale of the BZ diameters, therefore we rule out this hypothesis for explaining the reflectivity increase. Exposure of less mature soil is also not likely since the rocket exhaust did not excavate to depths that would be needed to expose large changes in maturity, according to Apollo core data. Smoothing of the surface and destruction of the fairy-castle structure of the regolith are both possible and more likely to have caused the increased reflectance. Ongoing efforts are aimed at modeling reflectance data to constrain the cause of differences in reflectance in BZs versus the unaltered surface. We are using Hapke functions to infer how changes in particle size, porosity, and surface roughness may have been affected by rocket exhaust and how these effects vary as a function of distance from the lander and height above surface.

Zinner elected to AAAS Fellow

Research professor of physics and of earth and planetary sciences, Ernst Zinner, was elected to the Section on Astronomy in the American Association for the Advancement of Science (AAAS) in February, 2012. Dr. Zinner was elected for his "pioneering cosmochemical work in discovering and characterizing presolar grains, particles formed in the outflows of evolved stars and found inside primitive meteorites.

Moynier awarded the Houtermans Award

In June, 2012, Frederic Moynier received the Houtermans Award at the 22nd Goldschmidt Conference in Montreal. The Houtermans award (named in honor of Friedrich Georg Houtermans, a Dutch-Austrian-German physicist) is given annually by the European Association of Geochemistry (EAG) for exceptional contributions to the field of geochemistry by a young scientist. Moynier uses isotopic geochemistry tools such as short-lived radioactive nuclides and heavy stable isotopes to understand the chronology of the early solar system, the early differentiation of the Earth, and the origin of the volatile elements in terrestrial planets.

Skemer elected Vice-Chair

In October Phil Skemer was elected vice-Chair of the Mineral and Rock Physics focus group of the American Geophysical Union (AGU). He will serve a two year term as vice-Chair (2013-'14) followed by two years as Chair (2015-'16). Phil will also sit on the AGU Council, which is the governing board that guides AGU's scientific agenda.

Geochemists host Geobiology Symposium

Department geochemists David Fike and Alex Bradley hosted The Midwest Geobiology Symposium on September 22, 2012 at the department of Earth and Planetary Sciences. About 60 Midwestern faculty, postdocs and undergraduates convened in Whitaker Hall to hear presentations on the coevolution of life, the environment through earth history and new analytical approaches to research. The day culminated in a poster session in the atrium and dinner in Holmes Lounge. The symposium was sponsored by The Agouron Institute, the McDonnell Center for the Space Sciences and the Missouri Space Grant Consortium.

Two Students win Presentation Awards

Graduate students Erica Emry and Amanda Lough both won the Outstanding Student Presentation Award at the 2012 annual meeting of the Seismological Society of America in San Diego. Amanda received the award for her poster, "Detection of Tectonic, Volcanic, and Cyrospheric Seismic Sources in Antarctica using POLENET Seismic Array and GSN Seismic Stations" Erica was given the award for her paper," Is the Mariana Subduction Zone Decoupled?" Amanda and Erica were two of the 12 students chosen out of 117 participants at the meeting.

Department hosts Shandong University delegation

Research scientist Alian Wang and the department hosted a delegation from Shandong University led by President Han in July of 2012. Dr. Han and his team visited with Chancellor Wrighton after two days of meetings to discuss their collaboration with our department. The Chinese scholars were given a tour of our labs and President Han gave a talk about Shadong University's new space science direction in archiving data from Chinese planetary missions.

Skemer receives mentoring award

Phil Skemer received the 2012 Faculty Mentor Award from the Washington University Center for Advanced Learning (Cornerstone) in April 2012. He was nominated by Hannah Rabinowitz ('12). Prof. Skemer gave a speech to students and administrators thanking them for the honor. As part of the award he was given the Sony Junior faculty equipment prize which included equipment he uses in the rock deformation lab.

Fike receives MRI grant

David Fike was awarded an NSF Major Research Instrumentation (MRI) award this past summer. He will be purchasing a secondary ionization mass spectrometer (SIMS)instrument with the 2.1 million dollar award and locating it in Rudolph Hall basement. Many researchers in Earth Science and Physics will use this instrument as well.

