PITTSBURGH GEOLOGICAL SOCIETY

November 10, 2021

MEETING TIMES
Social Hour 5:30 PM
Dinner 6:30 PM
Speaker 7:30 PM

DINNER COSTS
$35.00 regular member
$15.00 student member
$40.00 non-member

RESERVATIONS
Email your name and number of attendees to:
pgsreservations@gmail.com

Or reserve and use PayPal:
https://www.pittsburghgeologicalsociety.org/

MEETING LOCATION
Cefalo's Banquet & Event Center, Carnegie PA

COVID19 POLICY
See page 4 for guidance.

Appalachian Orogenesis:

A Manifestation of Interactions Between Crust and Mantle in Response to Plate Collision, Coupling and Capture?

Thomas H. Anderson, Ph.D.

Professor Emeritus
Department of Geology and Environmental Science
University of Pittsburgh

Early Deadline – Please RSVP by Wednesday, November 3

Speaker Abstract

As pointed out by John Rodgers (1971):

1) The Taconic orogeny of eastern North America was not, as traditionally defined, a single orogenic event that occurred at the end of the Ordovician period,

2) The orogeny comprised a complex series of orogenic episodes or climaxes spread over the larger part of that period,

3) In most sectors of the northern Appalachians it included at least three of the following: a) a disconformity in an external belt where carbonate was accumulating; b) severe early deformation (collision?) in an internal volcanic belt; c) gravity slides from internal uplifts into the external belt; and d) widespread deformation, especially in the more external belts,

4) These events did not occur at the same time in the various sectors; each took a considerable time, and they overlapped to some extent.

5) Detailed analysis of the "fine structure" of the Taconic orogeny “combats the dogma” that orogenies are sharp, discrete events punctuating the geologic record (separating periods and abruptly terminating geosynclinal sedimentation)

6) They reflect "random-walk" processes within the Earth, in all likelihood the same as those responsible for sea-floor spreading and the present tectonic state of the Earth.

Each of the classical episodes of orogenesis including Taconic, Acadian, and Alleghenian events, which contributed to the extensive orogen that is the Appalachian Mountains, shared the characteristics recognized by Rodgers. During the Taconic, two episodes of Ordovician volcanism preceded the culminating contractional deformation at ca. 450 Ma that marked by formation of the Bronson Hill arc, emplacement of olistostromes and thrust masses of the Taconic allochthon and deep emplacement of crust during induced subduction along a major suture, coincident with the Red Indian line, currently marked by outcrops of eclogite. Following this “tectonic dunk” resumption of extension in response to plate stretching was recorded by volcanic eruptions that spread ash across much of Laurentia and Baltica and accumulation of the Utica shale.

The initiation of Acadian orogeny coincides with convergence, recorded by plutons (~435 to 420 Ma), followed by collision of Laurentia and Baltica, or the microcontinent Avalonia, (ca. 423–385 Ma) during which time subduction of the margin of Baltica, beneath Laurentia was induced, followed by metamorphism and plutonism. Although the lack of key lithotectonic suites such as ophiolite and blueschist is puzzling, geochronologic results reveal deformation recorded by ca. 407-393 Ma (Emsian) movement of the deformation front, ages of many syntectonic, 408–404-Ma plutons, and peak, high-grade metamorphism (~405 to 398 Ma). Isoclinal upright folds and associated cleavage in deformed Emsian strata in New York state that are cut by dikes dated at 399 Ma, constrain the timing of shortening to between ca. 409 and 399 Ma. Cores and overgrowths in titanite are inferred to have formed along prograde (ca. 413 Ma) and retrograde (ca. 395 Ma) paths, respectively, associated with the induced subduction and exhumation (tectonic “dunks”) of a slice of Baltic basement, following collision. Induced subduction caused crustal shortening that correlates with formation of eclogite in west Norway and New England (USA). Exhumation of the deeply emplaced crustal rocks took place at releasing bends along the Great Glen fault in concert with volcanic eruptions and accumulations of black shale (e. g. Tioga and Marcellus).

