

Hydrology Program Grows Through EPSCoR Grant
 By Paul Gabrielsen (MS Hydro, '12)

Over the last four years, a quiet meander bend on the East Fork Jemez River has been transformed. Groundwater wells, a weather station, an isotope collector, and other instruments have sprung up among the sedges and grasses to help investigate the complex and dynamic ecosystem below. This site, built by students from the University of New Mexico and from



Paul Gabrielsen (MS Hydro '12) installing a new weather station at the East Fork of the Jemez River.

NMT Hydrology, has been getting a lot of attention. Last year a PBS filmmaking crew visited the meander to document its transformation, and this past summer the University of Texas-Austin used the site for its summer Hydrology field camp. After three field seasons of intensive study, the meander is starting to reveal its secrets.

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The grant behind this transformation, and those at two other sites in the Rio Hondo and El Rito watersheds, is the Track 1 New Mexico EPSCoR grant, now in its fifth year. EPSCoR (Experimental Program to Stimulate Competitive

Research) is a program of the National Science Foundation (NSF). The NSF awards EPSCoR grants to “stimulate sustainable improvements in R&D capacity and competitiveness” in states receiving the grant (www.nsf.gov). Each EPSCoR state crafts its proposal to address pressing local issues. Not surprisingly, the topic of New Mexico’s proposal is one that affects all New Mexicans: climate change effects on New Mexico’s mountain sources of water.

Dr. John Wilson leads NM Tech Hydrology’s involvement with New Mexico EPSCoR. In his opinion, EPSCoR benefits the NMT Hydrology program by “supporting good graduate students to do interesting research.” He has utilized EPSCoR funding to support students at all levels: two post-docs (including recent NMT graduate Marty Frisbee), three PhD students, and four master’s students. Three master’s students in the department have been hired as field technicians, and Wilson has also employed four under-



Undergrad Liz Tysor sampling water in a tributary of the El Rito during the snowmelt season of 2012.

graduates, also as field technicians. This year, new faculty member Dr. Dan Cadol will participate in the project, along with his graduate student Amy Galanter. EPSCoR researchers can also be found in NMT’s Chemistry and Computer Science departments and at universities

throughout the state. According to New Mexico EPSCoR (www.nmepscor.org), around 180 people have participated in the project over the past year.

Wilson and his students, in partnership with researchers at the University of New Mexico, began instrumenting the East Fork Jemez meander site in the summer of 2010. The site explores the hydrology and biochemistry of the hyporheic zone, a dynamic region of shallow streamwater-groundwater exchange. A site in the

Rio Hondo watershed, used to research deep groundwater flowpaths through mountain blocks, was developed through the cooperation of the US Forest Service, Taos Ski Valley and local property owners. The newest site to be instrumented is in the El Rito watershed. All three sites are in the mountains of northern New Mexico.



Jevon Harding (MS Hydro '12) using a distributed temperature sensing system at a tributary of the East Fork of the Jemez River.

All the instrumentation installed at these sites was purchased by EPSCoR. A significant portion of the EPSCoR budget was dedicated to purchasing new instrumentation, and the purchases by Wilson's group have significantly enhanced the department's research capability. Early purchases included a Picarro stable isotope analyzer, which Wilson says has already become "very valuable" to Earth and Environmental Science department students and faculty. A high-resolution distributed temperature sensing (DTS) unit, purchased by Wilson in 2009, has also been used in several projects, such as the development of a new geothermal well in Socorro by Dr. Mark Person's group. More recently, Wilson has purchased a versatile ground-penetrating radar system and a system to measure subsurface resistivity. NMT's Chemistry EPSCoR group, working closely with Hydrology, has utilized EPSCoR funds to outfit a cargo trailer as a state-of-the-art mobile water quality laboratory, currently deployed at the East Fork Jemez meander site.

Developing research capability is central to NSF EPSCoR's mission. One aim of EPSCoR grants is to position researchers to launch innovative spin-off projects, which can become productive lines of research in their own right. Within Wilson's group, several



MS Student Gus Tolley installing an OTT Pluvio 2 in the Taos Ski Valley.

such spin-offs have already taken flight. Prestigious NSF Graduate Research and EPA Star Fellowships have been awarded to his students, with the latter being used by PhD student Lani Tsinajinnie to study the hydrology of the Chuska Mountains in the Navajo Nation. PhD student Jesus Gomez has secured multiple grants and awards (most recently the Horton research grant from the American Geophysical Union) to build on his EPSCoR work on groundwater age distributions.

NMT's involvement with EPSCoR does not end with the end of the current five-year grant. The next proposal, investigating "the nexus of energy, water, and environment," is already in development with Dr. Mark Person slated for involvement through his geothermal energy work.

