2014 APPALACHIAN **GEOLOGY** NEWSLETTER

Building on Solid Foundations

Undergraduate Research Profiles - Faculty Notes - Field Course Updates

Greetings from the Chair



Bill Anderson

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Dear Alumni and Friends of Appalachian Geology,

Many of you know me, but for those of you who do not, I would like to introduce myself. I am the new Chair of the Department of Geology, having taking over from Dr. Johnny Waters on an interim basis in Fall 2012 and in a full-time role in July 2013. I have been a member of Appalachian Geology as a tenure-track professor since 2004, but some of you may remember me from my brief stint as an Adjunct Lecturer in Spring 1998 when I was a replacement for Dr. Ellen Cowan during her first research trip to Antarctica. Although I have big shoes to fill, it is my goal to continue the evolution of our curriculum to meet the needs of the 21st Century geoscientist while at the same time building on the solid foundations created by our predecessors and continuing our tradition of field-based geological education and research.

Johnny Waters spent eight years leading the Department and returned to the faculty after a well-deserved semester of off-campus leave. During Johnny's tenure as Chair, the Department grew from five tenure-track faculty and a handful of lecturers to our current 12 tenure-track faculty members and five lecturers. The number of majors also grew during this time to our present level of 130 majors. Our degree offerings have also grown during the past decade. In addition to offering traditional B.A. and B.S. degrees in geology, we now offer four concentrations. Two of these concentrations, Environmental Geology and Secondary Education, have been on offer for years. Two new concentrations have been developed over the past five years. The Concentration in Paleontology targets the dedicated undergraduate interested in pursuing a career in paleontology or the petroleum industry by providing a strong interdisciplinary background rooted in geology and biology. The Concentration in Quantitative Geoscience is for students who are interested in the mathematical side of geology, with a majority of the students earning a mathematics minor in addition to their geology degree.

The past couple of years has seen some exciting new developments in our course offerings. The addition of faculty with new specializations has allowed us to begin offering courses in geochemistry, geophysics, and quantitative data analysis. The creation of a new General Education curriculum five years ago enabled us to add two new introductory courses, Oceanography and Water: Mountains to Sea, in addition to a course on the history of coal that we co-teach with Appalachian Studies. This summer, after an absence of more than ten years, we will once again be offering our Summer Field Geology course in Italy (see page 8 for more information). Also this summer, we will be traveling to Iceland to teach our introductory environmental geology course to a number of non-majors (more information can be found on page 9), and, of course, we will once again be offering the annual Triassic Trip (more details on page 10).

Although the faculty of Appalachian Geology have changed and the program has grown, we remain an engaged and vibrant program and one that we consider to be one of the top undergraduate programs in North Carolina, if not the Southeast. Students continue to receive the same quality education that you received. The number of students engaged in research projects, including presenting at professional meetings and publishing in peer-reviewed journals, has grown tremendously and our quality faculty have been the ones to make this happen. With your support, we can continue the history of success at Appalachian Geology well into the future. We ask that you consider making a donation of any size to the department. Each little bit that we can raise helps us to further the experiences of Appalachian Geology students.

I hope that you enjoy this newsletter. My goal is for this to become an annual publication. Please let us know what you are up to. In future issues, we would like to spotlight the work of our alumni. If you have an idea for a story, please let us know.

Thank you for your support of Appalachian Geology,

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Bill Anderson



Selected Student Presentations, 2012-13

American Geophysical Union

"Postseismic deformation associated with the 1994 M6.7 Northridge Earthquake", Julia Irizarry '13 and faculty mentor Scott Marshall

Geological Society of America

"Garnet growth in response to mylonitization, Grandfather Mountain Window, Blue Ridge Province, western North Carolina", Anthony Frushour '14 and faculty mentor Rick Abbott

"Mapping and kinematic interpretation of hte Fries and Gossan-Lead Faults in northwest North Carolina", Kevin Quillan '14 and faculty mentor Jamie Levine

"Hydraulic conductivity across a range of hillslopes in the Little Tennessee River Watershed", Catherine Jones '13 with faculty mentor Joey Anderson

"Recognition of the Kellwasser and Hangenberg anoxia events in the Central Asian Orogenic Belt", Cameron Batchelor '16, and McCain Moore '15, with faculty mentors Sarah Carmichael and Johnny Waters

"Scale-dependent urbanization effect of stream flow and water quality of a headwater watershed in the Southern Appalachians", Kent Phillips '12, with faculty mentor Chuanhui Gu

Society for Vertebrate Paleontology

"A microvertebrate assemblage from the upper Blue Mesa member, Petrified Forest Formation (Adamanian), of hte Blue Hills in East Central Arizona", Alex Harrison '13, with faculty mentor Andrew Heckert

"A new database of Dinosaurian paleopathology", Logan Howell '14, with faculty mentor Andrew Heckert

Scholarships

Undergraduate Research Assistantships

Chase Batchelor '13, Cameron Batchelor '16, Anthony Frushour '14, Alex Harrison '13, Devin Hoffman '17, Hannah Krueger '17, Leanna Lockhart '13

Mark DeBroder Memorial Scholarship Anthony Frushour '14

McKinney Paleontology Scholarship Alex Harrison '13

Fred and Barbara Webb Scholarship Chase Batchelor '13

Loren A. Raymond Scholarship Kevin Quillan '14

Lloyd L. Hobbs Scholarship Chris Bagley '14

Awards

Promising New Major Award Alayna Smith '15

Outstanding Field Student Alex Harrison '13

Quantitative Geoscience Award Julia Irizarry '13

Outstanding Senior Geology Teaching Award Daniel Key '12

Mineralogy Award Anthony Frushour '14

Academic Achievement Award Aubry DeReuill '13

Outstanding Senior Geology Major Award Julia Irizarry '13

Student Presentations, Awards & Scholarships



Undergraduate Research Profile

An interview with Cameron Batchelor '16

Devonian Extinction in China and Mongolia

How did you get interested in the research projects that you have worked on?

I started doing geomicrobiology research with Dr. Carmichael during my freshman year. Near the end of the year, she offered me a new position on a more intensive research project on Devonian extinction that also includes Dr. Waters. I quickly became excited about the research project because the geochemical work has been extremely interesting to me.

Tell us a little about your research experience.

