The Lake George Gem and Mineral Club -

Club News

November, 2018

Please Note: Meeting time changes to 10AM every October

Program for the month: Saturday November 10, 10:00AM. Richard Kawamoto will talk about mining claims: Still interested in filing a mining claim? This month's encore presentation by club member, Richard Kawamoto, will be on the nuts and bolts of filing a mining claim in the US. There is no mystery; the average human can do it. The process just requires legwork, paperwork, checkbook and patience.

Silent Auction: We need donations for the silent auction! If you have "extras", whether minerals, fossils, books, or other items, and if you have a label saying what the item is and where it came from, we can use it. If not, bring some cash and be prepared to help support Club activities, including scholarships, Pebble Pups, and other items.

FROM THE PRESIDENT What makes a great club? Is it the great field trips? Over 30 this year. Is it the great educational programs? Mineral identification, monthly presentations, wire wrapping, fossil study. Our great annual gem and mineral show?
NO!
What makes the club great is the great people who support the club and its programs. How can you make a difference and keep these great activities going. Volunteer now and bring your skills to our great club.
FUN WITH SCIENCE at the Rocky Mountain Dinosaur Resource Center was an opportunity to talk with over 100 people about our club and specifically about the Pebble Pup programs at both CSMS and LGGM. Leesa and I spoke with many interested young people about the Earth Science educational programs and fun activities available through our club. We had a great time sharing stories about past field trips and talking about some of the rocks and fossils found in our area. –**Bob Baker**

✔ ✔ Upcoming Programs:

December- **Annual officers' election, towel show and party; no presentation. Please plan to bring a snack item (enough to serve 15-20 people) and a towel, along with specimens you have collected, traded, or purchased during the last year. More info in next month's newsletter.**

Coming Events

✔ ✔ Several mineral, fossil, and geology clubs meet relatively nearby and encourage visitors. These include:

>**Cañon City Geology Club**, meets on the 2nd Monday of the month at 6PM in the United Methodist Church, Cañon City;

>**Colorado Springs Mineralogical Society**, meets on the 3rd Thursday of each month at 7PM in the Mt. Carmel Veteran's Service Center, 530 Communication Circle, Colorado Springs;

>**Columbine Gem & Mineral Society**, meets on the 2nd Thursday of each month, 6:30PM in the meeting room, Mt. Shavano Manor, 525 W. 16th (at J St.), Salida;

>**Pueblo Rockhounds**, meets on the 3rd Thursday of each month at 6:30PM in the Westminster Presbyterian Church, 10 University Circle, Pueblo.

✔ ✔ **Pete Modreski** suggests **the following upcoming events:**

Fri., Nov. 9, Colorado Science Conference for Professional Development. Held at the Denver Mart, 451 E. 58th Ave., Denver; for all science educators. For full information and registration website see http://coloradoscienceconference.org/ .

Nov. 10-11, 39th annual New Mexico Mineral Symposium, at New Mexico Institute of Mining & Technology, Socorro, NM; see https://geoinfo.nmt.edu/museum/minsymp/home.cfml .

Wed., Nov. 14, 7:30 p.m., **Friends of Mineralogy, Colorado Chapter** bimonthly meeting; **"Still Crazy (about Franklin) after all these years: The minerals and Geology of Franklin and Sterling Hill, New Jersey**", by Carl (Bob) Carnein. Lakeview Event Center, 7864 W. Jewell Ave., Lakewood CO; all welcome.

Thurs., Nov. 15, 3:00 p.m., Denver Museum of Nature & Science, Earth Science Colloquium, **Mammals Inherit the Earth: How the K/Pg Mass Extinction Killed off Dinosaurs and Opened the Way for Mammals** ,by Greg Wilson, University of Washington. VIP Room, 3–4 p.m. Museum admission not required.
See http://www.dmns.org/science/research/earth-sciences/ for the schedule of DMNS Colloquia for the rest of the year.

Thurs. Nov. 15, 7:00 p.m., Colorado Scientific Society November meeting, topic TBA. Shepherd of the Hills Church, 11500 W. 20th Ave.,Lakewood.

Nov. 16-18, **Denver Area Mineral Dealers Show,** Jefferson County Fairgrounds, Golden CO**.** Free admission, public welcome.

Mon., Dec. 3, The Improbable Fossil Record of Jellyfish and Their Kin, by Graham Young, Manitoba Museum. Denver Museum of Nature and Science, VIP Room, 3–4 p.m.

For more lecture series during the year see:
Colorado Beer Talks (2nd Tuesday, 6-8 p.m.), Windy Saddle Café, 1110 Washington Avenue, Golden, "Golden's grassroots version of TED talks, Expand your mind with a beer in your hand", http://goldenbeertalks.org/
Colorado Café Scientifique in Denver, monthly lectures on science topics held either at Blake Street Station or Brooklyn's, Denver; open to the public, no charge other than refreshments you may choose to purchase; see http://cafescicolorado.org/ .
Colorado Scientific Society (3rd Thursday, 7 p.m.), see http://coloscisoc.org/ . Meets at Shepherd of the Hills Church, 11500 W. 20th Ave., Lakewood CO, except when noted.
CU Geological Science Colloquium (Wednesdays, 4 p.m.) see http://www.colorado.edu/geologicalsciences/colloquium
CSU Dept. of Geoscience Seminars (Fridays, 4 p.m.), see https://warnercnr.colostate.edu/geosciences/geosciences-seminar-series/
Van Tuyl Lecture Series, Colorado School of Mines, (Thursdays, 4 p.m.): https://geology.mines.edu/events-calendar/lectures/
Denver Mining Club (Mondays, 11:30), see http://www.denverminingclub.org/ **.**
Denver Museum of Nature and Science, Earth Science Colloquium series, 3:00-4:00 p.m., VIP Room unless noted, day of the week varies. Museum admission is not required; see http://www.dmns.org/science/research/earth-sciences/

