



NOTE: LGGM Club meetings in April through October will start at 9:00 a.m.

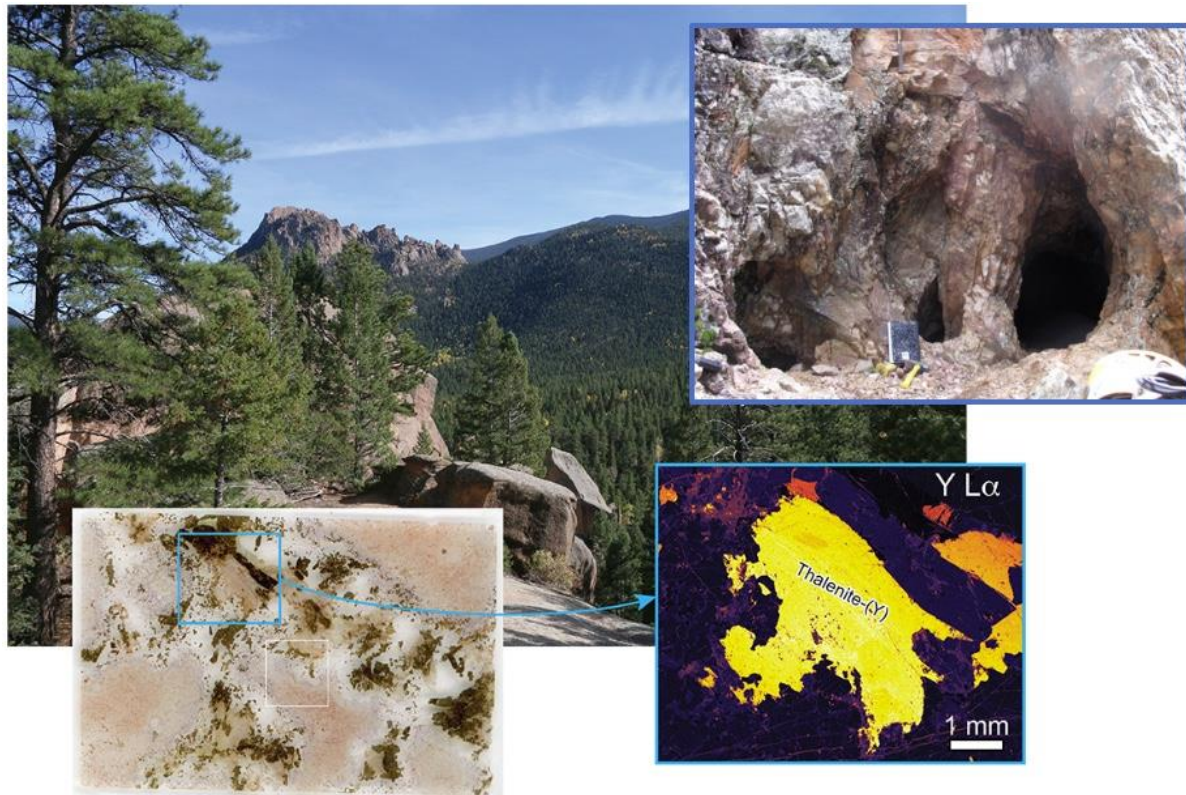
Program for the Month: Saturday, May 11, 2019, 9:00 a.m.

Mineralogy and Petrology of Rare Earth Pegmatites in the Pikes Peak Batholith

Markus Raschke, University of Colorado

The rare earth elements (REE) have special magnetic, electronic, optical and quantum properties which make them essential in a variety of technological applications such as REE magnets, lasers, lighting, or chemical catalysts. Understanding the formation of REE deposits related to igneous rocks and the role of different magmatic processes is thus highly desirable.

The Pikes Peak batholith has long been known for its large number and chemically diverse pegmatites, with many exhibiting unusual REE enrichment. Although not of economic significance, these pegmatites represent globally significant examples of their kind. However, the specific origin and formation of the pegmatites and the mechanism of concentration of the REE have remained unclear.



I will present a summary of recent projects of petrographic and mineralogical studies of selected REE pegmatites and related REE-rich structures from the South Platte district to Mount Rosa from collaborations with participants from the Colorado School of Mines, the USGS, and the University of Colorado. The South Platte pegmatite district is characterized by large, well-zoned pegmatites producing many rare and some exceptionally large REE minerals. From studies of individual such minerals, e.g., the heavy-REE rich thalenite, we gain new insight into crystal chemistry of such rare

REE minerals and processes in the pegmatites which lead to their formation. From studies of entire pegmatites including mineral composition, fluid inclusions, and isotope analysis, we can test models developed to explain whole pegmatite formation. The Mount Rosa Complex, with its complex range and late stage granites and dikes of different generations, hosts equally unusual, but chemically very different pegmatites. Unusual minerals from rock forming astrophyllite and arfvedsonite to locally abundant pyrochlore and rare aluminofluorides characterize these systems we are only beginning to understand.

