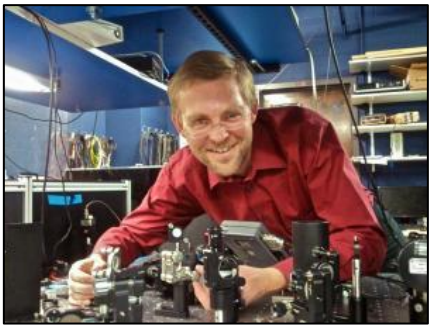
Flatirons Facets

Flatirons Mineral Club of Boulder County, Colorado

Volume 64, Number 1 January-February, 2021

January's Online Meeting
Xuebaoding: Mining Above the Clouds by Markus B. Raschke



Join us for this month's online meeting on Thursday, January 17, at 7:00 pm to learn about the world-famous Xeubaoding mineral location in China.

The Xuebaoding Mountain with its tungsten-selenium-beryllium deposits has emerged as a world-class specimen locality for scheelite, cassiterite, and beryl since its discovery in the 1950's. It is situated high above tree line on the northeastern edge of the Tibetan Plateau – an area known for its extreme earthquakes and vertical relief with mountains rising up to 7,500 m in elevation. The mineralized muscovite-rich quartz veins intruding Triassic metamorphic schist and carbonate rock are of a greisen-type associated with small alkali granite intrusions. Large well-formed crystals of scheelite, beryl, and cassiterite, and their aesthetic associations typically on muscovite matrix as well as the rare Sn-bearing minerals mushistonite and kësterite made the locality famous with the opening of China in the 1990's. At an elevation above 4,200 meters (14,000 feet), the locality is a full day trip and almost 3,000 meters (9,800 feet) above the adjacent valley floor. These difficulties in access to this remote locality have long limited systematic research of its geology and mineralogy. This includes several mysteries of the number and location of, in fact several, and geographically distinct localities, which have long been lumped together under the Xuebaoding label. From several trips to this and other related localities in the area, the actual origin of different species and mineral associations could be resolved. As part of an international collaboration, a new research effort has been started to understand the origin of the mineralizations. I will discuss from field trip adventures in pouring rain and overcoming landslide obstacles, our recent progress and new insight into the mineralogy, notably the unusual beryl of tabular habit.

Scheelite from Mt. Xuebaoding. Credit: Rob Lavinsky, iRocks.com. Wikimedia Commons, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported

Markus Raschke is in the Department of Physics, Department of Chemistry, and JILA at the University of Colorado at Boulder.

The Zoom link will be sent to members the day before the meeting.

In this newsletter

The Flatirons Mineral Club is a non-profit Organization which is dedicated to developing and maintaining interests in Earth science and associated hobbies. The purpose of this Club includes, but is not limited to, studying geology and Earth science, teaching others about our hobby, including young people, collecting gem, mineral and fossil specimens and learning lapidary skills.

The Flatirons Mineral Club is affiliated with the Rocky Mountain Federation of Mineralogical Societies, the American Federation of Mineralogical Societies, and the Greater Denver Area Council of Gem and Mineral Societies.

President's Message

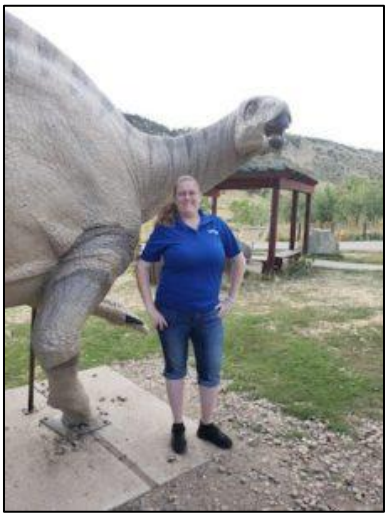
Happy New Year! In 2021 the FMC will try some new ways of operating in a COVID world. I have monitored other regional clubs and how they operated last year. Although their meetings were conducted via Zoom, some clubs held field trips. The FMC is beginning to plan several "socially distanced" field trips for the springtime. Stay tuned for more details.

We always are looking for interesting presenters for our Zoom meetings. If you know anyone who would like to present or have a topic you would like to see presented, please contact me.

Dennis would appreciate club members willing to contribute a rockhound-related article or willing to submit photos, artwork, or poetry for the March-April newsletter. Please let him know.

Regards,
Brian Walko

February's Online Meeting History of Dinosaur Ridge by Erin LaCount



Dinosaur Ridge has been a nonprofit organization for just over 30 years! Managing lands that stretch back 150 million years, this site is home to 12 unique holotypes and discoveries that go back to 1877. Let's explore the history of this place and the importance of the organization that oversees the fossil and geological sites!

Join us on Thursday, February 11, to hear Erin LaCount, Dinosaur Ridge Education Programs Director, recount this history of this fabulous paleontological site right in our backyard.

If you have not used Zoom to attend online meetings, please see the directions and guidelines on page 13.

2020 Rocks, Minerals and Jewelry Virtual Show

In lieu of the cancelled FMC Rocks & Rails Show originally scheduled for December, Andrew MacGregor, Dealer Chair, came up with a great idea: to hold a Virtual Show. Andrew contacted our dealers and offered to host links to their website, eBay, Etsy, Amazon, and Facebook sales pages.