Underlying the student funding, the proposal writing, and the instrument purchasing is the drive to know more. According to Wilson, EPSCoR has allowed NMT to further "explore new research issues of importance to New Mexico." EPSCoR has brought new people into the Hydro program and given them the funding and physical infrastructure to take off in new directions. The project has strengthened NMT Hydrology and strengthened earth science in NM.

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Note from the Chair



Gary Axen

Department Chairman
Associate Professor
of Geology

Dear E&ES Family,

It's hard to believe that another year has flown by. We hope that it was a good one for you and yours! Overall, 2011-2012 was a good year for E&ES, in spite of the slow economic recovery.

Our happiest news is having Dr. Dan Cadol join the Hydrology faculty in July 2012—Dan is profiled under “Faculty Highlights” in this issue. Also, Dr. Musa Hussein, Visiting Assistant Professor of Geophysics, joins us for the current school year. Musa will teach classes such as Reflection Seismology and Near-Surface Geophysics. Both Dan and Musa are accompanied by their wives and children, and we say heartily, “Welcome to Socorro!” The E&ES office staff now includes Beth Currie, helping out our tireless Manager Pat Valentine. Dr. Penny Boston became Associate Chair and Chair-in-Waiting, helping to keep the E&ES wheels turning smoothly. Sadly, Dr. Jeff Johnson left NMT for Idaho—he will continue his volcano and infrasound research at Boise State.

We are beginning a search for a tenure-track Geophysics professor, so watch for the ads coming soon! I'll be back to Brown Hall ASAP to advocate for an additional hire, probably in Geochemistry. Replacement of faculty members lost during the recession is happening, although we would (of course!) prefer a faster pace.

There have been two important changes to our building, MSEC (Mineral Science and Engineering Complex). First, this fall we opened the E&ES Graduate Learning Center in the former classroom across the hall from the Department Office—see “Title V Brings New Graduate Learning Center to E&ES” in this issue. Second, MSEC was rewired for a much faster computer network (gigabits per second), keeping E&ES at the cutting edge of computing and data management.

That's it for the “executive summary”; please enjoy this issue of *TECHtonics*, and keep us up to date on your situation!

E&ES Department News

Visit the E&ES Website and Facebook Page for Additional News!

Faculty Spotlight

New Hydrology Professor Dan Cadol

Greetings! I am the new Surface Water Hydrologist in the department, filling a position that was left open for several years due to the hiring freeze. It looks like the thaw will continue, and I hope that my hiring will be the leading edge of the replenishment of the E&ES faculty! I'm delighted to be joining such an accomplished (may I even say eminent?) group of hydrologists and even more encouraged by the wonderful level of collegiality and collaboration throughout the department.

I received my MS and PhD from Colorado State University but have spent the last several years as Visiting Professor at the College of William and Mary in Virginia and post-doctoring at the University of Maryland Center for Environmental Science. It was great to experience the culture and history of the east, but I am a westerner at heart, having grown up in Wyoming, and I'm very happy to be back in the wide-open spaces.

My research focuses on interactions and feedbacks between vegetation and the hydrologic system, projects that can be classified as ecohydrology or ecohydraulics, depending on the emphasis. I typically employ some combination of fieldwork, remote sensing, and either physical or numerical modeling in these efforts. In order to expand the physical modeling possibilities at Tech, I am using part of my startup package, along with a major funding assist from John Wilson and the EPSCoR program, to build a recirculating laboratory flume to be housed near IRIS/PASSCAL. At 10 meters long and 1.5 meters wide, and with flows up to 1200 gpm, we will be able to address an array of research questions, ranging from high-energy turbulent flow analyses to modeling of hyporheic exchange.



New Hydrology Professor Dan Cadol working in the field.

An important sub-field of ecohydrology in the Southwest addresses the geomorphic and hydrologic impacts of invasive riparian vegetation. I have worked on evaluating the impact of tamarisk (aka salt cedar) and Russian olive in the streams of Canyon de Chelly, AZ, and I look forward to continuing these studies with a series of new field sites along the Rio Grande and in northern New Mexico. With the recent introduction of tamarisk leaf beetle to the Southwest and its explosive spread along the San Juan River and other Colorado tributaries, I think the time is ripe to set up study plots so that pre-beetle baseline data exists. I also plan to collaborate with Dr. Jan Hendrickx to estimate evapotranspiration from satellite images throughout the impacted area as the beetle spreads.

Another area of active research is the transport and ecological effect of in-stream large woody debris (LWD). Wood in rivers has been shown to maintain habitat diversity and support greater fish populations in Pacific Northwest streams, and I have ongoing research in Costa Rica attempting to show the same there. But very little is known about LWD in the arid Southwest. The frequent fire regime is likely to be a key control on the introduction of new wood, and I currently have a student (first year Master's student Amy Galanter) formulating a thesis proposal that will analyze the transport and ultimate fate of fire debris in New Mexico, taking advantage of the ample field sites provided by the series of major fires over the past several years.