We have been working to understand the geochemistry of three Late Devonian formations in northwestern Xinjiang, China, which contain the Frasnian-Famennian (F-F) boundary and the Devonian Carboniferous (D-C) boundary in a highly fossiliferous shallow marine setting. In addition to the visible black shales that are commonly associated with these intervals, we are using multiproxy geochemical evidence to demonstrate that the Kellwasser and Hangenbeg ocean anoxia events are present in these sections. Last summer, I worked with Dr. Drew Coleman of UNC - Chapel Hill using strontium isotope ratios to date these rock sections, and this past semester I have been working with Dr. Carmichael to interpret the results from these age dates. I have also been looking at the composition of our rock sections under the SEM and analyzing the specific stratigraphy of these compositions. For my future studies, I will be determining the ages of these rock sections using U/Pb dating methods of zircon at UNC-CH.

Where has your research taken you?

I was able to attend the NAPC (North America Paleontological Conference) in Gainesville, Florida this past February to present my research. This was my first professional conference and being able to present my research there was a great opportunity to gain experience with talking to professors from all over the country, and world, and get people excited about my research. This August I will travel to Mongolia with Dr. Waters and Dr. Carmichael to conduct essential field work for our research. This will be an amazing experience and I cannot wait to be in the field.

Does this experience help to push you in a continued or divergent direction?



Cameron working on the SEM in the College of Arts & Sciences' microscopy lab.

When I first began doing research at Appalachian, my main goal was to get involved so I could figure out what I truly found interesting in geology because there are so many paths, such as geophysics, hydrogeology, geochemistry, and so on. I have loved every second working with Dr. Carmichael on geochemistry and through my research I have found my love for this field.

What skills have you gained that you did not get from the classroom?

I have gained skills in the laboratory by working summers at UNC-CH in a geochemistry lab and using a thermal ionization mass spectrometer. I have also been able to work with the XRD and SEM machines at Appalachian, which are skills that I would not have been able to obtain from the classroom. I will also get the opportunity to conduct intensive field work for my research in Mongolia that I would have never gotten the opportunity to do in the classroom.

Do you have plans to go to graduate school and if you had to guess, what kind of work would you like to do?

I hope to go to graduate school after I graduate from Appalachian and would like to continue my research in geochemistry and perhaps get involved with planetary sciences.



Planetary Geology & Metamorphic Petrology

How did you get interested in the research projects that you have worked on?

My interest in rocks, minerals and planetary geology led me to pursue experience in these fields of research.

Tell us a little about your research experience.

I am currently working on a project with Dr. Abbott looking at the metamorphic facies of rocks in the Grandfather Mountain Window. Another project involves research that I was involved in as an intern with the Lunar and Planetary Institute (LPI) in Houston, TX, studying alteration of lunar rock surfaces from exposure to space weathering.

Where has your research taken you?

I have presented my research with Dr. Abbott at the 2013 GSA Annual Meeting in Denver, CO, last November. I will present my research from LPI at the 45^{th} Lunar and Planetary Science Conference this March.

Does this experience help to push you in a continued or divergent direction?

During my internship with LPI, I got to work in the Astromaterials Research Labs at Johnson Space Center in Texas. My research experiences have refined my interest in pursuit of a career in planetary geology.

What skills have you gained that you did not get from the classroom?

During my time at Appalachian, I pursued research that allowed me to use our analytical facilities, including the SEM and XRD. My research opportunities have afforded me additional opportunities to use this and other equipment that is essential in my field.

Do you have plans to go to graduate school and if you had to guess, what kind of work would you like to do?

I have applied to the University of Tennessee Knoxville, Indiana University, Brown University, Georgia Institute of Technology, University of New Mexico, and University of Utah to study planetary geology. The planetary sciences continue to be an area of rapid growth in geologic research and I want to be a part of that.



Anthony in the lunar lab microscope at the Johnson Space Center.

Undergraduate Research Profile

An interview with Anthony Frushour 414



Undergraduate Research Profile

An interview with Kevin Quillan "14

Geologic Mapping in the High Country

How did you get interested in the research projects that you have worked on?

It was the fall semester of my junior year, and I had just taken the structure class with Dr. Casale when I decided that conducting undergraduate research would be the best thing I could do for myself in terms of academics. I asked Dr. Casale if there was any research I could help him with and he referred me to Dr. Levine, who had been looking for someone to help her with a project. She approached me about helping her with a mapping project and I was instantly on board with it.

Tell us a little about your research experience.

Dr. Levine's project has goals of determining the relationship between the Fries and Gossan-Lead faults, including the types of offset and the relationship, if any, to other faults southwest of the field area. Given that I had not yet taken mineralogy or petrology, my first task was to study ahead in those subjects. Dr. Levine and I met once a week for two months to learn aspects of those disciplines that pertained to the type of rocks we were going to be mapping. We spent two months during the summer of 2013 mapping in Ashe County, NC. After the mapping was complete, it was time to put all the data into a digitized version of the map that can now be seen in the ground floor of Rankin Science West near the Waters Undergraduate Research Laboratory.

Where has your research taken you?

I was fortunate enough to conduct my mapping near the North Carolina/Tennessee border about twenty minutes north of Jefferson, North Carolina. There were many times when I would be at the crest of a hill with an amazing view around me to enjoy, and meeting locals along the way was always interesting.

Does this experience help to push you in a continued or divergent direction?

I enjoyed the work that I did with the Fries and Gossan-Lead Faults, and I have applied to graduate schools across the country to do similar work. The research mapping was a lot of work, but in the end it was all worth it when I was able to produce a publication-quality geologic map.

What skills have you gained that you did not get from the classroom?



Kevin at an outcrop in Ashe County, North Carolina.

This project gave me a much better understanding of everything we learn in *Preparation of Geologic Reports* such as writing an abstract, making a research poster, writing a grant proposal, and taking proper field notes. I have also learned a great deal more about structural geology, including the types of textures and structures you see in sheared rock. I have also become much more familiar with Adobe Illustrator while compiling my map, which is something that I will be able to use forever. Perhaps most importantly, I have learned how real world projects do not always go as planned, and that there often are unexpected things that you must be prepared to spend time on.

Do you have plans to go to graduate school and if you had to guess, what kind of work would you like to do?

I have already applied to seven schools including University of Vermont, Western Washington University, and the University of Tennessee Knoxville. where I hope to work on field-based structural geology.



Geophysics in Arizona

How did you get interested in the research projects that you have worked on?