Andrew designed the virtual show page, and Brian programmed it. We delved into the world of Internet advertising by buying targeted ads on Facebook and Google. Our Facebook ads reached over 2,100 people within 50 miles of Boulder resulting in 174 virtual show page visits. An unintended bonus was 25 new people liked our FMC Facebook page. For Google, we used keywords such as jewelry, gems, minerals, lapidary, and mineral show, then targeted the entire state of Colorado. Our ad was shown over 12,000 times resulting in 250 page visits.

Donald Layden, FMC member and owner of Prestige Minerals & Gems, donated a 2.5-gram gold nugget as virtual door prize. The lucky virtual door prize winner of the gold nugget was Jennifer from Cotopaxi, CO (between Canon City and Salida). She was thrilled to win and is joining the FMC.

In conclusion, the Virtual Show helped our struggling dealers, spread FMC's name recognition throughout Colorado, and started a new virtual show trend that other clubs and shows are adopting.

Member Name Tags

Would you like a Flatirons Mineral Club name tag to wear at club events and field trips? The club places orders for name tags several times a year for members.

If you would like a name tag, please log onto our website and choose the "Request a Name Tag" link in the Members Area. Add your name to the list as you want it to appear on your name tag and it will be ordered for you. Your first name tag is free!

Example of a club name tag

Trilobites

Charlotte Small, Jr. Geologists

Introduction

Trilobites were animals that lived from Cambrian to Permian 541 million years ago to 252 million years ago. They lived in water and had an exoskeleton. They were probably related to the horseshoe crab. Most trilobites had a 3-part body with a cephalon (head), thorax, and pygidium (tail). In addition, they also have a left pleural lobe, right pleural lobe, and axial lobe.

Credit: Pixabay (https://pixabay.com/photos/fossil-trilobite-fossils-arthropods-96303/)

What was it like back then?

When trilobites were around, it was very different. Most of the animals were in the water, though some scientists think that there could have been some animals on land too. It is likely that trilobites ate water-worms. To move around, they used their many legs to swim or crawl on the seafloor. There is fossil evidence that they may have been eaten by *Pterygotus*, which were the largest arthropods to live in that time.

Credit: Heinrich Harder, public domain

How do they fossilize?

Imagine a trilobite molts its skin. Slowly the exoskeleton sinks to the muddy floor. It then over time gets covered by more mud and the mud slowly begins to get hard. Over the next millions of years, the mud gets harder and harder finally turning into rock. The rock erodes away, and a group of paleontologists come to evaluate the sites. These paleontologists pick up the rock that has the trilobite in it. The trouble is that the trilobite is sandwiched between the rock layers. How will the paleontologists get the trilobite? They just get a small hammer and tap the side of the rock. The rock splits open and reveals the trilobite.

Where to find them

Usually, you can find trilobites in limestone or sandstone. There are more than 20,000 trilobite species to find. That is mud or sand that is fossilized! They range in size from less than 1 mm to 72 cm! It is likely that you will find the fossilized exoskeleton rather than the actual trilobite. The most common trilobite found in the U.S. is *Elrathia kingii*.

One place to look for fossils in Colorado is Deckers. You will need a hat and sunblock, digging tools, protective glasses, warmer and cooler clothes, and hiking shoes.

Trilobites in my collection

Conclusion
Trilobites were creatures that lived in the Cambrian period and died in the late Permian, because of mass extinction. They are still creatures of wonder today. What ate them? What color were they? This is still to be found out. Trilobites were creatures that lived in the Paleozoic. The Paleozoic are the Cambrian, Ordovician, Silurian, Devonian, Carboniferous, and Permian Periods. Trilobites ate worms and lived underwater.

People know a lot about trilobites, because they fossilized very easily. But they are still creatures of wonder today. What color were they? How many years did they live? There is still more to be found out.

Charlotte is 12 years old and is in 7th grade at Horizons K-8. She joined the Jr. Geologists in 2014.

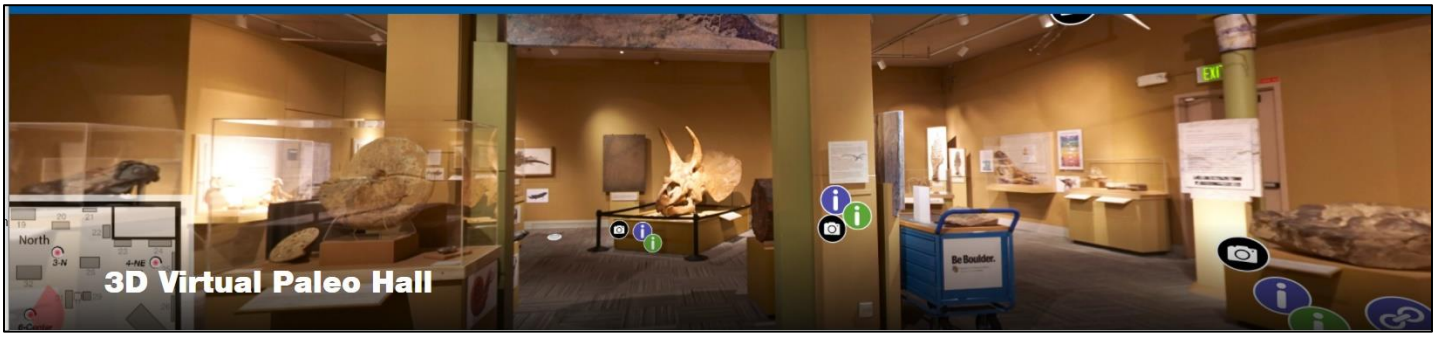
Tour University of Colorado Museum of Natural History Virtually

Although it is closed, you can now see some of the fabulous fossils in this museum. The CU Museum of Natural History has launched a new, virtual, 3D version of the Paleontology Hall's "Fossils: Clues to the Past." Now, you can journey backwards through time and examine the entire gallery, at your leisure on your phone, desktop, laptop or tablet! This new experience features HD images of specimens plus short, educational videos and can be navigated in English with Spanish translations! Click the link to explore: https://bit.ly/37nS71r

As you navigate through the hall, you can click on icons to see photos of the specimens, information about the specimens, and short videos about some of the specimens. There is no pre-determined path through the gallery; you can explore as you wish.