In this effort to track fire effects, we are relying on remote sensing to select field sites. We will employ the new stereophotographic dataset that has been obtained by the Bureau of Geology with 3D viewing and analysis capabilities on a new system to be installed in the department computer lab (see "Tech Takes Advantage of New Digital Terrain Data for New Mexico"). The system will also enable 3D mapping of debris fan volume as we track the mobilization and re-deposition of fire debris.

I am so happy to be at Tech, and my whole family has been warmly welcomed to Socorro. My wife, Beth, an avid runner, plugged right into the vibrant running scene; my daughter, Abby, age 2, has met a horde of other children in our neighborhood and delightedly points out the New Mexico flag wherever she sees one. I look forward to getting to know the alumni community in the

years ahead and to carrying on the tradition of world-class research in the E&ES department.

Cheers!

Dan

Title V Brings New Graduate Learning Center to E&ES

By Beth Currie



Hydro Theory & Field Methods students using the new Graduate Learning Center for lab.

If you stop by the E&ES department these days, you just might find graduate students gathered together in collaboration over the newly-garnered tables of the Title V Graduate Learning Center. New Mexico Tech's Title V grant has given funds (\$20,700 for E&ES) to each department on campus for one of these

Learning Centers, furnished with useful items, such as high-speed computers, tables, chairs, a white-board wall, projector, and even couches. So far, students have used the new Learning Center for practicing defenses, TA office hours, homework collaboration, club meetings, and class. With the creativity and ingenuity of these students, who knows what they will use it for next? According to Christy Neill, Director of Title V at NMT, "The grant initiative of increasing NMT's technology infrastructure is designed to give students the opportunity to have the best study and classroom technologies." When the grant cycle ends in 2014, everything in the room will transfer in ownership to E&ES.

Tech Takes Advantage of New Digital Terrain Data

By Gary Axen

E&ES is building a workstation to take advantage of exciting new digital data covering the entire State! Recently purchased by the NM Bureau of Geology, the dataset consists of >8 terabytes of 4-band orthorectified stereophoto coverage with ~1 m image resolution. The photos can be viewed in 3D using gaming technology (polarizing glasses and a monitor) driven by an add-on to ARC-

GIS. Better still, the coverage can be used photogrammetrically to obtain point elevations to <1.5 m accuracy! We anticipate that this dataset will be very valuable to many students working on projects in New Mexico and for instruction purposes as well.

MS students Mark Green and Brad Sion are already using the two Bureau workstations, but time on them is overbooked. Mark is mapping mesoscale folds and low-angle normal faults in the Sierra Larga east of Socorro, and Brad is investigating possible long-term (10s of ka) deformation of landforms by the Socorro magma body (the world's largest known magma body, discovered by Al Sanford and students in the 1970s). Dan Cadol, E&ES's new Hydrologist, will purchase the hardware, and the software will be purchased using grant and Alumni funds—your dollars at work helping students!

Field Camp Changes across the Country and at Tech

By Dave Johnson

Geology departments across the nation have been closing field camps, while keeping the requirement, expecting students to attend one of the remaining camps. While abandoning the NMT



Summer Field Camp 2012 students posing for a group shot at the Taos Mountain Lodging Center.

camp was considered, the department remained committed to maintaining a quality experience for our graduates and for some of those who must satisfy a field requirement at another university.

In 2004, universities reported 1,284 students

attending their camps. In 2011, universities reported 2,233 students. What's causing the trend? Increasing numbers of geology majors in departments across the country. We've been impacted. In the ten years prior to 2012, NMT averaged just over 9 students each summer. 2012 was different, with a whopping 26 students.

2013 will mark another milestone of sorts—my departure after more than 20 years as field camp director and the installation of Bruce Harrison as the new director. Bruce, I hope you have as much fun as I did.

A (Sometimes Sarcastic) Memory of the Faculty Roast

By Zachary Vance

You may recall that at the end of each year, graduate students in E&ES host a banquet, most delicately named “The Faculty Roast.” This roast involves no large chunks of meat slowly roasting on a spit over a fire—although, some of the E&ES students definitely feel the heat after “roasting” their professors with kind(usually)-hearted, jovial (hilarious) commentary (to put it nicely). This year’s roast was organized by MS students Zeke Salaz and Nels Iverson, and it turned out to be quite a hit (slap in the face!).

“Prospective” students came up on stage at the Capital Bar one at a time and asked pointed questions about what to expect in life as a graduate student at NMT to a panel of current professors (played—quite well if I do say so myself—by current graduate students). Scripts were all written by students (don’t we know the faults of our superiors best?!), and a few of the “actors” almost lost their lives during the show thanks to some killer glares by their advisors. In all seriousness, it was a great celebration of the fantastic community atmosphere in E&ES that we have all had the privilege of knowing.



