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## *Northeast Section* **NEWSLETTER** *Spring 2019*

*As published on 9/12/2019.*

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the Section is doing:  
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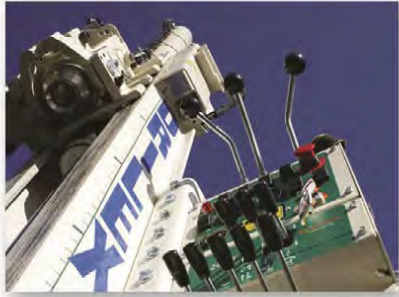
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# AIPG NORTHEAST SECTION NEWSLETTER

## SUMMER 2019

## EDITION No. 157

PUBLISHED BY THE NORTHEAST SECTION OF THE AMERICAN  
INSTITUTE OF PROFESSIONAL GEOLOGISTS

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The Newsletter of the Northeast Section of the American Institute of Professional Geologists is digitally published four times annually at [www.issuu.com/neaipg/docs](http://www.issuu.com/neaipg/docs). Design and layout by Brandon Tufano and Dick Young. Section Members and Advertisers are alerted to each issue by e-mail. Many thanks are extended to all who helped in compiling this issue.

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(Executive Committee continued from page 5)

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**Public Affairs:** Dennis McGrath (Chairperson)

**Scholarship:** Dennis McGrath (Co-Chairperson), Chris Brown (Co-Chairperson), Sam Gowan, Dean Herrick, Craig Werle, Tom West, Kelly Weyer.

**Section Directory:** Curt Kraemer, Editor, Dick Young, Publisher

**Section Meetings:** Jessica McEachern, Bob Blauvelt, Chris Brown

**Section Newsletter:** Brandon Tufano, Editor; Dick Young, Publisher

**Screening Board:** Charles Rich (Chairperson); Don Bruehl, Carol Graff, William Penn, Daniel Toder, Andrew Tolman, William Prehoda

**2019 Executive Committee Meeting Schedule:**

January 7<sup>th</sup>

March 11<sup>th</sup>

May 13<sup>th</sup> (date moves to accommodate Spring Meeting on-site)

July 8<sup>th</sup>

September 16<sup>th</sup> (or September 17<sup>th</sup> during National Meeting @Burlington)

October 7<sup>th</sup>

December 9<sup>th</sup>

*Meetings are typically held from  
4:00 to 6:00 pm via teleconference.*

(End)

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***Presidential  
Ramblings  
Summer 2019  
By Michael Grifasi***

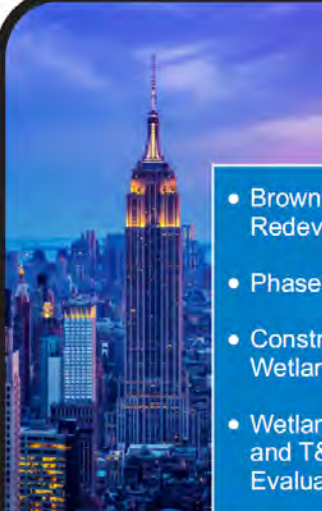


**National Conference Kickoff**

Hello Northeast Section! As I'm writing this "rambling", we have exactly 26 days until the kick-off of the AIPG National Conference in Burlington, Vermont! As you can imagine, the cake is out of the oven and the frosting has been applied. With the time we have left, we're focusing on all of those little final details that will make this event (not an actual cake) something for this Section to be proud of! Note my sincerity and overall excitement through my overuse of exclamation points!

I am genuinely excited about this meeting, as it has been something our Executive Committee has been considering since I came on board as Secretary around five years ago. It's true, National does a lot of the heavy lifting with the planning and execution of this Conference.

*(Ramblings continued on page 12)*



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***Thank you to all our advertisers and sponsors!***



*(Ramblings continued from page 11)*

That said, our Section has also contributed our fair share, and, considering we're a bunch of volunteers, I'm proud of everything we've been able to get done. I want to express a direct thank you to my colleagues on the Executive Committee—Jeffrey Frederick (serving as Co-Chair of this event), Robert Blauvelt, and Dennis McGrath—for really stepping up to ensure this event is as successful as it can be. Not that we haven't all helped out along the way, I just know this couldn't have been done without these three. Of course, Cathy Duran and Wendy Davidson over at National have been an absolute pleasure to work with... their level of organization is top notch!

So, if you're reading this and have not yet registered for the Conference, I urge you to do so soon!

A couple of "ramblings" ago, I attempted to build the case for Burlington beyond the Conference itself. Over the course of the Conference, there will be live music at the iconic venue Higher Ground as well as Burlington City Arts Center, Radio Bean, Club Metronome, ArtsRiot, and at Waterfront Park. Pick a brewery to drink and even eat at in Burlington – Foam (my favorite), Zero Gravity, Queen City, Switchback, Simple Roots, Four Quarters, Magic Hat, and Fiddlehead. Dine at A Single Pebble, The Farmhouse Tap & Grille, Pizzeria Verita (their Funchi Rustico pizza topped with an over-easy egg is one of the best things I've ever eaten), Hen of the Wood, Bluebird Barbecue, Pho Hong, American Flatbread, and/or Leunig's Bistro. Great destinations to visit include the Shelburne Museum, Shelburne Farms, the ECHO Leahy Center for Lake Champlain (great place for kids), the Burlington Farmer's Market on Pine Street (Saturday from 9:30am to 2pm at this temporary location during construction at City Hall Park), or just stroll through the pedestrian friendly portions of Church Street (between Pearl Street and Main Street). Note that you have access to Uber and Lyft in this City.

As I've said in previous "ramblings," this conference will have more to offer than geology... not that that isn't enough, I know! Please pack your hiking boots, your growlers, your appetite, something warm to wear while dining with us on Lake Champlain, and your passion for your profession.

I hope to see and meet many of you this September!

Sincerely,  
Michael



# Explore Burlington!



*(End)*



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# The American Institute of Professional Geologists NORTHEAST SECTION

American Institute of Professional Geologists - Northeast Section

AIPG National Conference  
Burlington, VT  
September 14-17th, 2019

*Rock of Ages Corp. Mine*



All,



This year, the 56th meeting of the American Institute of Professional Geologists National Conference is being held in the beautiful city of Burlington, Vermont.

Please set aside September 14th to the 17th to attend this year's conference, "**Geology in the Green Mountains: Scenic Beauty and Economic Engine.**".

*(Meeting Announcement continued on page 18)*

*(Meeting Announcement continued from page 17)*

The Northeast section is co-hosting the event and we are excited to show off everything we have to offer to our national audience. The AIPG National Conference is traditionally known for high quality field trips. National meetings often host up to 8 different field trips during the meeting, and they are very well attended. Our members come from all corners of the US, North America, and Europe to see the local geology and experience unique geologic terrains. Our membership includes geologic educators, environmental consultants, and mining/oil and gas geologists, to name a few specialties. Many of our members will not have experienced the Green Mountains, the Adirondacks, Lake Champlain, or any of the amazing quarries, famous roadcuts, and beautiful scenery we all take for granted.