Denver Region Exploration Geologists Society (DREGS; 1st Monday, 7 p.m.), http://www.dregs.org/index.html
Florissant Scientific Society (FSS); meets monthly in various Front Range locations for a lecture or field trip; meeting locations vary, normally on Sundays at noon; all interested persons are welcome to attend the meetings and trips; see http://www.fss-co.org/ for details and schedules.
Nerd Night Denver is a theater-style evening featuring usually 3 short (20-minute) TED-style talks on science or related topics; held more-or-less monthly at the Oriental Theater, 4335 W. 44th Ave., Denver; drinks are available; for ages 18+. Admission is $6 online in advance, $10 at the door. See https://www.nerdnitedenver.com/ .
Rocky Mountain Map Society (RMMS; Denver Public Library, Gates Room, 3rd Tuesday, 5:30 p.m.), http://rmmaps.org/
Western Interior Paleontology Society (WIPS; Denver Museum of Nature & Science, 2nd Monday, 7 p.m.), http://westernpaleo.org/ . Meetings are held either in the Ricketson Auditorium or the Planetarium at the Denver Museum of Nature & Science, unless otherwise noted
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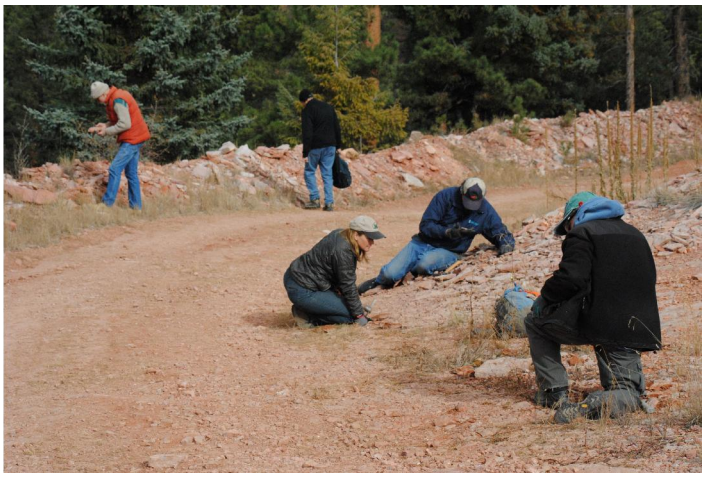
Worth noting: the Program, Abstracts, and Field Trip Guides, for the recent Aug. 4-5, 2018 symposium, "**Minerals from the Metallic Ore Deposits of the American Southwest**" are available for free download at the Friends of Mineralogy, Colorado Chapter, website, at http://friendsofmineralogycolorado.org/mmodas/ . Video recordings of the oral presentations will also be available soon at the CSM Library website.

Likewise, both the abstracts and field guides and video recordings of most presentations from last year's symposium, "**Gold and Silver Deposits in Colorado**" (July 20-24, 2017) are available for free viewing and download online via the Colorado School of Mines Library website, at https://dspace.library.colostate.edu/handle/11124/172170 .

✔ ✔ **Paul Combs** sent this short article about the October 17 Belvedere quarry field trip:

CEPHALOPODS, CYSTOIDS AND SNAILS, OH MY!

Wednesday, October 17, was the Lake George club's first fossil-collecting field trip since most of us could remember, and the planets came into alignment to make it a big success. The mid-October weather was fantastic. Everyone was telling jokes and in a great mood. And the fossils—they practically waved little flags to get our attention. Soon after arriving at the Belvedere Quarry, everyone was collecting specimens of sea life. But this sea life was from the Ordovician Period, more than 400 million years ago. Before long, 10 car-loads of club members were tossing around terms like "ichnofossil," "pygidium" and "bedding plane" as if they had known them since elementary school.

(left) Psuedofossil (dendrites of manganese/iron oxides) (right) Bob Carnein, Bob Baker, Laura Canini, David Gillard, and an unidentified club member getting "down and dirty" at the Belvedere quarry. (Paul Combs photos)

Dr. Bob Carnein, one of the trip's leaders and organizers, taught Invertebrate Paleontology when he worked at Lock Haven University, so no fossil was going to go home unidentified. Paul Combs originally majored in Invertebrate Paleontology at the U of Missouri, so Bob had some backup (*as if he needed it!*). In only three hours, we had collected specimens of most of the animal life the Manitou Dolostone had to offer:

- **Gastropod** (snail) – only one species is present, but we found dozens
- **Cystoids** (distant starfish relatives that grew on flexible stalks) – not common in the Manitou, but almost everyone found some
- **Crinoids** (another stalked starfish relative) – rare in the Manitou, but we found a few
- ***Apheoorthisis*** - one of the Manitou's two articulate brachiopods – they practically jumped into our pockets, despite being difficult to pronounce
- **Linguloid brachiopod** - the Manitou's only inarticulate brachiopod species – also easy to find
- **Orthocone cephalopods** (extinct relatives of today's chambered nautilus, they swam around in shells shaped like long ice cream cones) – not common, but we found several
- **Trilobites**, including some large ones – this is why the Manitou Formation is famous, and the "mud bugs" didn't disappoint us. As expected, we mostly found disarticulated shells that had been shed during "ecdysis" (normal growth stages). See the photo for a really good one.


(left) Unidentified trilobite pygidium (tail) and about 10 thorax segments, found by Barbara Middlemist; (right) Possible orthocone cephalopod (2 cm. long) found by Laura Canini. (Paul Combs photos)

- **Ichnofossils** - trace fossils, such as tunnels, trails and burrows – *not to be ignored*, these are strong clues about how animals lived as well as evidence of soft-bodied animals that were not preserved as body fossils
- **Fecal pellets** (fossil poop) – Like the ichnofossils, this isn't the animal itself, but another set of clues. There are paleontologists who specialize in fossil doo-doo, which must give their grad students endless joke material.

Later, we moved to a site about 1.5 miles away, where we found Cambrian-age fossils in the Sawatch Sandstone Formation (over 500 million years old). The fossils were similar to the Manitou, with plenty of trilobite parts and the greenish mineral glauconite, which is related to fossil poop (more joke opportunities). Paleontologists don't just like glauconite for its comedy potential; it is also useful for potassium / argon dating and it is an excellent indicator of abundant life forms in the ancient environment.

Toward the end of the day, Bob Carnein took a few members on a short hike to look at the Great Unconformity, a 500-million-year gap in the geologic record. He explained how it happened and why it is significant. It was a moving experience to reach out and put our hands across that incomprehensibly long half-billion-year span of time between the lower granite and the upper layer of sandstone. When the granite was forming, life on Earth only consisted of simple critters, like stromatolites and single-celled bacteria. By the time the sandstone was being deposited along a shallow shoreline over 500 million years later, multi-cellular life forms were everywhere in the oceans, including trilobites, snails, clams, cephalopods, conodonts, early echinoderms, corals, jellyfish, conularids and sea pens. All of them have relatives (although not necessarily descendants) that you might find on a beach today.