Dept. Chair/Assoc. Prof. of Geology Gary Axen with “Gary Axen” (aka MS Student John Nybo) at the 2012 Faculty Roast.

Lastly, thank you to all the volunteers for making the event possible; the Capitol Bar for use of the space and \$1 Pabst Blue Ribbon; Dr. Heizler’s dollar tab, on which we all had a few; and last, but definitely not least, the alumni who have generously donated funds that help support such lively events!

Sabbaticals Lead to Ground-Breaking Earthquake Research

By Glenn Spinelli

Last year, geophysics professors Sue Bilek and Glenn Spinelli spent their sabbaticals at the Geological Survey of Canada (GSC) on Vancouver Island, BC. While at the GSC, both Bilek (a subduction zone seismicity expert) and Spinelli (a marine geologist/hydrogeologist) re-



Sue Bilek, Glenn Spinelli, and their son Reed taking a walk on Clayoquot Island.

searched the Cascadia subduction zone offshore British Columbia and the U.S. Pacific Northwest.

The tectonic setting and seismic hazard in the region is similar to that of northern Japan (site of a magnitude 9 earthquake in March 2011 that generated the tsunami that compromised the Fukushima Daiichi nuclear power plant). Bilek explored possible connections between recently-discovered “slow” fault slip in Cascadia and magnitude 9+ earthquakes. In particular, she examined what the small magnitude earthquakes will be able to

tell us about fault zone conditions that might lead to a massive earthquake.

Spinelli’s research culminated in a publication showing that the potential rupture area for a large subduction zone earthquake in Cascadia extends more than 30 miles closer to the coastline (and populated areas around Portland, Seattle, and Vancouver) than previously estimated. This article, “A wider seismogenic zone at Cascadia due to fluid circulation in subducting ocean crust,” published in the October 2012 issue of *Geology* was the subject of articles in the Postmedia Network’s *National Post* and the regional *Victoria Times Colonist* newspapers.

New E&ES Classes!

Spaceship Earth LLC with Dr. Penny Boston

Dr. Penny Boston is leading a new Living/Learning Community (LLC) at New Mexico Tech – Spaceship Earth. This LLC is part of a new and ambitious initiative to improve freshman success and retention funded by the USDE Title V SES grant. The LLC concept involves students in research as soon as they arrive at Tech – students take a series of courses linked around the research theme. The Spaceship Earth LLC provides students with an integrated look at the Earth as a complex system and examines the critical interfaces between the atmosphere, oceans, global biological processes, and the land surface and subsurface.

A major component of the Spaceship Earth LLC is the research course, which is focused on water, geothermal heat, and life's effects on geology. LLC members are developing and conducting research in these areas, working on atmospheric and biological research in a greenhouse “biosphere” as well as field projects and laboratory follow-up dealing with surface and subsurface hydrology, geology and biology. Other faculty participants from EES include Dr. Bruce Harrison and Dr. Jan Hendrickx.

Thesis and Proposal Writing Seminar with Drea Killingsworth

New through Title V, departmental STEM fellows are designing writing workshops to improve graduate-level scientific writing skills. E&ES is offering a pilot thesis and proposal-writing seminar this semester to all graduate students in hopes of providing a supportive, low-pressure environment for the production of proposals, thesis materials, and manuscripts for publication.

Students have access to editing and formatting materials, LaTeX templates, and writing center tutors. The goal of this pilot seminar is to help students feel more comfortable writing at a graduate level early on and to help them make significant progress on individual projects. This progress will allow students to prepare for the Writing and Oral Presentation Center's January Thesis Boot Camp and other workshops offered throughout the year.

Reservoir/Caprock Field Course with Mozley and Campbell



Reservoir/Caprock Field Course students surround a spectacular iron-oxide concretion that records subvertical fluid flow in the Navajo Sandstone.

Instruction took place entirely in the field, taking advantage of many spectacular outcrops near Moab and Green River, Utah.

A portable permeameter was used to provide real-time data for the students on lithologic and structural controls on permeability. In addition, rocks at many of the field sites have large and small-scale patterns of mineralization that could be used to infer past focused fluid flow in the rock, which allowed students to directly relate their observations to flow characteristics. E&ES will offer this course again on a yearly or biyearly basis.