Teacher Assistant Awards

Andrew Lloyd won the Carl Tolman TA award for the past academic year (2011-'12). Letters of Recognition were given to Heng (Henry) Chen, Margaret Anne Hinkle, and Kun Wang.

Book Published

Professor Bruce Fegley's textbook "Practical Chemical Thermodynamics for Geoscientists" was published by Elsevier in July, 2012.

Aubreya Adams Postdoctoral Research Associate

Aubreya Adams grew up in Panama City, Florida and Alabama. She attended the University of Florida where she studied Geology and received her bachelor's degree. She completed her doctoral degree in geoscience at the Pennsylvania State University in State College, PA. Before arriving here, Aubreya spent two years working as a geophysicist for Chevron in Covington, LA. Aubreya started working for Doug Wiens in the seismology lab in August, 2012. She especially enjoys following the progress of a dataset when it is captured in the ground and watching it transform into meaningful information about the Earth. St. Louis is the largest city she has inhabited and she loves the diversity of things to see and do.

Rolf Bruijn Postdoctoral Research Associate

Rolf hales from Haarlen, the Netherlands, a medium size city between Amsterdam and the North Sea (also a prime tulip growing district). He obtained his BS and MS from Utrecht University, studying earth sciences and structural geology. In 2012 Rolf received his PhD in from ETH- Zurich in Switzerland, completing a thesis on the experimental compaction of clays and the high temperature deformation of marble. He began working in Phil Skemer's lab in September of this year. Rolf enjoys the diversity of working in the lab and being part of a young dynamic team. He also is finding it attractive to explore the American approach to living. He thinks St. Louis is a great place and enjoys the Arch, the loop and scouting around downtown.

Jennifer Houghton Research Scientist

Jennifer Houghton spent her childhood in upstate New York and then Ohio. She received her bachelor's degree in geology the College of Wooster in Wooster, Ohio and her doctorate in geology from the University of Minnesota in 2003. After that she moved to Memphis, TN and taught at the University of Memphis and Rhodes College. Jennifer started working in David Fike's lab in November of 2011 where she is currently working on microbial sulfur cycling. Jennifer and her husband, Lensyl Urbano, enjoy the many state parks near St. Louis. They and their children, Maren, 9 and Blas, 6 go hiking frequently in the area when they are not building robots at home.

Catherine Rose Postdoctoral Research Fellow

Catherine Rose spent her childhood in rural Herefordshire on the Welsh border in Great Britain. She calls it "God's own country". She graduated with a bachelor's degree in geology from the University of St. Andrews, Scotland. Catherine completed her graduate education at Princeton University and started working for Dr. David Fike in the stable isotope biogeochemistry lab in September 2012. Catherine likes field work to far-flung places, for example camping for three months at a time in the Australian outback while gathering data for her dissertation research. When asked what she likes about St. Louis, she replied, "the Arch and the Cardinals, obviously" which is significant since she grew up without baseball.

Paul Savage Postdoctoral Research Associate

Paul Savage spent his childhood in a small town called Hartlepool on the northeast coast of England, just south of Newcastle. He completed his undergraduate studies in geology at the University of Bristol and his doctoral studies at the University of Oxford, studying stable isotope geochemistry. Paul joined Fred Moynier's lab in January. He is enjoying the freedom to apply stable isotope theory and analysis to many varied topics in the geosciences, from cosmochemistry to terrestrial weathering and metasomatism. He likes spending time in Forest Park, with its running trails and many free attractions.

Christine Simurda Mission Archivist

Christine Simurda is from Lake Forest, California, a medium -size city in Orange County, Ca. She is an alumnus of Washington University, graduating in December 2011 with majors in accounting, archaeology, and earth & planetary sciences. She joined Ray Arvidson's Remote Sensing Lab in March and is a mission archivist for the PDS Spectral Library, working on certain datasets of NASA missions that are archived by the Planetary Data System. Christine enjoys the friendly coworkers in the Geosciences Node of the PDS and thinks the research is fascinating.