Sincerely,

Jeffrey Frederick, PG, CPG

Please keep an eye on your e-mails as updates on field trips, courses, and other pertinent information will be distributed by the Newsletter and [info@neaipg.org](mailto:info@neaipg.org).



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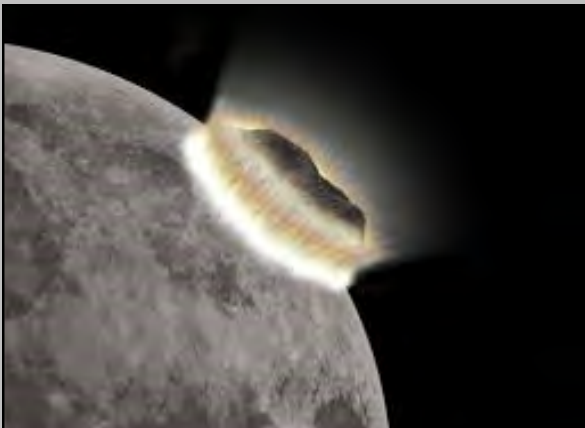
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# The Mystery of the Moon's Missing Metals

The Moon's missing precious metals may never have arrived in the first place. Colliding asteroids delivered metals such as gold and iridium to both Earth and the Moon early in the solar system's history, with Earth collecting more than its smaller satellite. But samples of Moon rocks collected by Apollo missions revealed that the Moon had significantly less material than could be accounted for by its size. New research now suggests the dearth may be caused in part by the Moon's inability to hold on to some of these metals, with the late crystallization of the lunar mantle also playing a role.

The early solar system was a violent place, with material left over from planet formation crashing into newborn worlds. One collision carved the Moon out of Earth, leaving both worlds briefly molten as their layers settled out. Precious metals, which have an affinity for iron, sank to the cores of newborn worlds, removing them from the crust and mantle. Any of these highly siderophile elements (HSEs) found in the crust today were delivered by collisions with smaller debris.

Because Earth presents a larger target than the Moon, scientists anticipated the Moon should have roughly 20 times fewer HSEs at its surface. Instead, Apollo samples revealed the satellite contains roughly 1,000 times fewer precious metals than Earth,



suggesting perhaps it was hit by significantly fewer objects. The discrepancy has had scientists scratching their heads for the past few decades.

*(The Mystery of the Moon's Missing Metals continued on page 21 )*

*(The Mystery of the Moon's Missing Metals continued from page 20)*

“We identify that a key factor for the interpretation of the HSE record is the impactor retention rate—the fraction of mass retained by the target,” Meng-Hua Zhu, a scientist at China’s Macau University of Science and Technology, said by email. Zhu’s team modeled how much material the Moon collected from impacts on the basis of their size and the angle at which they hit. The researchers assumed the more massive Earth retained the bulk of the precious metals delivered to it, an assumption that Simone Marchi calls “reasonable.”

Marchi is a researcher at the Southwest Research Institute in Colorado who models the formation and bombardment of terrestrial planets and the Moon.

The new research reveals that the Moon holds on to only about 20% of the material that it collides with, 3 times less than previously assumed. Previous simulations had suggested that the Moon held on to roughly 60% of the material that collided with it, but that still was not enough to explain the HSE difference.

Zhu’s team made more detailed simulations of lunar collisions that included a wider variety of impactor sizes, velocities, and angles than ever before. The researchers found that the Moon’s smaller size and lower gravity mean that most of the impacting material didn’t stick around and either escaped the Moon’s gravitational grasp or was blown completely from the surface. Although rocks that slammed head-on into the Moon became a permanent part of the lunar composition, other objects only skimmed the surface.

“This strikingly low value changes previous considerations on the Moon’s late accretionary history and suggests that significantly more material must have hit the Moon for a given HSE budget than previously envisioned,” Zhu said. The new research was published in the journal *Nature*.

The amount of debris lost from lunar collisions filled in only part of the discrepancy, bringing the Earth-Moon difference down to only about 100. So Zhu’s team turned to the lunar magma ocean.

After the collision that birthed the Moon, the surface of both worlds remained molten. Previous studies suggested that Earth’s

*(The Mystery of the Moon's Missing Metals continued on page 25)*

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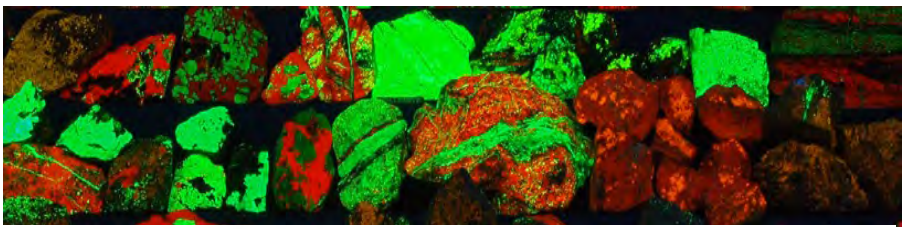


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magma surface took somewhere between 5 million and 10 million years to solidify into a rocky crust. Apollo samples suggest that the smaller Moon took longer to solidify, between 150 million and 200 million years, although not all scientists agree with this analysis. “It’s a problem that’s been debated for years,” says James Day, a geologist at the University of California, San Diego.

Assuming a long-lived molten mantle, material that slammed into Earth roughly 15 million years after the Moon formed would have polluted the terrestrial crust. But material colliding with the Moon at the same time would have been absorbed by its mantle and worked its way down to the core. The difference gives Earth a head start in collecting HSEs on its surface and could explain the rest of the discrepancy.

Although Day appreciates the implications of the new collisional model, he’s less certain about the molten magma explanation. “Purely from a geochemical point of view, that is still a problem,” he says. “I don’t think it’s a fatal flaw in their model by any stretch of the imagination, but it’s something that needs to be considered.”

Marchi also has concerns about the Moon’s magma ocean. According to the new research, the Moon should have 3–8 times more basins than those that visibly scar its surface today. Zhu argues that the magma ocean would quickly obliterate both crater rims and gravitational signatures, but Marchi isn’t certain. Although objects slamming into the Moon immediately after its formation should have been absorbed, it’s possible that cooling over the intervening tens of millions of years would have prevented a complete erasure of crater signatures.

“It may be possible, but I think it requires further investigation,” Marchi says.

—Nola Taylor Redd (@NolaTRedd), Freelance Journalist

**Citation:** Redd, N. T. (2019), The mystery of the Moon’s missing metals, *Eos*, 100, <https://doi.org/10.1029/2019EO128507>. Published on 12 July 2019.