Before my research in Arizona, I started taking water quality measurements for Dr. Anderson, going to 'Finding Fossils on Fridays' with Dr. Heckert, and generally showing an overall interest and participating in a variety of opportunities. After my first year of taking geology courses, Dr. Heckert asked me if I would conduct a geophysical survey while on the Triassic Trip. I was already signed up for the field course and I had completed the geophysics class the previous year. I was excited to use the geophysical equipment to help in constraining the age of the fossil bed we were going to be digging in.

Tell us a little about your research experience.

The research was a mix of stratigraphy and the utilization of the geophysical technique direct-current electrical resistivity. Research takes a certain level of initiative. Dr. Heckert and Dr. Marshall were great advisors and helped me with any questions or advice that I needed. However, I often found myself learning how to write code, writing an abstract, and planning my trip to the Geological Society of America meeting in Denver, CO, independently.

Where has your research taken you?

My research has taken me to east-central Arizona and Colorado. The work in Arizona was great! The entire landscape lacks vegetation and the stratigraphy is easily visible. Plus, the food out there is spicy and I like that. I was able to present my ER research at the Geological Society of America's National meeting in Denver, CO this past November.

Does this experience help to push you in a continued or divergent direction?

I like doing research and I would like to do more, but classes keep me too busy. In the future, I plan to switch my focus to hydrology. With that said, there is quite a bit of overlap in all the fields of geology. I think the research I have done has benefitted me no matter what I plan to do in the future.

What skills have you gained that you did not get from the classroom?

My research opportunities have afforded me leadership skills. For example, when we conducted the electrical resistivity survey, I had to explain to eight other people how to set up and breakdown all of the equipment, assign individual tasks, and try to keep their spirits up during a long, hot day in the desert.

Do you have plans to go to graduate school and if you had to guess, what kind of work would you like to do?

I plan on going to graduate school. I would like to focus on hydrogeology, more specifically groundwater hydrology geared towards computer models and simulations.

Undergraduate Research Profile

An interview with Chris Bagley '14



Chris running an electrical resistivity line in Arizona.



Field Course Update

Summer Field Geology in Italy



After a 12-year absence, Appalachian Geology will be returning to Italy this summer to teach its senior field course. This six week field course in the Northern Apennines of Italy consists of a series of two week field mapping exercises in Tuscany, Umbria, and Le Marche. Beginning in the Marche region, we will stay at the Osservatorio Geologic di Coldigioco and investigate the Mesozoic through Cenozoic stratigraphy, taking field trips to historic towns and key outcrops (including the infamous K-T boundary). We will then travel to the Umbria region to observe deformation of the now familiar Apenninic sedimentary rocks associated with the regional Africa-Eurasia collision. Here students will spend ten days participating in collaborative mapping exercises with their counterparts from the University of Perugia. This exercise will be followed by some free time to explore the medieval cities of Perugia and Pisa. Finally, during the final two weeks of the course, we will map the metamorphic rocks of the Alpi Apuane, including the world famous Carrara marble, well known in scientific circles as a laboratory standard, and in the art world as Michelangelo's medium of choice. During this time we will stay in a hotel in the village of Vagli di Sotto along the banks of an artificial lake that submerged the nearby town of Fabbriche di Careggina.



The village of Vagli di Sotto, the final field location of the course



Field camp faculty Gabe Casale and Jamie





Monte San Vicino, the mapping area in Le Marche.

The Alpi Apuane with the Carrara marble in the background.

Field Course

Update

Introductory Geology in Iceland

The Laugavegur Trail, part of the Iceland field course.

and a zodiac boat journey through the glacial lagoon, Jökulsárlón.

For the first time, Appalachian Geology is offering a summer field course in Iceland.

The course is aimed at introductory-level students in hopes of recruiting new majors and minors. The students will receive credit for *GLY 1103 - Environmental Change, Haz-*

ards & Resources. The two week expedition will take place in early August and will be led by faculty members Brian Zimmer and Scott Marshall. Students will have the opportunity to study volcanology, tectonics, coastal processes, and geologic hazards surrounded by Iceland's rugged beauty. The excursion will be a true field experience

as participants will be camping the entire time and during the second week they will take six days to hike the renowned Laugavegur Trail through the volcanic highlands of

central Iceland. The hike ends at the base of Eyjafjallajökull, the ill-tempered volcano that shut down European air travel for part of the summer in 2010. Students will have the opportunity to hike to the brand new cinder cones and lava falls at the pass where the eruption initiated. Other planned activities include a guided day-hike up a glacier, a ferry ride out to Heimaey where the 1973 eruption of Eldfell buried 1/3 of the village,



Iceland field course instructors Brian Zimmer and Scott Marshall sample some glacial ice on Jökulsárlón.



Alftavatn, or Lake of the Swan, on the Laugavegur Trail, Iceland.



Field Course Update

May Triassic trip to the Southwest



Every May since 2006 Dr. Heckert has taken Appalachian Geology students to the Upper Triassic of the American Southwest. Since 2007, these trips have been offered for credit as GLY 3549. No two trips are the same, but they have collected Triassic localities in New Mexico, Arizona, and Colorado, in conjunction with the scientific staff of either the New Mexico Museum of Natural History (NMMNH) or, more recently, the North Carolina Museum of Natural Sciences. Through a mix of museum and field experience students learn many aspects of prospecting for, discovering, collecting, and cataloging data associated with fossil vertebrates. The setting ranges from behind the scenes at the NMMNH in Albuquerque to the Painted Desert badlands. They camp onsite in the field and for most the trip is their first chance to get out and see geology that is not blanketed with vegetation. For many it is their first trip west of the Mississippi, and on the drive to/from the southwest they pass through Texas, Oklahoma, Arkansas, and Tennessee. The record-setting trip passed though 13 states! For the past few years the students have made short documentaries on the trip, which they are working to get immortalized on YouTube®. The students and Dr. Heckert cram a lot into the two weeks of the trip, but it is rewarding and provides a springboard that students have used for research projects or to earn internships.





Andy in the Petrified Forest NP in 2012





The Triassic trip's Blue Hills campsite in Arizona.

Fred Webb, Jr., Rock Garden



Barbara and Fred Webb visit the new rock garden sign, carved in Mt. Airy granite.

