



PGS Newsletter

<http://www.pittsburghgeologicalsociety.org/>



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Karen Rose Cercone, Editor

March 2017

Wednesday, March 22, 2017

THE CONNEMARA MARBLE: CROSS-ATLANTIC CONNECTIONS BETWEEN WESTERN IRELAND AND THE ARCHITECTURE OF THE CARNEGIE MUSEUM, PITTSBURGH, PENNSYLVANIA



**Professor Martin Feeley, National University of Ireland
Albert Kollar, Carnegie Museum of Natural History**

Geology has a long history of providing the source rocks or dimension stones to guide architects in their building designs. Some examples from antiquity include the Egyptian pyramids made from Nummulitic (foraminiferal) limestone, the Greek Acropolis and Statuary cut from Pentellic marble, the Romans' Italian travertine, and fossiliferous limestone from Croatia to build colosseums. The 14th century Venetians built Venice based on quarried Kirmenjak limestone shipped across the Adriatic from Istria, Croatia. Many of the neo-classical architecture buildings and bridges of 19th century Paris are mostly represented by fossil limestone from Echaillon and Hauteville France. In late 19th and early 20th century United States, the American architects that built many of this country's great public buildings in Boston, New York, Washington D.C. and Pittsburgh, utilized classical stones from Europe. As geologists, we can think of architecture stone being the story about Earth History and the processes that formed the igneous, metamorphic, and sedimentary rocks.

(Abstract continues on page 2)

Social hour - 6:00 p.m.

Dinner - 7:00 p.m.

Program - 8:00 p.m.

Dinner costs \$30.00/person, students \$10.00; checks preferred. For reservations, please email your name and number of attendees in your party to pgsreservations@gmail.com. You can also reserve and pay for dinners via PayPal on our website <http://pittsburghgeologicalsociety.org>. Please include your name and number of attendees in your party. **The deadline for reservations is noon on Monday, March 13.**

Meeting will be held at Foster's Restaurant, Foster Plaza Building 10, Green Tree.

ABSTRACT (Continued)

Some 600-million-year ago, a shallow subtropical sea, located south of the equator, was the birthplace of the Connemara Marble. Carbonate rocks formed in this sea were subsequently metamorphosed to form the Connemara, an integral part of the Connemara Metamorphic Complex. The geology of the complex records a mid-Ordovician event known as the Grampian Orogeny (equivalent to the Taconic Orogeny in the United States) which lasted for ~ 12 million years (i.e. between ~ 475 and 463 Ma.).

The distinctive green Connemara marble from County Galway, western Ireland is one of the world's finest marbles. The Connemara marble and the three distinctive color varieties is shown as the primary floor tile in 18 public spaces, private offices and meeting rooms within the Carnegie Library of Pittsburgh and the Carnegie Museum. The architecture spaces were designed for the Carnegie Extension during the period of 1904 – 1907 by the Pittsburgh architectural firm of Frank Ellis Alden and Alfred Harlow. Roughly 75 tons of high quality marble was extracted from the Streamstown Marble Quarry near the town of Clifden, County Galway. The Carnegie Museum is recognized as an Architecture Historic Landmark, on the National Registry of Historic Places by the United States Department of the Interior and Pittsburgh History & Landmark Foundation.

The geological events that led to the formation of the Connemara marble will be discussed by Professor Martin Feeley, National University of Ireland. Albert Kollar of the Carnegie Museum of Natural History will survey the Connemara Marble in the Architecture of the Carnegie Library of Pittsburgh and Carnegie Museum.