*(End)*



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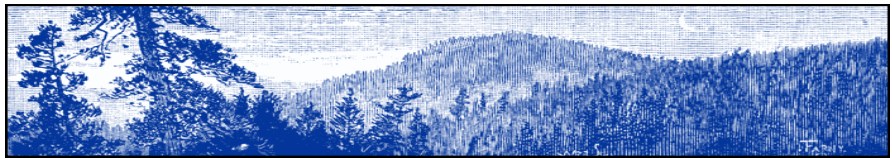
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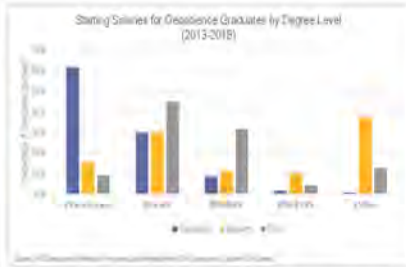
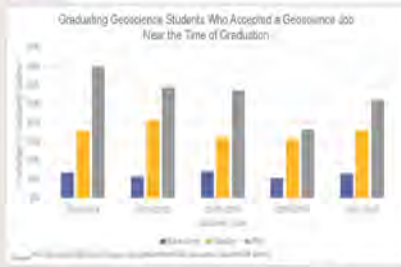
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### Starting Salaries for Graduating Geoscience Students (2013-2018)

Between 2013 and 2018 the percentage of graduating students accepting a job within the geosciences fluctuated with changes in the job market and the employment-seeking trends of graduating students. During the 2016-2017 academic year, the percentage of students at all degree levels securing employment in the geosciences near the time of graduation hit its lowest point with 10% of bachelor's graduates, 31% of master's graduates, and 36% of doctoral graduates securing geoscience positions near the time of graduation. Much of this can be traced to slower hiring within the energy and environmental and engineering services sectors where a large percentage of master's and bachelor's graduates typically find jobs. For doctoral graduates, there was a decline in the percentage of graduates securing employment within the academic sector, which is a primary employer of geoscience doctorate recipients. In the 2017-2018 academic year, however, hiring rebounded as 13% of bachelor's graduates, 36% of master's graduates, and 52% of doctoral graduates secured geoscience positions near the time of graduation.



Where graduating students secure employment directly impacts starting salary trends. Between 2013 and 2018, 61% of geoscience bachelor's graduates who secured jobs within the geoscience profession near the time of graduation reported starting salaries of \$40,000 or less. These graduates predominantly accepted positions within the academic sector, environmental and engineering services, federal government, and energy sector. Twenty-nine percent of geoscience bachelor's graduates reported salaries between \$40,000 and \$60,000, and most of these graduates accepted jobs within the environmental and engineering services and energy sectors. Ten percent of geoscience bachelor's graduates reported salaries of \$60,000 or more, and they predominantly accepted jobs within the energy sector.

Between 2013 and 2018, 15% of master's graduates reported starting salaries of \$40,000 or less, reflecting employment in the academic, environmental and engineering services, state and local government, and energy sectors. Starting salaries between \$40,000 and \$60,000 are primarily driven by employment in the environmental and engineering services, and to a lesser extent within the federal government and energy sectors. Starting salaries between \$60,000 and \$80,000 are primarily driven by employment in the energy and resource sector, and salaries above \$80,000 reflect employment in the energy sector.

Geoscience doctoral graduates starting salary trends are reflective of employment within the academic sector, with 75% of doctoral graduates reporting starting salaries between \$40,000 and \$80,000. Similar to master's graduates, starting salaries above \$80,000 for doctoral graduates reflect employment in the energy and resource sectors.

Read more in the 2018 Status of the Geosciences Report available at:  
<https://store.americangeosciences.org/status-of-the-geoscience-workforce-report-2018-digital-edition.html>

-Leila Gonzales

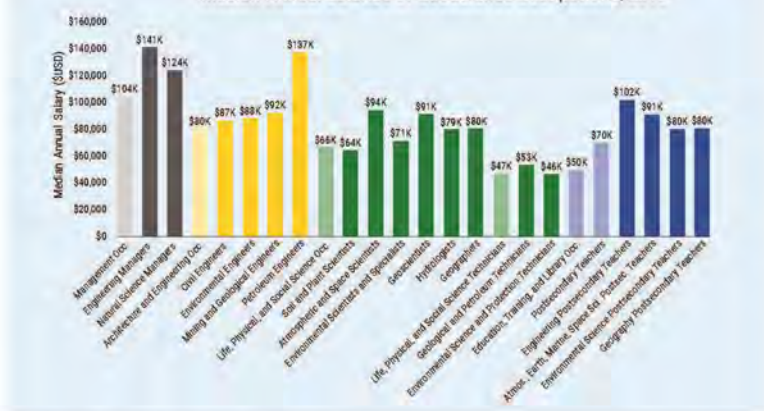
## 2018 Median Salaries for Geoscience-related Occupations

Salaries increase by 2% between 2017 and 2018

As a whole, geoscience-related median salaries increased by 2% between 2017 and 2018, on par with other major science and engineering occupational categories. The geoscience occupations with the largest increases between 2017 and 2018 include Environmental Science Postsecondary Teachers (5%), Natural Science Managers (4%), Petroleum Engineers (4%), Geographers (4%), and Atmospheric, Earth, Marine, and Space Science Postsecondary Teachers (4%). Geoscience occupations that had decreases in median salaries include Mining and Geological Engineers (-2%), Geological and Petroleum Technicians (-2%), and Hydrologists (-1%).

The majority of geoscience-related occupations have higher median salaries than salaries for related broad occupational categories (highlighted in lighter shades in the chart below), reinforcing that geoscience careers continue to be lucrative career paths within the U.S. The two geoscience-related careers that do not have salaries higher than related broad occupational categories are soil and plant scientists and environmental science and protection technicians; however, both occupations have similar (-\$2K, and -\$1K) median salaries to the broader occupational categories.

Median Annual Salaries of Geoscience Occupations, 2018



### Median Annual Salaries of Geoscience Occupations, 2018

American Geosciences Institute, Workforce Program; Data derived from the U.S. Bureau of Labor Statistics, Occupational Employment Statistics, 2018.

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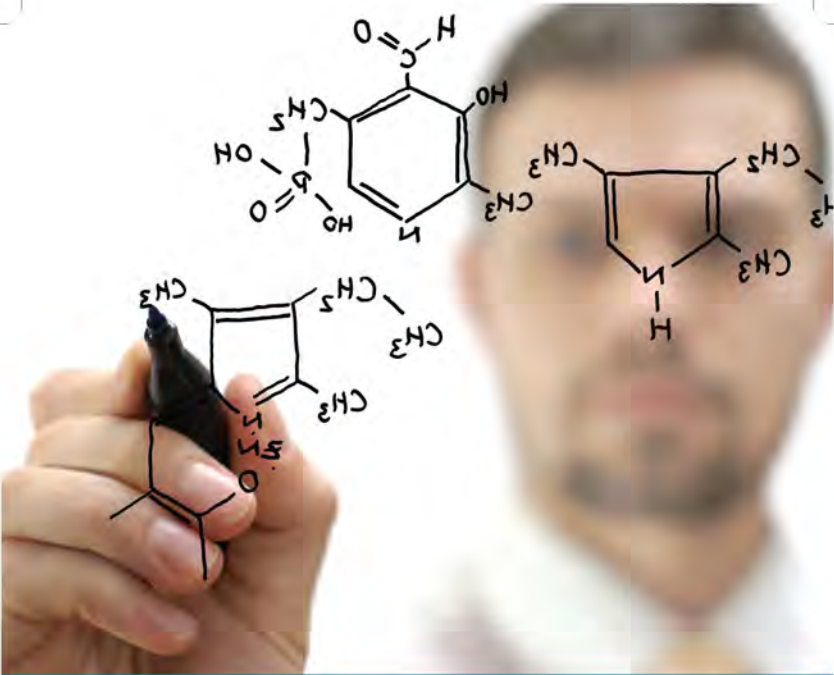
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# '100-year' Floods Will Happen Every 1 to 30 years, According to New Flood Maps