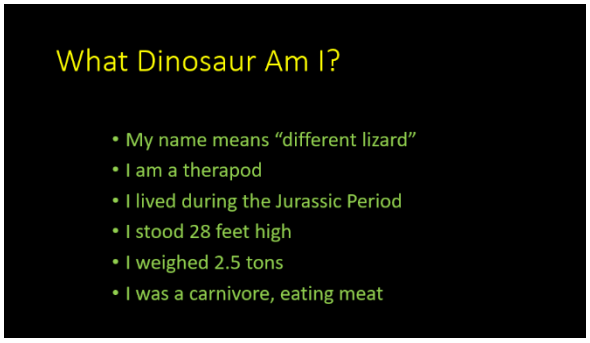
To enter the Paleontology Hall, use your mouse to click on any red dot on the floorplan (lower left-hand corner) or click on any white spot in the gallery. Click and hold your mouse to change your view from where you are. Full viewing and reading of the Paleontology Hall takes about ½ hour.

The University of Colorado Museum fosters exploration and appreciation of the natural environment and human cultures through research, teaching, and community outreach. It is located in the Henderson Building on the CU campus, 1030 Broadway Boulder, CO 80309.



Jr. Geologists Activities

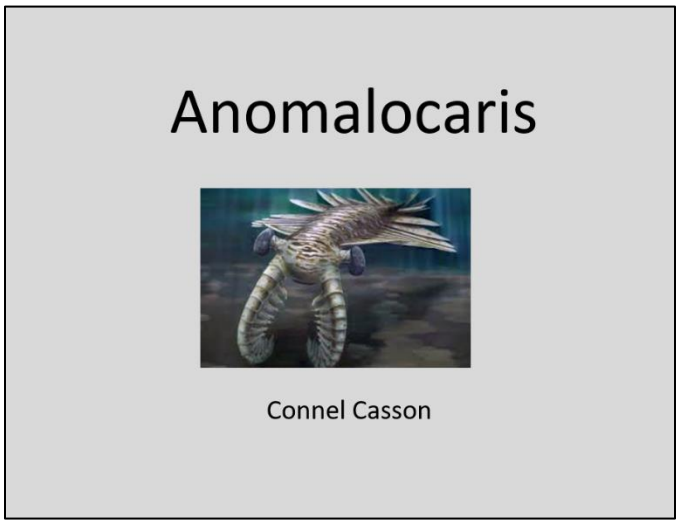
The Jr. Geologists have resumed meeting each month on Zoom. For December's meeting, we played Name That Dinosaur. The Jr. Geologists were emailed 12 dinosaur flashcards and encouraged to learn more about each of these



dinosaurs. During the meeting, facts about each dinosaur were given one at a time like the one shown below, and the Jr. Geologists held up the flash card of the dinosaur they thought it was. Several of the juniors got nearly all of them correct. (By the way, the answer to this one is Allosaurus.)

Jr. Geologists Presentations

One of the requirements for the Rocking on the Computer Badge is to prepare a presentation about a rockhounding subject of interest. Charlotte gave a presentation about trilobites and Connel presented information and a video about *Anomalocaris*, an ancient predator that lived during the Cambrian Period 500 million years ago. We hope more Jr. Geologists give presentations at future meetings, as they work on the Rocking on the Computer Badge.



Mineral Jeopardy

How well do you know minerals? The Jr. Geologists tested their knowledge playing Rock and Mineral Jeopardy during January's online meeting. Here are the Jeopardy questions; how many of these you can get right?

Rock and Mineral Jeopardy

	Quartz	Minerals We Use Everyday	Igneous Rocks and Minerals	Rocks	Crystals
100	Dark gray quartz crystals	Metal that carries electricity in our house	A rock that floats	A rock made from sand	The hardest mineral
200	A hollow round rock filled with quartz crystals	Common name for halite, a mineral we eat everyday	Shiny mineral that peels off in sheets	A type of rock that was melted	Gold colored crystals that are cube shape
300	Purple quartz crystals	Metal in cell phone batteries that comes from spodumene	A white mineral in granite and pegmatite	Type of rock that contains fossils	Crystal with six sides
400	Yellow quartz crystals	Metal in car batteries that comes from galena	A magnetic mineral	Colorado's state rock	Red mineral that is the Colorado's state mineral
500	Quartz that glows when rubbed together	Common name for nahcolite that we cook with	A pink mineral in granite and pegmatite	Volcanic glass	White crystals found on North Table Mountain outside Golden