Cover photo credits: Carnegie Museum of Pittsburgh (left) and Streamstown Quarry with permission, Ambrose Joyce, Jr. Connemara Marble Industries Ltd., Moycullen, Co. Galway, Ireland (right)

SPEAKER BIOGRAPHIES

Albert D Kollar is the geologist and invertebrate paleontologist at the Carnegie Museum of Natural History in the Section of Invertebrate Paleontology. Mr. Kollar received his B.S. in Geology from Southampton, and his M.S. in Geology and Invertebrate Paleontology from the University of Pittsburgh, under the late Professor H.B. Rollins. Albert is responsible for the curation of $\frac{3}{4}$ of a million invertebrate fossils and rocks, many from the classic localities of Europe and the United States. He has collected extensively throughout the United States, Nova Scotia, Canada, England, and France for Paleozoic and Mesozoic fossils. His research ranges from Carboniferous brachiopods, Geology of the Carnegie Dinosaurs, and fossil invertebrates and vertebrates from western Pennsylvania. His current interests are Geology and Architecture history of the Carnegie Museum building stones and Geology and Climate Change interpreted in Landscape Paintings by Pittsburgh Artists. His travels include Ireland, Croatia, France, and Italy. Mr. Kollar served as President of the Pittsburgh Geological Society from 2011 – 2013. Currently, he serves as Chair of the PGS Awards Committee.



Dr. Martin Feeley is Emeritus Professor of Earth and Ocean Sciences at the National University of Ireland in Galway as well as Adjunct Professor of Geological and Environmental Sciences at James Madison University, Virginia, USA. He has

authored/co-authored over 200 scientific articles and papers and has presented his research results at numerous national and international conferences in Europe, Canada & the US. He is a member of the editorial board for the *Irish Journal of Earth Science* and *Earth Science Ireland* magazine and he regularly reviews articles for numerous international journals and grant applications. He has published several guidebooks on the geology of western Ireland. He sits on three expert panels appointed by the Geological Survey of Ireland to select Ireland's natural heritage sites and is also a member of Galway County Council's Heritage Forum where he advises on research and promotion of the county's natural heritage. His current research activities include the study of living microbes in fluid inclusions from Searles lake California; investigating the heat potential of Irish granites and studying arsenic in groundwater wells near gold-bearing quartz veins in western Ireland.

PRESIDENT'S STATEMENT



Well, I checked the weather forecast for the next week on a balmy Monday (February 20) and found that the daily highs would continue to climb, eventually reaching 75° F by Friday. I wondered if it was already time to pull spring and

summer clothing out of storage. Too soon, if you ask me—I like my sweaters! But when I looked at the following week I felt a little better, seeing most daily maximums ranging from the low to high 50's and even a day of “teeth-chattering” 46. Still, we in the Pittsburgh area need to be on guard; old man winter often sleeps through most of the season only to belatedly awake and ask “Aren't I supposed to do something?” We often enough get one or two big snow storms in March—and even early April—when we are emotionally most ready for bright sunshine and flowers.

Hopefully the weather will be more than kind to the drilling workshop that will take place either in late March or early April on the new Chatham University environmental campus (the exact time yet to be nailed down) and the April 8 geology field trip to the Pennsylvania Main Line Canal near Saltsburg, PA. Speaking of the latter event, please don't forget the March 1 deadline for signing up. Another very important event to keep in mind is Student Night, sponsored by AEG, ASCE, and PGS, on April 19. Students, make sure you submit your 250-word abstracts to Tamra Schiappa at tamra.schiappa@sru.edu by March 15. And here's another heads-up for the geology students at our local universities: the board plans on establishing a mentoring program between you and professionals in the work force. Philip Graves, the PGS Board's Student Representative, and fellow student liaison Nicole Kelley are piloting a survey to gather data about what kind of mentorships you are interested in. You are strongly encouraged to participate.

At our last meeting the Board decided to commit to holding a family-oriented geology workshop at the Chartiers-Houston Community Library this summer. The content of the workshop will be

geared to the children (likely 5 to 10 years old), which is something different for most of us who are used to communicating about our work with college students and fellow professionals. But getting the early word out to our youngsters about how this lonely planet operates and how we should take care of it while simultaneously tending to the needs of a growing population is a challenge worth undertaking. The theme of the library's summer program is “Build a Better World.” Again, we are asking for volunteers to assist in this effort, especially those that live in the Houston, PA, area. If you are interested, please contact Ken Lasota, Chairperson of the Outreach Committee, at lasota@rmu.edu or me at shabell9@comcast.net. And speaking of volunteers.....we're fast approaching that time when we are seeking nominations for positions on the PGS Board of Directors. As in previous years, 7 positions are available, 4 officers (President, Vice President, Secretary, and Treasurer) and 3 Directors at Large. If you have someone you wish to nominate, or if you'd like to offer your own services, please contact the Nominations and Elections Chairperson, Ray Follador by email at geodawg@comcast.net.