A decade ago, as Dr. Fred Webb, Jr., entered retirement, the Appalachian Geology family decided to honor his career by establishing a "rock garden" composed of boulders from around the region. Thanks to alumni donations and the extremely generous support of Vulcan Materials Corporation and others, the Fred Webb Jr. Outdoor Geology Laboratory opened in the Spring of 2008. It has grown from an initial vision of 20 boulders to encompass 36 specimens representing all three rock types, four different states, and representative rocks from the Piedmont, Blue Ridge, Valley and Ridge, and Cumberland Plateau. Still, there's room for more, so if you have a lead on how to get rocks up the mountain, please contact Dr. Andy Heckert. In the meantime, check out the garden at http:// mckinneymuseum.appstate.edu/rock-garden.

Outreach Webb Rock Garden

School groups take advantage of the rock garden.



Outreach Ask-a-Geologist

Ask-a-Geologist, by Anthony Love 99

One of my duties is the *Ask-a-Geologist* outreach program. The public write in via email or, when more local, make phone contact asking, "what is this rock"? It can be very rewarding and entertaining. The variety of characters that I meet coupled with the variety of interpretations folks will offer about their rocks makes some of these visits priceless. As a geologist and one of the people responsible for moving our collections and samples, I always find it entertaining when folks tell me, "this is the strangest rock I have ever seen" or "it's heavier than most rocks." One individual described the size of his rock as being "similar to that of a small toad-frog". From folks who have rocks with gold, silver and diamonds in the same rock to the person who claimed he was having an allergic reaction to rocks he continued to handle, or the lady who was very insistent that a higher power directed her to pick up this specific rock, I am often left thinking of the phrase, "you can't make this stuff up."

With the recent publicity of meteorites and their associated value, we have received quite a few visitors who claim to have meteorites. Many times, the claim has been based off of a second hand report from a family member who saw it fall. After looking at the material and confirming it is not of extraterrestrial origin, I am often left with trying to dodge their question, "are you calling my relative a liar?" Since becoming the Department's resident *Ask-a-Geologist*, I have had two opportunities where folks brought in specimens that were indeed what they claimed to be. One was a gold prospector who found a nice nugget near a historic gold mine and another was a gentleman who found a meteorite - on Ebay!

I enjoy this opportunity to interact with folks, but sometimes feel unsatisfied with the results. People come in with samples or specimens that are typically common materials that are easily identifiable or man-made materials and byproducts that are not easily characterized. For unknown reasons, the man-made materials almost never occur in proximity to recent or historic operations where these materials could have been produced. In fact, many of these sam-ples seem to be buried, leading to the other in-

evitable question of "well, how typically look like a do not have did it get there?" This is, of course, where I fool because all I can tell them is what they and that I do not know why they found it where they did. No one ever likes to hear me say that "people pick up strange and interesting rocks and move them all the time."

> What I have come to recognize from my years of this service are people are attracted to rocks for strange reasons. Most people, even professionally employed geologists, are attracted to rocks for obvious reasons - Money! Its always a little saddening to me to find most of these folks lose interest when I tell them, "Your sample is not valuable but, I think it is interesting"! Whether dictated by a higher power, the lure of riches from a lucky find or just plain curious, all these folks at one time seem strange. Perhaps in comparison, it may be me who is the strange one for having no

A real meteorite sample, in thin section. who is the strange one for having no compelling reason to be interested in some worthless rocks.



Dr. Heckert routinely takes geology students to "fossil fairs" throughout the state. Here are some pictures from events held at the Schiele Museum in Gastonia and the Museum of Natural Sciences in Raleigh.

















Outreach

Fossil Fairs









Faculty & Staff Notes

Rick Abbott Bill Anderson

Rick Abbott, Professor

I'm still working on petrological problems in the Caribbean. Most recently, ASU alumnus Dave West '86 and I completed an Ar-Ar dating and trace-element study of amphibolite facies and blueschist-greenschist facies rocks in the Blue Mountains, east of Kingston in Jamaica. You can see the article in GSA Bulletin. Some of you recent alumnae who were on the Spring Break trip of 2011 will recall seeing some of these rocks. Adrianna, where are you? Currently, I'm looking at amphibolite facies rocks from a small exposure in the core of a limestone anticline at Green Bay just southwest of the Kingston. These rocks hadn't been examined since 1954, when shortly after the site became a gunnery range for the Jamaica Defense Force. For all these years, the site has been off limits because of the danger of unexploded ordinance. Throwing caution to the wind, last summer a couple of Jamaican colleagues and I got special permission to visit the site with an armed military escort. No one got blown up. I'm still here. Dave West '86, colleagues in Jamaica and I are trying to understand the relationship of the Green Bay rocks to the metamorphic rocks in the Blue Mountains. So far, based on the petrogra-

phy and some P-T calculations, I've got my money on the Green Bay rocks being equivalent to the amphibolite facies rocks in the Blue Mountains. Dave West's trace-element and Ar-Ar data will be decisive. Yes, I'm still tormenting students with crystallography and crystal chemistry. For some of you older alumnae the course is now known as Fundamentals of Mineralogy, "Fun Min" for shortyes indeed, fun for all.



Students on the 2011 Jamaica spring break trip.



GEOLOGY

Bill Anderson, Professor & Chair

I've been working on a variety of hydrogeologic problems over the past three years. I spent the spring and summer of 2011 as a Visiting Scholar at Plymouth University, UK, working with my colleague, Roland Gehrels. My family accompanied me on this extended visit. We lived in a Cornish village in a 300-year-old cottage and my daughters attended the village school. While in the UK, I worked on a paleo-sea-level project relating groundwater flow in freshwater marshes and gravel barriers to sea level. This work has just been accepted by the journal Marine Geology and I anticipate a second paper from this work within the next year. We will be working at new field sites in Wales this summer and have been funded by NERC, the NSF equivalent in the UK. I still have quite a bit of local research, including research on stream temperatures in Boone Creek that began in 2005. Several students have helped with this work over the past few years, including Rachel Storniolo '10, Josh Rice '11 and, currently, Claire Harris '14, who will present her research on temperature surges at Southeast GSA in April. In addition to recent publications with departmental colleague Chuanhui Gu and ASU colleague Kristan Cockerill, I continue to

work with former departmental colleague Ryan Emanuel on the influence of El Nino-Southern Oscillation on water resources in North Carolina. I anticipate our third paper on this subject soon, and I have involved geology student Sonia Sanchez '14 in this work. I continue to enjoy teaching *Hydrogeology* and an introductory course entitled *Water: Mountains to Sea*. The hydro course, which has grown to more than 30 students each fall, takes advantage of an outdoor laboratory, the ASU Educational Wellfield, which lies adjacent to the Boone Greenway and the South Fork New River.