Jr. Geologists Earn the Rockhound Badge

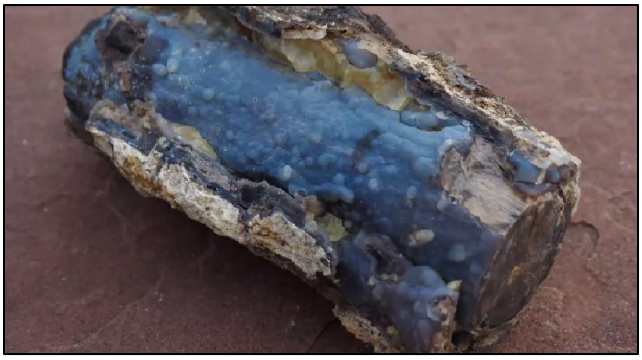
Jr. Geologists can earn badges from the American Federation of Mineralogical Societies about different rockhounding subjects. There are now 20 badges, covering geology, rocks and minerals, fossils, lapidary arts, and even space geology. Two of our Jr. Geologists have earned six badges, qualifying them for the Future Rockhounds of America Rockhound Badge. We congratulate Kemper Fitzgerald and Connel Casson for achieving this goal. Since the inception of the badge program over 15 years ago, only 28 juniors in Colorado have earned this badge. Kudus to Kemper and Connel for a job well done.

Virtual Towel Show

Although we could not meet for November's annual Towel Show, we were able to hold the show online. Here are photos of just some of the beautiful specimens and lapidary projects that members shared at the show.

Jade jewelry

Fossil fish from Wyoming



Blue Forest petrified wood

Agate from Last Chance, Utah

Banded iron, South Pass, Wyoming

Metalsmithing with jasper

Shorl from west of Boulder

Banded jasper

Central City gold vein; lead and copper sulfides

Pegmatite vein outside of Boulder

Calcite, fluorescent under longwave UV

Garnets

Copper oxide minerals from Central City mine

Lithium: Powering Today's Technology

Dennis Gertenbach

Lithium batteries (Figure 1) have become part of our everyday life, powering our electronics - cell phones, tablets, and laptops - electric tools, and Teslas and other electric cars, as well as storing electricity from banks of solar cells and wind turbine farms. As an example of the ever-increasing demand for lithium, a single Tesla contains 22 pounds of lithium in its batteries. And, the continuing increase in the use of wind and solar to generate electricity requires large banks of batteries to keep electricity flowing when the wind stops blowing and the sun goes down.

Figure 1. Lithium batteries. Credit: Panasonic, Wikimedia Commons, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported

But what is this metal that has become so critical to our lives? Lithium is a soft, light-weight metal with a silvery-white appearance (Figure 2). It is the third element in the periodic table with the chemical symbol Li. It is highly reactive and readily bursts into flame when exposed to air. When it contacts water or even humid air, lithium violently reacts to produce hydrogen gas. Because of its high reactivity, it is generally sold commercially as purified lithium carbonate, a

nonreactive, white powder (Figure 3). Many ceramic and glass applications use lithium ore concentrates, rather than purified lithium carbonate.

Figure 2. Pieces of lithium metal. Credit: Dnn87, Wikimedia Commons, licensed under the **GNU Free Documentation License**

Figure 3. Lithium carbonate. Credit: Walkerma, Wikimedia Commons, public domain

Current uses of lithium metal and compounds include batteries (65%), ceramics and glass (18%), lubricating greases (5%), polymer production (3%), continuous casting mold flux powders (3%), and other uses (6%) (Jaskula, 2020). With the ever-increasing use in batteries, the demand for lithium continues to climb.

Where does lithium come from?

Lithium carbonate is recovered from two main sources, lithium-rich brines and mineral deposits mostly containing spodumene. Each of these lithium sources requires very different processing steps to produce the purified product needed for batteries and most other applications.

The United States has only one large-scale lithium manufacturer, a brine operation in Nevada. Worldwide, there are six mineral operations in Australia, two brine operations each in Argentina and Chile, and one brine and one mineral operation in China. Worldwide lithium production in 2019 was about 88,000 tons. Most of the lithium used in the United States is imported from Argentina (53%), Chile (40%), China (3%), and other countries (4%) (Jaskula, 2020).

Producing lithium from brine

Brines are, by far, the main source of lithium. Although there is one large-scale brine operation in the United States, most lithium produced from brines comes from high-elevation shallow to dry lakes called salars from Argentina, Chile, and Bolivia (Figure 4). The lithium in these brines ranges from 0.05 to 0.7%.

To recover lithium from these high salinity salars, the lithium concentration must first be increased up to 6% by evaporating water from the brines. Rather than use expensive fossil fuels to evaporate water, commercial brine operations are located in dry areas where the sun is used to evaporate water in large solar ponds over a number of months (Figure 5).

Figure 4. Lithium-bearing Salar de Uyuni, Bolivia. Credit: Lion Hirth, Wikimedia Commons, public domain

As water evaporates from the brine, potassium chloride precipitates in the pond. This potassium chloride is harvested and sold as a byproduct to make fertilizer. With further evaporation, sodium chloride (salt) precipitates, which also removed. As more and more water evaporates, the lithium concentration in the brine increases to the optimal concentration.

Figure 5. The Chemetall Foote Lithium Operation in Clayton Valley, a dry lake bed in Esmeralda County, Nevada. Credit: Doc Searls, Wikimedia Commons, licensed under the Creative Commons Attribution 2.0 Generic

Once the optimal concentration is reached, the solution is pumped to a recovery plant where unwanted impurities are removed, including boron, magnesium, and calcium. The lithium carbonate product is then precipitated from solution, where it is filtered and dried for sale. The excess residual brine is recycled back into the salar.