✔ ✔ **Wayne Orlowski** sent the following interesting links:

** Florissant in China? https://www.atlasobscura.com/articles/fossil-preservation-at-jehol-biota-in-china?utm_source=Atlas+Obscura+Daily+Newsletter&utm_campaign=f7b270b0e5-EMAIL_CAMPAIGN_2018_10_25&utm_medium=email&utm_term=0_f36db9c480-f7b270b0e5-63289333&ct=t%28EMAIL_CAMPAIGN_10_25_2018%29&mc_cid=f7b270b0e5&mc_eid=4c09dd6067
It was discovered that much of the Yixian and Jiufotang Formations—two of the three rock formations containing the Jehol Biota—were lakebed deposits. Clearly, many of the animals were entombed at the bottom of prehistoric lakes.

Strangely, plenty of terrestrial animals were found within these lakebeds, suggesting that powerful forces brought these outsiders to their final resting places. As it happens, these ***lakebed layers are interspersed with volcanic deposits****, indicating that volcanic activity was a prominent feature of the region.*

** **Splosh! How the dinosaur-killing asteroid made Chicxulub crater**

t is hard to imagine billions of tonnes of rock suddenly start to splosh about like a liquid - but that is what happened when an asteroid struck the Earth 66 million years ago.

https://www.bbc.co.uk/news/science-environment-45986449
** Found this page while searching for the location of the boudinage outcrop I sent a few days age. I do not know anything about the site but it would serve one well if planning a vacation to a foreign location.
https://commons.wikimedia.org/wiki/Category:Geology_by_country
Just type your search in the upper right search box " ... by country" for results
Structural info by country
https://commons.wikimedia.org/wiki/Category:Structural_geology_by_country
Stratigraphy by country
https://commons.wikimedia.org/wiki/Category:Stratigraphy_by_country

▸ ▸ And here is the latest installment of **"Bench Tips" by Brad Smith** (www.BradSmithJewelry.com):

SMALL PARTS CONTAINERS

I'm always on the lookout for small containers to use for holding all those little parts and tools we deal with in making jewelry, especially since I'm always traveling to classes and workshops. My latest find is some plastic vials about 15 mm in diameter and 75 mm long. Best part is they are free. The vials are used in the doctor's office to draw blood samples. They cannot be used after their expiration date, and are thrown out. On my last doctors visit, I asked the nurse if they had any expired vials. She replied "How many do you want?" and tried to give me 400 of them. (We settled on 200).

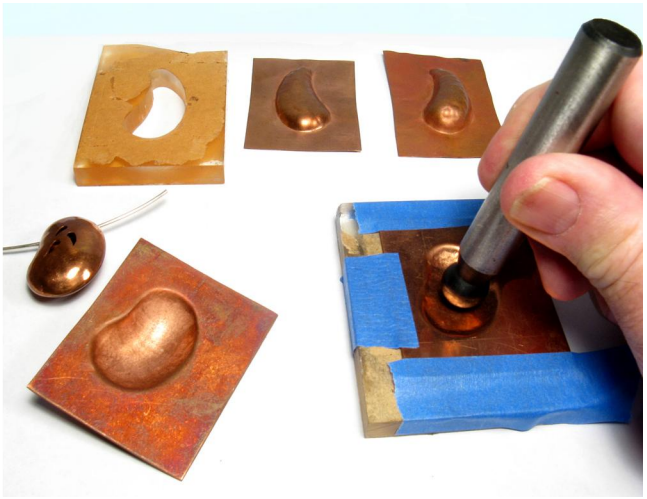
The ones I have are called "Vacutainers", but there are probably many other names. They are clear plastic with a rubber stopper and a paper label all ready to write on. I find them really handy for small parts like jump rings, prong settings, small drills, nuts & bolts, faceted stones, and precious metal filings.

SOURCE FOR PLASTIC

We often use plastic in our studios, like for a single part die or for a template, so it's handy to have a small supply along with the rest of your sheet, wire, copper and bronze. But we seldom think to buy

and stock any plastic.

The plastics store I go to has a scrap bin out back where they give away their scraps. I usually opt for the 3/8 and 1/2 inch thicknesses for use as forming dies, but there's always a variety of sizes and colors to choose from, including thin sheets that are good for templates.



If you can't find a shop with Google or Yellow Pages, do a search on Ebay.com for scrap plastic by the pound.

Pick Up a Few New Jewelry Skills With Brad's "How To Do It" Books
http://amazon.com/author/bradfordsmith

Notes from the Editor

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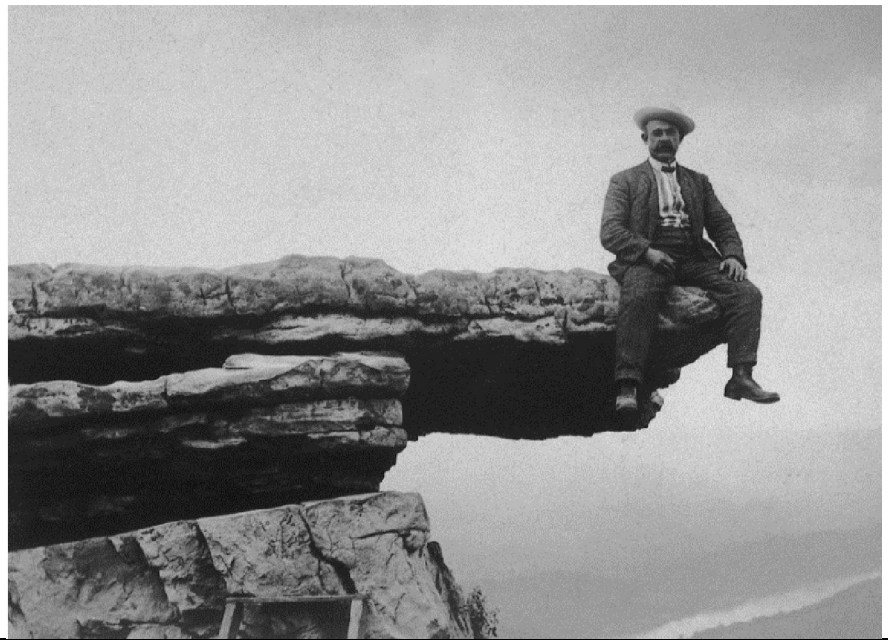


Steve Veatch sent this interesting article about a supposed fossil (maybe a pseudofossil?), and **Bev Keith** sent the following fine article about Alfred Wegener, “father” of plate tectonics and continental drift. Please take the time to enjoy club members’ hard work!

