

*Club News,*  
*August, 2022*



**The August meeting of the LGGMClub will be held at the Lake George Community Center (the “old” location), on the north side of US 24, ½ mile east of Lake George at 9:00AM August 13. After a short business meeting, members will move to the field next to the Lake George Post Office to set up for the show, which will be held August 19-21.**

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**Scheduled Programs at Club Meetings:**

The Club currently has no program coordinator. If this is a job that appeals to you, please consider volunteering to do this.

- **Sept. 10: Bob Carnein, “Where do Geodes Come From?”** Bring an unopened geode for **Richard Kawamoto** to crack with his pipe cutter. If you don’t have an unopened geode, contact Bob ([ccarnein@gmail.com](mailto:ccarnein@gmail.com)) to buy one, or bring one you’ve already opened for “show and tell”.
- **Oct. 8: Mark Jacobson, “The Crystal Peak Amazonite-Smoky Quartz Locality, Teller and Park Counties, Colorado (1873-1986)”** Mark is working on a major book about the history of mineral collecting in this area. You won’t want to miss his talk!
- We will skip the silent auction at the August meeting, but it will return in September.
- **Election of officers** has been postponed. Please contact one of the current officers (listed at the end of this newsletter) if you would consider running for a 2023 office.
- We’re still hoping for a talk about the famous Corral Bluffs fossil-mammal discoveries near Colorado Springs, to be followed by a field trip.
- **Carol Kinate needs your help at the 2022 LGGMC Mineral & Gem Show:**

**SAVE THE DATE – AUGUST 19-21, 2022 (LGGMC Annual Show)**

**LAST Word** from your Show Chair – I’m still looking for additional help with this year’s Annual Show. Listed below are the current positions that need to be filled to make our show a success. My contact information is also listed below.

- **“IMMEDIATE” NEED FOR A FOOD VENDOR (August 19-20-21).** Original Food Vendor(s) unable to meet requirements needed. If anyone knows of a Food Vendor with a State of Colorado license from CDPHE, please have them contact me **ASAP**. They have three weeks or less to get licensed in Park County.

- **Show Volunteer Coordinator (shift assignments – 2-hour shifts – volunteers for various shifts are still needed during the 3 days), Kids activities – 2 hour shifts.**
- **EXTRA ROCKS** that you are willing to part with for “Kids Activities”

~ Signup forms for shift assignments will be available at our **August** monthly meeting or you can call/text me and I can write in your name on signup sheets.

Thank you for your time and consideration. Please contact me with any questions whatsoever. Looking forward to a GREAT show!

Carol Kinate, Show Chair  
[kinatec@aol.com](mailto:kinatec@aol.com)  
719-648-9015 (call/text)

- **Dave Alexander sent this info about upcoming field trips:**

We have volunteer opportunities available for the following, contact me [dave@davealex.com](mailto:dave@davealex.com) or 303.641.5567:

1) June 30. Florissant Rough to Gem Event. Bring your lapidary skills to share with the public and socialize the club. We'll start about 9am and finish by 1pm or so.

2) Field Trip Leaders. If you are interested in leading trips, now is a great time; we will pair you up with an experienced leader on a trip you'd like to go on. It's really simple, and necessary to support the health of the club!

3) Field Trip Event Coordinators. We need several more people that would be interested in coordinating field trips (you can choose to lead them too, or find another leader if that doesn't interest you). This includes working with the coordinator team to ensure we have access (talking to claim owner, mine owner, and sometimes prospecting) and setting up the events on our field trip site. This role is important to keep our robust events schedule healthy for all club members!