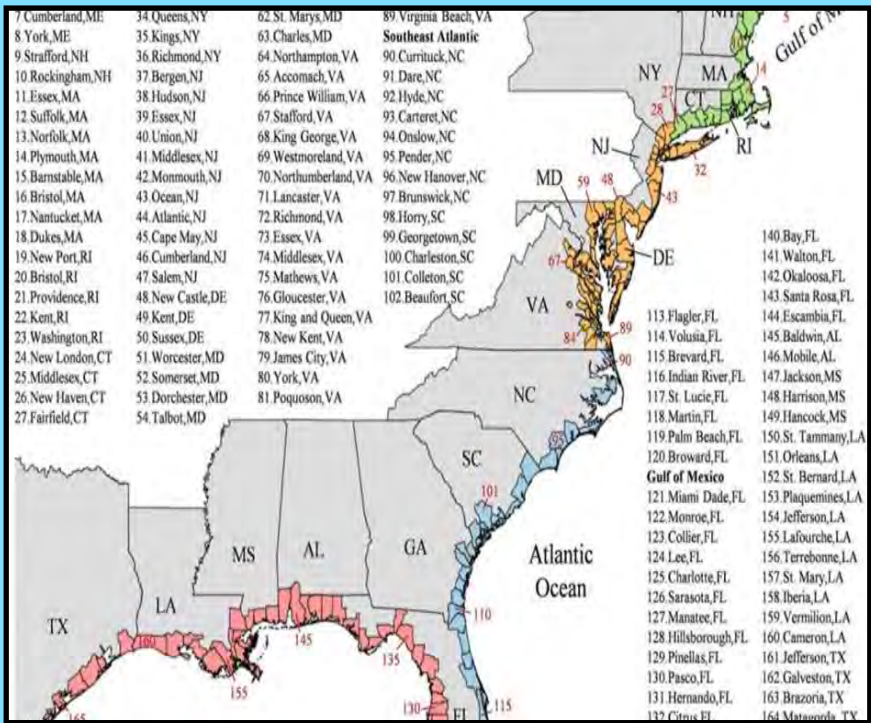
A 100-year flood is supposed to be just that: a flood that occurs once every 100 years, or a flood that has a one-percent chance of happening every year.

But Princeton researchers have developed new maps that predict coastal flooding for every county on the Eastern and Gulf Coasts and find 100-year floods could become annual occurrences in New England; and happen every one to 30 years along the southeast Atlantic and Gulf of Mexico shorelines.

"The historical 100-year floods may change to one-year floods in Northern coastal towns in the U.S.," said Ning Lin, associate professor of civil and environmental engineering at Princeton University.

In a new paper published in the journal *Nature Communications*, researchers combined storm surge, sea level rise, and the predicted increased occurrence and strength in tropical storms and hurricanes to create a map of flood hazard possibility along the U.S. East Coast and Gulf of Mexico. Coastlines at northern latitudes, like those in New England, will face higher flood levels primarily because of sea level rise. Those in more southern latitudes, especially along the Gulf of Mexico, will face higher flood levels because of both sea level rise and increasing storms into the late 21st century.

*(100-Year Floods continued on page 41.)*



*Researchers at Princeton University calculated flood risks for 171 counties across four regions: New England (green), mid-Atlantic (orange), southeast Atlantic (blue), and Gulf of Mexico (red). They found that what used to be considered 100-year floods will occur far more often depending on the location.*

*Credit: Reza Marsooli et al*

“For the Gulf of Mexico, we found the effect of storm change is compatible with or more significant than the effect of sea level rise for 40% of counties. So, if we neglect the effects of storm climatology change, we would significantly underestimate the impact of climate change for these regions,” said Lin. The study’s predictions are different than what else is currently available, said Reza Marsooli, assistant professor at the Stevens Institute of Technology,

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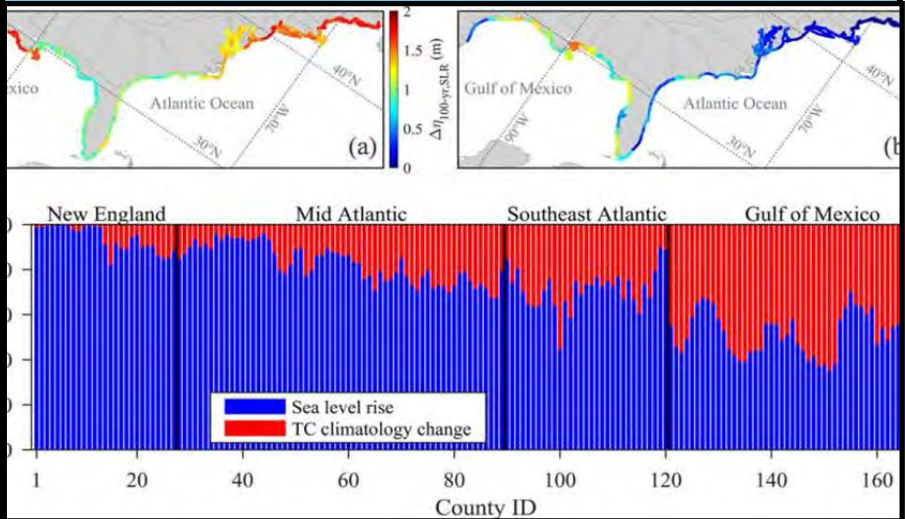
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(100-Year Floods continued from page 40.)



*The relative contributions of rising sea levels and changing storms differed according to the area of the country being studied. In northern areas, sea level rise is a major contributor to increased flooding, while changing storm dynamics are relatively more important in southern areas. Credit: Reza Marsooli et al*

who worked on this study while a research scholar at Princeton, because they combine multiple variables that are typically addressed separately. For example the new maps use the latest climate science to look at how tropical storms will change in the future instead of what they are right now, or even looking backwards at previous storms, as federal disaster officials do to build their flood maps. These data, in turn, are integrated with sea level analysis.

The researchers hope that creating more accurate maps—especially those that are customized according to local conditions down to the county level—will help coastal municipalities prepare to face the effects of climate change head on.

(100-Year Floods continued on page 45)

"Policy makers can compare the spatial risk change, identify hotspots, and prioritize the resource allocation for risk reduction," said Lin. "Coastal counties can use the county-specific estimates in their decision making: Is their risk going to significantly change? Should they apply more specific, higher-resolution data to quantify the risk? Should they apply coastal flood defenses or other planning strategies or policy for reducing the future risk?"