In southern New England, outcrops of ultramafic cumulate rocks that formed during deep-seated (~1.1 GPa) fractional crystallization contain subhedral to anhedral zircons that record the Acadian thermal episodes (ca. 410 and 392 Ma) as well as younger Carboniferous (ca. 360 and 337 Ma) deformation. Metamorphism and ductile deformation resulting from the inferred Alleghanian (ca. 320 Ma) collision of Laurentia and Gondwana are restricted to narrow shear zones, which separate broad zones containing older fabric and mineral assemblages. At about 300 Ma., a culminating contractional deformation is also inferred.

In the southern Appalachians, the largely Neoproterozoic to middle Cambrian Carolina terrane (east of regionally autochthonous North American margin), is a calc-alkaline island arc, exotic to Laurentia until the late Paleozoic Alleghanian orogeny. Field and geochronological studies have shown that metamorphic fabric in most of the Carolina terrane formed prior to 535 Ma. The Carolina terrane comprises three belts with different metamorphic and petrological characteristics: (1) the Kings Mountain belt, which consists of greenschist facies mafic metavolcanic rocks, (2) the Charlotte belt, which consists largely of lower to middle amphibolite facies, dominantly mafic metavolcanic and metaplutonic rocks; and (3) the Carolina Slate belt, which is dominated by low-grade (greenschist to subgreenschist) felsic metavolcanic rocks. Large displacements along dextral, strike-slip faults probably played an important role in emplacement of the Carolina terrane.

Speaker Biography

Dr. Thomas H. Anderson earned a BA from Franklin and Marshall College and MS and Ph.D. from the University of Texas (Austin). His graduate research involved field studies in western Guatemala where he mapped Los Altos Cuchumatanes range, which comprises the northern margin of the Motagua-Polochic fault zone and suture. From 1968 until 1974 he conducted regional mapping and geochronological reconnaissance in northwestern Mexico while a post-doctoral fellow at the California Institute of Technology. The results, which revealed apparent offset of Proterozoic terranes and overlying sedimentary units through Triassic age, are interpreted as indicating about 800 km of sinistral movement, contemporaneous with the opening of the central Atlantic Ocean, beginning at ca. 170 Ma. In 1974 he joined the Department of Geology and Planetary Science, now Geology and Environmental Science, at the University of Pittsburgh. His research and that of his students, 32 of whom earned graduate degrees, focused mainly upon mapping and structural analyses in Guatemala, northern Mexico, British Columbia (Canada), the central Appalachian Mountains and Plateau, and southern Nevada. Anderson, who spent 15 years as Departmental Chair, retired in 2010.

Please note that PGS is monitoring the COVID-19 situation closely and will continue to modify our mask policy based on the recommendation of national and local experts. The US Centers for Disease Control and Prevention (CDC) currently recommends the following:

- Those who are not vaccinated should wear a mask indoors in all public places.
- Those who have a condition or are taking medications that weaken their immune system should wear a mask indoors in all public places.
- If you are fully vaccinated, to maximize protection from the Delta variant and to prevent possibly spreading it to others, you should wear a mask indoors in public places if in an area of substantial or high transmission. Allegheny County is classified as an area of high transmission

To best align with the recommendations of the CDC, PGS strongly recommends that meeting attendees wear a mask and maintain social distancing to protect other meeting attendees and themselves. Masks may be removed when eating or drinking; however physical distancing is encouraged for those times. Please note that some members in attendance may qualify as immunocompromised, or may be caregivers for those who are, regardless of vaccination status.

UPCOMING PGS MONTHLY MEETINGS

Meeting Date	***Scheduled Speaker***	***Presentation Topic***
December 15, 2021	Mary Hubbard, Montana State University	Geology of the Himalayas
January 19, 2022	Todd Halihan, University of Oklahoma	Engineering Geology Topic
February 16, 2022	David King, Auburn University	Chicxulub Crater Geology
March 16, 2022	Jamie Farrell Utah State University	Geology of Yellowstone
April 20, 2022	19th Annual Student Research Night	
May 11, 2022	TBA	Oil and Gas Industry Topic

The Pittsburgh Geological Society welcomes several new members:

Jake T. Didion, GIT and Laboratory Supervisor
American Geotechnical & Environmental Services, Inc.

Michael Pungitore Geologic Specialist
American Geotechnical & Environmental Services, Inc.