The Mystery of Genevieve:
The Golden Dinosaur from the Depths of the London Mine

Steven Wade Veatch
and
Teresa L. Stoiber

The legend of "Genevieve," a fossilized dinosaur not only made of stone—but also of gold—began on July 3, 1932. That was the day W. K. Jewett, owner of the London Mine near Alma, Colorado, stopped at the Antlers Hotel in Colorado Springs and made the official announcement of its unearthing. The story was picked up by the news services, and word of the fantastic find spread through the scientific world like a prairie fire.

The golden dinosaur was discovered by William White, 700 feet (213 m) underground—deep in the London Mine (W. K. Jewett, 1932). Curiously, the miners had been using the creature's nose as a lamp holder, not realizing there was a "dinosaur" (if that is what it was) there. White, a hard rock miner, believed at first he was looking at two stumps. In reality, it was a dinosaur lying on its back with its limbs at an angle of 75 degrees. Eager to retrieve it from its rocky tomb, miners blasted it out of rock at the 700-foot level of the London Mine with dynamite. The explosion shattered the specimen. Bits and pieces of the dinosaur were hoisted to the surface, where curious crowds gathered to see the prehistoric monster.

As the story goes, a geology professor at Colorado College, Robert Landon, traveled to Alma so he could examine Genevieve—an extraordinary record of a former world. The measurements he made revealed that the animal was 18 feet (5.4 m) long and 6.5 feet (2 m) high (W. K. Jewett, 1932) The creature had a long neck that supported a small head. It also had a long tail.

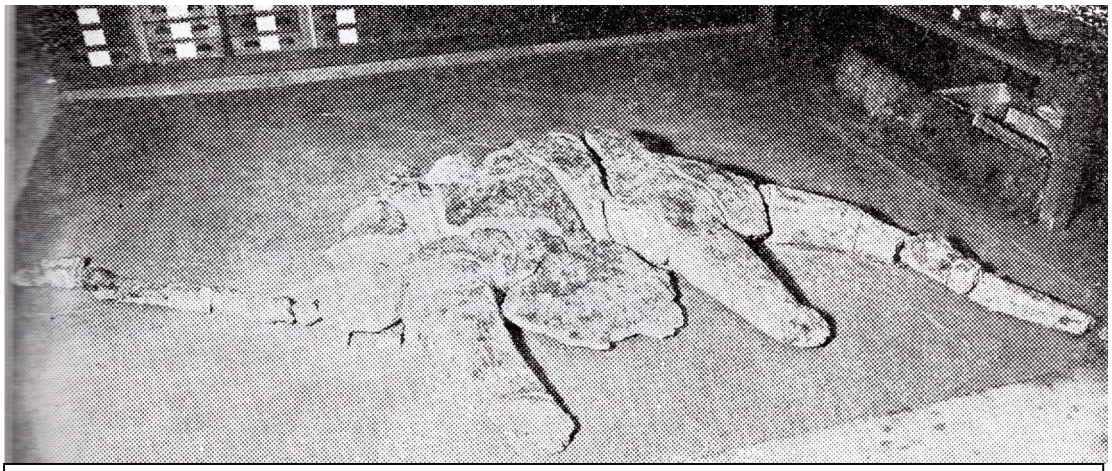


Fig. 1. The only known photo of Genevieve taken in the basement of Cutler Hall, Colorado College. Photo credit: *Colorado College Tiger*, August 12, 1932. Page 3. Courtesy of Colorado College Tutt Library, Special

Jewett, who gave to the city of Colorado Springs the Patty Jewett golf course, presented the dinosaur to the Colorado College museum (Skeleton of Dinosaur, 1932). The 16-ton (14.5 metric ton) dinosaur reached Colorado College by truck, where a crew of men carefully carried it to the basement of Cutler Hall. College technicians spent countless hours in the basement, where they enthusiastically cemented together what the newspapers hailed as the rarest find ever made in paleontology (Genevieve, Colleges Latest Acquisition Now Ready to Receive Callers, 1932). After the repair of the fossil dinosaur, it was moved to Colorado College's museum and put on display (Will Bring Dinosaur Here Late this Week, 1932).

There is a real mystery that surrounds this dinosaur. In the 1960s, the museum closed and Genevieve's display was removed. No one seems to know what happened to this specimen. Was Genevieve smelted down, put in the basement archives and forgotten, or taken to a professor's house for a private collection? The mystery of her disappearance still stands to this day.

Three critical questions must now be answered: Was Genevieve a dinosaur, where did she go, and was she really made of gold? The past would not easily give up these secrets.

An article, from Greely, Colorado's *Tribune-Republican*, dated July 2, 1932, stated the dinosaur remains were made known to Mr. Jesse Figgins, Director of the Colorado Museum of Natural History (noted for work on the famous Folsom archaeological site in New Mexico), who said this unusual dinosaur fossil must be the remains of a marine reptile. Nowhere in the article does it report that Genevieve was made of gold—but it does state that she was shattered when dynamited out of the mine, and that restoration wasn't expected to take long.

When asked about Genevieve, Colorado College archivist Jessy Randall said she had been questioned about her before. The last time was in 2004, when Professor Emeritus Bill Fischer, the former chair of the geology department, was still alive. Fischer gave this response:

> *"The one man who would have had the answers, Professor Bob Landon, died in 1995, and all of the people associated with the college museum are also deceased. . . I never heard of the specimen during my 50-year association with the school, and I suspect that it really was never installed in the museum and that the college newspaper account that 'it was resting on a pedestal in the museum' is totally false. From the photograph, one can see that with 16 tons of matrix and bone it would have taken months if not years to prepare the specimen for display. Now for a few thoughts as to the fossil itself. First of all, it is not a dinosaur and probably not a rhynchocephalian reptile. The photograph is of very poor quality, but my best guess is that it may have been a Phytosaur—but regardless of the correct identification it was a very valuable find, and I am sorry if it ended up in a smelter. . . Good luck in your search and sorry I couldn't be of more assistance". Signed:* Bill Fischer.