**If you have a site you'd like to visit, let me know the details.**

Thanks!  
--Dave

- Dave also asked me to include this about field trips:  
**The field trip website sends out automatic email notifications from a Google email address. Can you ensure you keep our domain in your safe senders list?**  
**Lggmcfeldtrips.com**

## **Buena Vista Contin-Tail Gem, Mineral, & Fossil Show**

**Buena Vista Rodeo Grounds, Gregg Dr., Buena Vista, Colorado, August 11-14, 9AM-6PM**

22nd Annual  
**LAKE GEORGE Gem & Mineral Show**  
Hwy 24 (East of Post Office) (4 mi. W of Florissant)  
Lake George, CO 80827  
www.lggmclub.org

**AUGUST 19-21, 2022 (9-5 Daily)**

**FREE ADMISSION & PARKING**

30+ vendors - Local Specimens, Rocks,  
Minerals, Fossils, Gems, Beads, Jewelry,  
Lapidary and More!



**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 2<sup>nd</sup> Monday of the month at 6PM in the United Methodist Church, Cañon City
- **Columbine Gem & Mineral Society**, meets on the 2<sup>nd</sup> Thursday of each month, 6:30PM in the meeting room, Mt. Shavano Manor, 525 W. 16<sup>th</sup> (at J St.), Salida
- **Colorado Springs Mineralogical Society**, meets on the 3<sup>rd</sup> Thursday of each month at 7PM in the Mt. Carmel Veteran's Service Center, 530 Communication Circle, Colorado Springs;
- **Pueblo Rockhounds**, meets on the 3<sup>rd</sup> Thursday of each month at 6:30PM in the Westminster Presbyterian Church, 10 University Circle, Pueblo.
- Here's a poem from our Michigan member, **Steve Veatch**:



An unpolished puddingstone from Michigan. Some puddingstones contain trace amounts of gold and diamonds. These rocks are commonly found just after farmers plow their fields in Michigan. Puddingstones were brought to Michigan by Ice Age glaciers. A Jo Beckwith specimen. Photo by S. W. Veatch.







- **Dinosaur Ridge**, west of Golden, is well worth a visit:

Short video on the area just west of Denver called Dinosaur Ridge, as listed in the video menu of Rock&Gem magazine web site.

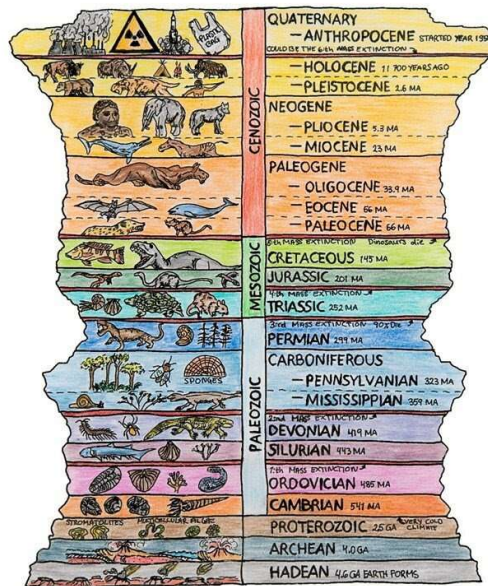
<https://www.rockngem.com/aiming-for-virtual-adventures-dinosaur-ridge/>

There is also a museum/science center at the site. <https://dinoridge.org/>

- *Paleodictyon*, a hexagonal-patterned fossil, is a bit of a mystery. We don't even know whether it's a trace fossil, or the organism itself. So... what could it be?  
<https://www.facebook.com/EonsPBS/videos/590549095764773>
- 'Fire of Love' Is the Greatest Lava Story Ever Told  
With video trailer -  
<https://uproxx.com/movies/fire-of-love-review-documentary-wes-anderson/>  
and review -  
<https://www.rollingstone.com/tv-movies/tv-movie-reviews/fire-of-love-1378247/>
- A Brief History of Geologic Time - how old are you?  
Short video on geologic time, also called deep time  
<https://www.youtube.com/watch?v=rWp5ZpJAIAE>

By looking at the layers beneath our feet, geologists have been able to identify and describe crucial episodes in life's history. These key events frame the chapters in the story of life on earth and the system we use to bind all these chapters together is the Geologic Time Scale. Current geologic epoch is called the ANTHROPOCENE - marked by human civilization

## An·thro·po·cene



And here are a few more interesting links found by yours truly:

- Acid mine drainage is a problem even in Colorado. The Colorado Geological Survey's "rock talk" blog has an article about it:

We just published a new article at the Colorado Geological Survey >RockTalk< blog:

### "Case Study: NARD"



You can view it here: <https://coloradogeologicalsurvey.org/2022/63980-case-study-nard/>

- And here's a link to another C.G.S. Blog:

We just published a new article at the Colorado Geological Survey >RockTalk< blog:  
"Earth Explorations vlog/podcasts"



You can view it here: <https://coloradogeologicalsurvey.org/2022/63233-earth-explorations-vlog-podcasts/>

- Did you wonder why the first image from the James Webb telescope looked so distorted? Here's an explanation:

[https://www.sciencenews.org/article/james-webb-space-telescope-first-image-galaxy-stars-data?utm\\_source=email&utm\\_medium=email&utm\\_campaign=latest-newsletter-v2&utm\\_source=Latest+Headlines&utm\\_medium=email&utm\\_campaign=Latest+Headlines](https://www.sciencenews.org/article/james-webb-space-telescope-first-image-galaxy-stars-data?utm_source=email&utm_medium=email&utm_campaign=latest-newsletter-v2&utm_source=Latest+Headlines&utm_medium=email&utm_campaign=Latest+Headlines)

- Has anybody ever told you that they think science is a “belief”? Here’s a treatment of why that’s wrong:

[https://www.dailykos.com/stories/2022/7/19/2111379/-Science-does-not-require-belief-it-is-not-a-religion?detail=emaildkre&pm\\_source=DKRE&pm\\_medium=email](https://www.dailykos.com/stories/2022/7/19/2111379/-Science-does-not-require-belief-it-is-not-a-religion?detail=emaildkre&pm_source=DKRE&pm_medium=email)

- Here is the latest installment of “**Bench Tips**” by **Brad Smith**: ([www.BradSmithJewelry.com](http://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 are 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 shown above are called "Vacutainers", but there are probably many other names. They're 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.



#### FINISHING PIERCED PATTERNS

After sawing patterns there's always a little cleanup to do, and the smaller cutouts can be a challenge. Needle files (7-8 inches) can get into the larger areas, and escapement files (4 inches) can get into some of the corners. But I often find myself wanting even smaller files. I couldn't find them, even at a watchmaker tools supply company, so I had to try something else. I ended up grinding down the tip of a small 4" barrette file using a separating disk (or cutoff wheel) in your Dremel or Foredom.

Be sure to wear your safety glasses when using this tool. A flake of steel in your eye makes for a bad day.





## **FULL STORY**

A 15-year study led by the Carnegie Institution for Science details the origins and diversity of every known mineral on Earth, a landmark body of work that will help reconstruct the history of life on Earth, guide the search for new minerals and ore deposits, predict possible characteristics of future life, and aid the search for habitable planets and extraterrestrial life.

In twin papers published today by *American Mineralogist* and sponsored in part by NASA, Carnegie scientists Robert Hazen and Shaunna Morrison detail a novel approach to clustering (lumping) kindred species of minerals together or splitting off new species based on when and how they originated. Once mineral genesis is factored in, the number of "mineral kinds" -- a newly-coined term -- totals more than 10,500, a number about 75% greater than the roughly 6,000 mineral species recognized by the International Mineralogical Association (IMA) on the basis of crystal structure and chemical composition alone.

### ***80% of Earth's minerals were mediated by water***

"This work fundamentally changes our view of the diversity of minerals on the planet," says Dr. Hazen, Staff Scientist with the Earth and Planets Laboratory, Carnegie Institution for Science, Washington DC. "For example, more than 80% of Earth's minerals were mediated by water, which is, therefore, fundamentally important to mineral diversity on this planet. By extension, this explains one of the key reasons why the Moon and Mercury and even Mars have far fewer mineral species than Earth."