JeKai L. King, Student Member, CalU
Jacob L. Krivijanski, Student Member, CalU
Travis R. Sitko. Student Member, CalU

PRESIDENT'S STATEMENT

Our October meeting was a hit with a wonderful talk provided by Dr. Tom Jordan, PG, regarding the use of geophysics to locate clandestine graves and to aid in FBI investigation of missing persons. It was a lovely meeting overall with great scientific discussion and, as usual, a delicious meal.

After reviewing the applications for selection of a student representative to the board, the Pittsburgh Geological Society is proud to announce the selection of **Jasmine Davis** from California University of PA, who will serve as the Student Representative to the PGS Board of Directors for the remainder of the 2021-2022 program year.

Jasmine will be seeking to contact potential students from other universities that wish to act as a liaison for their program. These liaisons will communicate directly with the student representative to receive updates regarding PGS board business and will communicate to the representative any concerns or input for the board's consideration. To seek more information, or to apply to serve as a student liaison, please use the "Contact Us" page of the PGS website.

The October meeting also advertised a new field camp offering provided through collaboration among the various Pennsylvania State System of Higher Education (PASSHE) geology programs which will be available to students of PASSHE schools starting this May. This field camp will be a five-week offering to take place in Pennsylvania and will have a special emphasis on stratigraphy, field technique, and skillsets tailored towards the needs of Pennsylvanian geologists.

The hope is to offer a field camp experience that will better train students for a geology career in Pennsylvania. The coordinators of the field camp are currently accepting any advice or guidance on skillsets and field techniques to emphasize in the planning of the field camp. Advice may be submitted through the "Contact Us" page of the PGS website. All suggestions will be forwarded to the coordinators for incorporation into the upcoming field course.

I'm looking forward to our November talk about Appalachian Orogenesis by Pitt Emeritus Professor Thomas Anderson (better known to many of you as TA). The date for this meeting is **November 10, 2021**. This is the second Wednesday of the month, a departure from our usual monthly meeting schedule.

The earlier date means that dinner reservations will need to be made a week earlier as well. Be sure to RSVP through our website or via email by **November 3** to ensure we have an accurate dinner count.

I hope to see you all in November!

Dan

LOCAL GEOLOGICAL EVENTS

GEOPHYSICAL SOCIETY OF PITTSBURGH (GSP)

November 2, 2021 **11:30 AM – 2:00 PM**

" Revealing the forgotten conventional prospects of "shale 3D": The Knox Unconformity play of Ohio" by Randy Hunt of Hunt Geophysical

Cefalo's Banquet Center, Carnegie PA 15106

Details and RSVP link: http://www.thegsp.org/event-4522191

SOCIETY OF PETROLEUM ENGINEERS (SPE)

November 2-3, 2021 **Multi-Day**

"2021 SPE Eastern Regional Meeting"

Nemacolin Woodland Resort, Farmington, PA 15437

Details: https://connect.spe.org/pittsburgh/home

HARRISBURG AREA GEOLOGICAL SOCIETY (HAGS)

November 11, 2021 **6:30 – 8:00 PM**

"Dam That Muddy Creek! Lake Arthur Dam Siting, Design and Construction History (Moraine State Park)" by Gary Fleeger, P.G., PA Bureau of Geology, retired (Zoom presentation)

To request a meeting link, email secretaryhags@gmail.com

PENNSYLVANIA COUNCIL OF PROFESSIONAL GEOLOGISTS (PCPG)

November 16, 2021 **2:00 - 3:00 PM**

"Geology and Geomorphology of the Youghiogheny River and Laurel Highlands" by Frank J. Pazzaglia, PhD, Dept. of Earth and Environmental Sciences, Lehigh University (Webinar: 60 minutes)

Details and registration: https://pcpg.wildapricot.org/event-4478980

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

Historic aerial photo of Munhall. In the early days, it was a "pie-shaped" borough whose borders were the Monongahela River on the north, Ravine Street on the east, and McClure Street on the west (between the white arrows). It ran to a point near what is now 17th Street. Over the years, Munhall has expanded in all compass directions except north.