Sarah Carmichael, Assistant Professor

I have had a busy year working on a variety of local and international research topics. I spent last summer circumnavigating the globe (twice!). I first traveled to the Engare Sero footprint site in Tanzania with Dr. Liutkus-Pierce to determine the geochemical preservation mechanism of these early human footprints and to better constrain the paths of Oldoinyo L'engai mudflows through volcanic clast distribution. Student Travis Hartney '16 is now assisting with this project. A week after returning to the US, I got back on a plane to Kunming, China, where I presented my research at a joint NSF-SinoNSF workshop on the geochemistry of mass extinctions (a UNESCO funded project in collaboration with Dr. Waters). Dr. Waters and I will be returning to China early in June 2014, and in August will travel to western Mongolia to continue fieldwork on late Devonian mass extinctions. Student Cameron Batchelor '16 is currently assisting with this project and will accompany us to Mongolia in August. In the meantime, I am continuing my interdisciplinary work on manganese biomineralization in caves and in paleokarst in the southern Appalachians. I currently teach Petrology, Introduction to Physical Geology, Preparation of Geologic Reports, and an interdisciplinary class with the Appalachian





Faculty & Staff Notes

Sarah Carmichael Gabe Casale

Studies program called the *History of Coal from the Pennsylvanian to the Present*. Last year I won the Wayne D. Duncan Faculty Enrichment and Teaching Fellowship for Excellence in Teaching in General Education.

Gabe Casale, Assistant Professor

I am in my third year in Appalachian Geology, and the second year in the structure tenure-track position. Structure is steadily growing and is expected to have 30 students in the fall, up from 23 my first semester here. This year Dr. Levine and I will be returning to Italy to lead the first Appstate geology field course there in a decade; we hope it becomes a trend. Back in the US we are starting a new field-based research program in northeast Georgia to look at exhumed mid-crustal rocks in the Tallulah Falls dome. This project will include the first thermochronometric ages determined in-house using the Autoscan Fission Track set-up on long term loan from UNC Chapel Hill.



Gabe at the Glarus Thrust Fault in eastern Switzerland.



Faculty & Staff Notes

Ellen Cowan **Brian Gibson**

Ellen Cowan, Professor

Over ten years ago I submitted a proposal to IODP with a bunch of Alaskan research colleagues to drill in the Gulf of Alaska and this summer we did it! I spent the months of June and July 2013 as a sedimentologist on the JODIES Resolution. We had fantastic weather (better than Boone) and great core recovery. Once again the lab is filled with inter-



esting mud and new research students will be sieving and weighing IRD. We are also continuing to study coal ash from the TVA spill with plans to develop a method to track it in rivers and reservoirs using magnetic susceptibility. Daniel Gaspari is finishing up a honors the-

in Ashe County.

sis on the topic. I still enjoy teaching *Geomorphology* and the class has grown enough to offer two lab sections next year. This fall, Keith and I will be parents of a freshman as Alison heads to college. We enjoyed experiencing the recruiting perspective from the other side of the table.

Brian Gibson "11, Lecturer

Salutations! As the newest faculty member to the Geology Department and a recent graduate of this very program, I'm proud to once again call Boone my home. I returned here after spending a couple years at the University of Kansas working on my Master's Degree in Hydrogeology. These past couple semesters I have been spending my time teaching a gamut of

intro geology labs and further developing the Hydrogeology lab. The department has been developing a wonderful wellfield on the South Fork New River here in town, and I have enjoyed taking students there to conduct hydrogeologic experiments. I am also proud to say I got married to my best friend this past year and look forward to the end of the school year so we can take our honeymoon cruise to the Bahamas! Thanks Mom and Dad! If you find yourself in Boone this summer, come join me on the Watauga River. I'll be working as a whitewater raft guide for the first time ever (full disclosure J).



Chuanhui Gu, Assistant Professor

This past year has been filled with lots of excitement on many perspectives. Last fall, I advised Chase Batchelor '13 with her senior thesis work on stream hyporheic exchange and nutrient uptake. Chase had done excellent work and graduated with University Honors. She is presenting her work at the SE GSA in Blacksburg, so if you're there, stop by and say hi. I am currently advising Alex Beck and Laura Heinen on groundwater surface water interaction in headwaters this semester. Last summer, I traveled

to Yangzhou University in China to continue the collaborative project on land application of biosolids in mudflats. Part of the impetus for the trip was to do some reconnaissance of the mudflat site as a potential field area for heavy metal leaching research. We hope to decipher the conditions under which heavy metal contamination becomes a concern to suggest the BMPs for agriculture developed from mudflats amended .with biosolids. Two new pub-



Gu , Dr. Bai, and Chinese graduate students of Yangzhou University at the Mudflat site in Summer 2013.

lications just came out of this project recently. Back at home, I am part of a newly formed research cluster consisting of faculty across multiple departments on local water issues. With the financial support from ASU, we've been meeting with a large number of experts from universities, government agencies, and private companies to develop a socio-biophysical framework for riparian conservation to protect water resources in the High Country. On the other hand, our own hydro group (Bill Anderson and me) has continuously made progress. Our work on air-stream temperature correlation in two local streams is about to be disseminated soon. On the personal front, my wife and I just moved in our newly built house with our newly adopted dog Buddy who has kept us quite busy, mostly by being incredibly cute.

Steve Hageman, Professor

I have been at ASU since Fall 1998 (and '92-'93 as a sabbatical replacement). When Fred Web retired ten years ago, I took over teaching *Preparation of Geologic Reports*, which has grown from six students to the need for three full sections requiring the independent services of Carmichael, Levine and Wilson. This a good reflection on the growth and health of the Department in recent years. I also continue to teach *Principles of Paleontology*, which is no longer a capstone course for the major, but is now an interdisciplinary course with students from Geology, Biology and Anthropology. I continue to use fossil and modern Bryozoa to study microevolution and speciation and have included molecular methods of genetic fingerprinting in my lab (on modern material, not ancient). I currently have a project working with Appalachian alumnus William Miller III '75 from which we have some exciting discoveries in the fossil succession across the local Ediacaran–Cambrian boundary in the Chilhowee Group of TN and VA. Most of my service these days is at the University level with Faculty Senate, CAS Dean's Advisory Council, and General Education Science Coordinating Committee. I also spend a significant amount of time as Co-editor of the *Journal of Paleontology*.