I wish to express sincere appreciation to Peter Cormas, Professor of Math and Science Education at California University of Pennsylvania, for conducting the workshop on “Google Earth inquiry activity” at the February 16 Allegheny Intermediate Unit Network Connections. The attending teachers were keenly interested in Peter's approach to introducing the concept of plate tectonics to middle school students. Distance and commitments prevent him from attending our meetings at Forster Plaza. That makes his willingness to do this for us all the more meaningful.

Finally, I would like to recognize The Baron Group and Hayward Natural Resources, Inc. for their generous corporate contributions to the society.

See you at our next meeting on March 15.

Peter R. Michael

GEOLOGICAL EVENTS

GEOPHYSICAL SOCIETY OF PITTSBURGH

March 7, 2017

Marc Prince, ESG Solutions – “The Significance of Bedding Planes to Hydraulic Fracturing and Production”

Cefalo’s Event Center, Carnegie PA

April 4, 2017

Andrew Nyblade, Penn State University – “Induced and Natural Seismicity in Pennsylvania”

Cefalo’s Event Center, Carnegie PA

SPE - PITTSBURGH CHAPTER

March 28, 2017

Michael Gillen, Baker-Hughes – “Applications and Advantages of Logging-While-Drilling in High-Angle and Horizontal Wells”

Cefalo’s Event Center, Carnegie PA

ASCE GEO-INSTITUTE OF PITTSBURGH

March 7, 2017

Rob Woodman, PE – “Green Infrastructure and Low-Impact Development for Stormwater Management”

Rolland’s Restaurant, Strip District, Pittsburgh PA

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

April 12, 2017

Student Night featuring Patrick Frier – “Volcanic and volcanoclastic rocks in the central Brooks Range AK”

Cefalo’s Event Center, Carnegie PA

(Student attendance is free at this event and a donation will be made by PAPG to the university with the highest student attendance.)

PROFESSIONAL GEOLOGIST ALERT

The grandparent provision for being admitted into the New York State licensure program for Pennsylvania Professional Geologists expires on **November 20, 2017.**

Honoring a Century of Women Petroleum Geologists

The AAPG Annual Convention in Houston will host an event on Saturday, April 1st, 2017, celebrating Women Geologists in Petroleum. It can be registered for separate from the main conference (\$65 attendance, \$40 for students).

AAPG PROWESS – AWG – SEG Forum – Pioneering Women in Petroleum Geology: 100 Years
Saturday, 1 April 2017 • 7:00 a.m. – 8:00 p.m. • George R. Brown Convention Center
\$65 Professionals, \$40 Students • Continental Breakfast, lunch and post-forum reception (open to all)

Join us for an exciting celebration of women geologists and their historic contributions to 100 years of oil exploration!

AAPG’s Professional Women in Earth Sciences (PROWESS) will host an all-day forum featuring “rock stars,” panel discussions and the world premiere of a new documentary: “Rock Stars: Pioneering Women in Petroleum Geology.”

“Rock Stars,” an engaging video that examines and celebrates the century-long history, achievements and advancements of women in the profession, will be shown and discussed in four segments, each of which examines the culture and the experiences women faced while pursuing their love of petroleum geology.

Claire Farley, vice chairman-energy for KKR, will be the keynote luncheon speaker.

This event also will feature the debut of Robbie Gries’ book titled: *Anomalies – Pioneering Women in Petroleum Geology: 1917 – 2017*. She will be autographing copies throughout the conference.

Another highlight: An historical costume contest, organized by AAPG Young Professionals. Forum participants are invited to wear business or field attire such as was worn by women geologists between 1917 and today.