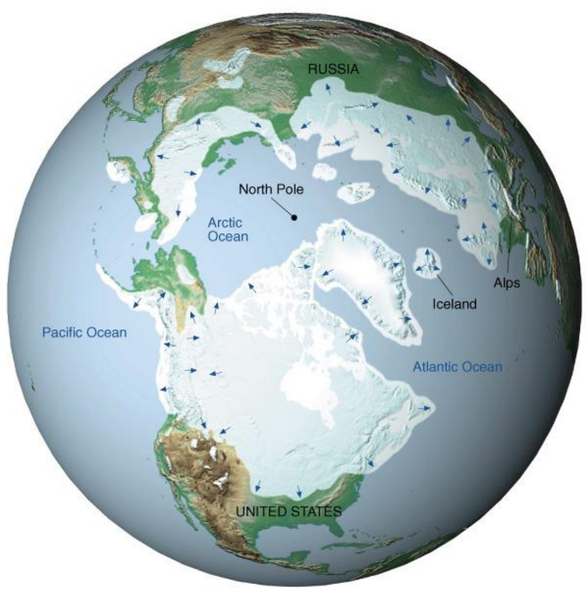
Although a post office called Munhall was established in the vicinity of Homestead on the Monongahela River about eight miles from the Point at Pittsburgh in 1887, it took until the 1890s for the Carnegie Land Company, a subsidiary of Carnegie Steel, to purchase properties from the McClure, Hayes, and Munhall families for the purpose of expanding their Homestead Works and selling lots to its workers for the construction of homes. The Munhall Brothers laid out the town lots, sold them to mill employees, and constructed houses for sale or rental to Carnegie Steel employees in "Munhall Hollow," the area now occupied by Ravine Street, about one mile northwest of the Rankin Bridge.

On June 24, 1901, Munhall, named for John Munhall, was incorporated as a borough. It was a pie-shaped section of the Homestead area that included "East Homestead", Munhall Station, and properties of the United States Steel Corporation along the river. The "pie" ended uphill near what is now 17th Street, and a section of the "pie" near the Carnegie Library of Homestead was developed as the elite section of the two boroughs. Over the years, Munhall expanded to the south until it now abuts six communities, including Homestead, West Homestead, and the Pittsburgh neighborhood of New Homestead on the west, and Whitaker and West Mifflin on the east, and the Pittsburgh neighborhood of Lincoln Place on the south.

DID YOU KNOW . . . ?

New research indicates that the melting of polar ice due to climate change is not just increasing water levels of the oceans, it is changing Planet Earth itself. Researchers from Harvard University found that, as glacial ice from Greenland, Antarctica, and the Arctic Islands melts, the crust beneath those land masses has been warping, and that the impact of this warping can be measured hundreds or thousands of miles away.

Over the years other researchers have done a lot of work looking directly beneath ice sheets and glaciers, so they were aware that melting ice defined the area where the glaciers exist. They hadn't realized, however, that it was global in scale. The new research progressed by analyzing satellite data on ice melt from 2003 to 2018 and studying changes in Earth's crust. They were then able to measure the shifting of the crust



During the Pleistocene, ice covered as much as 1/3 of the Earth's surface. When the ice melted, the isostatic readjustment affected more than just the crust below the ice.

horizontally. Their research found that in some places the crust was moving more in a horizontal direction than it was lifting, giving researchers a new way to monitor modern ice mass changes.

In order to understand how the ice melt affects what is beneath it, the researchers imagined the system on a small scale, like a slab of wood floating in a tub of water. Pushing down on the wood moves the water underneath downward, and picking the wood up allows the water to move upward to fill the space, movements that have an impact on the continued melting. For example, in Antarctica, as the crust rebounds during melting of overlying glacial ice, it is changing the slope of the bedrock and that can affect the ice dynamics.