"The work also tells us something very profound about the role of biology," he adds. "One third of Earth's minerals could not have formed without biology -- shells and bones and teeth, or microbes, for example, or the vital indirect role of biology, such as by creating an oxygen-rich atmosphere that led to 2,000 minerals that wouldn't have formed otherwise. Each mineral specimen has a history. Each tells a story. Each is a time capsule that reveals Earth's past as nothing else can."

### ***40% of Earth's mineral species formed in more than one way***

According to the paper, nature created 40% of Earth's mineral species in more than one way -- for example, both abiotically and with a helping hand from cells -- and in several cases used more than 15 different recipes to produce the same crystal structure and chemical composition.

Of the 5,659 recognized mineral species surveyed by Hazen and colleagues, nine came into being via 15 or more different physical, chemical and/or biological processes -- everything from near-instantaneous formation by lightning or meteor strikes, to changes caused by water-rock interactions or transformations at high pressures and temperature spanning hundreds of millions of years. And, as if to show she has a sense of humor, Nature has used 21 different ways over the last 4.5 billion years to create pyrite (aka Fool's Gold) -- the mineral world's champion of diverse origins. Pyrite forms at high temperature and low, with and without water, with the help of microbes and in harsh environments where life plays no role whatsoever. Composed of one part iron to two parts sulfide (FeS<sub>2</sub>), pyrite is derived and delivered via meteorites, volcanos, hydrothermal deposits, by pressure between layers of rock, near-surface rock weathering, microbially-precipitated deposits, several mining-associated processes including coal mine fires, and many other means.

To reach their conclusions, Hazen and Morrison built a database of every known process of formation of every known mineral. Relying on large, open-access mineral databases ([mindat.org](http://mindat.org) and [ruff.ima.info](http://ruff.ima.info)), amplified by thousands of primary research articles on the geology of mineral localities around the world, they identified 10,556 different combinations of minerals and modes of formation, detailed in the paper, "On the paragenetic modes of minerals: A mineral evolution perspective."

In all, minerals have come into being in one or more of 57 different ways, according to that paper and a sister paper published simultaneously by the same journal, "Lumping and splitting: toward a classification of mineral natural kinds," co-authored by Drs. Hazen and Morrison in collaboration with mineralogists Sergey Krivovichev of the Russian Academy of Sciences and Robert Downs of the University of Arizona. The goal of their efforts: "To understand how the diversity and distribution of minerals have changed through deep time and to propose a system of mineral classification that reflects mineral origins in the context of evolving terrestrial worlds."

### ***Distinguishing minerals based on how and when each kind appeared through Earth's 4.5 billion+ year history***

In earlier studies over more than a century, thousands of mineralogists worldwide have carefully documented almost 6,000 different "mineral species" based on their unique combinations of chemical composition and crystal structure. Dr. Hazen and colleagues took a different approach, emphasizing how and when each kind of mineral appeared through more than 4.5 billion years of Earth history. "No one has undertaken this huge task before," says Dr. Hazen, honored by the IMA with its 2021 medal for his outstanding achievements in mineral crystal chemistry, particularly in the field of mineral evolution. "In these twin papers, we are putting forward our best effort to lay the groundwork for a new approach to recognizing different kinds of minerals. We welcome the insights, additions, and future versions of the mineralogical community."

The papers' new insights and conclusions include:

- Water has played a dominant role in the mineral diversity of Earth, involved in the formation of more than 80% of mineral species.
- Life played a direct or indirect role in the formation of almost half of known mineral species while a third of known minerals -- more than 1,900 species -- formed exclusively as a consequence of biological activities.
- Rare elements play a disproportionate role in Earth's mineral diversity. Just 41 elements -- together constituting less than 5 parts per million of Earth's crust -- are essential constituents in some 2,400 (over 42%) of Earth's minerals. The 41 elements include arsenic, cadmium, gold, mercury, silver, titanium, tin, uranium, and tungsten.
- Much of Earth's mineral diversity was established within the planet's first 250 million years
- Some 296 known minerals are thought to pre-date Earth itself, of which 97 are known only from meteorites (with the age of some individual mineral grains estimated at 7 billion years -- billions of years before the origin of our solar system)
- The oldest known minerals are tiny, durable zircon crystals, almost 4.4 billion years old

More than 600 minerals have derived from human activities, including over 500 minerals caused by mining, 234 of them formed by coal-mine fires

According to the research, 3,349 (59%) of IMA-approved mineral species are known to occur from just one process (paragenetic mode), 1,372 species (24%) from two processes, 458 (8%) from three processes, and the rest, 480 (8%), from four or more processes.