Publications of the results of this research are available through this website:

<https://nano-optics.colorado.edu/index.php?id=71>

Club members: if you found 'strange' looking, typically heavy, brown or black, or otherwise unusual rocks and minerals from pegmatites or know of occurrences, please bring them along to the club meeting on May 11th. Markus would love to hear from you at other times as well. Please feel free to contact him at markus.raschke@colorado.edu or 720-315-9705. It would help with the research, and you may get a free analysis.

BIOGRAPHY:



Markus Raschke is professor at the Department of Physics, Department of Chemistry, and JILA at the University of Colorado at Boulder. His research is on the development of novel nano-optical spectroscopy and microscopy techniques with applications to single molecules, quantum materials, and fundamental control of light matter interaction. Based on a long personal interest in field collecting minerals, his research also ventured into geology and mineralogy, with projects in Washington, Colorado, and the Sichuan Mountains in Tibet/China. He received his PhD in 2000 from the Max-Planck Institute of Quantum Optics and the Technical University in Munich, Germany. Following appointments at the University of California at Berkeley, and the Max-Born-Institute in Berlin, he became faculty member at the University of Washington, followed by his appointment in Boulder in 2010. He is fellow of the Optical Society of America, the American Physical Society, and the American Association for the Advancement of Science.

Scheduled Programs at Club Meetings:

June - Conrad North, Fluorescent minerals (field-trip prep)

July - Bob Carnein, Basic geology of the Colorado Springs/Ute Pass area (field-trip prep)

August - Steven Veatch, Pebble Pup Presentation

September - Steve Gorman, history of the Gold City Claim

October - Richard Walker, Meteorite find near Cotopaxi. Use of metal detectors

November - Doug White, Newmont CC&V geology of Cripple Creek gold mine

December - Towel show, no presentation

Silent Auction: We need donations for the silent auction at our club meetings! 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.

LGGM Club Field Trips:

As trips get closer, they will be published on our field trip website at <https://lggmclubfieldtrips.com/>. See that website for more details and to sign up for a field trip. Please review the requirements for attending our field trips: 1) LGGMC membership, 2) register on club website field trip page, 3) meet at designated location and time, 4) if you cannot attend, remove your name from the participant list so that others may attend, and 5) follow normal rockhounding etiquette including following land/claim owner's rules and refilling your holes before you leave.

We are still looking for people willing to be a trip leader or assistant for our **May 18** trip and others. Being a field-trip leader or assistant is simple and rewarding. Please contact your field-trip coordinators Dave Alexander (dave@davealex.com) or Laura Canini (caninilaura@gmail.com), or any club leader to volunteer, or to get more information about how easy it is to participate. Look forward to collecting with you this year!

--dave

SCHEDULE OF LGGM CLUB PROGRAMS, FIELD TRIPS & EVENTS			
Date(s)	What	Where	Leader/Notes
Sa 5/4	Blue Barite	Harvey Claim - Hartsel	Linda Watson
Sa 5/11	Mineralogy and Petrology of Rare Earth Pegmatites in the Pikes Peak Batholith	LGGMC Presentation	Markus Raschke
Sa 5/18	Quartz, amazonite, fluorite etc.	Wigwam Club Claim	Needs Trip Leader or will be cancelled
W 5/22	Jaspers	Trout Creek Pass & Mushroom Gulch	Linda Watson
Sa 6/1	Geology & History of Phantom Canyon Road	Phantom Canyon Rd.	Paul Combs
Sa 6/8	Fluorescent Minerals	LGGMC Presentation	Conrad North
Sa 6/15	Fluorescent Minerals	Gold City Claim	Bob Baker/Steve Gorman Evening/Night Trip at full moon
Sa/Su 6/22 – 6/23	Epidote, quartz Garnets	Calumet & Sedalia Mines	Dave A & Richard Kawamoto Joint Trip with RAMS
Sa 6/26	Quartz, amazonite, fluorite	Wigwam Club Claim	
Sa 7/13	Geology of Ute Pass	LGGM Club Presentation	Bob Carnein
Sa 7/27	Magnetite, fluorite	Badger Flats	Linda W
Sa 7/31	Blue Barite	Harvey Claim - Hartsel	Linda W
Sa 8/10	Pebble Pup Presentation	LGGM Club Presentation	Steven Veatch
F 8/16 – Su8/18	LGGM CLUB ANNUAL GEM & MINERAL SHOW	Lake George (between Post Office - Starkeys)	See lggmclub.org for more details
Sa 9/14	History of Gold City Claim	LGGM Club Presentation	Steve Gorman
W 10/2	Fossils	Hwy 115 Pierre Shale	
Sa 10/5	Colorado Springs Area Geology Day #1	GOG, Manitou Spr, Cave of the Winds, Crystola	Bob Carnein
Su 10/6	Colorado Springs Area Geology Day #2	Ute Pass (Woodland Park to Rainbow Falls)	Bob Carnein
Sa 10/12	Meteorite near Cotopaxi	LGGM Club Presentation	Richard Walker
Sa 11/9	Newmont CC&V Geology of Cripple Creek-Victor Gold Mine	LGGM Club Presentation	Doug White
Additional Presentations and Field Trips to be added after they are confirmed.			