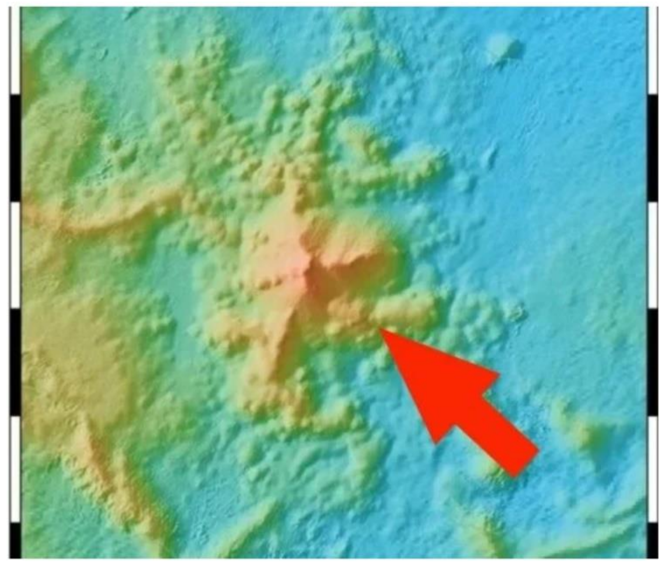
The current melting is not the only movement researchers are observing. The Arctic, for example, also has a lasting signal from the Pleistocene. The Earth is still rebounding from that time when the last continental ice sheet melted. On the timescale of thousands of years, the Earth acts like a very slow-moving fluid, which explains how newer eustatic episodes are overlaid on the older ones. The Pleistocene processes took a long time to play out, so we can still see the results of them today.

The implications of this movement are far-reaching. Understanding all of the factors that cause crustal movement is very important for a wide range of geologic problems. Accurate observation of tectonic movement and earthquake activity, for example, requires us to be able to separate out motion generated by modern-day ice-mass loss. Understanding the extent of this movement clarifies all studies of the planet's crust.

This new research is the first to show that recent mass loss of ice sheets and glaciers causes 3D motion of the Earth's lithosphere that is greater in magnitude and spatial extent than previously identified. We can now look for these signals in regional and larger-scale global navigation satellite system datasets to produce improved constraints on the distribution of ice mass fluctuations and/or solid Earth structure.

https://scitechdaily.com/warping-of-planets-crust-melting-of-polar-ice-shifting-earth-itself-not-just-sea-levels/

A large seismic event starting on May 10, 2018 off the eastern coast of Mayotte, an island between Madagascar and the African continent, was felt across the entire globe. That event gave birth to a gigantic new underwater volcano, which rises 2,690 feet off the ocean floor. It is the largest active submarine eruption ever documented. The new volcano is thought to be part of a tectonic structure between the East African and Madagascar rifts. It is helping scientists understand some relatively little-known deep Earth processes.



Subsea elevation map reveals the location of the volcano that erupted off the coast of Mayotte between Madagascar and Africa.

Just a few days after the initial rumbling, a magnitude 5.8 earthquake struck, rocking Mayotte. Scientists were initially puzzled, but it didn't take long to figure out that a volcanic event, the likes of which had never been seen before, had occurred. The event occurred about 31 miles from the eastern coast of the island, a French territory and part of the volcanic Comoros archipelago. The French government sent a research team to investigate. They found an undersea mountain that hadn't been there before.

The team began monitoring the region in February 2019 using multibeam sonar to map a 3,320-square-mile area of seafloor. In addition, they placed a network of seismometers on the seafloor, up to 2 miles deep, and combined this with seismic data from Mayotte. Between February 25 and May 6, 2019, the network detected 17,000 seismic events from a depth of around 12.5 to 31 miles below the ocean floor. This was a highly unusual finding, because most earthquakes are much shallower. An additional 84 events detected at very low frequencies were also highly unusual.

Using these data, the researchers were able to reconstruct how the formation of the new volcano may have occurred. According to their findings, it started with a magma chamber deep in the asthenosphere. Below the new volcano, tectonic processes possibly caused damage to the lithosphere, resulting in dykes that drained magma from the chamber up through the crust, which produced swarms of earthquakes. The magma eventually made its way to the seafloor where it erupted, producing about two cubic miles of lava and building the new volcano. The low-frequency events were likely generated by a shallower, fluid-filled cavity in the crust that could have been repeatedly excited by seismic strain on faults close to the cavity. The researchers indicated that, as of May 2019, the extruded volume of volcanic material was between 30 and 1,000 times larger than estimated for other deep-sea eruptions, making it the most significant undersea volcanic eruption ever recorded, and comparable to those seen during eruptions at Earth's largest hotspots.