Sadly, it looks like Genevieve's case has gone cold. The museum has long been closed, and those associated with the museum are deceased. It is doubtful that she was made of gold—but she was found in a gold mine, the source of a good rumor and the basis for a great story surrounding her mysterious existence and disappearance.

Although Genevieve remains a mystery, this article has dug up and weaves together most of what is known and speculated about her. Although her real story has been buried with the museum workers and gold miners who have passed away, there are still a few miners who, while relaxing at a local saloon, fondly ponder the puzzle of Genevieve. They raise their shot glasses and make this toast to the miners who found Genevieve, the golden dinosaur: "May you always stand on ore and your labors be in vein."

Author's Note: The lithology and age of the rocks in the London Mine do not support the find of a large animal from the Mesozoic. Since the fossil has vanished, we may never know its true nature.

Acknowledgments

The authors thank Danny Alfrey for bringing Genevieve to our attention back in 2011. We also appreciate Ben Elick's help in obtaining the photograph of this mysterious fossil.

References

Find Skeleton of Dinosaur in Ore of London Mine. (1932, July 2). *Colorado Springs Gazette*, p. 2.

Genevieve, Colleges Latest Acquisition Now Ready to Receive Callers. Made Presentable by Profs. (1932, August 12). *Colorado College Tigers*

W. K. Jewett Gives Skeleton of Prehistoric Animal to Colo. College Museum. (1932, July 3). *Colorado Springs Gazette*, p. 2.

Will Bring Dinosaur Here Late this Week. (1932, July 6,). *Colorado Springs Gazette*, p. 5

Dr. Alfred L. Wegener
Meteorologist, Arctic Explorer, Father of Plate Tectonics
Prepared by Beverly Keith, 8/2018

Since the earliest publications of world maps, geographers have been curious about the shapes of the continental coastlines on both sides of the Atlantic Ocean. In 1596, Abraham Ortelius, a Flemish cartographer and geographer, published his third edition of *Thesaurus Geographicus* and noted the matching shapes of the coastlines of Africa, Europe, and the Americas, pointing out that the pieces almost seemed capable of fitting together like a jigsaw puzzle. He proposed that the Americas had been torn away from Europe and Africa and that the projecting parts of these two continents would fit the recesses of America's east coast. He suggested proof of the rupture would be revealed if someone produced a detailed map of the world, carefully considering the coasts of the three continents. Three hundred and sixteen years later, Dr. Alfred L. Wegener provided the evidence suggested by Ortelius (references 2 & 5).

Ortelius's suggestion that the continents once fitted together raised questions within the scientific community. Most geographers believed the continents and oceans were permanent features placed in their present locations at the time of creation.

In 1829, Leonce Elie de Beaumont, a French geologist, proposed the "contracting Earth theory" to explain the origin of continents and oceans as permanent features. The theory dominated European geology textbooks. It was further developed by others and morphed into the permanence theory, proposing that as the center of the Earth slowly cooled, and shrank, the surface contracted and formed mountains and ocean basins. All were approximately the same age, and oceans and continents were fixed in place once they formed (references 2 & 3).

In the middle of the 19th century, some geologists suggested that the continents and oceans were not permanent features. William L. Green of England suggested that segments of the Earth's crust floated on a liquid core (reference 1); Antonio Snider-Pellegrini of France suggested that the continents were once connected during the Pennsylvanian Period (reference 10), and Charles Lyell of Scotland suggested that continents, although permanent for whole geological epochs, shifted their positions entirely in the course of millennia (references 3 & 11).

Dr. Alfred L. Wegener, a German meteorologist and arctic explorer, was the first scientist to present a well-supported theory regarding the origin of continents and oceans. His theory of continental drift revolutionized the scientific community and introduced new ideas of how continents, mountains, oceans, and seas formed and changed over geological time. He based his 1912 theory on the matching coastlines of the continents on

both sides of the Atlantic and on fossil and geological matchups between continents that are now thousands of miles apart (references 2, & 4 thru 8).

Wegener hypothesized that about 300 million years ago, the continents drifted across the surface of Earth and merged to form a single supercontinent that stretched from pole to pole and a great ocean surrounded the supercontinent. About 200 million years ago, the supercontinent began to split apart, and the continents slowly drifted to their present locations. His theory hypothesized that new mountains, oceans, and seas formed when the continents merged and when they separated (references 2 thru 7).

Alfred Wegener was born in Berlin in 1880, and studied at the universities of Heidelberg, Innsbruck, and Berlin, specializing in astronomy, meteorology, physics, and paleoclimatology.
He graduated from the University of Berlin with a Ph.D. in astronomy and was employed as an assistant to his brother, Kurt, a meteorologist at the Royal Prussian Aeronautical Observatory. The brothers were the first meteorologists to use weather balloons and kites to study the upper atmosphere and track air masses. In 1906, they broke the world endurance record by staying aloft in a hot air balloon for 52.5 hours while drifting across Germany and testing an instrument for flight navigation. While working with his brother, Alfred decided to abandon astronomy and pursue a career in meteorology (references 1, 4, 6 & 7).

In 1906, Wegener received an invitation to serve as the official meteorologist on a Danish sponsored polar expedition to the northeast coast of Greenland, known as the Danmark Expedition of 1906-08. He participated in two additional expeditions to the island, in 1912-13 and 1930-31. Wegener played a significant role in the exploration of Greenland, pursuing research in glaciology, meteorology and climatology, and published several papers regarding his research. To learn more about the expeditions and to read Wegener's personal diaries, see: www.environmentalsociety.org/exhibitions/wegener-diaries.

In 1909, Wegener accepted an appointment as Associate Professor of Meteorology and Geophysics at the University of Marburg in Graz, Austria, where he lectured on meteorology, astronomy and astronomic-geographic position fitting for explorers. He made quite an impression with his peers and students due to his ability to explain difficult concepts in simple terms. His lectures were the foundation for his textbook, *The Thermodynamics of the Atmosphere*, first published in 1911. It became a standard text in Germany (references 1, 4 & 7).

Wegener relates that his first ideas about continental drift came to him in 1910 when he was observing a world map and was impressed with the matching coastlines on either side of the Atlantic. At that time, he did not pursue the idea because he regarded it as improbable. However, in the fall of 1911, he accidently came upon an abstract of a report in which he learned for the first time of paleontological evidence for a former land bridge between Brazil and Africa. The report referred to identical fossils of reptiles and a plant found in South America, Africa, India, Australia, and Antarctica (references 1, 7 & 8).