Student Spotlights

PhD in Geophysics Rob Anthony

After receiving my B.A. in Geology and Physics from Ohio Wesleyan University in 2010, I immediately dragged my wife south to Socorro, where I began working on my PhD in geophysics under Dr. Richard Aster. NMT has offered me some incredible opportunities as part of my research, which focuses on characterizing seismic background noise levels across Antarctica as well as utilizing

Professors Peter Mozley and Andrew Campbell, together with E&ES alumnus Jason Heath (now at Sandia National Laboratories), ran a three-day field course on reservoir and caprock analysis for undergraduates and graduate students the week before fall classes began.

seismic noise at long-running stations across the globe to look for changes in the wave-state of the world's oceans. Global climate change may cause changes in the location and wave energy of oceanic storms, and these changes have potential to drastically impact coastal environments, especially under rising levels.

In December of 2010, Tech granted me the opportunity to travel to Antarctica to help with the deployment and servicing of seismic stations across the interior of the continent. I was based out of Byrd Camp, a 30-person field camp in West Antarctica, where travel was by small planes to access the instrumentation sites.



PhD Student Rob Anthony getting ready to board a U.S. Airforce plane at the end of his West Antarctica trip.

Living in a tent in the middle of Antarctica for a month with limited communication to the outside world was an unforgettable

experience. Furthermore, visiting the stations allowed me to gain hands-on experience with the instrumentation and local geology, which has subsequently aided in my understanding of differences in noise levels between stations.

The interior of Antarctica is thought to be the quietest place on the planet, seismically, and assessing the background noise for the continent should aid in the location and instrumentation of future seismic deployments. Also, one of the major sources of seismic noise, oceanic waves, differs drastically in Antarctica compared to elsewhere on Earth due to the changing extent of the sea ice surrounding the continent. Thus, seismically monitoring ocean wave energy reaching the interior of the continent can serve as a “state-

of-health” analysis for sea ice extent and stability in our warming climate regime.

This past summer, I was honored to participate in the Cascadia Open-Access Seismic Transects (COAST) seismic cruise off of the Washington coast. The two-week cruise collected 2D reflection data across the Cascadia subduction zone with the objectives of improving the location of the plate boundary and constraining the extent of the seismogenic zone. This information is crucial for accurately modeling strong motions and assessing the hazards associated with Cascadia’s next megathrust earthquake. Although not directly related to my research at Tech, the cruise was an exciting way to learn reflection seismology techniques in a real-life setting.

MS in Hydrology Yipeng Zhang

My master’s study at New Mexico Tech was a fulfilling experience. During my first year of research, I helped my advisor, Dr. Mark Person, develop a sharp interface analytical-numerical model for



Yipeng Zhang (MS Hydro '12) posing for the camera at Jing Yue Tan Park (Clean Moon Lake Park) in Changchun, China.

predicting pore pressure increase in the Illinois Basin, due to basin-wide CO₂ injection. The model we developed is less computationally expensive than multiphysics models, such as the TOUGH2, and the simulated results qualitatively matched the results generated by TOUGH2. I presented the research results at the annual meeting of AGU in 2011 and was awarded the Outstanding Student Paper Award.

During my second year, as induced seismicity issues had drawn a lot of attention because of the large number of unconventional oil and gas practices, we developed a simplified 2D analytical-numerical hybrid model to investigate the possibility of induced

earthquakes in the Illinois Basin due to basin-wide CO₂ sequestration by increasing the pore pressures in the subsurface and reactivating critically stressed faults. Some of the modeling results were presented by Dr. Mark Person at the CCS meeting at Pittsburgh, hosted by DOE in August.

Now, I have moved to Penn State University to pursue my PhD, working on pore pressure changes due to seismicity wave propagation in the subduction zone of the Nankai Trough in Japan. The goal of the project is to shed light upon the mechanics of the Fukushima Earthquake of 2011. I hope to have the chance to go on an ocean drilling cruise to take borehole samples from the Pacific Ocean, realizing one of my childhood dreams.

I miss my lovely friends, my advisor, brilliant hydro faculty, EES, New Mexico Tech, and the friendly and outgoing people in the small town of Socorro. I wish I could have the chance to go back to visit and explore more about New Mexico! I am glad I started my journey in the US at New Mexico Tech. The memories will be long-lasting, deep in my heart, and they give me power whenever I feel lonely or helpless.

Faculty and Student Awards/Accomplishments

Visit the E&ES Website and Facebook Page for Additional Award Announcements!

Kyle Wins 2012 Distinguished Researcher Award



Professor Phil Kyle receiving the 2012 NMT Distinguished Researcher Award.

Geochemistry Professor Phil Kyle received the 2012 NMT Distinguished Researcher Award. Dr. Van Romero, vice president for Research and Economic Development, presented the award to Kyle at the May Commencement Ceremony. Kyle is best known for his 39 years of research in

Antarctica at the Mount Erebus Volcano Observatory. Visit www.nmt.edu/nmt-news/347-2012/4442-dr-philip-kyle-

distinguished-researcher-2012 to read Thomas Guengerich's news article about Kyle winning the award.