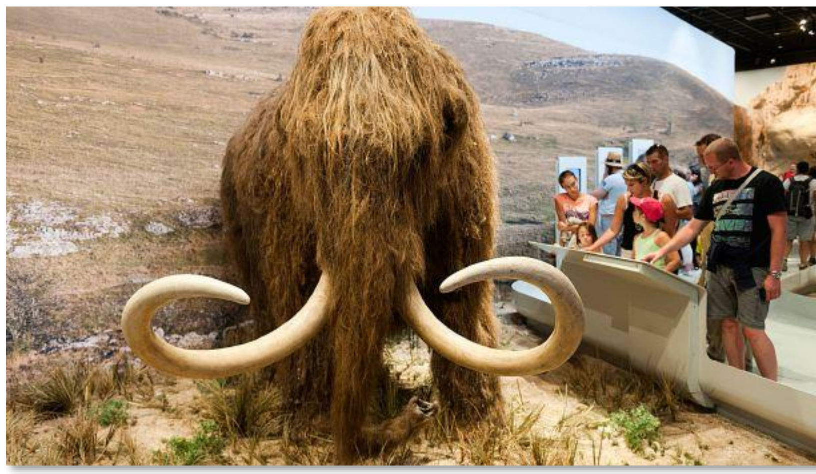
What does the future hold for this new volcano? It is possible it could include a new caldera collapse, submarine eruptions on the upper slope, or onshore eruptions. Large lava flows and cones on the upper slope and onshore Mayotte indicate that this has occurred in the past. Since the discovery of the new volcanic edifice, an observatory has been established to monitor activity in real time, and return cruises continue to follow the evolution of the eruption and edifices.

https://www.sciencealert.com/the-largest-underwater-volcanic-eruption-ever-recorded-gave-birth-to-a-new-volcano

We've all seen and had fun with the movie "Jurassic Park" and its four (so far) sequels where geneticists bring extinct animals back to life to run rampant on two islands and even in two places in the U.S. This is, of course, pure science fiction.

But just when you think such things are impossible we find out that advances in genetics are making resurrecting lost animals a tangible prospect after all.

Scientists have already cloned some endangered animals, and they are able to sequence DNA extracted from the bones and carcasses of long-dead, extinct animals. Now, a team of geneticists propose to bring the woolly mammoth back to life and restore it to its natural habitat, and some supporters believe that, by bringing back the mammoth in an altered form, the animals could help restore the fragile Arctic tundra ecosystem, combat the climate crisis, and preserve the endangered Asian elephant, the woolly mammoth's closest living relative.



Imagine seeing a live wooly mammoth in a zoo or a park. Now, through the "miracle" of genetic engineering, it might be possible in a few years.

This is a bold plan, loaded with ethical issues, of course, but there are folks with deep pockets who are willing to fund the project with a $15 million investment. The project would not simply clone a mammoth: the DNA thus far extracted from woolly mammoth remains frozen in permafrost is far too fragmented and degraded. Instead, the scientists plan to use genetic engineering to create a living, ambulatory elephant-mammoth hybrid that we wouldn't be able to tell from the real thing just by looking at it. And they think they can achieve the first step, mammoth calves, within six years.

The scientists said the project had been a "backburner" venture until their investors stepped forward and anted up. To start, the research team analyzed the genomes of 23 living elephant species and extinct mammoths. Now they believe they will need to simultaneously program about 50 changes to the genetic code of the Asian elephant to give it the traits necessary to survive and thrive in the Arctic.

What are these traits? How about a 10-cm layer of insulating fat, five different kinds of shaggy hair, including some that is up to three feet long, and smaller ears that will help the animal endure the Arctic cold? In addition, the team proposes to try engineering the animal without tusks so they won't be a targeted by ivory poachers. Once a cell with the proper traits has been programmed successfully, the team plans to use an artificial womb to make the step from embryo to calf. That takes almost two years for living elephants.

The technology is far from being nailed down, however, so the team hasn't ruled out using live elephants as surrogates. But there are ethical questions to be answered as well. There are those who believe using live elephants as surrogates for birthing a genetically engineered animal is unethical because mammoths and Asian elephants are as different as humans and chimpanzees. Can you imagine using a human woman as a surrogate giving birth to a chimpanzee? Or vice versa?

https://www.ksl.com/article/50240812/scientists-want-to-resurrect-the-woolly-mammoth-they-just-got-15m-to-make-it-happen

A new study by an international team of scientists indicates that decaying wood releases around 10.9 gigatons of carbon worldwide every year, a number approximately equal to 115% of emissions from burning fossil fuels. This is the first time researchers have been able to quantify the contribution of deadwood to the global carbon cycle. Until recently, very little had been known about the role of dead vegetation. Living trees play a fundamental role in absorbing CO_2 from the atmosphere, but until now no one knew what happened when those trees decomposed.