Producing lithium from ores

The second source of commercial lithium is from pegmatites containing lithium minerals. The major mineral mined for lithium is spodumene ($LiAlSi_2O_6$, Figure 6), but lithium is also recovered from petalite ($AlH_4LiO_{10}Si_4$), lepidolite ($KLi_2AlSi_3O_{10}(OH,F)_2$), zinnwaldite ($KLiFeAl_2Si_3O_{10}(F,OH)_2$), and amblygonite ($(Li,Na)AlPO_4(OH,F)$).

Ore mined from lithium-bearing pegmatites typically contains about 1 to 2% Li_2O (0.5 to 1% lithium). For processing into lithium carbonate, the ore must be upgraded to 6 to 7% Li_2O (about 3% lithium). This is accomplished by flotation, in which the ore is ground with water to the consistency of sand, and special chemicals are added that adhere to the surface of the spodumene (and other lithium minerals). As air is bubbled through this slurry, the special chemicals cause the ground spodumene to stick to the air bubbles. These bubbles are then collected, yielding upgraded ore.

The most common process for converting the upgraded spodumene ore to lithium carbonate first involves heating the ore to above 2,000°F, which converts the naturally occurring α-spodumene to β-spodumene. This conversion is necessary to dissolve the spodumene in sulfuric acid to recover the lithium. The β-spodumene is mixed with concentrated sulfuric acid and heated again. When added to water, the acid-treated β-spodumene dissolves.

With the lithium now dissolved in water, a number of steps are needed to remove iron, calcium, and magnesium. As with the brine process, lithium carbonate is then precipitated, filtered, and dried for sale.

Figure 6. Spodumene from the Walnut Hill Pegmatite, Hampshire County, Massachusetts. Credit: Robert M. Lavinsky, Wikimedia Commons, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported

Lithium batteries now and in the future

As described above, a number of processing steps are needed to produce lithium carbonate, whether from brine or pegmatite ores. To convert the purified lithium carbonate to lithium batteries, many more chemical steps are required. These many steps result in the relatively high price for lithium and lithium batteries. However, researchers continue to investigate ways to produce lithium more efficiently and less expensively.

The mining publication, *The Northern Miner* (2020), projects that global demand for lithium will double between now and 2024. To meet this demand, current lithium producers are expanding and several more commercial brine and mining operations throughout the world will be operating in the near future.

References and Additional Reading

Dessemond, Colin, Lajoie-Leroux, Francis, Soucy, Gervais, Laroche, Nicolas, Magnan, Jean-François (2019), "Spodumene: The Lithium Market, Resources and Processes," *Minerals*, vol. 9, p. 334-350, https://www.mdpi.com/2075-163X/9/6/334.

Flexer, Victoria, Baspineiro, Celso Fernando, Galli, Claudia Inés (2018) "Lithium Recovery from Brines: A Vital Raw Material for Green Energies with a Potential Environmental Impact in Its Mining and Processing," *Science of the Total Environment*, p. 1188–1204, https://www.researchgate.net/publication/325386404_Lithium_recovery_from_brines_A_vital_raw_material_for_green_energies_with_a_potential_environmental_impact_in_its_mining_and_processing/link/5c13adb14585157ac1c19ecd/download.

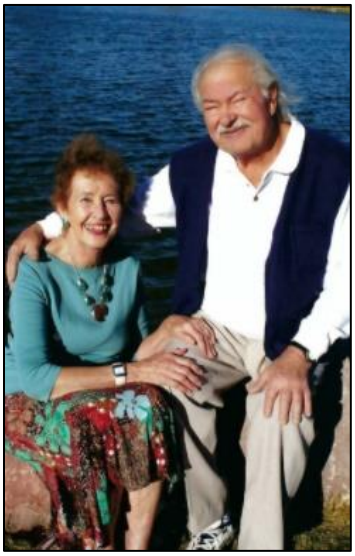
Jaskula, Brian W. (2020), "Lithium Data Sheet - Mineral Commodity Summaries," U.S. Geological Survey, https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-lithium.pdf.

Murodjon, Samadiy, Yu, Xiaoping, Li, Mingli, Duo, Ju, and Deng, Tianlong (2020) "Lithium Recovery from Brines Including Seawater, Salt Lake Brine, Underground Water and Geothermal Water" https://www.intechopen.com/books/thermodynamics-and-energy-engineering/lithium-recovery-from-brines-including-seawater-salt-lake-brine-underground-water-and-geothermal-wat.

The Northern Miner (2020) "Global Lithium Demand Expected to Double by 2024," October 8, https://www.mining.com/global-lithium-demand-expected-to-double-by-2024/#:~:text=Global%20demand%20for%20lithium%20is,production%20over%20the%20same%20period.

In Memoriam: Jordan Sawdo

February 13, 1932 – November 12, 2020



Jordan and his late wife Ruth

We are saddened by the death of Jordan K. Sawdo, long time FMC member, who passed away in his home in November. Jordan was well known to Denver Metro rockhounds as one of the founders of the Western Interior Paleontological Society (WIPS) and one of the mainstays of the Denver Gem and Mineral Shows.

Jordan was born in 1932 in Denver. growing up in rural Denver. It wasn't until second grade that his family had electricity and running water. He attended West High and was in the graduating class of 1950. It is there that he met his sweetheart, Ruth G. Sausaman and they were married in 1952. Jordan and Ruth shared 65 years together, before her passing in 2017.