Axel Wittmann Research Scientist

Axel Wittmann grew up in Southwestern Germany, and studied for his bachelor's degree in geology/paleontology at Friedrich-Alexander University in Erlangen-Nuernberg. From 2002 to 2006, he conducted his doctoral research at the Museum of Natural History of Humboldt-University in Berlin, which included petrologic work on a drill core through the Chicxulub impact crater 7. Axel stated working for Randy Korotev in January of 2012 and is excited to investigate what certain lunar meteorites will tell us about the Moon's original crust. His favorite things in St. Louis include the public radio station, KWMU, and the Missouri Botanical Gardens. He and his wife, Sonia Boyum, have a one-year old child, Nicholas.

Alumni News (or where they are now)

Bernard Hill, Jr. (AB '51) of River Ridge, LA retired from Chevron Exploration Geology in 1992 and today is a ground water hydrologist.

Tom Bilhorn (AB '52) still works part time and is retained by the state of California on ground and surface water resources in the desert.

Dick Berry (PhD '63) and his wife, JoAnne, recently moved from San Diego, CA to Avon, CT in order to be closer to children and grandchildren. In 2010 he volunteered to teach a graduate level course in Clay Mineralogy at San Diego State University which turned out to be his last professional activity. He did attend the Clay Minerals Society meeting at the Colorado School of Mines in 2012 but more recently has been spending time with 5 grandchildren, grades 2-5. JoAnne and Dick will attend the GSA meeting in Charlotte, NC at which time he will celebrate his 50th year as a GSA fellow.

Max Reams (PhD '68) just celebrated 45 years of teaching geology at Olivet Nazarene University, Bourbonnais, IL. He has been an administrative chair of various academic units and is presently chair of Physical Science. Recently Max has written a book titled "Geology of Illinois State Parks" and hopes to get it published. He and his wife, Carol, send greetings to those of the late '60s era.

Gary Knapp (AB '79) recently visited Russia, Poland, Lithuania and the Ukraine this past year in his capacity as a consultant for Miller and Lents, Ltd. an international oil and gas consulting firm offering services and expertise in the upstream petroleum industry. He also is enjoying time with his two grandsons, ages 4 and 2.

Erol Morey (AB '82) is still employed at GeoEye, a high-resolution commercial satellite imaging firm in the Denver Co area, as a Senior Director in the operations group. Geoeye is currently supplying high-resolution satellite imagery, digital terrain data, digital airport maps and digital maps of obstacles (tower, buildings, high terrain) in support of aircraft flight and ground navigation. He has travelled worldwide in support of this new endeavor. Erol and Barbara have a son in college and a daughter in high school.

Neil Sturchio (PhD '83) co-convened the International Workshop on Tracer Applications of Noble Gas Radionuclides in the Geosciences at Argonne National Laboratory in June, 2012. He also spent time in northern Alaska during August 2012, doing permafrost studies out of the Toolik Lake base camp, from where he returned to Chicago just in time to wrap up his 11-year headship of the Department of Earth and Environmental Sciences at the University of Illinois at Chicago.

Shelley (Bougan) Petroy (PhD '91) has left the world of aerospace behind and is a Senior Scientist at NEON, the National Ecological Observatory Network, where she is responsible for developing data products from airborne/spaceborne observations to support the ecological research community. Husband **Dave (MS '88)** is still at Golden Aluminum Inc. a manufacturer of sheet aluminum. Their daughter, Erika, is at Univ. of So. Cal and their son, Alex, is a junior in high school.

Mike Shepard (PhD '94) is beginning his 17th year at Bloomsburg and is a Professor of Geosciences. His research is on two fronts: observing the M-asteroids using the Arecibo radar facility, and measuring the photometric (light scattering) properties of planetary regolith analogs to test photometric theories like Hapke. He started a Planetary Science option there in the geosciences program and frequently brings his students to LPSC and Arecibo. His oldest daughter, Samantha, is now in her freshman year at Temple.

Meenakshi "Mini" Wadhwa (Phd '94) is currently a professor of geological studies at Arizona State University's School of Earth and Space Exploration. She is also the director of the ASU's Center for Meteorite Studies. She remains a research associate at Chicago's Field Museum serving as their curator of meteorites.