Other Upcoming LGGM Club Events:

- **Mineral Physical Properties** by **Bob Carnein**
This class was cancelled due to lack of interest at this time.
- **(TBD in fall 2019): Basic Wire Wrapping** by **Jerrolynn Kawamoto**. **Darlene Cotton** will be assisting in the course.

ADDITIONAL COMING EVENTS OUTSIDE THE LGGM CLUB: (Nearby gem, mineral, fossil and geology events that you may enjoy.)

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

Leonardo da Vinci at the Colorado School of Mines, Arthur Lakes Library: In addition to the **Leonardo da Vinci: 500 Years of Genius** exhibit now in progress at the Denver Museum of Nature and Science (see <https://secure1.dmns.org/leonardo-da-vinci-500-years-of-genius>), there is another excellent exhibit about his work, currently on display at the Lakes Library on the CSM campus. The **Machines of Change: The Da Vinci Machines** exhibit includes "over 60 authentic reproductions of machines and devices designed by Leonardo DaVinci were created using similar materials, building techniques and tools that Leonardo would have had access to in his time", plus full-size reproductions of Leonardo's most famous paintings. The exhibit, free to all visitors, is spaced around the corridors and reading rooms of the main floor of the library. Library hours are 8 a.m. to 8 p.m. most days, 12 to 6 weekends.

Sat., May 4, 11 a.m. to 2:45 p.m., **Colorado Mineral Society Silent Auction**; Holy Shepherd Lutheran Church, 920 Kipling St., Lakewood. Checkout begins at 2:45 p.m.; all are welcome; for more info, see www.coloradomineralsociety.org or contact Ben Geller, 303-550-5993 or email auction.coloradomineralsociety@gmail.com.

Thurs., May 9, 7:30 p.m., Friends of Mineralogy, Colorado Chapter, bimonthly meeting: featuring Marty Houhoulis, of Westcliffe, CO, on "**Collecting Garnet**". Marty will talk about his longtime experience field collecting garnet crystals, particularly at Garnet Hill, Ely, Nevada, and other locations as well (including Sonora, Mexico). FM's previously scheduled talk, "Rhodochrosite from the Capillitas mine, Argentina" by David Stout, had to be rescheduled to a future date. Meeting is in Berthoud Hall, Room 109, Colorado School of Mines campus, Golden. All are welcome..

Fri., May 10, 2:00 p.m., Denver Museum of Nature & Science, Earth Sciences Colloquium, [note 2 p.m. start time; a 2nd talk follows at 3:00] "**The dinosaur resurrection: Modern birds, and their rise from Chicxulub's ashes**"; Dan Field, Univ. of Cambridge. VIP Room, DMNS; all are welcome, museum admission is not required. 2nd presentation this same day:

3:00 p.m.: **The end-Permian mass extinction from a high southern palaeolatitude perspective**, by Chris Fielding, Univ. of Nebraska.

Tues., May 14, Colorado Scientific Society annual Emmons Lecture, by **Dr. Mark Barton**, Univ. of Arizona, Lowell Institute for Mineral Resources, **Synthesis, serendipity, and an open mind: timely approaches to timeless challenges in mineral deposits**; exact location on the CSM campus, TBA. This public presentation will take place in conjunction with a 2.5-day USGS-CSM joint Mineral Resources Forum.

Wed., May 15, 3:00 p.m., Denver Museum of Nature & Science, Earth Sciences Colloquium, “**Before there were ankylosaurs there were aetosaurs**”; Andy Heckert, Appalachian State Univ. In Studio 102/103 (not in VIP Room) DMNS; all are welcome, museum admission is not required.

~~**Thurs., May 16**, 10:30 a.m., USGS Rocky Mountain Science Seminar, **It’s not just about nitrogen and phosphorus: Why sulfur in agriculture is a growing concern**. Eve-Lyn Hinckley, CU-Boulder. Building 25 auditorium, Denver Federal Center; visitors are welcome. Enter Building 25 at entrance E-14, by the security guard’s station.~~

Sun., May 19, Friends of Mineralogy, Colorado Chapter, **Silent (+Vocal) Auction**. Noon to 4 p.m. (setup begins at 11 a.m.), Clements Community Center, 1580 Yarrow St., Lakewood CO. All are welcome to attend.

~~**Thurs., May 30**, 10:30 a.m., USGS Rocky Mountain Science Seminar, **Levering published geological information in Macrostrat to test Earth systems hypotheses**: Shanan Peters, Univ. Wisconsin, Madison.. Building 25 auditorium, Denver Federal Center; visitors are welcome. Enter Building 25 at entrance E-14, by the security guard’s station.~~

Fri.-Sat.-Sun., May 31-June 2, **Pikes Peak Gem & Mineral Show**, Norris-Penrose Event Center, 1045 Lower Gold Camp Road, Colorado Springs, CO 80905. Sponsored by the Colorado Springs Mineralogical Society. Hours: noon-7 pm Fri., 10-5 Sat, 10-4 Sun. Adult admission \$5.