In 1885, Eduard Suess, an Austrian paleontologist and geologist with no formal training (which was not unusual for that time period), proposed that the five continents where the identical fossils were found were once located near each other, and land bridges (aka "intermediate continents") connected them, allowing an interchange of animals and plants. Suess named the continental assembly Gondawanaland (aka Gondwana), and the ocean that surrounded it the Tethys. He proposed that Gondwana fragmented sometime in the mid to late Mesozoic in response to terrestrial contractions caused by secular cooling (the cooling of the Earth's lithosphere composed of the crust and upper mantle), and the land bridges sank, forming the ocean floor. Today, scientists credit Suess with naming the supercontinent Gondwana and the sea that surrounded it (references 1, 3, 9 & 12).

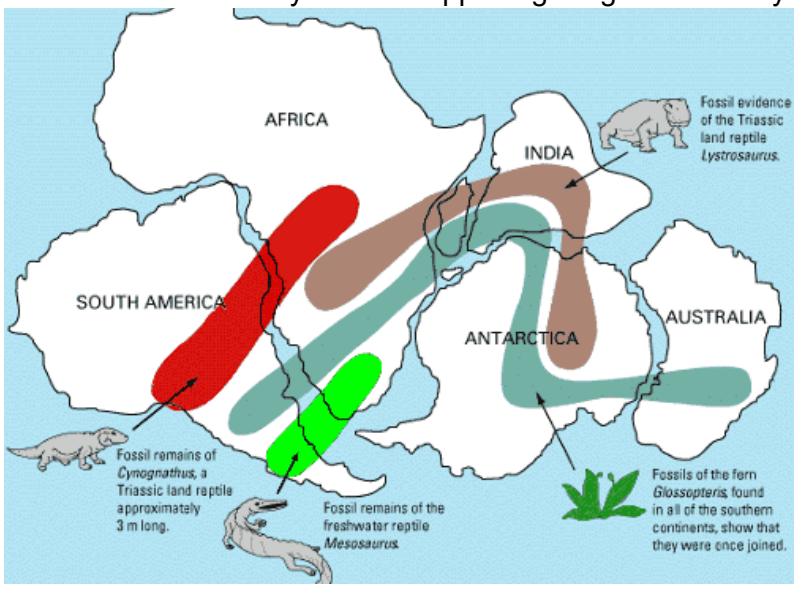
After reading the report, Wegener (1) wrote, "As a result I undertook a cursory examination of relevant research in the fields of geology and paleontology, and this provided immediately such weighty corroboration

that a conviction of the fundamental soundness of the idea took root in my mind." Wegener was referring to his idea of continental drift.

Using a world map, he cut out the five continents and placed them side by side to form Gondwana. Next, he outlined the locations where the plant and reptile fossils were found and discovered that the distribution of the fossils across the five continents formed linked patterns, providing the first piece of evidence that the continents were once merged (Fig. 1) (references 2, 7 & 8). He needed additional evidence and he found it.

He learned that one of the fossils, the *Mesosaurus*, was an early Permian fresh water reptile, and it would have been impossible for it to swim the ocean to other continents. The same applied to *Lystrosaurus* and *Cynosaurus,* Triassic mammal-like reptiles. He also learned that *Glossopteris,* a woody, seed bearing shrub/tree was a dominant species in the Permian Period. It had very large seed pods, but it was unlikely the seeds survived drifting across the ocean to another continent. Today, paleontologists recognize that these fossils are only found on the five referenced continents (references 2, 7 & 8).

Figure 1: Distribution of Some Key Fossils supporting Wegener's theory.



www.timetoast.com

Wegener also refers to Darwin's theory of evolution, which says that it is highly improbable that plants and reptiles evolved separately on separate continents at approximately the same time. He speculated that a sub-tropical or tropical climate existed on all five continents favoring the existence of the plant and reptile species listed (references 1, 2, 7 & 8).

Wegener dismissed the theory that land bridges or intermediate continents once connected the continents and sank to form the ocean floor. He emphasized the principle of isostacy, which had been around for several decades and stated it would not allow continents to sink. If they were somehow forced to the ocean bottom, they would rise to their former elevations when the force was released, restoring isostasy. He noted that continents are made of granite, a rock less dense than the volcanic basalt that makes up the deep-sea floor. Therefore, continents float like icebergs and move up and down to maintain equilibrium. He referred to the continuing buoyant uplift of Scandinavia due to the removal of an inland glacier which completely melted more than 10,000 years ago. He notes that the only logical conclusion, from the fossil distribution and geological evidence, was that the continents were once joined and have since drifted apart (references 1, 3, 4, 6 & 7).

As additional evidence that the five continents were once merged together, Wegener referenced the correspondence of rock units and paleoclimate data. He noted corresponding strata along the coastlines of Brazil and Africa, including older and younger granites, alkali-rich rocks,

Figure 2: Matching Rock Units and Continental-Shelf Edges.

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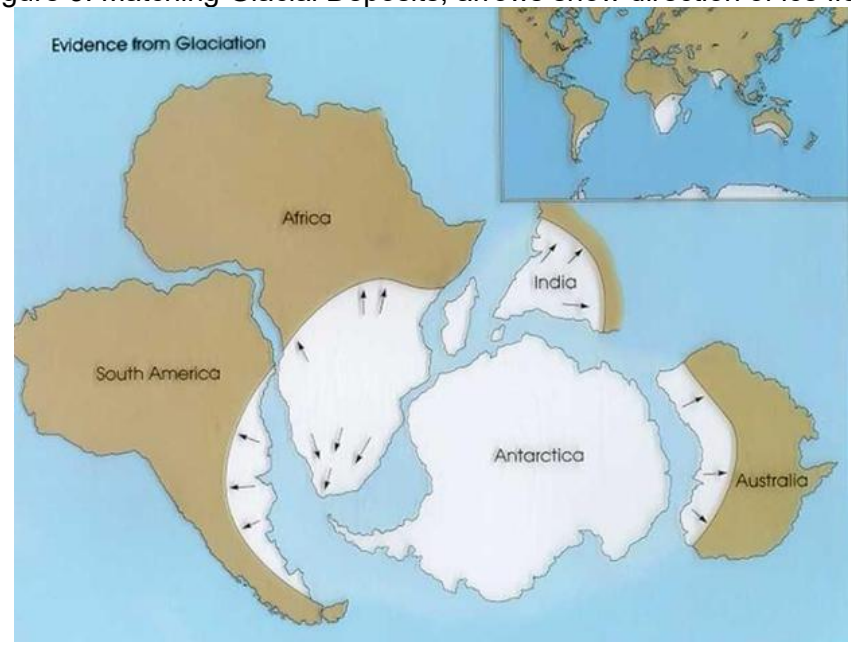
Jurassic volcanic rocks, intrusive dolerite and kimberlite (Fig. 2). He specifically referred to the occurrence of bodies of kimberlite, known as 'pipes', in Brazil and Africa, which yield diamonds in the Minas Gerais State of Brazil and north of the Orange River in South Africa, as well as the fact that diamonds are also found in India. He also noticed that coal deposits ran uninterrupted across Africa and South America when the two continents were merged (references 1, 4, & 6 thru 8).