Stephen Schmidt (AB '95) is an Assistant Professor of City and Regional Planning at Cornell University in Ithaca, NY.

Gina Chavez (AB '96) lives in Crystal, MN with husband, Shawn and 2 sons. She has been with Creative Water Solutions since 2003 and is the Vice President of Operations. Her company uses sphagnum moss to condition water and reduce dependence on chemical additives to keep water stable and fresh in residential and commercial pools, spas and fountains. They are currently doing research in the cooling tower industry and whole home water treatment.

Allan Telio (AB '00) is helping to run a start-up, MyEnergy.com. Their site helps people become more energy efficient and reduce their energy spend. He and his wife just had their second child, Eli, who is doing a good job of giving them sleep deprivation.

Brian Ebel (AB '01) is a visiting fellow at the Cooperative Institute for Research in Environmental Sciences (CIRES) located at the University of Colorado Boulder. He is working on wildfire hydrology when he is not otherwise engaged in backpacking, hiking, and fly-fishing. Check out his video on YouTube, made while he was at the USGS, "Education and Outreach: COSEE 2012 Brian Ebel."

Walter Kolczynski, Jr. (AB '02) graduated from Penn State in August with a PhD in Meteorology. He became a post doctoral research assistant in the Department of Meteorology at the Naval Postgraduate School in Monterey, CA. His research focuses on the identification of errors in the numerical weather models and statistical post-processing of ensembles on numerical weather models.

Brian Shiro (AM '02) is in his seventh year as a geophysicist at the NOAA Pacific Tsunami Warning Center in Hawaii. He is also pursuing his interests in aviation and space, having recently earned his private pilot certificate and flew as a research on a series of NASA zero gravity flights. He has resumed his PhD studies at the Univ. of Hawaii Institute of Geophysics and Planetology. Brian and his wife, Holli, have a 5-year old son and 2-year old daughter.

Gillian Galford (AB '04) has just become a Research Assistant Professor at the Univ. of Vermont. She is also a Fellow at the Gund Institute for Ecological Economics. Recently Gillian was awarded a NASA Land-Cover and Land-Use grant to study environmental and socioeconomic impacts of intensified food production of the 21st C African Green Revolution. She is also continuing her research in agroecology in the Amazon.

Vanessa Heil-Chapedelaine (AB '07, DPT '12) graduated from the Washington University Physical Therapy Department this past spring and is employed at the Washington University in St. Louis PT Clinic. She married fellow EPS alum, **Michael Hunter Lanier (AB '07)** in a surprise wedding on graduation day.

Emily Park (AB '08) is living in Cleveland, OH where hubby, Brian Lewis (Wash U '08) is studying medicine. She is working as an industry analyst with the Freedonia Group and writes research reports on the use of various chemicals in the US and International markets with a primary focus on agricultural chemicals.

Nancy Akerman (PhD '09) finished her post doctoral work with Julie Huber in Woods Hole, MA. She has moved to Washington DC and started an AAAS Science & Technology Policy fellowship on September 1. She will spend the next year working in the Stratospheric Protection Division at the Environmental Protection Agency. Her division manages and implements programs that protect the ozone layer. She lives right down the street from NSF, so if anyone is going there, let her know and she will show you around town.

Matthew Ampleman (AB '11) is also living in the Washington DC area and working for the Environmental Protection Agency. He is helping drinking water and wastewater utilities adapt to climate change at EPA headquarters.

Amy Shaw (PhD '12) has recently started a postdoctoral position at York University in Toronto, where she is bracing for her first Canadian winter. Her work at York involves reflectance analysis of meteorites and terrestrial analogs for dark asteroids with a focus on understanding the target of NASA's OSIRIS-REx asteroid sample return mission.

ALUMNI, VISIT US THIS DECEMBER

Fall AGU Meeting
San Francisco
Department and Alumni Reception
Jillian's@Metreon

101 Fourth Street
San Francisco
Tuesday
Dec. 4, 2012
7:00–10:00 PM

Washington University in St. Louis

Department of Earth & Planetary Sciences
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St. Louis, Missouri 63130

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