Aster and Colleagues Publish Second Edition of *Parameter Estimation and Inverse Problems*

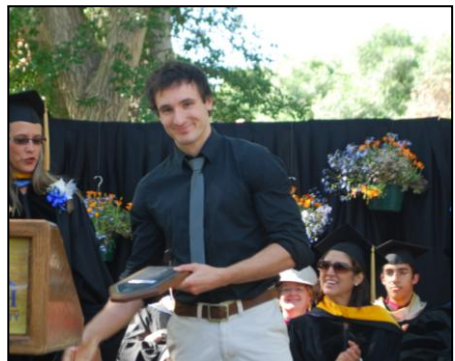
Professor Rick Aster, along with co-authors Professors Brian Borchers (NMT Mathematics) and Clifford Thurber (University of Wisconsin Department of Geoscience) recently published the second edition of their widely-used book, *Parameter Estimation and Inverse Problems* (Elsevier). The text is used broadly around the world by Earth and other scientists, engineers, mathematicians, and other quantitative researchers and students (a recent query to Google Scholar indicated more than 650 citations for the book since the publication of the first edition in 2005). The book was written to address the needs of both researchers seeking a comprehensive reference on fundamental methods of determining parameters and models that satisfy mathematical descriptions in geology, physics, and other disciplines, and as a textbook for advanced undergraduates and graduate students in many fields.

Nature Article Cite's Condie's Archean-Proterozoic Boundary Work

Visit www.nature.com/nature/journal/v485/n7399/full/485452a.html to read the "News & Views Commentary" in the May 24 issue of *Nature*, where Professor Kent Condie's work is heavily-cited.

Chaput Wins Two Significant Awards for Recent Work

Geophysics PhD student Julien Chaput was one of the Best Student Paper awardees at the 2012 San Diego Seismological Society of America Meeting for his recent work on crustal structure in Antarctica with the POLENET project. He also received the 2012 New Mexico Tech Langmuir Award for his recent paper on volcanic imaging using coda wave interferometry (Chaput, J. A.; Zandomenoghi, D.; Aster, R. C.;



PhD Student Julien Chaput accepting the 2012 NMT Langmuir Award.

Knox, H.; Kyle, P. R. Imaging of Erebus volcano using body wave seismic interferometry of Strombolian eruption coda Geophys. Res. Lett., Vol. 39, No. 7, L07304 10.1029/2012GL050956).

Curtis Gets NM NASA Space Grant Again

PhD Student Aaron Curtis has earned the NM NASA Space Grant for the second time during his career at Tech. Through this grant, he will receive \$10,000 towards his Mount Erebus research. Of particular interest to NASA is his work in astrobiology with ice caves and developing quad copters.

Gomez Receives AGU Horton Research Grant

Hydrology PhD student Jesus Gomez recently received the AGU Horton Research Grant for 2012. His proposed research, "Using realistic synthetic watersheds to understand deep groundwater contributions and their role in the watershed's response," explores the role that geology, topography, and river network structure has in the hydrological and geochemical response of natural watersheds.

EPA Awards Tsinnajinnie STAR Fellowship for Work with the Navajo Nation

Hydrology PhD student Lani Tsinnajinnie has been awarded a new 3-year EPA STAR Fellowship to study the mountain sources of water for the Navajo Nation. Snow-dominated mountainous watersheds play an essential role in the water resources of the Southwest. Lani's project involves the Chuska Mountains, located in the central part of the Navajo Nation. Her hydrologic study will feature a wide range of field observations and the development of a hydrologic model that will be used to increase the understanding of mountain hydrology. The study will help Navajo communities surrounding the Chuska Mountains plan for the potential impacts of climate change and other environmental impacts. Lani, who works with John Wilson, is the second of John's current PhD students to receive a STAR Fellowship.

Zhang Earns AGU Outstanding Student Paper Award

Hydrology MS Student (graduated summer '12) Yipeng Zhang received an Outstanding Student Paper Award for his presentation at the 2011 Fall Meeting of the American Geophysical Union. His presentation was called, "Multi-Layer, Sharp-Interface Models of

Pore Pressure Buildup within the Illinois Basin due to Basin-Wide CO₂ Injection." See his "Student Spotlight" in this issue of *TECHtonics*.

End-of-the-Year Outstanding Student Awards

At the end of the 2012 spring semester, outstanding undergraduate and graduate students were recognized with awards from the New Mexico Geological Society (NMGS), the Carlsbad Gem and Mineral Club (CGMC), the Albuquerque Gem and Mineral Club (AGMC), and the

Earth & Environmental Science Department (with the help of generous contributions from alumni and friends of the department). Highlights included the NMGS Senior Scholarship to Neil Currie, the CGMC Road Runner award to Jeremy McComas, and the AGMC award to Jennifer

VanHouter. Jessie Hubbling, Drea Killingsworth, and David Parmelee were recognized by the department for their outstanding efforts as Teaching Assistants



PhD Geology '12 Graduates Amy Luther and Laura Rosales-Lagarde and MS student Mussie Tewelde enjoying the End-of-the-Year Awards BBQ.