*Article provided by Princeton University*

'100-year' floods will happen every 1 to 30 years, according to new flood maps (2019, August 23) retrieved 26 August 2019 from <https://phys.org/news/2019-08-year-years.html>

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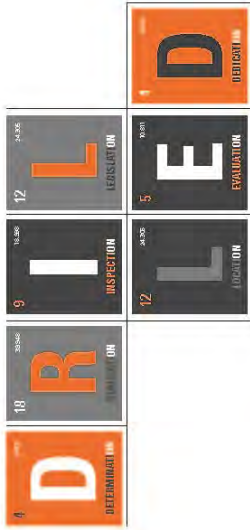
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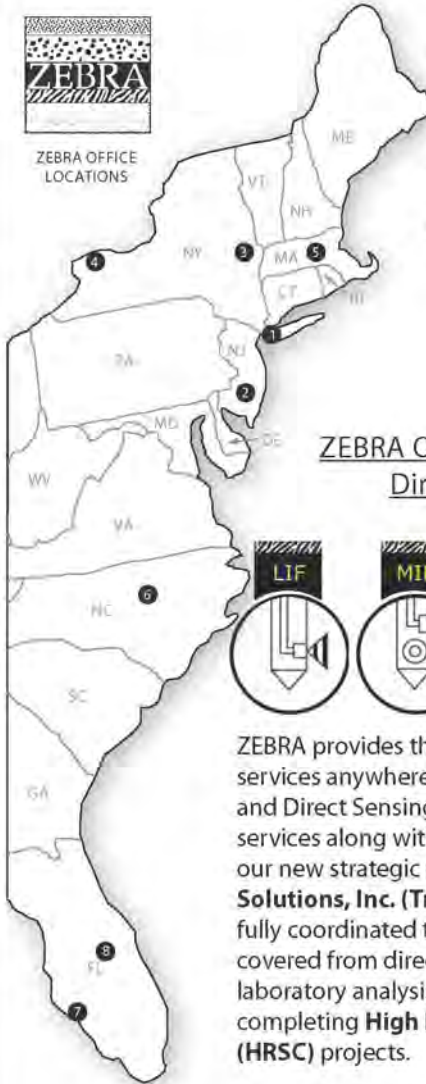
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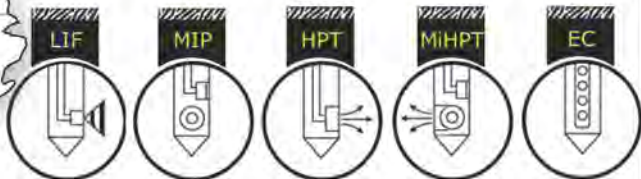
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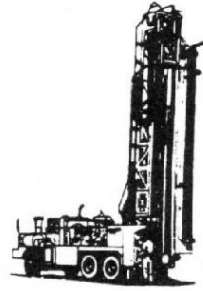
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# Listening to Rock Music

By Michael Lucibella  
*Antarctic Sun* Editor Posted July 8, 2019



Rocks are cracking up all over Antarctica's McMurdo Dry Valleys.

Though it may take hundreds of thousands, or even millions of years, the slow but inevitable processes of weathering eventually reduce all rocks into sand or even clay.

But precisely how that happens and what drives the process is poorly understood.

This year, a team of researchers set up an experiment to literally listen to these rocks at the bottom of the world.

"We're trying to study erosion and weathering in the coldest, driest, windiest place on the planet," said Jennifer Lamp, an earth scientist at Columbia University's Lamont-Doherty Earth Observatory and principal investigator on the project. "We're interested in the unique



*Jen Lamp adjusts one of her instruments that's monitoring erosion in the Beacon Valley.*

*(Listening to Rock Music continued on page 55.)*

*Photo Credit:*

*Mike Lucibella*

*At the far end of the  
McMurdo Dry  
Valleys, Jen Lamp  
performs some final  
checks before  
leaving her  
experiment out for  
the austral winter.*



With a firmer grasp of erosion in this climate, scientists could better understand how landscapes change over time, as well as to more accurately determine how long rocks have been exposed at the Earth's surface, an important benchmark for scientists trying to gauge the age of glacial deposits. Lamp's research is supported by the National Science Foundation, which manages the U.S. Antarctic Program.

## **Why Rocks Crack**

The McMurdo Dry Valleys are unlike almost anywhere else on the planet. Though originally named "dry" because they are perpetually ice-free, their extreme combination of bitter cold and barren dryness stands in stark contrast to warmer, relatively damper desert regions elsewhere in the world that have been more extensively examined. Acoustic emission monitors wired up to the team's rocks listen and record as the stones crack from erosion.

"People have been studying rock weathering in deserts for a while, but they're really focused on hot deserts," said Kate Swanger, a geologist at the University of Massachusetts, Lowell. "A lot of the conditions are similar, but a lot aren't."



Getting a better understanding of what causes rocks to break down and erode away in the cold, dry deserts of Antarctica will give scientists insight into what shapes the landscape more broadly, both in Antarctica and other cold dry regions around the world.



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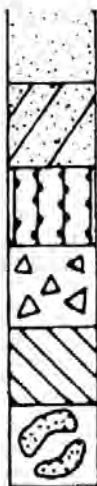
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*(Listening to Rock Music continued from page 55)*

"Part of understanding Antarctic geomorphology, is understanding how rocks actually crack," said Martha-Cary (Missy) Eppes, a geologist at the University of North Carolina, Charlotte. "Understanding the factors that influence rock fracture on Earth's surface generally is something that we haven't quantified."

The exceptional dryness of the Dry Valleys act as a kind of laboratory experiment to study physical weathering more closely. Water is the number-one factor that drives erosion and weathering, either by flowing over rocks and wearing them away, or catalyzing the chemical and physical processes that do. But there's so little water in the inland portions of the Dry Valleys that other factors may reign supreme.

In any desert, rocks tend to be broken down by physical phenomena like blowing sand eroding away their outer layers and cracks propagating from stresses in the environment such as freezing or heating by the sun. But which of these dominate in Antarctica remains a mystery.

To find out how and the rate at which Antarctic rocks are breaking down, the all-woman team camped for three weeks in the Beacon Valley at the far end of the McMurdo Dry Valleys to set up their equipment.

Though New Mexico may be an arid environment for North America, it's downright damp compared to the extreme climate of the McMurdo Dry Valleys. The particularly dry desert conditions of the Beacon Valley and the adjacent Mullins Valley are what attracted the team to their research sites.

"There's no flowing liquid water," Lamp said. "There's no macroscopic biological life, so we don't see things like lichen or any of the other things that you see in other parts of the Dry Valleys."

Their instruments are designed to "listen" to rocks breaking apart in real time to get a better idea of how often these cracking events occur and what causes them.