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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 Paleontological Society (WIPS); beginning January 2019, WIPS will meet on the 1st Monday of the month, 7 p.m., at Lowry Conference Center, 1061 Akron Way, Denver. See <http://westernpaleo.org/>.

Lake George Gem & Mineral Club

May, 2019

Steve Veatch also sent this notice about a special program at the Western Museum of Mining and Industry:

SPECIAL PROGRAM ON MICROMOUNTING AT MINING MUSEUM

Richard Parsons of the Rocky Mountain Micromineral Association (RMMA) will present "Introduction to Micromounting" May 14th at The Western Museum of Mining and Industry's (WMMI) Speakers' Bureau lecture series.

The RMMA is an organization formed for the purpose of learning about and promoting the enjoyment and study of tiny minerals. "Our May 14 lecture at WMMI will show why participants are so excited about this branch of the mineral hobby" says Parsons. "Whether you have a budding interest or you're a seasoned collector, this lecture will provide invaluable education about the science, collection and display of minerals—many of which can be found right here in Colorado" continues Parsons.



Micromounting is the study and collection of mineral specimens that require magnification to be appreciated. The typical micromount is a group of crystals only a few millimeters in diameter, mounted in a small box and properly labeled with species and location. Collectors study and enjoy their minerals under low-power stereo microscopes.

Guests at the lecture will have the opportunity to view numerous mineral specimens currently on display at WMMI. These valuable specimens include rhodochrosite from the Sweet Home Mine in Alma, Colorado, a rare specimen of cahnite, amethyst samples from Last Chance Mine in Colorado, gold ore samples from Cripple Creek, and more.

The lecture will take place Tuesday, May 14 from 7:00pm to 9:00pm (doors open at 6:30pm) at WMMI, located at 225 North Gate Blvd., Colorado Springs, CO 80921. Admission is free to members of the Museum and \$5 per person for general public. Registration is currently available online at wmmi.org/events or by calling the museum at 719-488-0880.

LGGM Club News:

Reclamation of the LGGM Club Claim

More than thirty members of the LGGM Club and the Denver Mineral Guild spent the day on Sunday, April 28, 2019 doing reclamation on the club claims (Patience and Piety) near the Wigwam Creek Trailhead. We filled large holes left open by club members and/or unauthorized diggers. After the reclamation work was finished, club members also spent a little time rockhounding for fluorite, amazonite and quartzes. Thanks to everyone who

volunteered. There may be a second reclamation field trip near the end of the rockhounding season.



Fig. 1. Large holes that remained after rockhounding excavation were refilled until they created gently rolling terrain.



Fig. 2. After reclamation was completed club members had a little time to look for new specimens of fluorite, quartz and other minerals.

Wayne Orlowski sent us this link to an article about the way that diamonds are cut.

http://www.geologypage.com/2019/04/how-are-diamonds-cut.html?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+geology-page+%28Geology+Page%29

and this link about unusual spherical rocks in Kazakhstan:

<http://www.geologypage.com/2016/10/valley-of-balls.html>

and another fascinating link about a prehistoric whale with otter-like features:

[Ancient, four-legged whale with otter-like features found along the coast of Peru](#)

Pebble Pup News:

Pikes Peak Pebble Pup Member on KCME's Culture Zone

By Steven Wade Veatch

Jonathan Hair, a member of the Pikes Peak Pebble Pups and Earth Science Scholars, was interviewed by KCME's Keith Simon in Colorado Springs on April 29, 2019. Simon is the producer of *The Culture Zone* where Jonathan's interview will air. *The Culture Zone* is a weekly mix of interviews and music. The program is recognized for spotlighting cultural events and personalities in the Pikes Peak region. *The Culture Zone* airs each Sunday at 5PM and Monday at 7PM on KCME radio, 88.7 FM.

Simon interviewed Jonathan about his recent presentation at a joint section meeting of the Geological Society of America, which was held at Manhattan, KS and sponsored by Kansas State University. Jonathan described his experience there, and how exciting it was to win one of the top student awards for his presentation. Jonathan also discussed the Pebble Pup program and the opportunities it provides for the youth of the Pikes Peak region. During the interview, Jonathan said, "I plan to be a petroleum geologist. Next semester I will start geology classes at Pikes Peak Community College while still attending high school." Jonathan is 15 years old and in the 10th grade.



Fig. 1 Jonathan Hair at KCME
Photo by B. Hair.



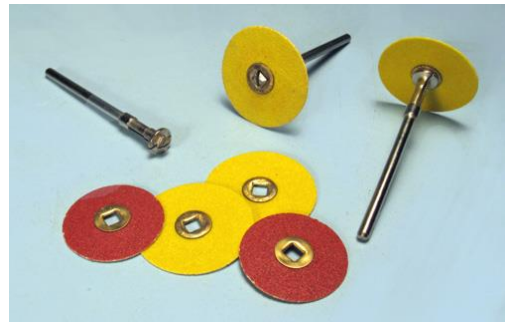
Fig. 2 Jonathan Hair (right), Steve Veatch (left) and Keith Simon (center) at the KCME studios.
Photo by B. Hair.