Diamonds, for example, composed of carbon, have originated in at least nine ways, including condensation in the cooling atmospheres of old stars, during a meteorite impact, and under hot ultra-high-pressure deep within the Earth. These processes led to distinct diamond variants -- e.g., stellar, impact, mantle, and ultra-high-pressure -- which the authors designate as different "natural kinds."

The authors propose that, complementary to the IMA-approved mineral list, new categorizations and groupings be created on the basis of a mineral's genesis (paragenetic mode). For example, science can group 400 minerals formed by condensation at volcanic fumaroles -- openings in the Earth's surface that emit steam and volcanic gasses.

The papers detail other considerations in the clustering and classification of minerals, such as the eon in which they formed. For example, Earth's "Great Oxidation Event" about 2.3 billion years ago led new minerals to form at the planet's near-surface. And about 4.45 billion years ago, when water first appeared, the earliest water-rock interactions may have produced as many as 350 minerals in near-surface marine and terrestrial environments.

It appears, too, that hundreds of different minerals may have formed on Earth prior to the giant impact that vaporized much of our planet's crust and mantle and led to the Moon's formation about 4.5 billion years ago. If so, those minerals were obliterated, only to reform as Earth cooled and solidified.

"The sharp contrast between Earth's large complement of minerals and the relative mineralogical parsimony of the Moon and Mercury, as well as the modest diversity found on Mars, stems from differing influences of water," the authors say.

In addition to accidental mineral creations in mining fires, humanity has manufactured countless thousands of mineral-like compounds that don't qualify for recognition by the IMA -- building materials, semiconductors, laser crystals, specialty alloys, synthetic gemstones, plastic debris and the like. All, however, are "likely to persist for millions of years in the geologic record, thus providing a clear sedimentary horizon that marks the so-called 'Anthropocene Epoch'."

Meanwhile, there are 77 "biominerals," according to the paper, formed by a variety of metabolic processes -- everything from corals, shells, and stinging nettles, to minerals in bones, teeth and kidney stones. Another 72 minerals derive directly or indirectly from the guano and urine of birds and bats. That list includes the rare mineral spheniscidite, which forms when the urine of penguins (order Sphenisciformes, hence the mineral name) reacts with clay minerals beneath a rookery on Elephant Island in the British Antarctic Territory.

### ***Mineral evolution and the origins of life***

The authors note that the formation of oceans, the extensive development of continental crust, and perhaps even the initiation of some early form of subduction (the process that drives plate tectonics today) in the early Hadean Eon 4.0 to 4.5 billion years ago, meant many important mineral-forming processes -- and as many as 3,534 mineral species -- occurred in Earth's first 250 million years. "If so, then most of the geochemical and mineralogical environments invoked in models of life's origins would have been present 4.3 billion years ago," they say.

If life is "a cosmic imperative that emerges on any mineral- and water-rich world," the authors say, "then these findings support the hypothesis that life on Earth emerged rapidly, in concert with a vibrant, diverse Mineral Kingdom, in the earliest stages of planetary evolution."

### ***Extraterrestrial mineralogy***

The work also points ways forward for future researchers and explorers:

"What mineral-forming environments occur on the Moon, Mars, and other terrestrial worlds? Enumerating paragenetic modes, and placing each mineral species into one or more of those categories, offers an opportunity to evaluate extraterrestrial mineralogy with a new perspective. If Mars had (or still has) a hydrological cycle, what mineralogical manifestations might we expect? For example, are there Martian hydrothermal sulfide deposits and, if so, were a variety of metals mobilized? On the other hand, if the Moon is truly dry, then what paragenetic processes are excluded? And do extraterrestrial bodies display paragenetic processes not seen on Earth, such as cryo-volcanism on Titan?"