Spring/Summer 2012 E&ES Graduates

Bachelor's Degrees

Paige Czoski	B.S. in Earth Science with Volcanology Option
Raphael Perea	B.S. with Geology Option
Peter Revelle	B.S. in Environmental Science with Hydrology Option
Molly Whitt	B.S. in Environmental Science with Biology Option

Master's Degrees

Hydrology

Paul Gabrielsen	"Hyporheic Zone Process Controls on Dissolved Organic Carbon Quality"
Casey Gierke	"Sourcing Tree Water in the Sacramento Mountains, New Mexico: A Stable Isotope Study"
Jevon Harding	"Building the Foundation for a Hydrology Model of the Rio Hondo Watershed, NM"
Michael Petersen	"Understanding the Heterogeneity in the Banderier Tuff: Correlations between Geophysical and Hydrologic Data"
Yipeng Zhang	"Is Hazardous Waste Injection Into the Basal Aquifer a Good Idea?"

Geology

Maureen Moore-Roth	"Supergene Enrichment Profile at Copper Basin Battle Mountain, Nevada"
Yong-Jae Oh	"Clastic Injectites of the Dry Cimarron Valley of Union County, New Mexico: Implications for Caprock Integrity"

Geochemistry

Clark Short	"Evaluation of the Multiple Domain Diffusion Model of Argon Thermochronology through Characterization and Dating of Single K-Feldspar Fragments"
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Doctor of Philosophy Degrees

PhD in Hydrology

Hugo Gutierrez-Jurado	"A Holistic Explanation of the Ecohydrologic and Geomorphic Properties for a Semiarid Basin with Contrasting Ecosystems"
Shasta Marrero	"Calibration of Chlorine-36 Production Rates Using Multiple Site"

PhD in Geophysics

Maya El Hariri	“Investigation Earthquake Triggering Mechanisms and Rupture Variability in Subduction Zones”
Hunter Knox	“Eruptive Characteristics and Glacial Earthquake Investigation on Erebus Volcano, Antarctica”
Omar Marcillo	“Extracting Atmospheric Conditions of the Lower Atmosphere by Studying Volcanic Infrasound Recorded at Local Distances”

PhD in Geology

Amy Luther	“Deformation and Paleostress Analysis of Fault Rocks: Fault Zone Processes from the Elastic-Plastic Transition through the Brittle Crust”
Laura Rosales-Lagarde	“Investigation of Karst Brackish-Sulfidic Springs and their Role in the Hydrogeology, Subsurface Water-Rock Interactions, and Spelogenesis at Northern Sierra de Chiapas, Mexico”
Amanda Rowe	“Ore Genesis and Fluid Evolution of the Goat Hill Orebody, Questa Climax-type Prophyry-Mo System, NM and It’s Comparison to Climax-type Deposits of the Colorado Mineral Belt”
Matthew Zimmerer	“The Volcanic-Plutonic Relationship at Three Contrasting Rio-Grande-Rift-Faulted Calderas”

E&ES Alumni News

E&ES Alumni Fund Donors

Thank you to the following people, who have already generously donated to the E&ES Alumni Fund in 2012. Donors at press time include:

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E&ES Alumni Relations and Fundraising

By Andrew R. Campbell, Professor of Geology



During this past year, we have increased the Clay Smith Endowment and the Rob Bowman Fund with your generous donations. However, the Bowman fund is still short of the \$15,000 needed for an endowment, so we continue to solicit your support. Over the past year, alumni endowment funds have supported several graduate students, a new departmental facility for topographic analysis (see “Tech Takes Advantage of New Digital Terrain Data for New Mexico”), and several department social activities (like the awards

dinner and faculty roast). One of the great things about this department is our ability to laugh at ourselves and have a good time while doing it.

The department faculty supports the continuation of our strength in ore deposit teaching and research, and Dave Norman’s position has remained unfilled, so the next position we request from the administration will be in that area. With the urging of an alumnus (thanks Tom), we are embarking on a fundraising effort to support ore deposit research. We have set a lofty, but hopefully attainable, goal of raising \$1,000,000. I will lead this effort, along with Bill Chavez, who is an alumnus as well as an ore deposits colleague. We know that to reach this goal we will need corporate as well as alumni donations. If you work in the field of economic geology and can work with us to identify the appropriate people in your

company to be approached for corporate donations, please let either Bill or I know.