Following the Women’s Forum, from 6-8 p.m., will be a Champagne Reception. This will be a great opportunity to network and socialize with panel members.

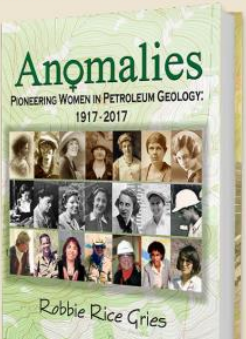


A documentary on oil industry pioneers will be debuted and a companion book ***Anomalies*** by Robbie Gries will be released that same day.

“*Anomalies* celebrates the inspiring achievements of an intrepid group of pioneering women that have laid the groundwork for female geoscientists today. Robbie Gries provides an entertaining and informative narrative of 100 years of trailblazers that is enriched by excerpts from diaries, letters and interviews. The women in these pages were true scientific contributors and innovators at a time when women were just emerging into the growing field of petroleum geology. This is a must read for any historian of the oil patch, as it provides the only comprehensive record of the hidden history of these ground-breaking women.”

– Allyson Anderson Book,
Executive Director - American Geosciences Institute

Once released, the book can be ordered from the AAPG Store for \$50 plus shipping and handling. Please e-mail publications@AAPG.org expressing your interest and we will contact you as soon as the book is available. Don't want to wait? Visit the AAPG Center at the 2017 ACE meeting to purchase your copy.



PGS Professional Member Featured Interview

Dr. Tamra Schiappa

Company, title or role, years with company?
Associate Professor, Department of Geography,
Geology and the Environment, Slippery Rock
University. 15 years.

How long have you been a member of PGS?
15 years

Have you held any officer positions?
Currently Vice President



Education:

BS SUNY Plattsburgh 1983, MS Geology Boise State Univ., 1993, Ph.D. Geology, Univ. of Idaho, 1999.

What is the best and worst thing about your current job?



The best thing about my job is working with young adults teaching them about Earth's history. I also have the luxury of taking students into the field and watching the light bulb go on when they apply information learned in the classroom to what they observe in the field.

What is your dream geology job?

I currently have my dream geology job. I educate young adults about my passions, in particular, geology, earth history, stratigraphy and paleontology. I travel to beautiful places and have the opportunity to expose young adults to a variety of landscapes.

What is one thing you wish someone would have told you when you were starting out in the geology profession?

I wish that I had mentors that would have encouraged me to get involved in professional societies, seek out internships and take advantage of all the opportunities to travel regionally and abroad.

What is one class you wish you would have taken in college? (doesn't have to be a geology class)

I wish I had taken a Latin class, but they did not offer one at the universities I attended.

What is the most exciting place you have been geologically?

I have traveled to many places that have spectacular geology. Some of my favorites include: Italy, Iceland, SW US (Grand Canyon, Bryce, Arches, etc.) and Bahamas.

What's your favorite rock, mineral, or fossil?

My favorite rock is any kind of carbonate that contains fossils. Favorite mineral is labradorite and my favorite fossils are Paleozoic ammonoids.

What are some things on your Geology Bucket List?

1. Feel a substantial earthquake, but not get hurt or anyone else.
2. Travel to Palau to swim with Nautilus.
3. Visit Siccar Point, Scotland at the locality where James Hutton recognized an angular unconformity and used relative dating to support an Old Earth.
4. Collect fossils along the cliffs of Lyme Regis, UK.



The Pittsburgh Geological Society is delighted to welcome the following new student members:

From Slippery Rock University of PA

Jaclyn D. Burke
Dillon L. Carr
Logan Jacobs
Mitchell S. Kohler
Matthew R. Scott
Luke J. Sherer

From Indiana University of PA

Travis S. Anderson
Allison A. Berry
Ian P. Dickie
Brennan M. Ferguson
Danielle K. Guttman
Cyrielle F. Humbert
Erin H. Johnson
Brock L. Kennedy
Drake S. Kutkat-Tonkin
Tyler P. Lloyd
Cara N. Mehalek
Austin D. Patch
Kyle W. Potts
Molly J. Rudolchick
Nicholas D. Santoro
Aaron D. Seidel
Garrett D. Sharp
Brooke A. Simpson
Matthew T. Spegal
Sara E. Trio



The deadline is looming for local geoscience students (graduate and undergraduate) to submit their research projects for presentation at the ASCE-AEG-PGS Student Night on April 19.