*Photo Credit: Martha-Cary  
(Missy) Eppes  
Jen Lamp and Kate Swanger  
collect rock samples along  
the headwall of the Mullins  
Glacier in inclement weather.*

*(Listening to Rocks Music continued on page 67)*

# MARCH 2019 MEETING MINUTES

## NE SECTION – AIPG EXECUTIVE COMMITTEE MEETING MONDAY MARCH 11, 2019

Distribution:

Jessica McEachern	Michael Grifasi	Bob Blauvelt
Jeff Frederick	Kelly Weyer	Luanne Whitbeck
Laurie Scheuing	Chris Brown	Brandon Tufano
Dennis McGrath	Jennifer Becker	Adelina Prentice
Dick Young		

### Call to Order (4:06 PM)

**Secretary's Report:** Minutes prepared by Adelina Prentice. The January 2019 meeting minutes were reviewed, and additional comments requested. A motion was made and seconded to approve the January 2019 minutes. Treasurer's Report.

**Treasurer's Report January & February 2019:** Bob Blauvelt has recently been receiving emails and text messages from people posing as Excom members requesting checks. The scam requests Bob send money immediately and more information will follow. Be aware this latest phishing attempt is targeting treasurers and committee members and use caution.

The NE Section budget is currently in good standing. The January and February treasurer's report includes a considerable amount of advertising revenue. Payables to the fund include bank card, and the Star Chapter web hosting fees. The Angelo Tagliacozzo Memorial Geological Scholarship (ATMGS) fund has one donation in January and has recouped considerably from the December down turn.

Bob investigated the credit card processing issue prior to the National meeting. The problem stems from a bad merchant ID number that expires annually. Bob has updated that with the website and Wells Fargo and it should now be seamless going forward.

### Correspondence:

#### Student Chapter Updates:

- Jennifer Becker is attempting to nail down a date with Brooklyn College for a career panel and will update via email once a date is established.

*(January Minutes continued on page 74)*



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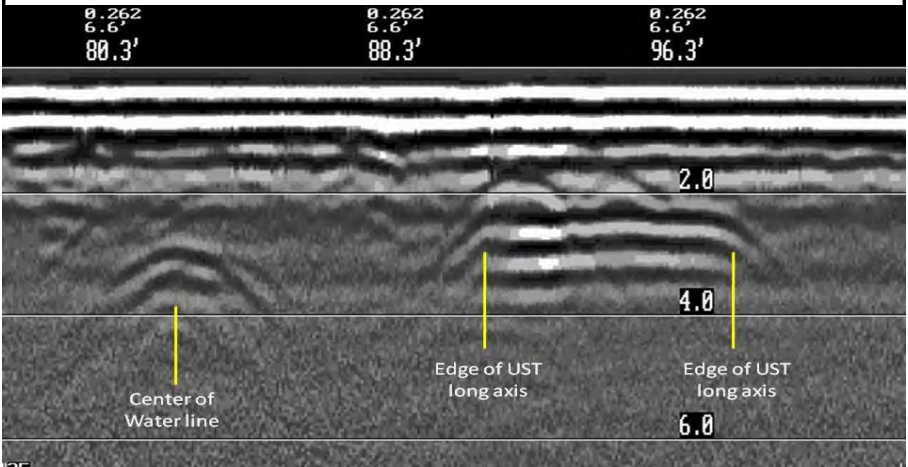
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*(Listening to Rock Music continued from page 60)*

"One of the techniques we're using is called acoustic emission monitoring," Lamp said. "Acoustic emissions are the generation of small elastic waves that come from the formation of new or propagation of existing micro-cracks.

"Whenever a rock breaks or a crack spreads, it gives off subtle elastic waves, an example of which are sound waves, which pass through the body of the rock. By attaching instruments that can "hear" these cracks, the team will know how often a rock is breaking apart and when it happens.

"[The monitors] are similar to passive seismic monitoring, except that we're looking at a smaller scale," Lamp said.

Along with the monitors, the team set out a weather station next to their instrumented stones. The station records wind speed and direction, sunlight intensity, barometric pressure, air temperature and humidity. The team also wired up the boulders with temperature sensors, and a number of other nearby boulders with sensors to record their surface moisture.

"The idea is to try to compare the timing of those acoustic emission events with the environmental conditions," Lamp said. "Do we see more events, which would be micro-cracks, after say snowfall or during times of fast temperature fluctuations, or in times of high wind speeds? So, the idea is to try to figure out which of those processes is causing weathering and erosion under the current present-day climate."



Covering the boulders with multiple sensors lets the team isolate as much information as possible about what was happening to the rocks.

"The other thing that we can do with the software that we have is to do a 3-D location on where the cracks are happening," Lamp said. "We can use the location of the cracks to say something about the process and what's happening in the rocks."

*Kate Swanger hauls a GPS unit to get precise location data for each rock sample they collected.*

*(Listening to Rocks Music continued on page 70)*



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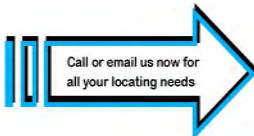
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*(Listening to Rock Music continued from page 67)*

## **Fieldwork in a Barren Land**

The team was selective about the rocks they ultimately chose to instrument, leaving no stone unturned in search of the perfect samples.

"We spent about a week, almost, hiking around and identifying the absolute best boulders," Eppes said.

They were looking for a range of samples with different compositions and crystal- grain structures that were representative of the different rock types throughout the valley.

Once they found their four boulders, they epoxied six acoustic emission monitors to each of them and set them out under the sun. The boulders look like they have stethoscopes glued all over them with numerous cables running to the nearby computer terminal and power source.

"There're wires everywhere," Eppes said. "It took quite a long time to rock all of that down and make sure the wires weren't flapping in the wind."

As luck would have it, nature prepared a sort of unplanned test for the setup. Just a day or so after they finished setting out the instrumented boulders, their string of good weather came to an end. The camp was battered with a brutal storm, with wind gusts reaching 70 knots (80 miles per hour) at times. After a harrowing day huddled inside their tents, the team emerged to find that their setup had weathered the storm.

*Photo Credit: Mike Lucibella*

*Jen Lamp adjusts a setting on the weather station adjacent to her team's instrumented boulders.*

"We're actually feeling pretty confident that it looks like the equipment was adequately anchored down and the sensors were on the rock well enough that if we leave it for the year, hopefully it will make it till next fall," Lamp said.

Measuring acoustic emissions is a relatively new technique in geology. It was originally developed for engineering, listening to the telltale signs of stress cracking on bridges and other infrastructure. Eppes was among the first to use it to study the weathering of rock.



*(Listening to Rock Music continued on page 71)*

She's conducted two previous versions of this experiment, similarly instrumenting stones in North Carolina and New Mexico. This is the first time the technique has been used in Antarctica.

"We really strongly see an influence of the environment on rock cracking," Eppes said. "Rates of rock cracking increases by orders of magnitudes as [water] vapor pressures increase... but we don't have a lot of data at extremely low vapor pressures."

## **Space Particles**

In addition to the instrumented boulders, the team collected more than 60 rock samples from throughout the Beacon Valley and along the Mullins Glacier, which flows into the upper part of the Valley. They're in the process of analyzing these samples, trying to determine their ages.

"We're trying to quantify erosion rates over a range of time periods," Swanger said.