Paleoclimatology is the scientific study of climates of past geologic periods, and Wegener was very interested in the subject. He and his father-in-law, Wladimir Koppen, a Russian and German geographer, meteorologist, climatologist and biologist, are noted for being the first to use a systematic approach to understand early climates (references 1 & 3). Wegener found geological evidence that identical glacial deposits once covered sections of South America, southern Africa, India, and Australia. The evidence includes glacial striations found on bedrock exposures indicating that thick ice sheets, similar to those found today in Antarctica, existed about 300-280 mya (Fig. 3).

Wegener believed that the four continents exhibited correlating glacial evidence because they were merged when the glaciations occurred during the Permo-Carboniferous Period (about 300-280 million years ago). He attributed the climate change, from tropical to sub-tropical to polar, to a combination of continental drift (Gondwana drifted close to the South Pole) and a moderate shift in the position of the South Pole (displaced to southern Africa). He related that polar wandering and continental drift linked up to form an astonishing pattern of simplicity. Wegener also recognized that during the Carboniferous, coal beds were forming in tropical

swamps in the eastern United States, Europe, Asia Minor and China (references 1, 4, 6, 8 & 9). He decided to turn his attention to North America and Eurasia (Europe and Asia).

Figure 3: Matching Glacial Deposits; arrows show direction of ice flow.



www.muhammed-geography.blogspot.com

Referring to a world map, Wegener noticed two mountain ranges that matched up along the coastlines of South America and Africa. These are the Sierras of Buena Vista in Argentina and the South African Cape Mountains. He also noticed a mountain range that matched up along the coastlines of eastern North America and western Europe. These are the Appalachian Mountains on the east coast of North America, which extend up into the Canadian provinces of Newfoundland and Labrador, and the Caledonian Mountains of eastern Greenland, northeastern Scandinavia and Great Britain (Fig. 4) (references 1 thru 4, & 8).

Figure 4: Matching Mountain Ranges along the Atlantic Coastline of Africa, Europe, North America and Greenland

www.es.slideshare.net

Wegener recognized that these mountain ranges formed along the margins of their respective continents when they merged. The corresponding mountain ranges and coal deposits provided Wegener with evidence that the North American continent was once merged with Europe. Note: The Anti-Atlas Mountains of Africa are associated with the Caledonian Mountains; however, Wegener did not recognize them as such. Additional mountain ranges throughout the world are referenced in Chapter 5, Wegener (1).

Once again, using a world map, Wegener cut out the continents of North America, Europe and Asia (Eurasia). He slightly rotated the North American piece clockwise, and placed the northeast coastline alongside the west coast of Eurasia, forming a supercontinent known today as Laurasia. Next, he placed the eastern coastline of North America alongside the northwest coastline of Africa (Gondwana). The two jig-saw puzzle pieces, Laurasia and Gondwana, formed a massive supercontinent which Wegener first named Ur-Kontinent, German for 'one continent,' later changing it to Pangea (aka Pangaea), Greek for 'all lands.' He named the ocean that surrounded Pangea the Tethys (Fig. 5) (references 2, 3, & 6 thru 9).

Figure 5: The Supercontinent of Pangea: Laurasia and Gondwana

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Wegener relates that the Appalachians and the Caledonian Mountains are a single large fold system formed in the Carboniferous Period and his theory sees them as fragments of the edges of separating continents. He explains that due to the evidence of corresponding coastlines, mountain belts, and sediments on either side of the Atlantic Ocean, the ocean is an expanded rift. Wegener (1) wrote, "It is just as if we were to refit the torn pieces of a newspaper by matching their edges and check whether the lines of print run smoothly across. If they do, there is noting left but to conclude that the pieces were in fact joined in this way."

Wegener reports that the assumption that the continents have never changed is incorrect. Wegener (1) referred to the continents as "blocks" and wrote:

> The continents must have shifted. South America must have lain alongside Africa and formed a unified block which was split in two in the Cretaceous; the two parts must then have become increasingly separated over a period of millions of years like pieces of a cracked ice flow in water. The edges of the two continents are even today strikingly congruent. In the same way, North America at one time lay alongside Europe and formed a coherent block with it and Greenland, at least from Newfoundland and Ireland northwards. This block was first broken up in the later Tertiary and in the north as late as the Quaternary, by a forked rift at Greenland, the sub-blocks then drifting away from each other. Antarctica, Australia and India up to the beginning of the Jurassic lay alongside southern Africa and formed together with it and South America, a single large continent, partly covered by shallow water. This block split off into separate blocks in the course of the Jurassic, Cretaceous and Tertiary, and the sub-blocks drifted away in all directions.

On January 6, 1912, Wegener presented his theory to the Geological Association in Frankfurt, Germany. Four nights later, he gave a second presentation to the Society for the Advancement of Natural Science in Marburg, Germany. As he expected, his theory ignited a firestorm of rage and rancor in the scientific community. A few scientists welcomed his theory but most responded with disdain and harsh criticism. He was considered an outsider, a meteorologist, who was attacking the very foundations of geology (references 1, 4, 6 & 7).

Wegener recognized there was a problem with his theory: he could not adequately explain the forces that moved the continents. Wegener (1) wrote:

> We may, however, assume one thing is certain: the forces which displace the continents are the same as those which produce great fold-mountain ranges. Continental drift, faults, compressions, earthquakes, volcanism, transgression cycles and polar wandering are undoubtedly connected causally on a grand scale. Their common intensification in certain periods of the Earth's history shows this to be true. However, what is cause and what effect, only the future will unveil.