Faculty & Staff Notes

Chuanhui Gu Steve Hageman

Steve exploring an outcrop somewhere in southwest Virginia

Faculty & Staff Notes

Andrew Heckert Jamie Levine

SOLID ROCK

Jamie working in Ashe County on solid rock.

GEOLOGY

Andrew Heckert, Associate Professor

I am now finishing my first decade at Appalachian and it has been busy. Beyond teaching various introductory courses and working hard to develop GLY 2250, Evolution of the Earth, I have also overseen the installation of exhibits in the McKinney Museum (http://mckinneymuseum.appstate.edu/) and, thanks to the support of alumni, the rock gar-



den (see article on page 11), both of which helped me earn the 2011 Outstanding Earth Science Educator award in North Carolina. Right now I am preparing to lead the ninth annual "Triassic trip" (see page 10 for more details).

My research is in the field of vertebrate paleontology, focus-

ing principally on Triassic tetrapods, including early dinosaurs. I have published a variety of projects based on fossils from both the American Southwest and the Triassic of North Carolina in journals like the *Journal of Vertebrate Paleontology, Journal of Paleontology, Palaeontologica Electronica* and others. I am proud that several of these publications have been with students that have gone on to graduate school in paleontology at Iowa, Chicago, and Kent State. Friday afternoons are dedicated to "Finding Fossils on Fridays," working with students to pick microvertebrate fossils from matrix to support diverse research projects. Most recently I have begun working at Dinosaur National Monument, including bringing two App students as field assistants last summer. This fall I plan to enjoy an opportunity to conduct research in museums and in the field in Argentina, which is world-famous for its Triassic fossils. To best get to know me and my research, check out my personal web page (http://www.appstate.edu/~heckertab/).

Jamie Levine, Assistant Professor

I joined the department in the fall of 2012 to help teach the ever expanding Evolution of the Earth course and I have also been teaching Prep. As a newcomer to the Appalachians I spent most of my first year and a half in the department trying to learn the very complex history associated with four different orogenies, and especially the nomenclature. My dissertation work focused on studying the role of strain in migmatitic rocks, and as a structural/metamorphic petrologist I have been excited to explore these high-grade polydeformed metamorphic rocks. I spent the summer of 2013 with a student mapping at a 1:24,000 scale along the Fries and Gossan-Lead faults in Ashe County (see the interview with Kevin Quillan on page 6). Considering that it was the third rainiest summer on record, going out in the field every day was a major feat, and I also learned (the hard way) that I'm extremely allergic to poison ivy. On days when we were not inundated we found some great exposures of mylonites, particularly along the Gossan-Lead fault zone. When not in North Carolina I have also been exploring some of the rocks in northeastern Georgia with Crystal Wilson and Gabe Casale, as well as preparing to teach field camp in Italy this summer of 2014.

Anthony Love "99, Research Operations Manager

I have been with the department since 1996, first as a student and since 2000 as the assistant lab manager and now research operations manager. In addition to managing the labs, classroom supplies, working in the museum, I serve as one of our outreach coordinators for our Ask-a-Geologist program. I have worked with Loren Raymond to pub-

lish abstracts and articles on Appalachian Geology but am also engaged in meteorite classification. I'm interested in clasts igneous within meteorites that tell us more about impact processes that occur on their parent asteroids. Outside of my university academic and pursuits, I continue to be an avid rock climber.



Cindy Liutkus-Pierce, Associate Professor

I can hardly believe that I'm approaching my 10-year anniversary at App, but as they say, time flies when you're having fun. I still teach Sedimentology and Stratigraphy (GLY3800), and if you had that class early in my career with maybe 4-8 other students you'll be surprised to hear that the class has grown to about 35 students/semester. Evolution of the Earth (GLY2250) is going well and is also growing by leaps and bounds, and sometimes I get lucky enough to teach an Honors course called Geoforensics. I continue to be the faculty advisor for the Appalachian Geological Society (or "Geo Club") and am still very active in College and University committees like the University Research Council, the Office of Student Research Advisory Board, and the Outstanding Alumni Committee (so send me your nomi-

nations!). I'm thankful that my research continues

to challenge and amaze me, and I'm fortunate to work with some pretty amazing colleagues here at App and elsewhere (like the Smithsonian, AMNH, and various museums in East Africa). The Engare Sero footprint project persists with some very interesting results, and I have several students working on that project as well as a new endeavor looking at early Miocene primate paleoecology in Kenya. Not all my work involves an expensive plane ticket and malaria meds, though, and I continue to work with Andy Heckert and Nick Fraser on the Triassic rift basin sediments exposed in the Solite Quarry in Virginia. In fact, Andy and I are excited to lead a SE GSA field trip to this site in April 2014. One thing that has changed is the length of my last name, as I got married in May 2012. My husband and I live in Wilkes County, and are currently building a house that overlooks the mountains of neighboring Ashe County. I love hearing from alums, so keep those "just saying hi" emails coming!



Faculty & Staff Notes

Anthony Love Cindy Liutkus-Pierce

GEOLOGY

Faculty & Staff Notes

Laura Mallard Scott Marshall

Laura Mallard, Lecturer

I am happy to say that I am still busy here in the Department of Geology advising our majors seeking teaching licensure in Earth Science. The number of students entering this program varies from year to year, but there seems to be a slow and steady rise in the number of future earth science teachers coming out of ASU. During the summer break from classes, I have been running workshops for middle and high school science teachers. These workshops have involved field trips to nearby outcrops including Linville Falls and Elk Knob, building simple earthquake simulators, caving under the mountains of Tennessee, and hands-on investigation of meteorites. Our STEM Outreach does not



stop there – many Department of Geology faculty take geology straight to the K-12 classrooms in our area and provide demonstrations, support, and handsactivities at on events across North Carolina, I continue to teach lecture classes that involve the Environment. Introducing college students to geologic problems

Laura checked out coastal processes on Cumberland Island over spring break.

and solutions is increasingly complex, sometimes depressing, but always rewarding! I am involved in the teaching of most of our introductory lab classes. These lab classes are always improving with new ways to look at our amazing earth processes. In my free time, I chase my 2 little boys (5.5 and 2.5 years old) around our mini-

farm. We enjoy growing and preserving a harvest every summer and fall. With my husband, I am still involved in the business of whitewater rafting and other outdoor adventures. In my free time away from my family, I try to be a potter.