Abstracts no longer than 250 words should be submitted to

Tamra Schiappa
(tamra.schiappa@sru.edu).

Each of the three sponsoring societies will select one student paper (graduate or undergraduate) for oral presentation. Additional abstracts will be accepted for poster presentations. All presenters will receive certificates of recognition and appreciation, as well as complimentary dinner. The three oral presenters will each receive awards of \$100, while the three top poster presenters will each receive \$50.

**THE DEADLINE FOR
ABSTRACT SUBMISSION IS
WEDNESDAY MARCH 15.**

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES



The Spang Mansion, Locust Street, Etna

a major supplier to the Pennsylvania Canal System. The mill was also the first iron-pipe manufacturer west of the Allegheny Mountains. In 1838, Centerville changed its name to Stewartstown, a name that remained on the books for another 30 years until the town incorporated in 1868 as Etna, in homage to the Spang family's ever-growing influence in the community. The Greek Revival-style Spang "Mansion", built around 1828, still stands on Locust Street.

When the Pennsylvania Mainline Canal was built in the late 1820s and early 1830s, it brought all kinds of industry to the Allegheny River valley and created something of a boom town where Pine Creek flows into the river 5 miles northeast of downtown Pittsburgh. The lowlands of the creek valley were divided into town lots and the community was named Centerville. One of the first industries to find a home in the little town was the Pine Creek Iron Works. In 1828, Henry S. Spang, who owned and operated the famous Etna Furnace in Blair County, bought the failing Pine Creek Iron Works and changed its name to the Etna Iron Works to match his business in Blair County (the constant glow from the furnaces apparently reminded Spang of Mt. Etna, the volcano in Sicily). Spang greatly expanded the existing mill and established it as

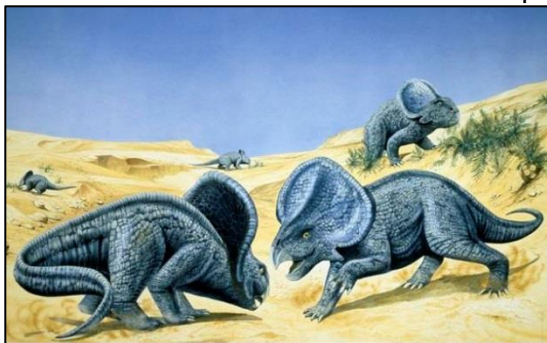
DID YOU KNOW . . . ?

According to new research, non-avian dinosaur eggs took between 3 and 6 months to hatch. Paleontologists had often hypothesized that dinosaur incubation periods were similar to those of birds. Bird eggs hatch between 11 and 85 days after being laid, whereas comparable-sized reptile eggs usually take weeks to many months to hatch. Dinosaur eggs are large, leading paleontologists to suggest that they must have experienced rapid incubation, and that birds inherited that characteristic from their dinosaur ancestors. The new research used the fossilized teeth of two well-preserved embryos, one of the small ceratopsian *Protoceratops*, whose eggs were quite small at 7 ounces, and one of the large

duck-billed *Hypacrosaurus*, whose eggs weighed more than 9 pounds. The researchers took CT scans of the embryonic jaws of the two dinosaurs, then used advanced microscopy to look for and analyze the pattern of growth lines present in the teeth (these growth lines occur during the development of all vertebrates, and they accrue on

a daily basis). The researchers could literally count the lines to see how long each dinosaur had been developing. The results indicated that incubation periods in the two dinosaur was more similar to that of reptiles than birds, implying that birds probably evolved more rapid incubation rates after they

branched off from the rest of the dinosaurs. The researchers speculate that the results might have been very different had they been able to analyze the embryos of a more bird-like dinosaur such as *Velociraptor*.