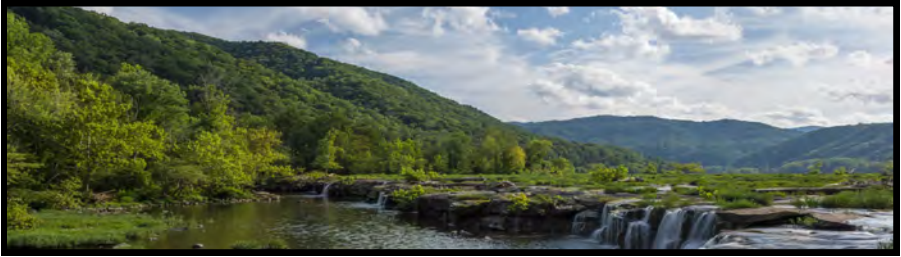
Swanger is focusing how long it takes rocks in the Dry Valleys to break down because the actual processes of weathering and erosion can affect how scientists measure the age of rocks.

One tool that scientists use to date the age of rocks is a process called cosmogenic nuclide dating. As long as a rock is exposed on the Earth's surface, it's bombarded by cosmic rays, particles streaming down from space that penetrate a few centimeters into the surface of the rock. These particles affect the composition of the rocks, creating isotopes embedded within them that were not originally present. By measuring the concentration of these isotopes, geologists are able to date how long a rock had been exposed at the surface of the Earth.

The team is hoping that the four rocks wired up with acoustic emission sensors will collect data throughout the austral winter.

At the same time, as the outer layers of the rock erode away, these isotopes erode as well. Some also undergo radioactive decay, with both processes affecting the isotopic concentration that gives scientists the ages of rocks. Researchers make assumptions about what these rates of erosion are to compensate for their loss of surface layers, but the team is hoping to use their range of samples pin down that rate more precisely.

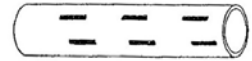
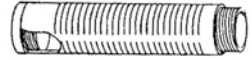
"The idea is we get a better idea of erosion rates for different rock types," Lamp said. "Hopefully next time someone goes out and is looking at landforms made of dolerite or sandstone they would have a better idea of what to assume for the erosion rate to use when they're trying to do exposure age calculations."



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*(March Minutes continued from page 61)*

- Michael Grifasi has a point of contact for SUNY Geneseo and we have agreed to host a professional event on campus on April 19<sup>th</sup>. A few members have volunteered to participate, and SUNY Geneseo should be encouraged to participate in the Fall AIPG meeting.
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- ♦ AT Scholarship – Scholarship Committee Recommendations for 2019 Awards: The scholarship committee recommends awarding 10 scholarship awards, ranging from \$1,000 to \$4,000 and totaling \$18,000. A discussion followed comparing the budgeted amount to the suggested amount, and options to pay out the scholarships, including paying entirely from Section account, and contributing a portion from the scholarship checking account or from the fund itself.
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- ♦ A motion was made and seconded to adjourn the trustees meeting at 5:09 pm.
- ♦ Excom meeting was recalled to order at 5:09 pm.
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### 2019 Annual Meeting, Burlington, VT – Updates

Short Course Updates – A few courses have been planned: a course on geophysical techniques for environmental investigations including a field demo has been approved for 8 tech credits; a 4-hour short course on using drones on site investigations; additionally there is one more course planned and Bob will follow up with the details.

*(March Minutes continued on page 78 )*



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# North America is About to Get Its Largest Copper Mine

By Erik Klemetti | August 13, 2019 for



*Shaft in the Superior-Resolution copper prospect in Arizona.*

Copper is one of the most valuable metals on the planet. Sure, it lacks the cachet of gold, silver or platinum—those are “precious metals” after all. Yet, without copper, the world as we know it would not operate. If you have electricity, you need copper.

This week, Rio Tinto and BHP Billiton, one of the world’s largest mining companies, were given permission from the U.S. Forest Service to move ahead with the Resolution prospect near Apache Leap in Arizona. This would become the largest copper mine in North America once the mine is operational in the 2020s. The mine would also be one of the deepest in the world, boring down more than 2 kilometers (7,000 feet).

*(Copper Mine continued on page 77)*

The companies have already invested over \$2 billion into the project, so you can imagine how much value the site has for the companies. Politically, it fits with the president's goal of resource independence as well.

Thing is copper isn't really that uncommon on Earth. If you took just the top one kilometer of the planet's crust and crushed it all up, then sifted out the copper, you'd end up with roughly  $10^{14}$  tons of copper. That's over twice the mass of the asteroid Ida (in other words: a lot of copper!)

All that copper is not evenly distributed. The average concentration of copper is only ~50 parts per million. If you wanted to extract that copper from your average chunk of Earth's crust, and make money doing it, well, you'd be out of luck. Most copper mines need the metal to be concentrated to over a few percent in the average rock of the deposit.

How does that happen? Lots of ways. You can have copper in hot fluids that move around under volcanoes (known as porphyry deposits) or from black smokers on the ocean floor or even in sedimentary rocks. Most of the time, these fluids will cause minerals like chalcopyrite, bornite, chalcocite, covellite and more to form — and they're all copper rich.

Those copper deposits where you can make a profit extracting the metal are somewhat rare. Since 2010, the world's largest copper producer has been Chile, thanks to the abundant porphyry copper in the Andes. Chile produces almost twice as much copper as the number two country, Perú.

*(March Minutes continued from page 74 )*

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*(End)*



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*(Copper Mine continued from page 77 )*

The other top countries include China, the US, the Democratic Republic of the Congo, Australia, Zambia, and Indonesia.

The United States has a long heritage of copper production. Early U.S. copper was mined in Michigan, even before Europeans arrived. Huge deposits in places like Butte, Montana, Bingham, Utah, Yerington, Nevada (which is reopening), and Morenci, Arizona helped drive the electrification of the country. Many of these mines have since closed, but the American Southwest still produces a lot of copper.



*Mine operations at Chuquicamata, one of the largest copper mines on Earth. Use the van in the bottom of the frame (arrow pointing to it) for scale.*

Like most geologic resources, copper prices have had their ups and downs. Prices were low during the 1980s,

*(Copper Mine continued on page 81)*

but after a peak of ~\$4.40 per pound in 2011, copper is currently selling for ~\$2.85 per pound.

So, if you want to open a copper mine in the United States, the higher cost of labor and permitting means you need one that has lots of the metal. The Resolution prospect in Arizona is just that: a copper deposit that could supply a quarter of the country's current copper demand.

But mines are also destructive to the environment, especially operations like copper mines. You need a lot of ore to get the copper when only a few percent of the rock is the metal you seek. The most effective way to get the rock is just to dig a big pit or a network of tunnels to get at the richest ore.

This has led to some of the largest man-made features on Earth, like the pits at Chuchiquamata or Collahausi in Chile. Resolution wouldn't be a new open pit mine because most of the copper lies over 2 kilometers down, but lots of material from the mining would still make it to the surface.

On top of the destruction caused by the mining itself, there are a lot of byproducts from copper mining. With copper comes sulfur—these two elements love each other and most copper minerals used in mining are sulfides. So, when you mine and extract the copper, you get a lot of leftover sulfur that can get into the environment. This sulfur interacts with water to create sulfuric acid... and that leads to acid mine drainage.

