

## Geosciences March Highlight



### Unlocking the Mysteries of Earth's Evolution

The geologic processes involved in the break up of the supercontinents shaped today's world and have been linked to mass extinctions in the past. Yet, the separation of the supercontinents represents one of the most significant mysteries in the world of geosciences. Esteban Gazel, a professor for VT Geosciences, suspects unlocking the key to this mystery may lie in Earth's crustal and mantle melting processes.



Esteban Gazel in Italy

So it's no surprise that understanding melting processes underlies every research project Gazel has taken on at Virginia Tech. More specifically, Gazel looks at the geochemistry and petrology of melting processes deep within the earth as a means of solving the supercontinent mystery.

The first question Gazel sought to answer at Virginia Tech was how thick, continental crust, made predominantly of andesite, could form from basaltic oceanic crust. Most planets have a crust made mainly of basalt, similar to Earth's oceanic crust. Understanding how our planet developed its unique continental crust is crucial to understanding the formation and evolution of Earth. With an NSF grant, Gazel

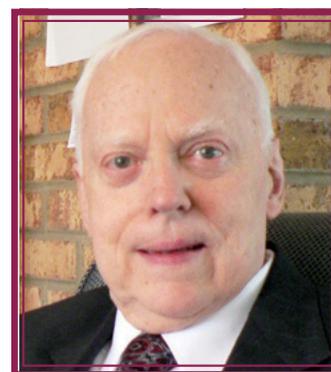
and his team traveled to the Central American land bridge, where relatively recent geologic processes probably mimicked processes that would have been more common during the Archaean era, when much of Earth was still evolving. There they collected geochemical and geophysical data to help them determine if specific subduction processes, similar to those from the Archaean, could have created the young continental crust found there. This geologic quest culminated with a paper that was just accepted for publication by *Nature Geoscience*.

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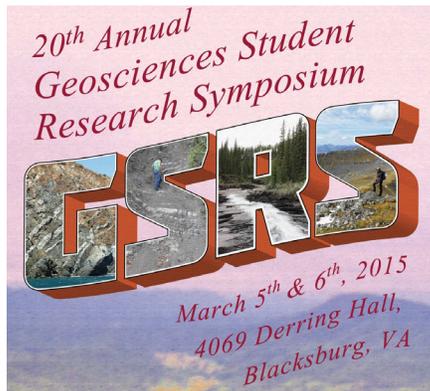
## In Memoriam: John K. Costain



It is with great sadness that we announce that professor emeritus John K. Costain passed away on March 25, 2015. John Costain was professor of geophysics for 29 years until his retirement in 1996. Details of his remarkable life and achievements can be found [here](#).

## Geosciences in the News

### 20th Anniversary of GSRS



This year marked the 20th anniversary of the Geosciences Student Research Symposium (GSRS). Starting back in 1996, approximately 40 students have presented their work to the department each year, for a total of 792 presentations. 2015 was no different. This year's GSRS was engineered and executed by Drew Hawkins and a small team of geosciences students, and the result was two days of excellent presentations from 39 students.

GSRS is a wonderful opportunity for students to practice presenting their work in a friendly environment, but it's also a chance for students to learn about other research occurring in the department.

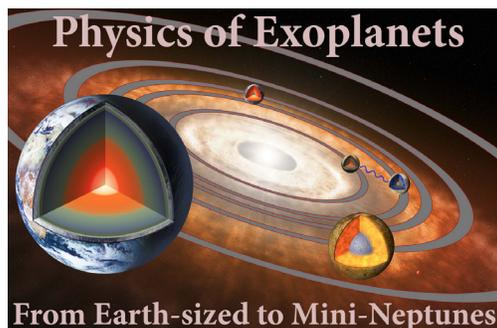
As Hawkins, said, "I know all these people in geosciences, but they're in slightly different fields from mine, so I don't always know much about their research. GSRS is so great because it's where I can learn all the cool work they're doing."

The VT Geosciences department is fortunate to have sponsorship every year from such companies as BP, ConocoPhillips, Chevron, Range Resources and Schnabel Engineering but this year, thanks to the hard work of Tiffany Jebson, the program also garnered more local sponsorship from Draper Aden & Associates and Environmental Systems Services.