Fig. 3 KCME studios
Photo by B. Hair

Here is the latest installment of “**Bench Tips**” by Brad Smith: (www.BradSmithJewelry.com)
SANDING DISKS

One of my favorite flexshaft tools that saves a lot of time is the snap-on sanding disk. I mainly use the medium and fine grits but sometimes like the very fine ones sold for working with platinum.



Ordinarily, you'd think of placing the disk on the mandrel with the grit side facing away from your hand, but notice that you end up with your elbow up in the air. Instead, try flipping the disk so that the grit side is towards your hand. It's a much more comfortable position because the elbow is down near your side, and it lets me hold the work up close where I have a better view of what I'm sanding. I use these snap-on disks so frequently that I keep multiple mandrels with different grits already mounted in the bur stand. Some mandrels have the grit facing out and some facing in.

EASIER PRONG SETTING

When setting stones in a prong mount, the tool is less likely to slip off the prong if you grind a groove into its face or rough up the face a bit with sandpaper. Some folks prefer a prong pusher for doing this, and others like a set of pliers.

The easiest way to create a slot on the pusher is with a file, and the easiest way to create a slot on one jaw of your pliers is with a cutoff wheel. Then do a rough polish on the slot with a medium grit, knife-edge silicone wheel.

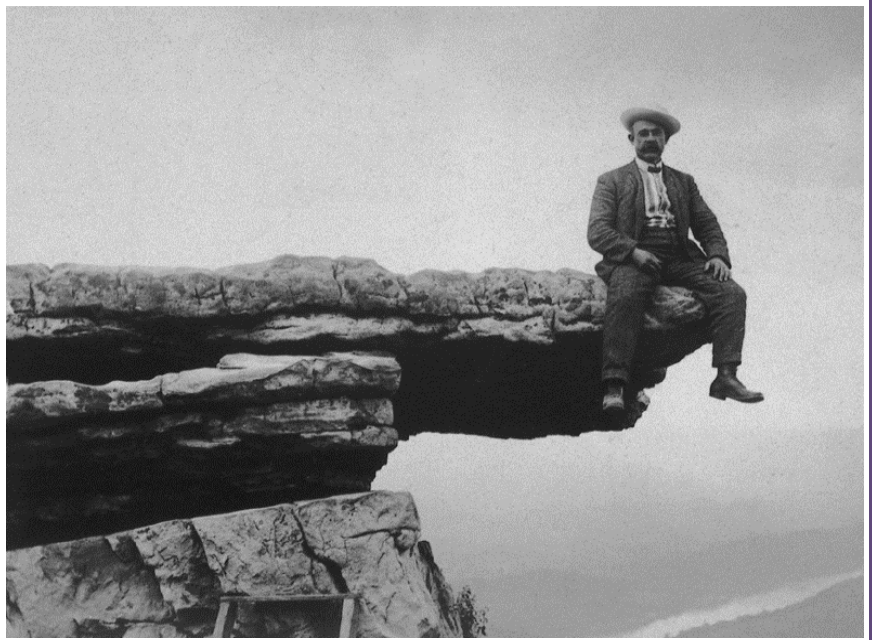
Solve Problems and Be More Productive With Brad's "How To" Books
www.Amazon.com/author/bradfordsmith

Happy hammering,
- Brad

Notes from the Editors

Jerrolynn Kawamoto
Editor
jerrolynn@wildblue.net
719-748-8152

Bob Carnein
Associate Editor
ccarnein@gmail.com
719-687-2739



Our new paleontology group has gotten off to a good start, with several newsletter articles and plans for field trips this year. Before we start purchasing fossils at gem shows for our collections, **Paul Combs** has some suggestions about several ways to evaluate the authenticity of the fossil specimens with the mosasaur as a great example.

FAKE FOSSILS: EVERY ROCKHOUND'S HEADACHE HOW CAN WE SPOT & AVOID THEM?

by **Paul Combs**

Paleontology Study Group, Lake George Gem & Mineral Club

THE PROBLEM: We've all seen it: You spot a tempting fossil at a rock shop or a gem & mineral show, but you can't tell if it is really what it claims to be. You have wanted one of those beauties for a long time, but you know there are excellent fakes out there. There are hundreds, if not thousands, of fake or altered fossils for sale on the internet. If you aren't a trained paleontologist, it can appear impossible to determine if you are holding a 100-million-year old mosasaur jaw or a nearly worthless chunk of plaster with a few real teeth. The dealer wants to charge you \$250 dollars, so this is no small decision. What do you do?



Fig. 1. Fake "fossil scorpions" crafted as cheap souvenirs in Morocco but shown here at the Tucson Gem & Mineral Show as the real thing. Originally posted on *The Fossil Forum*.