As Dr. Gary Axen mentioned in his “Note from the Chair,” the faculty hiring freeze is slowly thawing after five years, starting with one new hire in our department this fall. As the economy turns around, the department will strive to rebuild our faculty numbers, but we will be competing with programs across campus. Having strong and involved department alumni support should help us strengthen our case with the administration. To that end, we are establishing an Alumni Advisory Committee. We are looking for three alumni who would like to serve with our faculty committee (Axen, Aster, Wilson, and Campbell) to help shape the direction of alumni affairs and be involved in fundraising. If you are interested, please contact me (campbell@nmt.edu).

Best wishes for a great 2013!

Andy

You're invited!

What: *GSA Alumni Reception, Rio Grande Universities*

When: *Mon., Nov. 5, 7-10 p.m.*

Where: *Hilton Charlotte Center City Hotel, Mecklenburg Hall*

Alumni Spotlight

Nelia Dunbar (PhD Geochemistry '99)

I first started working on volcanic ash, or tephra, as an undergraduate student at Mount Holyoke College. My undergraduate advisor, Dr. P. Thompson Davis, encouraged me to do an undergraduate thesis project, but I was more interested in hard rock geology, particularly volcanology, than his specialty, which was glacial geology. After some discussion, he realized that some sediment cores he had taken from two lakes in the Pacific Northwest contained a sequence of tephra from pre-1980 eruptions of Mount St. Helens. He turned these tephra over to me to analyze, and I studied their mineralogy and geochemistry, which allowed me to write an undergraduate thesis and to present a poster at GSA.

Right after graduating from college, I headed to Socorro to begin graduate school at New Mexico Tech in the fall of 1983. I had spent the previous summer working at Chevron Oil Field Research Company in sprawling Los Angeles, so even though I was a bit shocked by the smallness of Socorro, it was such a relief

to be away from the crowdedness of Los Angeles that New Mexico seemed like a great place to be! At Tech, I worked on my MS and PhD research under the direction of Dr. Philip Kyle. In the process of getting to my field area in New Zealand, I was first introduced to the fascinating world of Antarctic volcanic geology, and I met my husband, Bill McIntosh, who was also just about to start a PhD program at Tech. My PhD research, while not entirely on tephra, focused on understanding the pre-eruptive gas content and degassing behavior of a very explosive rhyolitic magma system in New Zealand's Taupo Volcanic Zone. Working on this project at Tech provided a combination of interesting field work and the opportunity to use great laboratory facilities both at Tech and elsewhere, and it was a perfect launching point for a career in geochemistry. The Tech faculty provided great training and research expertise, and my community of fellow students, many of whom resided in the once-great, now-defunct Eaton Hall, made living in Socorro a memorably-fun experience!



Nelia Dunbar (PhD Geochemistry '99) surveys a blue ice sheet during a research trip to Antarctica.

After finishing my PhD in 1989, I spent several years as a postdoctoral researcher at New Mexico Tech, Arizona State University, University of Tennessee, and Oak Ridge National Laboratory, always working on some variant of magmatic and volcanic processes. I then returned to New Mexico in 1992 to work at the New Mexico Bureau of Geology and

Mineral Resources, where I remain today as Geochemist and Deputy Director. My research has continued to focus on volcanic and magmatic processes but has cycled back to work on tephra, mainly used as chronological markers in sediments and ice. I am involved in research projects in New Mexico, Nevada, Ecuador, and Antarctica, among other places and have the pleasure of running a Cameca SX100 electron microprobe laboratory, where I do most of my work on the geochemistry of the volcanic glass component of tephra layers. I also continue to be very involved with the Tech Earth and Environmental Science Department, working both with faculty and graduate students on a wide variety of projects. Stop by to visit next time you're in Socorro!

Editorial Note: In early 2012, Nelia was awarded a new three-year, \$167,000 NSF research grant. This grant not only aids her in research with Antarctic ice cores, but it also gives her additional funds to help support E&ES graduate students.

Recent Alumni Awards

Visit the E&ES Website and Facebook Page for Additional Award Announcements!

Bayani Cardenas (PhD Hydrology, 2006) Wins Kohout Early Career Award

Cardenas will receive the 2012 Kohout Early Career Award from the Geological Society of America at their annual meeting in October. Dr. Cardenas is the first recipient of this award. It is his second such award. Last December he received the Early Career Award from the Hydrology Section of the American Geophysical Union.

Scott Tyler (MS Hydrology, 1983) Wins 2012 Foundation Professor Award at University of Nevada, Reno

Tyler was awarded the Foundation Professor Award for his excellence in research and teaching. As a recipient, he will receive a three-year, \$5,000 annual stipend towards his research, one course per semester of reduction in his teaching load, and recognition at the annual Foundation Banquet at the University of Nevada. His name will also appear in the University's Honor Court.

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