Scott Marshall, Assistant Professor

The past few years have been challenging, but exciting for me. Since arriving at Appalachian State University in 2008, I have expanded my fault mechanics research into the cutting edge field of satellite geodesy. I now process GPS and InSAR satellite data that can measure mm-scale motions of the surface of the Earth. Much of my work has been funded by the Southern California Earthquake Center (SCEC). In recognition of my work on the complex fault of the Transverse Ranges in southern California, I have been named as one of the leaders of the SCEC Ventura Special Fault Study Area (SFSA). Recent work suggests that this fault system has created several ~M8 earthquakes in the past, so the SFSA's goal is to fund work that will help to better constrain the seismic hazards of this complex system. I am currently working with two geology students: Hugh Harper is writing an analytical fault modeling code to simulate earthquake-related deformation patterns, and Hannah Krueger is analyzing GPS time series data to determine aquifer-related deformation patterns in southern California. On the teaching front, I have been taking my Geophysics class into the field and training students to collect and interpret ground-penetrating radar (GPR), seismic refraction, rect current electrical resistivity data for 5 years. I have also re-

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34.24

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34.

Lauri Miller, Administrative Support Specialist

As I approach my nine year anniversary of working in Geology, I am reminded of just how much I love working in the Department. Not only do I get to interact with our amazing students and faculty, but I seem to learn something geologically new every single day! Hobbies outside of work include reading, cooking and crafting. I currently have two children in college and look forward to one day being able to retire at the beach.



Lauri exploring beach retirement sites with her daughter Emily.

Joey Mosteller, Adjunct Lecturer

Joey Mosteller has been of recent assistance in the Appalachian State University Geology Department filling in as an adjunct professor teaching GLY1101 labs. He is a native of Western North Carolina and has a Master of Science degree from ASU where he is also an adjunct professor in the Appropriate Technology Department. In addition to his teaching duties, he spends some of his time at the Appalachian Energy Center as a research assistant working primarily on landfill gas to energy projects in North Carolina and Brazil, as well as, an upcoming biogas project in Haiti. Joey's geology background traces back to the University of Kansas where he received his Bachelor of Science degree. After graduation he continued to work concurrently at both the Geology Department and the Kansas Geological Survey as the Thin Section Technician before moving back home to North Carolina. Joey is excited to reconnect with his geology roots by getting to spend time teaching in the ASU Geology Department.

Faculty & Staff Notes

Lauri Miller Joey Mosteller



Faculty & Staff Notes

Johnny Waters Lauren Waterworth

Johnny Waters, Professor

I returned to a normal faculty position in 2012 after 8 years as Chair of the Department. In addition to teaching responsibilities, I am engaged in two very interesting and challenging research projects. The first involves the evolutionary biology of fossil echinoderms, particularly Paleozoic blastoids and crinoids. This research is funded by an NSF Assembling the Echinoderm Tree of Life grant to the University of Tennessee with work farmed out to me. In the past three years I have traveled extensively working on this project and have done fieldwork in the mountains of Timor (Indonesia) and laboratory at the synchrotron at the Paul Scherer Institute outside Zurich, Switzerland. I have

three students working as undergraduresearch ate assistants on this project. My second project involves collaborative research with Dr. Sarah Carmichael on anoxia in the Late Devonian of the Central Asian Orogenic Belt. This is a massively collaborative



A typical field experience for Johnny, this one in Mongolia.

project that has yielded both exciting new results and an new model for oceanic anoxia. One of our student research assistants will accompany Sarah and I to Mongolia for fieldwork this August.

Lauren Waterworth 401, Lecturer

Greetings fellow alumni! After graduating from the Department in 2001, I returned to join the faculty in January 2011. In the interim, I received my M.S. in Geology from Texas A&M University and a J.D. from Tulane University Law School with a certificate in Environmental Law. I teach primarily Intro Geology labs and have also taught an Honors course in Environmental Law and, this past fall semester, I taught a special topics course on Environmental Regulation. In addition to teaching, I continue to practice law. In the past few years I have had the privilege to serve on a legal team that represents several regional and national environmental nonprofit organizations in regulatory disputes involving mountain top removal coal mining permits in Kentucky and Virginia. Most notably, in 2010, these groups brought to light widespread effluent reporting violations and numerous pollution violations by companies operating in Kentucky under Clean Water Act National Pollutant Discharge Elimination (NPDES) permits. Though the companies have not disputed the violations, extensive litigation has arisen regarding whether settlements reached between the companies and the state agency are sufficient to correct the environmental harm done and to deter future violations. More recently, our clients have challenged whether the state agency circumvented their due process rights in reaching a settlement with the one of the companies. A ruling from the court is expected "soon". My time in court certainly informs my teaching. And teaching within the sane, orderly, objective discipline of science is a nice balance to the whirlwind that is our justice system. And last but not least, I will be on maternity leave this fall semester. My husband, Alex, and I (and our two dogs Tanner and Turtle) are looking forward to welcoming our baby girl in July!



Grystal Wilson, Lecturer

After serving 2-years as secretary-treasurer for the Carolina section of Society of Mining, Metallurgy, and Exploration, I continue to be an active supporting member by connecting students to the Society through Facebook and on field trips. The Department and Geology Club support student travel to these trips, which will visit the classic Miocene/Pliocene phosphate deposits of the Aurora Mines this April (a must-do for any NC Geologist). Last year (March 2013), students walked away as no-fools loaded with pyrite cubes from the pyrophyllite mine in Glendon, NC. As for field time, I will join ECU's North Carolina Summer Field Course in Geology for a 4th year to teach mapping in Proterozoic basement –Mesozoic cover sequences near Taos, NM and Creede, CO. I continues to work on the Geology of Elk Knob State Park in my spare time, mapping complexly deformed amphibolite/schist of the Ashe Metamorphic Suite.