ORIGIN: My wife, the lovely Denise, and I just returned from 2 weeks in Morocco and that wonderful trip gave me the inspiration to write this

article. While we were there, we visited a workshop that produces legitimate fossils and I learned a few things from the manager. First, I want to clarify an important point: ***The Moroccans know they are selling fake fossils and most of them are happy to admit it. Don't blame them.*** They don't want you to think you are buying the real thing. Many of the fakes in Morocco are labeled as fakes in Arabic, French and English. When I told my Moroccan host that the mosasaur "fossils" are almost always sold as "real" in the USA, he was obviously frustrated. The Moroccans offer the fakes as cheap souvenirs, not actual fossils. The real swindling begins farther down the road, among our fellow Americans, and here I am pointing my finger directly at rock shops and the dealers at rock shows.

You don't need to go far to find those fake mosasaur fossils. There are some for sale at a large rock shop west of Canon City, for instance. I have pointed out to them that they are marketing fakes and their attitude seemed to be, "What are you going to do about it?"

THE SOLUTION: Remember: The dealer needs you much more than you need him, so take some time to examine the specimen and think. Maybe you can come back tomorrow or - if you are in a rock shop - come back in 6 months. In this column, I'll give you a short course on how to spot the fakes on the type of fossil that is most frequently altered or fabricated – mosasaurs from Morocco. Even if you only remember part of it, you will be much better equipped to avoid wasting your money.

EDUCATION IS ON YOUR SIDE: Learn about the site of origin and the physical characteristics of the particular fossil you are looking for before you buy.

The fossil shop manager in Morocco told me that the mosasaur fossils come from large, phosphate deposits in northern Morocco, near Khourigda, the Ouled Abdoun Basin and the Gantour Phosphate Basin. These deposits are Cretaceous in age (140 – 65 million years ago) and the locals collect huge numbers of fossils as a byproduct of mining phosphate. The phosphatic sediments are marine in origin and they were deposited in the Tethys Sea, a branch of the Atlantic that used to cover parts of north Africa, southern Europe and areas to the east. As a matter of fact, the Mediterranean Sea, Black Sea and Caspian Sea are remnants of the ancient Tethys Sea. By far, the most common fossils in the phosphate are teeth: shark teeth, crocodile teeth and especially mosasaur teeth. Teeth are made of calcium phosphate, so they are more durable than bone. Bone is not often found in the phosphate deposits and, when it is, it is always very soft, chalky and crumbly. The Moroccans collect the scattered teeth and reassemble them in fake "jaws" and "skulls" that can appear very convincing. They put the teeth in a "rock" that looks like sandstone but is most often plaster of Paris covered with sand. The "jaws" are usually stained plaster without the sand coating or— and this is pretty creative—broken goat bones that have weathered outdoors for a few months.

Here are some points to help you tell fake from real and some of them came directly from my Moroccan host. Other points are from courses I took in college on Invertebrate Paleontology and Taphonomy (the process of fossilization).

(1) My host told me that, if a dealer offers you a mosasaur fossil in what appears to be a solid piece of sandstone, you should remember that the real fossils are found in whitish, fine-grained, crumbly phosphate deposits. Hard, coarse-grained sandstone should set off a flashing red light in your head. Walk away.

(2) As mentioned above, the Moroccan phosphate deposits rarely preserve bones. The few bones that are found are very soft and chalky. If the dealer is offering you a specimen with fairly solid-looking bone, walk away.

(3) Marine vertebrate skeletons are almost always found disarticulated, meaning that the bones, teeth and other hard parts have been separated and scattered by predators, scavengers, wave action or currents (Donovan 1991, Shipman 1993). If you are offered a vertebrate fossil that is even partly articulated, you should automatically become suspicious. This is especially true if the accompanying bone appears to be in pretty good shape. If it is too good to be true, then it probably isn't true.

(4) Since dealers often offer partly articulated skeletons, let's talk about conditions that permit bones to be found together. When an animal dies in water (and predators and scavengers haven't found it), it will bloat, float, pop, and drop. Those are the terms that paleontologists actually use, although I knew one who liked to say "stink and sink". When the carcass arrives at the bottom, it can still be attacked by scavengers. In many bodies of water, the lowest layers are hypoxic, which means there is insufficient oxygen for life to exist, even bacteria (Donovan 1991, Shipman 1993). The Black Sea is one example. The lack of oxygen at the bottom of the water column prevents scavengers from attacking the carcass and it does one more thing that is useful to you when you are shopping for a fossil. That uneaten organic material and the surrounding sediments eventually become rock. The carbon in the organic material colors the rock gray or black, which is very common in shales and some limestones. I mention all this because the Moroccan mosasaur fossils are found in whitish sediments, which means there was probably plenty of oxygen at the sea bottom and we should expect them to have been scavenged—and they were. But the fake fossils being offered to you are still articulated. Walk away.



Fig. 2. This fake pair of *mosasaur* jaws is currently for sale for \$28 on Ebay. In this case, the seller is at least partially honest about the fakery. But remember: Like the other pairs of fake mosasaur jaws you can find in Canon City or anywhere else, the only real part is the teeth. The "jawbones" are actually old goat bones. The Moroccans label them as cheap souvenirs but Americans usually offer them as the real thing, with prices to match. *Originally Posted on Ebay.*

(5) The typical fake Mosasaur fossil consists of a jaw, or a pair of jaws, with the teeth in place. You can often spot a fake by looking at those teeth. Here's how:

(a) Each species of reptile has teeth that are pretty uniform in shape, so look for mismatched teeth, which means mismatched species.