***Protoceratops* (top)
and *Hypacrosaurus*
(right)**

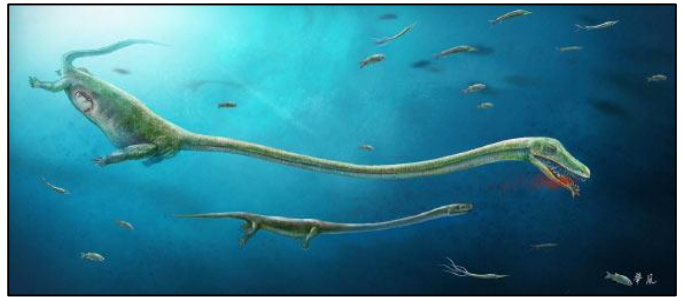


Since dinosaurs had slow incubation times, required considerable resources to reach adult size, and took more than a year to mature, they would have had a distinct disadvantage in coping with any kind of major catastrophe, like the end-Cretaceous extinction event, when compared to animals such as amphibians, reptiles, birds, and mammals that survived and prospered during the Paleogene.

The following quote is from a wonderful article entitled *The “Anthropocene” epoch: Scientific decision or political statement?* by Stanley C. Finney and Lucy E. Edwards from March, 2016 that was reprinted in the February, 2017 issue of GSAToday. Finney is a former Chair of the International Commission on Stratigraphy (ICS) and Edwards is with the USGS: “The evolution of vascular land plants and their spread across the continents from late in the Devonian to early in the Permian completely altered Earth’s surface, left a significant stratigraphic record, and dramatically altered CO₂ and O₂ concentrations in the atmosphere and oceans far greater than humans are projected to do . . . Yet there is no drive to name a unit in the ICS Chart that formally recognizes that profound and irreversible change to the Earth system. Perhaps promotion of the Anthropocene is anthropocentric as well as political? The ‘Atomic Age,’ a term coined by The New York Times journalist William L. Lawrence in September 1946, has an identical boundary and content to the Anthropocene proposal of Zalasiewicz et al. (2015). By rights, the Atomic Age has nomenclatural priority. If the Anthropocene is not a political statement, those who value priority should prefer the Atomic Age.”



Beginning of the Anthropocene?



Artist's conception of *Dinocephalosaurus*.

Scientists from China, the US, Australia, and the UK have found the first evidence of live birth in animals thought only to lay eggs. Viviparity (live birth), although well known in mammals and very common in lizards and snakes, was previously unknown in the Archosauromorpha, a 260-ma group represented today by egg-laying birds and crocodylians. But a new fossil of a long-necked archosauromorph called *Dinocephalosaurus* from the Middle Triassic of China shows an embryo inside the mother — clear evidence for live birth.

The discovery of a pregnant Triassic marine reptile is big news. The researchers said the embryo was inside the mother's rib cage, and it faced forward. Predators swallow prey animals head-first to help them go down the throat, resulting in the prey facing backward in the gut, so it is unlikely the small animal is prey. Also, both the big animal and the small one inside it are the same species. The discovery pushes back evidence of reproductive biology in the group by roughly 50 ma, and shows that there is no fundamental reason that archosauromorphs could not achieve live birth.

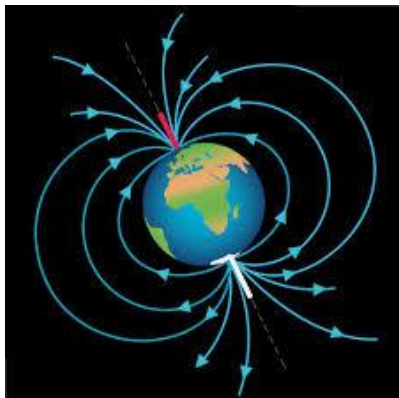
In addition, evolutionary analysis showed this live birth was associated with genetic sex determination. While some modern reptiles determine the sex of their offspring by the temperature inside the nest, the researchers identified that *Dinocephalosaurus* determined the sex of its babies genetically, like mammals and birds. This suggests that the combination of live birth and genotypic sex determination might have been necessary for such animals to become aquatic. All in all, the new China fossil specimen modifies our current understanding of the evolution of reproductive systems.