Brian Zimmer, Lecturer

Greetings to all! Life in my little corner of the geology department continues to be diverse and exciting. I continue to teach the bread and butter introductory geology lectures and labs but have had the opportunity over the last year to expand my course offerings by teaching two first-year seminar courses. A Walk in the Woods teaches students various bushcraft skills (plant identification, bird calls, hide tanning, fire by friction, etc.), while reading books from great conservationists like Aldo Leopold and Daniel Quinn. This spring I am teaching, for the first time, a course called *Juggling and* the Circus Arts. It is as fun as it sounds. Student final project videos will be linked from my webpage at the end of the year, so keep an eye out. I continue to work with Cindy Liutkus-Pierce and Sarah Carmichael on the Engare Sero Footprint site in Tanzania and have also initiated a new summer field course in Iceland. Scott Marshall and I will be making the first expedition with students during late July and early August of this year (see page 9 for more information on this course). I also continue to organize the Spring Sustainability Film Series that is already in its 5th year. We screen films on all topics of sustainability for the greater Boone community and host discussion panels after the films. Best wishes wherever you find yourself.

Faculty & Staff Notes

Crystal Wilson Brian Zimmer



Emeritus Faculty Notes

Jack Callahan Loren Raymond

Jack Callahan, Emeritus Professor

Hi all! It has been 12 years since I retired and I cannot believe It. Time flies when you are having fun or so they tell me. I am still in the old home place in Blairmont and starting to throw everything geological out in preparation for downsizing in a year or two. I still have many of the giant rocks we all collected on many field trips in my yard and from graduate school days. I look at them and remember the good times (I think) I had in Ontario, Labrador, Idaho and of course many western US field trips with many of the "old bunch". I would appreciate hearing how you are doing but never use the ASU mail but can be reached at goldjec@hotmail.com or 828-264-2554 days. I still enjoy getting out and working with the younger kids in elementary school and teaching them about minerals and rocks and the geology of NC. I know that most of you would never recognize me now with all this extra hair (except on the top) but yes, this is me. My best to all old graduates from the 70's -2002 who I still think about with kind thoughts.



Jack out in the field in the western US.

Loren Raymond, Emeritus Professor

I am alive and well in California and have been an Emeritus Professor since 2007. I am completing East Coast geologic research while re-establishing research on Franciscan rocks in California. Dr. Webb, Anthony Love and I published a paper in the GSA Bulletin on the Silurian stratigraphy of SW Virginia and have a paper

in press in Southeastern Geology expanding on that work. With Dr. Arthur Merschat '00 (USGS) and Dr. Kelly Vance (GSU; former Instructor at ASU), I am completing work on my last (?) ultramafic rock study in North Carolina. One additional paper on deformation of Blue Ridge ultramafic rocks may arise from collaboration with a new colleague, Professor Haemyeong Jung, from Seoul University. In California, I lead winery tours, sight-seeing + birding-wildflower-geology outings for visitors from NC, and geology hikes for the Sonoma Land Trust; between home renovation work in Santa Rosa and research work on Franciscan rocks of the Diablo Range, plus geologic studies on the Sonoma Coast, Marin County, and the Tiburon Peninsula with David Bero of Sonoma State University. I gave a presentation on Terranes and mapping in the Franciscan Complex at the Cordilleran GSA meeting last Spring and have an invited paper in press in International Geology Review on that topic. In addition, I continue to work with Dr. Neil Johnson (former Instructor at ASU) on a book on Crustal Earth Materials (for Waveland Press). I also am working on two hiking guides — one for the Blue Ridge and one for public lands of northern Marin and southern Sonoma Counties of

 Loren on the Jenner Headlands in coastal California near Santa
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 at ASU) on a book on Crustal Earth Materials (for Waveland Fress).

 also am working on two hiking guides — one for the Blue Ridge and one for public lands of northern Marin and southern Sonoma Counties of California. There are too many interesting rocks and too little time, but enjoying family, food, wine, landscapes, and the Santa Rosa Symphony make the California experience a complete one for me in my retirement. Margaret does remind me that I am retired.

Marjorie McKinney, Emeritus Lab Manager

I've been busily reinventing myself. Interesting process! I'm currently acting temporary president of a new branch of the NAACP here in Watauga County. Leading up to that I organized a Moral Mondays - Forward Together group that put on a huge rally and brought Rev. William Barber to the campus in the fall. All of that is in response to actions of last year's NC Legislature and Governor that dramatically reduced financial support to education at all levels, medical care and unemployment for low-income people, and threatens to damage voting rights in the state (especially impacting college students). I continue to bring concerns about climate change, our environment, and geologic history into conversations. I still enjoy teaching, informal as it is.

Fred Webb, Jr., Emeritus Professor

I continue to have fun and enjoy retirement. Geology occupies a reduced part of life, but I still am working on Appalachian stratigraphic research. Current industrial interest in the Appalachian Paleozoic stratigraphy has involved me in leading field trips and seminars in the past year. Barbara and I visit with our daughters and their families in Colorado and Iowa every chance we get. It has been great fun visiting grandchildren and their schools at Juilliard and Duke. In addition to exercise I normally get splitting firewood, yard work, and home maintenance, I work out at the gym five days weekly and have recently started RowFit and QuickFit. Genealogy offers me a great chance to do research on line as well as in libraries, courthouses, cemeteries, and brier-infested patches of riversides. While visiting our grandson who was at Glasgow University for one semester, it was especially fun to go to the hometown of my grandfathers who migrated to America in the 17th century. Barb and I plan to go to the Vancouver 2014 GSA meeting via Amtrak's Empire Builder. We will be joined by our daughters there and spend some time beach combing on the Olympic Peninsula before the meeting. Part of the hassle associated with retirement is taking care of the 15,000+ slides, photos, and negatives that I have accumulated. The time required to do this is so daunting, that I am concentrating on documentation of rare, long-disappeared outcrops, "forgotten" people, and cultural heritage. Of course, family images rank first among the priorities. Loren Raymond and I continue working on several projects including our book on our mapped portion of SW Virginia's Valley and Range. We also are compiling an atlas of stratigraphic units in SW VA. We have one additional structural problem to solve pending a few days of fieldwork.

Emeritus Faculty Notes

Marjorie McKinney Fred Webb, Jr.





Parting Shot

Some further views of the Apennines of Italy, site of this summer's field course



Entrance to an abandoned Carrara marble mine in the Alpi Apuane, Italy. This is the marble made famous by Michelangelo.





An active Carrara marble mine nearby. Both of these sites are proximal to the final mapping location of field camp.