*Delicious GSRS food, another staple for the last 20 years..*

### Searching for Exoplanets



The world-renowned [Kavli Institute of Theoretical Physics](#) recently invited Scott King out to California to join with other top astronomers and geophysicists to discuss the ongoing search for exoplanets. King visited the institute for three weeks of a ten-week program, and he presented a talk entitled, "Mercury, Venus and Mars, Oh my!" during a conference there.

Prior to 2009, when the Kepler space telescope was launched, most planets discovered outside of our solar system were similar to Jupiter. Since its launch, the Kepler mission has confirmed over 1000 "earthlike," rocky planets, while over 4000 possible planets have also been identified. The Kavli Institute brought researchers like King together in an effort to understand what observations can be made with the data that's been collected. The institute's own description of the program says, "This program is intended to synthesize recent advances from astrophysics and geophysics to advance the theory of the composition, structure, and dynamics of rocky planets."

King's talk, presented on February 26, explains what we know about Mercury, Venus, Mars and Earth, and how scientists can apply that knowledge to their search for new planets outside of our solar system. During his stay, he also participated in daily activities designed to bring the group together and to foster informal discussions and new ideas.

Links to all of the presentations given during the conference can be found [here](#), and King's presentation can be found [here](#).

...continued from *Geosciences March Highlight*.

Much of Gazel's research also revolves around various large igneous provinces (LIPs) around the world. LIPs are extremely large areas of igneous rock that have been connected to both the break up of continents and mass extinctions. Lisa Whalen, a student of Gazel's, is looking at LIPs and how they may have triggered the breakup of both the Rodinia and Pangea supercontinents. She explains:

"Plate tectonics, as the unifying theory for the geosciences pretty much explains the formation of supercontinents through subduction and continent-continent collision, but how and why super continents breakup is still a missing piece. LIPs have been suggested as a potential trigger for mass extinction events through the release of climate-changing gasses, making them a force for shaping the evolution of life on this planet (and potentially on other planets). Understanding how LIPs form is important for our understanding of the evolution of life and the affect of climate."



Lisa Whalen



Jarek Trela

Another student of Gazel's, Jarek Trela, is working on one of the group's newest and most ambitious projects: to understand the complete evolution of the Galapagos mantle plume. Says Trela, "Our goal is to characterize the lithological, thermal, and geochemical evolution of the plume from the head stage to the tail stage. This research will clarify the 'life-death' cycle of mantle plumes, as well as the fate of recycled oceanic crust." This project represents the first time a group has traced the entire thermal and chemical history of a plume – in this case, 90 million years of geologic history.

Then there are the Virginia volcanoes. Last year, Gazel and his student, Sarah Mazza, made headlines when they published their paper on geologically recent volcanic activity in eastern North America, specifically, in Virginia. Previously, this region was thought to have been inactive for the last 200 million years, but their work has shed light on a volcanic swarm that took place as recently as the Eocene (approximately 40 million years ago). The news was picked up by major scientific magazines, including *Scientific American*, *Live Science* and *NPR*. Says Mazza in her quote from *Live Science*, "These rocks are our only physical window into processes that helped shape Virginia and even the whole southeastern Appalachia as well."



Sarah Mazza

According to Gazel, these Virginia volcanoes were a one-off event, so further volcanic activity is unlikely. If anything, they may help provide more information about seismic activity around Virginia.

In total, Gazel has six students on his team studying different melting processes, and he's also collaborating with Virginia Tech researcher, Esther Schwarzenbach, on serpentinization research in Costa Rica.

Since joining the Virginia Tech Geosciences Department in 2011, Gazel and his team have won over \$1 million dollars in funding from NSF grants; he's published 16 papers, including one in *Nature Geoscience*; his work has been highlighted in popular scientific journals; and he received a Top 40 Under 40 accolade as someone who has positively influenced the Costa Rica region. That's all just in his first four years. We can only look forward to what else is to come.

Learn more about Gazel's work at his website for [VT Volcanoes](#).

## Geosciences News Continued...



From [Research at Virginia Tech](#): “The Office of the Vice President for Research recognizes Sterling Nesbitt, an assistant professor of geological sciences in the College of Science, who reveals the history of life through the discovery, analysis, and comparison of fossil remains of reptiles, dinosaurs, and their predecessors, the archosaurs.

A vertebrate paleontologist, Nesbitt has been involved in naming 17 different reptiles, dinosaurs, and dinosaur relatives in the last 10 years, including seven which he discovered.”