Their life together began with Jordan's military experience in the Navy Reserve and US Air Force. He then went on to graduate school, where he went to class by day and worked by night as a janitor and at the local bowling alley to provide for his family of three children at that time.

After graduating Magna Cum Laude from the University of Colorado in 1958, he went to work for General Mills for over a decade, and then another decade with National Tea Company, where he was eventually the director of operations for over 44 stores statewide.

Finally, after devoting many years to the grocery business, he had the opportunity to work in the field of geology. This led to directional drilling and subsurface surveying, and he became the district manager for Wilson Downhole, overseeing Colorado, Wyoming, Utah, North and South Dakota. Jordan was so well known and respected in the field, he went on to start his own company, which also allowed him to teach courses in Petroleum Technology, as well as designing oil wells for major oil companies. He never missed an opportunity to teach and did so at various colleges and universities, including the University of Colorado (Denver), Colorado School of Mines for many years, an extension course for the University of Texas, and as a guest faculty member at Adelaide University in Australia, while he and Ruth were on a teaching exchange.

Additional lifetime teaching experiences ranged from his dedicated work of teaching from his basement at night, to a decade of fossil and related geology classes at the Denver Museum of Nature and Science. Furthermore, Jordan created courses for anyone who requested them, including school groups. He and Ruth devoted many hours of volunteer time to educate youth. Jordan also provided displays and unique specimens to many museums, including the Adams County Museum, the Smithsonian Museum, and the Denver Museum of Nature and Science, where the fossil named after him, *Eretmocrinus sawdoi*, is currently housed.

He held offices in many local organizations, including the Flatirons Mineral Club, Colorado Mineral Society, North Jeffco Mineral Society, and Rocky Mountain Mineral Society; he published and co-authored many books, and founded the Western Interior Paleontological Society (WIPS), where he leaves behind many friends.

Jordon is survived by his son and three daughters, 5 grandchildren, and 3 great-grandchildren. A celebration of life may be considered when it is safe to gather again. The family would like contributions to go to Western Interior Paleontological Society for educational grants and scholarships in his honor. Checks can be sent in memory of Jordan Sawdo to: Western Interior Paleontological Society, P.O. Box 200011, Denver, Colorado 80220.

FMC Virtual Meetings on Zoom: How to Participate.

The 7:00 PM meeting on May 14, will be a virtual meeting presented over **Zoom**. Try to join by 6:55 PM using a URL link to be emailed to you before the meeting. Seasoned Zoom veterans will know what to do.

If you are a Zoom novice, this summary with video links gets you started. Zoom allows a Host presenter who controls the roles of other **Participants**. As a novice, allow yourself a *minimum* of 15 minutes to set up before the time of the presentation. (It could take less, but be pessimistic.) These short videos describe what you will do - the same basic information presented three different ways. *Watch them well before the meeting*:

https://support.zoom.us/hc/en-us/articles/201362193 'Joining a Zoom meeting.' 1.09 min.
https://www.youtube.com/watch?v=6fIYWnfTc5o 'Joining a Zoom meeting for the first time – A cozy step-by-step guide.' 6.08 min.
https://www.youtube.com/watch?v=NIYudDeULlw 'How to join a Zoom meeting for the first time.' 2.26 min.

These videos are for laptops (Windows or Mac) and explain a Zoom download and install if required. The link you will receive also works for your iPad or Smartphone, but with some screen variations. Download & install the Zoom App ahead of time

The many on-line guides and videos mainly address the Host function rather than the Participant function. Participants can reset various options including their background image, but this is beyond the scope of this introduction. Controls/options may be frustratingly hidden by default until you hover the mouse over the bottom edge of the screen. At top right of the default screen, as a participant you can toggle between **Speaker** and a **Gallery** of the participants - see this link: https://support.zoom.us/hc/en-us/articles/201362323-How-Do-I-Change-The-Video-Layout-

Enjoy, and smile for the camera!

Fossils in the News

Dennis Gertenbach

Bizarre Ancient Mammal Lived with Dinosaurs in Madagascar

David Krause of the Denver Museum of Nature and Science, along with an international team of researchers he led, reported in the journal *Nature* about a bizarre opossum-sized mammal that lived 66 million years ago in Madagascar. Called *Adalatherium* (from the Malagasy and Greek languages meaning "crazy beast"), it looked somewhat like a badger from the outside. But its fossilized skeleton indicates that it was very different, termed "outlandish" by the research team. Its skull had more holes (foramina) on its face than any known mammal. These holes provide passageways for nerves and blood vessels to the whiskers, indicating that the snout was quite sensitive. Also, there is a large hole on the top of its snout, which is not found on any other prehistoric or modern mammal.

A reconstruction of *Adalatherium hui* from the Late Cretaceous of Madagascar. Credit: ©Denver Museum of Nature & Science/Andrey Atuchin, used by permission

The skeleton provided other strange surprises. The teeth are quite different from any other known mammal. Its backbone has more vertebrae than any other mammal that lived before the extinction of the dinosaurs. And, one of its leg bones was strangely curved. How this animal fits within mammal evolution has paleontologists puzzled.