A stamped jar handle from Judea.

The Earth's magnetic field was discovered 180 years ago, and over the years scientists found it continues all the way to the core. But today, scientists are concerned that it has been weakening, which, if true, could spell trouble for life on the planet. A new international study, however, finds there is no cause for alarm because the geomagnetic field has been fluctuating for thousands of years. The researchers came to this conclusion after obtaining data from a set of 67 kiln-fired ceramic storage-jar handles from Judea in present day Palestine.

The jars bear royal stamp impressions that are well known by archaeologists to date from the 8th to 2nd century BCE. Magnetic minerals baked into the kiln-fired jars locked in information about the magnetic field at the time of firing. Therefore, the researchers could date any changes in the Earth's magnetic field detected in the jar handles. What they found were numerous fluctuations in the strength of the geomagnetic field during that time period, between the early Iron Age and the end of the Hellenistic Period. The data indicated a spike during the 8th century BCE, the early Iron Age, which is the strongest recorded in the last 100,000 years. These data show that the recent decline in field strength is not unique. The field has, in fact, often weakened and recovered over the last several millennia.



Earth's magnetic field

Pittsburgh's identity was founded on coal and iron/steel. The city's largest skyscraper is the US Steel Tower, the football team is the Pittsburgh Steelers, and steel magnate Andrew Carnegie funded numerous libraries throughout western Pennsylvania that bear his name, as well as the Carnegie Museums of Art and Natural History. So anyone not familiar with the city's history it might find it difficult for to acknowledge that glass manufacturing actually dominated the region long before iron and steel.



Some of the items made by Pittsburgh glass manufacturers in the early 1800s.

Begun in 1797, only 30 or 40 years after the first mining of the Pittsburgh coal on Mount Washington, Pittsburgh's glass industry grew rapidly because of its river access, the abundance of sand from glacial outwash deposits found in the river valleys, and coal for fuel. Pittsburgh's glass quickly became famous throughout the country. At one time, hundreds of factories dotted the river banks and throughout the region, and by 1920, 80% of the glass manufactured in the US came from the Pittsburgh area.

Along the way, Pittsburgh glass adorned the tables of five presidents, filled the window frames of the Statue of Liberty's crown, and tiled the insides of both the Lincoln and Holland Tunnels in New York. Today, the neo-Gothic glass buildings of the PPG (Pittsburgh Plate Glass) complex in downtown Pittsburgh are all that's left to remind us of the city's heritage in glass.

Recent geophysical data suggest that a 2 million mi² area beneath the southwestern Pacific Ocean that includes New Zealand and New Caledonia, is a single, intact piece of continental crust geologically separate from Australia. A team of geologists from New Zealand, Australia, and New Caledonia think it should be considered a separate continent and have dubbed it “Zealandia” (an unofficial name, since there is no international body in charge of naming continents).



Zealandia in the South Pacific

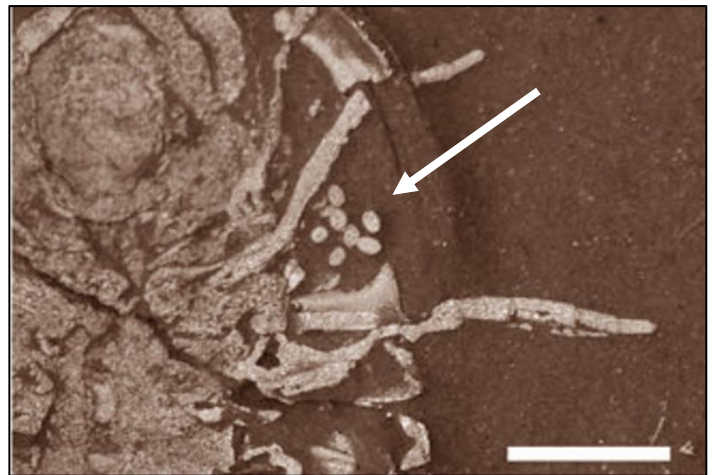
Zealandia apparently began to separate from Gondwana about 100 ma, making it an independent chunk of continental crust that, for the most part, eventually sank beneath the surface of the ocean. Today, only New Zealand and New Caledonia remain above the waves.