Some big copper mines have devastated the surrounding countryside due to acid mine drainage. The Butte copper pit, once the mine closed, became one of the first Superfund sites thanks to a lake that filled the mine pit with a pH of ~2.5... so acidic it killed birds that landed on it.

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*(Copper Mine continued from page 81)*



*The devastated landscape around Ducktown, Tennessee in 1939. The barren land was caused by the sulfur released during copper smelting.*

Ducktown in Tennessee (see above) is a famous site still recovering from copper mining and smelting in the 1900s-60s.

Mining is also dangerous. The depth of the Resolution mine means the actual mining will happen where the ambient temperature is between 76-82°C (170-180°F)! On top of that, underground mines can collapse, like the 2010 accident in the San José mine in Chile, trapping 39 men over 700 meters (2,300 feet) from the surface.

It can be easy to say that all mining is wrong. Yet, in order to live the lifestyles we are accustomed to, we need raw materials from Earth. The question becomes: at what cost? Careful consideration of the impact of the mine and the resources that come from it, the recovery of the area after the mine closes and the treatment of the workers is required to make sure we are mining responsibly.

Many times, the dollar signs involved in mining mean that these considerations get ignored or repealed as “government red tape”. The damage that can be done to the environment and communities due to irresponsible mining can be immense. The potential opening of the Resolution prospect should remind all of us that we need to be vigilant about such development — the demand might be there, but unfettered mining can be catastrophic.

*(End)*

# **NE/AIPG 2019 PUBLICATION SCHEDULE**

## **Winter Newsletter**

January 11	Deadline (Material to Editor)
January 25	Content to Publisher
February 11	E-mail to Members

## **Directory of Members**

February 11	Deadline (Material to Editor)
March 15	Content to Publisher
April 15	E-mail to Members

## **Spring Newsletter**

March 22	Deadline (Material to Editor)
April 5	Content to Publisher
April 22	E-mail to Members

## **Indian Summer Newsletter**

July 26	Deadline (Material to Editor)
August 16	Content to Publisher
September 3	E-mail to Members

## **Holiday Newsletter**

October 11	Deadline (Material to Editor)
October 25	Content to Publisher
November 11	E-mail to Members

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## **Celebrating 32 Years of Scholarships! The Angelo Tagliacozzo Memorial Geological Scholarship**

The Angelo Tagliacozzo Memorial Geological Scholarship was established by the Northeast Section of the American Institute of Professional Geologists in late 1986. The first Scholarships were presented to undergraduate Geology students in 1987.

ATMGS recognizes the dedicated leadership and service which Angelo provided to NE/AIPG, to AIPG, and to the geological profession, until his untimely passing on October 11, 1986. The Scholarship furthers Angelo's goal of acquainting young geologists with AIPG and with AIPG's importance to the geological profession.

### **ANGELO TAGLIACOZZO (1936 - 1986)**

Angelo Tagliacozzo received his doctorate in Geology from the University of Rome (Italy) in 1962. Thereafter, he worked in various positions as geologist, geophysicist, and hydrogeologist, which included assignments abroad, in the U.S., and with the United Nations. Angelo provided exemplary service to AIPG at the Section and National levels. He was a Northeast Section Executive Committee Member (1973-1982), Vice President (1977-1978), President (1979-1980), National Advisory Board Delegate (1981-1982), and Screening Board Chairman (1984-1986). Angelo's dedication to and leadership of the Northeast Section Screening Board has become the ultimate standard against which service in such a position is measured. Angelo also served as an AIPG National Executive Committeeman (1982); he was a vigorous advocate of measures to increase professionalism. Angelo was (and will be remembered as) a respected professional...and a friend.

### **THE SCHOLARSHIP**

NE/AIPG grants Scholarships to undergraduate geology students annually. The Scholarships are designed to help with the cost of summer field courses, textbooks, and other aspects of geological education. Scholarships are awarded, both on academic achievement and on financial need, to students enrolled in recognized geology programs at colleges or universities in New England, New Jersey, & New York.

### **YOUR CONTRIBUTIONS**

Your participation is encouraged in support of this dynamic memorial to Angelo and his recognition of the importance of AIPG to the geological profession. Contributions to the Scholarship Perpetual Trust Fund should be written to:

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[mcgrathdg@gmail.com](mailto:mcgrathdg@gmail.com) Cell: 914-424-8816

**Memorandum**

**To:** Dennis McGrath, Chairman, ATMG Scholarship, Northeast Section, AIPG

**From:**

**Date:**

**Re:** *I'm Taking the Pledge: 'M IN FOR 2019!*

Dear Dennis,

Just a quick note to let you know that I'm 100% with you when it comes to achieving the Section's goal of 100% participation in support of the Scholarship Perpetual Trust Fund during 2019, the 32nd Anniversary of the Scholarship! I agree with your encouragement that each and every Section Member make a contribution in accordance with their ability... and this is the one time when I don't want to be the odd person out!

***'M IN FOR 2019!***

For 2019, the 33rd Anniversary, I'm considering pledging... Thirty Bucks A Week, Thirty Bucks A Month, or Thirty Bucks for the Year!

Now, I know that it could be more—and you know that it could be less!—but I am committed to contributing as much as I can, so I'm not going to delay it any longer: ***'M IN FOR 2019!***

Yes, my personal budget is tight, but I figure that, somehow, I can set aside \$30 each month (aka the cost of daily lattes) this year to give back to the profession that has given me so much. Also, I just wanted to tell you I am delighted to know that every one of those hard-earned dollars that I contribute will be INVESTED in the Scholarship Perpetual Trust Fund, so that my contribution today can keep on giving, year after year!

And that makes me feel like my contribution really means something, both now and in the long term! I have thought it over, and I know how important 100% participation is for Section pride! So, Dennis, ***'M IN FOR 2019***

Professionally yours,

\_\_\_\_\_

*Times are really (GREAT / poor), so I am pledging:*

\_\_\_\_ 30 Bucks A Week (\$1560 for 2019)

\_\_\_\_ 30 Bucks A Month (\$360 for 2019)

\_\_\_\_ 30 Bucks A Year (\$30 for 2019)

Other: \_\_\_\_\_ (Every little bit is better than nothing!)

\_\_\_ I'll make it easy on you; I have enclosed my check, made out to "*Angelo Tagliacozzo Memorial Geological Scholarship Trust Fund.*"

\_\_\_ Please invoice me for my 2019 pledge by 10/31/19. I'll pay by 12/1/19.

*Signed:* \_\_\_\_\_

Name Printed: \_\_\_\_\_

Address: \_\_\_\_\_

*Mail this Pledge to:* NE/AIPG Geological Scholarship Trust Fund, c/o Bob Blauvelt,  
345 Stuyvesant Ave Lyndhurst, NJ 07071

- or -

*Email this Pledge to:* NE/AIPG Geological Scholarship Trust Fund, c/o Bob Blauvelt  
blauvelt@geiconsultants.com