[Read more about Nesbitt’s work here.](#)

The most recent issue of the [Virginia Tech College of Science Quarterly Magazine](#) highlights the research, awards and achievements of Bob Bodnar, Esteban Gazel, Scott King, Sterling Nesbitt, Nancy Ross and Michelle Stocker. To learn more about the accomplishments of the Geosciences department that were highlighted in this magazine, as well as great work from other departments in the College of Science, [check out this latest publication.](#)



[The Imperial Barrel Award.](#) It’s a competition founded by the American Association of Petroleum Geologists to give geosciences students an opportunity to “explore a career in the energy industry.” Students work together as teams, spending 8 weeks analyzing given datasets before presenting their results to the judges in a 25-minute presentation. This represents the first year a team from Virginia Tech is participating. Good luck to Kyle Overby, Sam Ritzer, Ali Can Diyarbakirli and Telly Manos! Their work will be highlighted in this newsletter after they’ve completed the competition.



From [The Roanoke Times](#):

“Bloss 69th Anniversary ‘S Wonderful, ‘S Marvelous (You should care for me) Miss Louise Land of Eminence, Kentucky and Don Bloss of Chicago, Illinois, now of Blacksburg, Virginia, were married on March 2, 1946, after his return from overseas with the United States Army.” Congratulations from the Geosciences department on your 69th anniversary!

## VT Museum of Geosciences Open House



Visitors line up for a chance to have their rocks identified.

The Virginia Tech Museum of Geosciences hosted a Teacher Open House on March 12. The event had a great attendance, with 33 adults and 14 children visiting the museum. The “Identification Station,” which allowed people to present their own rocks for identification, was a big hit. Said Llyn Sharp, museum coordinator, “Almost every visitor brought rocks to be identified!” The museum extends a special “thank you” to Neil Johnson who staffed the rock ID station for four hours.

Other stations were set up around the Museum to highlight some of the educational kits available to the teachers and educators who showed up. The EmRiver Stream simulator ran throughout the evening, and visitors were especially taken with the OmniGlobe experience.

## Geosciences Publications & Posters

Ashley, K.T., and Law, R.D., 2015. *Modeling prograde TiO<sub>2</sub> activity and its significance for Ti-in-quartz thermobarometry of pelitic metamorphic rocks*. Contributions to Mineralogy and Petrology 169, 1-7.

Ashley, K.T., Thigpen, J.R., and Law, R.D., 2015, *Prograde evolution of the Scottish Caledonides and tectonic implications*. Lithos, doi:10.1016/j.lithos.2015.03.011.

King, S. D., Frost, D. J., Rubie,, D. C., (2015), *Why cold slabs stagnate in the transition zone*, Geology, March 2015; v. 43; no. 3; p. 231–234

Kiracofe, Z.A., Schreiber, M.E., Henika, W.S., Beard, J. (March 2015). *New insights into the formation of manganese ore deposits in the Piedmont Province of Virginia*. Geological Society of America, Southeastern Section Meeting. Chattanooga, TN.

## Geosciences Awards & Grants

Natalia Bykova was awarded the Tillman Teaching Excellence Endowed Scholarship from the College of Science for her outstanding work as a T.A. in Geosciences.

A three-year NSF grant, totalling over a quarter of a million dollars, was recently awarded to Tom Burbey. The title of the award is: *Using horizontal and vertical deformation signals to characterize water availability in fractured and faulted crystalline-rock aquifer systems*.

## Congratulations to the graduate students who successfully defended their Masters and PhDs!



Congratulations to Kyle Ashley for his successful PhD defense, titled, *Constraining Metamorphic and Tectonic Evolution in Convergent Terranes: How Trace Elements and Mineral Inclusions Shape Mechanical and Reconstructive Models*. Ashley's work presents a new approach to understanding how pressure-temperature-time deformations impact the history and creation of metamorphic rock. His research helps provide a more comprehensive picture of the conditions surrounding a rock's evolution.

Congratulations to Tony Giuffre for his successful PhD defense, titled, *Biomolecular Controls over Nucleation: Insights to Calcium Carbonate Formation and Geochemical Signatures*. Much of Giuffre's research focused on the thermodynamics and kinetics of the mineralization processes involved in the production of calcified skeletons. The results of some of his experiments will also provide useful insights into the carbonate biominerals found in the fossil record and how that can be applied to changing oceanic chemistries.