Harsh criticisms did not deter Wegener. In 1912, he published two papers regarding the origin of continents. Further work on the theory was delayed when he participated in a second expedition to Greenland in 1912-13, and later by service in World War I. He was seriously wounded twice in battle and declared unfit for service. As a result, he was assigned to the army's weather service. While recuperating from his injuries, Wegener managed to publish his first book in 1915, *The Origin of Continents and Oceans*. Revised editions were published in 1920 and 1922. The 1922 edition was published in Russian, English, French, Spanish and Swedish. The early editions contained a presentation of the theory itself and a collection of the individual facts in support of it. The fourth and final revised edition, published in 1929, explains new branches of research supporting his theory. It was translated into English in 1962 and is referenced in this article. For a more concise explanation of his research, please refer to reference 1.

Wegener decided that an additional revision of his book would be beyond his capabilities, as the literature relevant to the problem had become too extensive and specialized for a single worker to survey. Wegener (1) wrote, "The only way I achieved the degree of comprehensiveness was due to the very large number of communications I received from scientists in all the relevant fields."

In 1926, Wegener was invited to an international symposium in New York to discuss his theory. He found some supporters but many speakers were sarcastic to the point of insult. It was reported that he just sat smoking his pipe and listening (reference 4).

After his presentation, Wegener returned to his family in Austria, and continued working on his theory and teaching meteorology and geophysics at the University of Graz. He was looking forward to a third expedition to Greenland in 1928 with his Danish friend and fellow explorer, J. P. Koch. In 1928, Wegener received word that Koch had died and funding for the expedition

was in jeopardy. Wegener contacted the German Research Institute of Polar Science and they agreed to sponsor a 1930 expedition to Greenland (reference 1).

Wegener was appointed the leader of the expedition on which he would be responsible for the safety and well-being of 18 scientists and technicians and numerous Greenland native assistants. By all accounts, he took his responsibility seriously. In September 1930, Wegener, with several companions traveled to a remote weather station 250 miles inland to check on the welfare of two fellow meteorologists. Wegener died on the return trip to the west camp (references 1, & 4 thru 7). To learn the details relating to his duties in Greenland and the circumstances leading up to his death, please see references 4 and 6.

In the 1930s, Wegener's continental drift theory sank into obscurity in Europe and America. In the early 1960s, U.S. universities were teaching geology students about land bridges, animals floating across the ocean on logs, etc., and a curious middle school student was sitting in a classroom studying a world map and wondering why the continental coastlines on both sides of the Atlantic appeared to match up like a jigsaw puzzle!

After World War II, scientists began using new and improved technologies to explore the Earth's surface and ocean floor. In the 1960s, new data about seafloor topography, the age and magnetic properties of ocean-floor rocks, and the global distribution of heat flow, volcanic activity, and earthquakes, could no longer be reconciled with the contracting/permanence Earth theory. Sufficient evidence had accumulated to provide a mechanism to explain Wegener's continental drift hypothesis: seafloor spreading (references 2 thru 9).

Eventually, the hypotheses of seafloor spreading and continental drift were combined in the theory of plate tectonics. Plate tectonics explains what Wegener could not, the forces that move continents across the face of the planet Earth. Fittingly, Dr. Alfred L. Wegener is known as the Father of Plate Tectonics.

Today, geologists estimate that Pangea formed about 320-300 million years ago and began to rift apart about 220 million years ago. Several supercontinents existed before Pangea. Plate tectonics is an ongoing process. Two hundred million years ago, there was no Atlantic Ocean. Two hundred million years in the future, the world will look different that it does today. The continents will again merge and eventually rift apart, in the process creating new oceans, seas, and mountains; all explained by plate tectonics and related to Wegener's theory of continental drift.

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Monthly Mineral Quiz

Answer to last month's quiz: Siderite

Siderite ($FeCO_3$) is a common iron mineral that occurs in a variety of geologic environments, including sedimentary rocks and hydrothermal ore deposits. In the Lake George area, siderite was once a common constituent of the Pikes Peak pegmatites—pseudomorphs of siderite replaced by hematite or goethite are common in the amazonite/smoky quartz pockets we all love to collect. Before the huge hematite deposits of the upper midwest were first mined in the late 1800s, siderite was an important iron ore, and the specimen in the photos came from a famous old iron mine near Roxbury, Connecticut.

This Month's Mineral: Shown in the **photo below** is a common mineral that occurs in localities in both eastern and western Park County (i.e., near Wilkerson Pass and west of Fairplay). The picture came from a locality a few hundred yards from **Dave Harvey**'s Hartsel barite locality.This mineral is a common indicator of the presence of copper ores, such as chalcopyrite and bornite. It has a specific gravity of 3.6 to 4 and a hardness of 31/2 to 4 (but is brittle and very easily scratched). It typically occurs with cuprite (see a past newsletter), azurite, and chrysocolla. What is it?

Lake George Gem & Mineral Club
PO Bo 171
Lake George, CO 80827

The Lake George Gem and Mineral Club is a group of people interested in rocks and minerals, fossils, geography and history of the Pikes Peak/South Park area, Indian artifacts, and the great outdoors. The Club's informational programs and field trips provide opportunities to learn about Earth science, rocks and minerals, lapidary work and jewelry making, and to share information and experiences with other members. Guests are welcome to attend, to see what we are about!

The Club is geared primarily to amateur collectors and artisans, with programs of interest both to beginners and serious amateurs. The Club meets on the second Saturday of each month at the Lake George Community Center, located on the north side of US Highway 24 on the east edge of town, sharing a building with the county highway shops. **In the winter, we meet at 10:00AM. From April through October, we meet at 9:00AM, to allow more time for our field trips.**

Our organization is incorporated under Colorado law as a nonprofit educational organization, and is a member of the Colorado, Rocky Mountain, and American Federations of Mineralogical Societies. We also sponsor an annual Gem and Mineral Show at Lake George, where collectors and others may purchase or sell rocks, minerals, fossils, gems, or jewelry. Annual membership dues (Jan. 1 through Dec. 31) are $15.00 for an individual (18 and over), and $25.00 for a family (parents plus dependents under age 18).

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