Information from https://www.dmns.org/press-room/press-releases/marooned-on-mesozoic-madagascar/

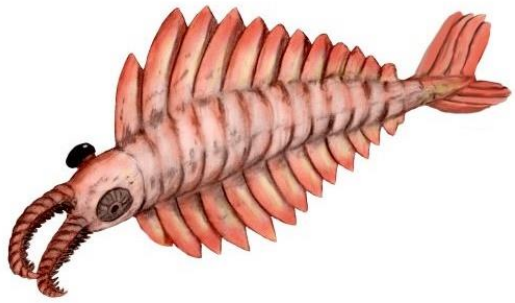
The Discovery of a Strange New Dinosaur

Continuing with the theme of bizarreness, scientists have discovered a chicken-sized dinosaur named *Ubirajara jubatus*. This dinosaur had a mane of long fur-like feathers down its back and stiff ribbons projecting out from its shoulders. These ribbons were made of keratin, much like our fingernails. Based on these strange features, its name comes from the Tupi Indian name for "lord of the spear' and Latin meaning "maned" or "crested". No other dinosaur has been discovered with similar features.

Ubirajara jubatus, a bizzare dinosaur with fur-like feathers and spikes on its shoulders. Credit: Luxquine, Wikimedia Commons, licensed under the Creative Commons Attribution-Share Alike 4.0 International

Ubirajara jubatus lived about 110 million years ago during the Cretaceous Period in the Crato Formation in Brazil. At that time, the area was a shallow inland sea. Professor Martill, one of the researchers who found this dinosaur, said: "What is especially unusual about the beast is the presence of two very long, probably stiff ribbons on either side of its shoulders that were probably used for display, for mate attraction, inter-male rivalry, or to frighten off foe." The tails of modern peacocks or birds-of-paradise serve a similar purpose.

Information from http://www.sci-news.com/paleontology/ubirajara-jubatus-09158.html



An artist's reconstruction of *Anomalocaris* Credit: Nobu Tamura, Wikimedia Commons, **GNU Free Documentation License**

Cambrian Arms Race

A recently published paper provides new information about the evolution of marine animals nearly 500 million years ago. An international study focused on deep-sea creatures called radiodonts (radiating teeth). Radiodonts were swimming predators with a pair of large, segmented appendages on its head for capturing prey, a circular mouth with serrated teeth, and a squid-like body. *Anomalocaris* is one of the best known radiodonts. Radiodont fossils found in the Emu Bay Shale in Australia preserved eyes with lenses of more than thirty different species, which were the basis of this study.

This study showed that some of these animals lived to depths of 3,000 feet (1,000 meters) and developed large, complex eyes to see in the darkened environment at that depth. As these radiodonts with more acute vision evolved into animals that lived at shallower depths, they may have fueled an evolutionary arms race between predators and prey. Trilobites are a good example; they also developed compound eyes that provided better vision to avoid predators. And, thus, the arms race was on.

The fossils in this study also show how the eyes changed as the animal grew. Like modern arthropods (insects, spiders, crustaceans), new lenses formed at the edge of the eyes as the animal grew.

Information from https://sciences.adelaide.edu.au/news/list/2020/12/03/ancient-deep-sea-creatures-radiodonts-evolution-vision

Fossil Fish Poop Shows What Fish Ate for Lunch 200 Million Years Ago

A recent study of fish coprolites, fossil fish feces, provides new insight into the food web of an ancient, shallow sea around Bristol, England, about 205 million years ago. By using new CT scanning technology to look inside coprolites, Marie Cueille was able to learn who was eating whom.

Coprolite containing a fish vertebrae and other pieces of bone. Credit: James St. John, Wikimedia Commons, licensed under the Creative Commons Attribution 2.0 Generic

One coprolite specimen showed that a large (based on the size of the fossil poop) fish ate part of the head of another fish, then later snipped off two vertebrae from the tail of a small marine reptile called *Pachystropheus*. Other fish had crushing teeth to feed on shelled animals like oysters and clams. The broken shells are found in their coprolites. And for the first time, the researchers found coprolites from crabs and lobsters, giving researchers an idea about how these crustaceans fit into the food web. Unlike modern large marine predators like sharks, crocodiles, and killer whales, which have powerful stomach acids to dissolve bone, these ancient fish just passed bones they ate through their digestive systems. That might have been uncomfortable at times.

Information from https://www.bristol.ac.uk/news/2020/november/fossil-poop.html

Mineral Theft from Buena Vista

The Buena Vista Police Department is seeking help locating mineral specimens that were stolen from the area. They are seeking support from Colorado rockhounds to be on the lookout for possible stolen specimens. These minerals were originally displayed on foam blocks with the labels printed by a label printer. Please call the Buena Vista Police Department with any information in regards to the possible location of these items.

Denver Gem & Mineral Show Mini Report for December

Cursed 2020 - the year with no show!
The deadly coronavirus has laid us all low!
But there's hope for a vaccine
To vanquish COVID-19.
It's proved a most formidable foe!

As you probably know, current expectations are for distribution of a vaccine from Pfizer and possibly one from Moderna to commence in the near future *[editor: they now have begun!]*. This is a very promising and important development! The Show Committee is confident that, although a return to normalcy may progress slowly, 2021 will see shows, meetings, field trips, and other activities happening again. The committee is planning for the 2021 Denver Gem & Mineral Show to take place.

The dates for the 2021 show are September 17-19 and the venue is the usual Denver Mart, 451 East 58th Avenue. The show theme is "Fabulous Fluorite". The Show Chair is Linda Burns, a member of the Denver Gem & Mineral Guild. Linda can be reached at 303-263-0391 or burns.henley@gmail.com and is always open to your input regarding the show.