As it turns out, it has a massive impact. Decomposition and recycling of nutrients is driven by natural processes, including temperature and wood-boring insects such as longicorn beetles, which is a critically important process in forests. Insects such as termites and longicorn beetles can accelerate deadwood decomposition, but until now scientists didn’t know how much they contribute to deadwood carbon release globally. As it turns out, insects account for 29% of deadwood carbon release each year, but their role is disproportionately greater in the tropics and has little effect in low temperature regions.

The research team studied wood from more than 140 tree species found in 55 forest areas on six continents to determine the influence of climate on the rate of decomposition. They placed half of the wood in mesh cages to keep out insects, which allowed them to study their contribution, and found both the rate of decomposition and the contribution of insects are highly dependent on the climate, increasing with increasing temperatures. In addition, they found that higher levels of precipitation accelerated decomposition in warmer regions and slowed it in lower temperature regions.

Tropical forests contribute 93% of all carbon released by deadwood because of their high wood mass and rapid rates of decomposition. The study demonstrated that both climate change and the loss of insects have the potential to alter the decomposition of wood, which can alter the carbon and nutrient cycles worldwide.

https://scitechdaily.com/deadwood-releasing-10-9-gigatons-of-carbon-every-year-more-than-all-fossil-fuel-emissions-combined/

Decaying wood releases around 10.9 gigatons of carbon worldwide every year, which is about the same as 115% of fossil fuel emissions.

It is commonly believed that humans arrived in North America from Asia about 13 to 16 ka ago by crossing Beringia, the land bridge that connected the two continents during the Ice Age. More recent discoveries, however, suggest humans might have been in North America earlier than that. The discovery of fossilized human footprints in White Sands National Park in New Mexico provides the first unambiguous evidence that humans were in here at least 23 ka ago.

A trackway of fossilized human footprints has been found and radiocarbon dated in New Mexico to between 21,000 and 23,000 years ago, indicating that humans have been living in North America a lot longer than many people have been willing to accept.

The subject of the first people in the Americas has been a contentious one for many years, and some archaeologists are extremely stubborn when it comes to this topic, mostly because of a lack of data. A team of researchers studying the New Mexico footprints have been able to date 61 footprints accurately using radiocarbon dating on aquatic plant seeds preserved above and below the footprints to 21 to 23 ka ago. These dates look extremely solid, with the seeds providing very reliable and precise ages. The timing and location of these prints suggests that humans had to have arrived on the North American continent much earlier than previously thought.

The people who made the footprints, who apparently were mostly children and young teenagers between 9 and 14 years old, were living in New Mexico during the height of the Wisconsinan Stage of the Pleistocene. Tracks of extinct animals such as mammoths, giant ground sloths, and dire wolves were also present at the site. Between 19 and 26 ka ago, a time known as the Last Glacial Maximum, two massive ice sheets covered the northern third of North America and reached as far south as New York City, Cincinnati, and Butler, PA. Inasmuch as the ice and severely cold temperatures during that time would have made a journey across Beringia impossible, it stands to reason that the people who made the footprints must have arrived much earlier than the radiocarbon dates would indicate. This is important because it allows investigators to look at the older, more controversial sites, such as Meadowcroft Rock Shelter in Washington County, PA, in a different light.

The only problem is that no artifacts, such as stone tools, have been found in the area of the footprints. It has been suggested that the footprints indicate a division of labor – adults skilled in hunting, manufacture of weapons, preparing food, etc., would have been elsewhere while the fetching and carrying duties were delegated to the children and teenagers.

https://www.cnn.com/2021/09/23/americas/footprints-humans-arrive-in-north-america-scn/index.html

Many people have wondered why high-pressure metamorphic rocks consisting primarily of garnet and omphacite, called cold eclogites, disappeared from geological records during the early stages of the Earth's development between 1.8 and 1.2 ga ago, then reappeared afterward. These are important rocks because they are sensitive to temperatures in the upper mantle, and they also provide evidence of rapid transportation deep below Earth's surface along faults that form during plate tectonic convergences.