Two egg-bearing specimens of the trilobite *Triarthrus eatoni* have been found in the Whetstone Gulf Formation in a quarry in New York State. Although this isn't the first report of supposed trilobite eggs, it's the first time that eggs have been positively identified in association with a body fossil, firmly establishing the little blebs as actual eggs. The trilobite is a typical Ordovician form, about 450 million years old.

The eggs are very small, about 200, spherical to elliptical in shape, pyritized, and were found clustered in the genal area of the cephalon. Although this sounds strange, it had been

proposed previously that trilobites probably brooded their eggs in pouches in the front of the cephalon. Modern horseshoe crabs, trilobites' closest living relatives, carry their unfertilized eggs in the head.

The researchers say the pyritized blebs are too large to be microbial fossils, and their distribution on the exoskeleton indicates they are not epibionts, fecal pellets, or localized pyrite growth. Although they are small, 200 μm falls within the size range of eggs from other fossil, as well as modern, arthropods. The research team that studied the eggs used a micro CT scanner to get a set of images through the preserved trilobites and eggs, essentially dissecting them digitally, and reassembled them on computer. The eggs can only be seen from the bottom of the trilobite, and there was no sign of a brood pouch, and no recognizable sexual dimorphism in the species.



Part of *Triarthrus eatoni* showing eggs (arrow) in the cephalon (head) region. Scale bar = 2mm.

Before this discovery, nothing was known about an early phase of the development of trilobites. Since the eggs are smaller than the earliest-known trilobite developmental stage, trilobites might have had an unmineralized early stage in their ontogeny, and that the earliest mineralized shield formed only after hatching. Therefore, if *Triarthrus eatoni* reproductive biology is typical for trilobites, these long-extinct, enigmatic animals probably spawned with external fertilization, possibly the ancestral mode of reproduction for all early arthropods.

PGS Website of the Month



<http://www.whoi.edu/>

Pittsburgh Geological Society Officers and Board of Directors

President:	Peter R. Michael	Director-at Large:	Diane Miller	Director-at Large:	Wendell Barner
Vice President:	Tamra Schiappa	Director-at Large:	Mark Barnes	Director-at Large:	Peter Hutchinson
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Other PGS Positions		Historian:	Judy Neelan	AAPG Delegate:	Andrea Reynolds
		Continuing Ed:	Frank Benacquista	AAPG Delegate:	Dan Billman

Officer Contacts: If you wish to contact a current PGS Officer, you can email Peter Michael, President, at shabell9@comcast.net; Tamra Schiappa, Vice President and Speaker Coordinator, at tamra.schiappa@sru.edu; Kyle Fredrick, Treasurer, at fredrick@calu.edu; and Karen Rose Cercone, Secretary and Newsletter Editor, at kcercone@iup.edu.

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 Tamra Schiappa, Program Chair at tamra.schiappa@sru.edu.

PGS Website: Access many online PGS resources at <http://www.pittsburghgeologicalsociety.org/>

Facebook: Follow the PGS at <https://www.facebook.com/PittsburghGeologicalSociety> for breaking news, announcements and interesting geological facts.

Twitter: PGS now has a Twitter Feed! You find it at <https://twitter.com/> on the web or look for [@PghGeoSociety](https://twitter.com/PghGeoSociety) on your mobile Twitter app.

LinkedIn: PGS has added a dedicated [LinkedIn page](#) to our social media portfolio. We'll use it to post job opportunities and other professional announcements for our members.



Fun Fact Having Nothing to Do with Geology

The average desktop computer can hold 5 to 10 times more computing power than was used to land a man on the moon.

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