(b) Most mosasaur teeth are shaped like curved cones, with a slightly compressed cross-section. They were used to catch and kill prey, such as ammonites, fish and smaller mosasaurs and they weren't as sharp as shark teeth (Larson 1997).

(c) Tylosaurs are a genus of mosasaurs that had longitudinal facets on their teeth, somewhat like the surface of a wooden pencil.

(d) Even more obvious, some "mosasaur" jaws have shark teeth instead of mosasaur teeth. Shark skeletons are made of cartilage and almost never fossilize, even in ideal conditions, and conditions in the phosphate deposits were far from ideal.

(e) My host told me that you can find some fake jaws with fossil crocodile teeth. Those are a little harder to spot, but are generally longer and pointier than mosasaur teeth. Crocodile teeth are easier to detect if they are mixed with mosasaur.

(f) Also, ask yourself if the teeth seem to be too big or too small for that jaw.

(g) Are the teeth different sizes and lengths, as though they came from individuals of different ages?

(h) Very often, a worker has given a tooth a short, stubby root of a lighter color. I have worked with mosasaur jaws and alligator teeth and they sit in their sockets with almost no root at all. This is because mosasaurs were constantly wearing out and replacing their teeth and an individual tooth rarely lasted longer than a year. When a tooth became loose, the animal apparently spat it out, because there are millions of mosasaur teeth in the Moroccan phosphate deposits. (*There are also mosasaur and shark teeth in our local Pierre Shale Formation, which we will explore along HWY 115 this fall!*)

(6) My favorite problem with the mosasaur "jaws" is the jaws themselves. Many of the specimens for sale are paired jaws. All those paired jaws are fake and here is how you can tell:

(a) When an animal dies, rigor mortis almost always causes the mouth to open as wide as possible. But the fake mosasaur jaws are parallel (Donovan 1991).

(b) The fake jaws evidently became separated from the rest of the carcass, yet they remain an inch or so apart and parallel, as they were in life. How could that possibly happen? Walk away.

(c) A lower jaw is an independent bone. An upper jaw, or maxilla, is part of the skull. If the maxilla is no longer attached to the skull, there will be a broken surface and it will certainly not resemble the lower jaw. Yet the "jaw bones" in the fake fossils are usually nearly identical (Shipman 1993).

(d) Besides the nearly identical jaws, the proximal and distal ends of both jaws are missing. How can the jaws remain in life position while undergoing such violent breakage? Walk away.

(7) Mosasaurs were reptiles, but they weren't dinosaurs. They were squamate reptiles, which means they were related to snakes and lizards. You can see this today in their skeletal structure and especially in their teeth. Mosasaurs, snakes and lizards are different from other

reptiles in that their upper jaws contain two sets of teeth. The outer, larger teeth extend in a U shape around the entire upper jaw. That is like most other animals, including us. The second set of smaller teeth, called pterygoid teeth, is arranged in a V shape toward the rear of the palate, in the back of the mouth. I mention this because I have never seen a fake mosasaur upper jaw with pterygoid teeth. This is another sure sign of a fake.

(8) If someone used a tool to expose the mosasaur jaws and teeth for better viewing, where are the tool marks? There are none. Walk away.

(9) Dr. Kay Behrensmeyer is the Curator of Vertebrate Paleontology at the Smithsonian Institution and she has conducted decades of research on taphonomy (the process of fossilization) in East Africa. One of her projects consisted of studying mammal bones that had been left outdoors on the savanna for different periods of time and in different conditions. She determined that the effects of the sun and climate could be divided into four categories of deterioration (Behrensmeyer 1980). This is very similar to what a crime scene investigator would study about human remains. Believe it or not, Dr. Behrensmeyer's research also applies to fake mosasaur fossils because the Moroccans often leave mammal bones outdoors to "age", then break them and use them in their reconstructed "fossils". After having studied about Dr. Behrensmeyer's research in a course on taphonomy in college, I can assure you that a fragment of recent goat bone that has been left on the surface of the ground for a few months does NOT resemble a reptile jaw that has undergone fossilization over 80 million years or so. This is especially true when the goat bone is still pretty hard and the mosasaur bone, if it exists at all, is soft and chalky. Walk away.

(10) A foramen is any opening or orifice. These allow for passage of arteries, veins, nerves and muscles. Many bones have foramens, especially around the skull, and mosasaurs were no different. The mandible (lower jaw) and maxilla (upper jaw) of a mosasaur have several large and small foramens, so these are good things to look for when you are trying to determine whether the rock shop's specimen is a fake. Since the Moroccan fossil workers often use goat leg bones, which have almost no foramens, this can help you to tell when you are holding a fake. No foramens—walk away.