The prevailing thought is that cold eclogites are preserved only when supercontinents collided. There is sufficient evidence, however, suggesting a nearly continuous record of cold eclogites over the past 700 ma during a time when two supercontinents formed and then broke-up. In addition, the change in eclogites is accompanied by a change in the concentration of many trace elements in igneous rocks found elsewhere in the crust, providing additional evidence of heating beneath continents. These trace elements are found in critical minerals, those vital minerals important for the economic well-being of the world's major and emerging economies.

Researchers from Australia found evidence from the trace element chemistry of granites suggesting a large-scale heating of the continents around 2 ga ago corresponding with the assembly of Nuna, a supercontinent which has also been called Columbia, Paleopangaea, and Hudsonland. This enormous mass of continental crust completed its formation 1.6 ga ago.

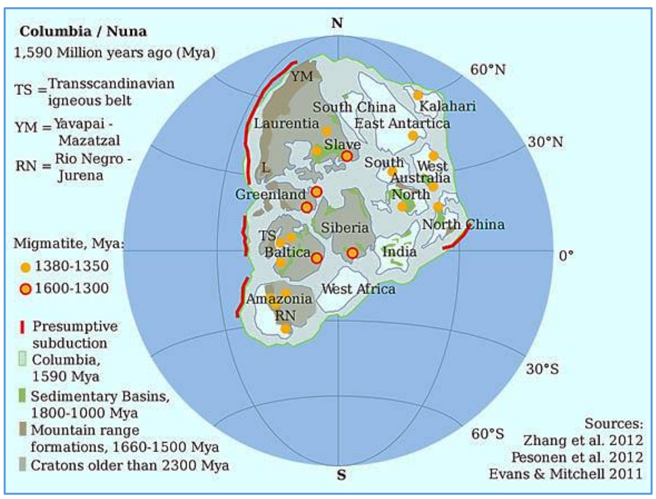


Image of the supercontinent Nuna about 1.6 billion years ago.

Although the Earth has been, in general, cooling since its formation, Nuna acted like a thick blanket, insulating the mantle, which caused temperatures to rise beneath the continents and prevent the preservation of eclogites and change the chemistry of granites. Changes in chemistry due to this unusual warming event could help us to locate certain critical minerals, depending on which element is of being looked for, by searching for rocks formed before or after this heating event.

http://www.sci-news.com/geology/eclogites-mantle-heating-10101.html

A red elbaite crystal from the Malkhan pegmatite field in Russia.

When it comes to geologic events that happen fast, you might think of an earthquake or an erupting volcano. But crystal growth can also happen at a surprisingly rapid pace, according to new research.

A recently published study shows that large crystals, more than a meter in length, could grow in a matter of days. The researchers calculated the growth rate from smaller quartz crystals in pegmatite, but meter-long crystals have been found in similar types of rock.

Using cathodoluminescence, the researchers were able to identify defects in the crystal lattice that allowed trace elements to be incorporated into the quartz structure. They used another technique called laser ablation to understand the arrangement of the trace elements, which revealed the growth rate. One intriguing finding: The crystal doesn't grow at the same rate everywhere. The middle seems to grow more slowly, and the researchers modeled an uptick at the edges.

Understanding the rate of crystal growth in pegmatite intrusions could help scientists look for lithium, a mineral that is vital to modern life due to its use in batteries.

https://www.insidescience.org/news/meter-long-crystals-may-grow-just-few-days

WEBSITE OF THE MONTH:

[Explore Maine Geology: Maine Geological Survey: Maine ACF]

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Memberships: For information about memberships, please write PGS Membership Chair, PO Box 58172, Pittsburgh PA 15209, or e-mail jharper.pgs@gmail.com. Membership information may also be found at our website: www.pittsburghgeologicalsociety.org.

Programs: If you would like to make a presentation at a PGS meeting or have a suggestion for a future speaker, contact Pete Hutchinson, Program Chair at pjh@thggeophysics.com.

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Fun Fact Having Nothing to Do with Geology

Leonardo da Vinci, in 1508, drew the first sketches suggesting that human eye optics could be altered by putting the cornea in contact with water. This concept eventually led to the development of contact lenses.

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