The Denver Gem & Mineral Show is sponsored and owned by the Greater Denver Area Gem & Mineral Council but is planned and operated by the Show Committee, an august group of some 40-plus dedicated volunteers. The Show Committee meets monthly during the year, except for the months of December, February, and July. Currently, the meetings are conducted on Webex rather than in person. There are always personnel changes on the committee and a need for new members. After serving many years as the Trophies and Saturday Night Event Chair, Nick North has resigned from the committee since he may relocate to Texas. Thus, there is a need for new Trophies and Saturday Night Event Chairs. There is also a need for an Assistant Treasurer, a Tear Down Chair, and another Schools Assistant. The Schools Chair is converting to a more online approach for reaching out to local schools and home schools, and consequently would appreciate assistance from someone more conversant in online communication.

The Denver Gem & Mineral Show is the most exciting event in our local area for the gem, mineral, and fossil hobbies. So, since we have all been mostly cooped up during 2020, why not take on some new adventure and spread your wings to immerse yourself in these incredible hobbies that we all enjoy so much. **JOIN THE SHOW COMMITTEE!!** You will be glad you did! You will help with the show, meet new people who love the hobbies as you do, and benefit yourself, as well as the local earth science community. When you join the committee, there are people who will help you orient yourself and get started in whichever area you have selected to work. We don't expect you to do that on your own. There are also Operation Procedures to assist in learning show operations. So please think about it. Get involved! The show needs YOU!

You can take the first step by contacting Show Chair Linda Burns or your club representative to the committee. The representatives are as follows: Colorado Mineral Society - Amber Brenzikofer 720-480-5234 or amberbrenzikofer@gmail.com; Flatirons Mineral Club - Gerry Naugle 303-591-2830 or gnaugle@earthlink.net; Friends

of Mineralogy - Larry Havens 303-757-6577 (Cell 720-401-6543) or lwrnchavens@comcast.net; Denver Gem & Mineral Guild - Kathy Honda 303-315-7749 or katherine.honda@ucdenver.edu; Littleton Gem & Mineral Club - Lynette Warren 303-956-4634 or flywithle123@comcast.net; North Jeffco Gem & Mineral Club, Inc. - Ron Knoshaug 303-423-2923 or jrknoshaug@comcast.net; Mile Hi Rock and Mineral Society - Judy Knoshaug 303-423-2923 or jrknoshaug@comcast.net; Western Interior Paleontological Society - Nancy Kimber 303-470-6491 (Cell 303-807-8919) or nkk9960@hotmail.com.

Thank you for your consideration. We hope to see you at a future meeting.

Respectfully submitted, Judy Knoshaug, Show Secretary

Other Rockhounding Events and Activities in the Area

Here are several virtual programs you might enjoy.

- **Wednesday, January 13**, 8-10 am. Free Zoom webinar by the **Payne Institute for Public Policy at the Colorado School of Mines**. Dr. Morgan Bazilian will speak on **How Can Biden Reposition the US as a Climate Leader in his First 100 Days in Office?** https://calendar.mines.edu/event/how-can-biden-reposition-the-us-as-a-climate-leader-in-his-first-100-days-in-office-webinar/

- **Tuesday, January 19**, 7:00-8:30 pm. The **Denver Council on Foreign Relations** is hosting a Zoom webinar about **Critical Minerals & U.S. National Security** by Dr. Morgan Bazilian, director of the Payne Institute for Public Policy at the Colorado School of Mines. https://calendar.mines.edu/event/critical-minerals-u-s-national-security-webinar/

- **Wednesday, January 20, 7:00-8:00 p.m.** The **Denver Museum of Nature and Science** is presenting a virtual program on **Digital Earth: Ice**. Prepare for a trip to Himalayan glaciers, chilly fjords, and the frigid coast of Antarctica. Geologist Bob Raynolds and Ka Chun Yu, curator of space science, will guide you through landscapes defined by snow and ice, which are also increasingly affected by rising global temperatures. Free members, $8 nonmembers. https://www.dmns.org/virtual-offerings/.

- **Thursday, January 21**, is the January **Colorado Scientific Society** meeting. Christian and Becky Shorey of the Colorado School of Mines will talk about **Snowmastadon Fossil Dig: A Love Story.** The link for this online Zoom meeting is available at https://coloscisoc.org/.

- **Monday, February 1**, 7:00-9:00 is the monthly **Western Interior Paleontology Society** meeting, featuring John McLeod talking about **When Rivers & Reefs Collide: An Unusual Fossil Biota from the Pennsylvanian of North Texas**. See https://www.westernpaleo.org/ for more details.

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Denver Show Club Table
open

Practice social distancing
Wear a mask in public
Be Safe
Stay Healthy!

Flatirons Facets
P.O. Box 3331
Boulder, CO 80307-3331

First Class Mail

Upcoming Events

Thursday, January 14, 7:00 pm	Club Meeting: Xuebaoding: Mining Above the Clouds by Markus B. Raschke	Virtual meeting on Zoom
Thursday, February 11, 7:00 pm	Club Meeting: History of Dinosaur Ridge by Erin LaCount	Virtual meeting on Zoom

The Zoom link for club meetings will be emailed to all members the day before the meeting.

Online Jr. Geologists meetings are once a month. Families will be notified by email about upcoming activities.