NOTE: The Moroccans, and local American dealers, often sell beautiful, legitimate, individual mosasaur teeth, although some of them have added roots. (Put the tooth in water for a few hours to dissolve the plaster root.) My Moroccan host told me that, when Moroccan workers find a broken tooth, it is usually used in a fake jaw, with the good side toward the viewer. So, if you were to dissolve a plaster "jaw" in water, you would likely be disappointed by the teeth that remained.

TEST YOUR KNOWLEDGE! So, do you think you have learned enough to tell fake from real? Here is the web site address for an interactive page with 10 photos of real and fake Moroccan fossils. It shows mosasaur fossils, a trilobite, a shark tooth, a brittle star and more. Take a look at each one, then click on the photo to discover whether you were right. **Good luck!** I can tell you that I missed two, although I'd like to have a better look at one of them

<https://www.playbuzz.com/evanwx10/fossils-real-or-fake>

ONE MORE WORD - CHINESE FOSSILS: While I am on the subject of fakery, there is an increasing number of Chinese "fossils" on the market. China has a lot of highly desirable

fossils and many collectors want to get their hands on them, but you should remember that it is against Chinese law to export any kind of fossil. Unlike the Moroccan mosasaur “fossils”, which are created as souvenirs for tourists, the Chinese merchants label their products as real fossils, and offer them for a lot of money. The overwhelming majority of Chinese “fossils” in American rock shops and gem & mineral shows are fakes, and often very good ones. A few have been smuggled out. This warning also extends to Chinese “dinosaur eggs”, which are nearly 100% fake. Unless you are intimately familiar with the various textures of the exteriors of dinosaur eggs, don’t even consider buying one. Your precious \$500 - \$1,000 dinosaur egg is molded and colored plaster, almost beyond a doubt.



Fig. 3. A pair of alleged hadrosaur eggs from China for sale on Ebay for \$1,295. Chinese law forbids the export of any fossils, but allows dealers to export excellent fakes. *Originally Posted on Ebay.*

References & Further Reading:

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Monthly Mineral Quiz – May, 2019:

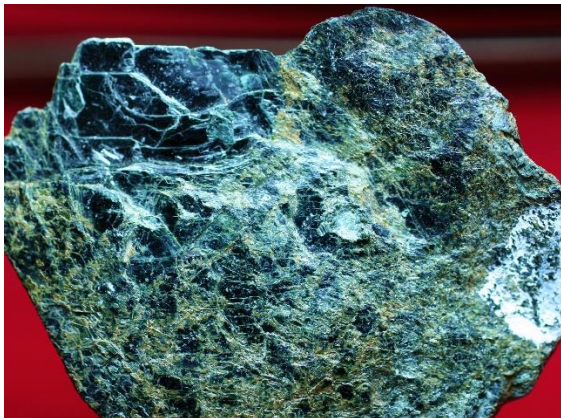


Last Month's Mineral

Epidote is one of the common green minerals that beginners find confusing. It occurs in a wide variety of habits, including encrustations, “needle” crystals (as in the left photo), and blocky crystals that may be several inches long (striated crystal in the right photo). The pistachio green color is one of its identifying characteristics, but blocky crystals may look almost black. In Colorado, it occurs at many localities, the most famous being the Calumet iron mine, in Chaffee

County, operated from 1882 to 1928 by Colorado Fuel & Iron (the diggings.com). There, it occurs with limpid quartz crystals, andradite, actinolite, calcite, and magnetite, which was the ore of iron there. You will also see it at the Gold City claims, Sedalia mine, and widespread wherever the Idaho Springs metamorphic rocks occur in central Colorado.

This Month's Mineral



Here's another one of those pesky, common green “minerals” that any serious mineral collector needs to know. It's actually a group of a half dozen minerals that you'll find in both igneous and metamorphic rocks. Because they're difficult to distinguish, the group name is often used where more detailed IDs aren't needed. As in last month's mineral, this one may look almost black in thick pieces. The sample on the left exhibits its pinacoidal (one-direction) cleavage; the sample on the right is an aggregate, in which the cleavages are tiny. Hardness is in the 2 to 3 range and specific gravity ranges from about 2.6 to 3.3. It often forms by alteration of other minerals under low temperature conditions. What is it?



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).

Our Officers for 2019 are:

Richard Kawamoto, President
7584 Cedar Mountain Rd.
Divide, CO 80814
719-748-8152
kawahome@wildblue.net

John Rakowski, Vice President
PO Box 608
Florissant, CO 80816
719-748-3861
rakgeologist@yahoo.com

Lorrie Hutchinson, Secretary
10915 Grassland Rd.
Colorado Springs, CO 80925
719-382-3503
4lohutch@gmail.com

Cathy McLaughlin, Treasurer
11595 Owls Nest Rd.
Guffey, CO 80820
702-232-3352
cathy_mclaughlin@hotmail.com

C.R. (Bob) Carnein
Newsletter Associate Editor
507 Donzi Trail
Florissant, CO 80816
719-687-2739
ccarnein@gmail.com

Jerrolynn Kawamoto
Newsletter Editor
7584 Cedar Mountain Rd.
Divide, CO 80814
719-748-8152
jerrolynn@wildblue.net