The research was supported by the John Templeton Foundation, the NASA Astrobiology Institute ENIGMA team, and the Carnegie Institution for Science.

### ***By the numbers***

- 5,659: Mineral "species" recognized by the International Mineralogical Association at the time of this research. (That number has since risen to more than 5,800 species)
- 10,556: Combinations of minerals species and means of origin ("mineral kinds")
- 57: different physical, chemical or biological processes that created Earth's minerals
- 40%: Proportion of mineral species that originated in more than one way
- 3,349 (59%): Minerals that occur in just one process (paragenetic mode)
- 1,372 (24%): Minerals that occur in two ways
- 458 (8%): Minerals that occur in three ways
- 480 (8%): Minerals that occur in four or more ways
- 9: Minerals that came into being via 15 or more ways
- 21: Ways in which pyrite (Fool's Gold) has formed -- the most of any mineral
- 9: Ways in which diamonds have formed in environments from outer space to deep Earth
- 80%: Minerals that water played a dominant role in creating
- ~50%: Minerals in which biology played a direct or indirect role in creating
- 1,900 (about 1/3rd): Minerals formed exclusively by biological processes
- 41: Rare elements (constituting less than 5 parts per million of Earth's crust) involved in forming 2,400 (over 42%) of minerals
- 296: Mineral thought to pre-date Earth itself
- 97: Minerals known only from meteorites
- 7 billion years (pre-dating our solar system by billions of years): The age of individual mineral grains discovered in meteorites
- Up to 350: Minerals created in near-surface marine and terrestrial environments when water first appeared on Earth ~4.45 billion years ago
- 4.4 billion years: Age of the oldest known mineral created on Earth: zircon crystals
- 3,534: minerals thought to have formed within Earth's first 250 million years
- 600+: Minerals derived from human activities, including 500+ caused by mining, 234 from coal mine fires
- 77: Biominerals (formed by metabolic processes)
- 72: Minerals derived directly or indirectly from the guano and urine of birds and bats

#### Journal References:

Hazen, R.M., and S.M. Morrison, 2022, On the paragenetic modes of minerals: A mineral evolution perspective: *American Mineralogist*, 107 (7): 1262 DOI: 10(.)2138/am-2022-8099

Hazen, R.M., S.M. Morrison, S.V. Krivovichev, and R.T. Downs, 2022, Lumping and splitting: Toward a classification of mineral natural kinds: *American Mineralogist*, 107 (7): 1288 DOI: 10(.)2138/am-2022-8105

Carnegie Institution for Science. "Crushed, zapped, boiled, baked and more: Nature used 57 recipes to create Earth's 10,500-plus 'mineral kinds'." *ScienceDaily*. ScienceDaily, 1 July 2022. <https://www.sciencedaily.com/releases/2022/07/220701102810.htm>

## Monthly Mineral Quiz

### The Monthly Mineral for August (Carnein photos and collection)



The mineral for August is a silicate that has a sheet-like structure (a phyllosilicate), in which the sheets are held together by weak chemical bonds. As a result, it “flakes” readily, like a mica (but it isn’t a mica). The sheets are flexible but not elastic. It forms from other magnesium-rich minerals (e.g. serpentine, olivine, pyroxene) where water and carbon dioxide are present (for example, in continental collision zones where oceanic lithosphere is shoved upward, rather than subducting). It’s seldom obvious and almost never well crystallized. Its low hardness and specific gravity, “foliated” habit, light color, and commonly pearly luster help with identification. It has many industrial uses—you have probably used it yourself. What is this common mineral?

### Last Month’s Mineral: Sillimanite, $\text{Al}_2(\text{SiO}_4)\text{O}$ .



July’s mineral is one of 3 common aluminum silicates that are used by geologists to estimate temperature and pressure conditions in metamorphism accompanying mountain building. The others are kyanite and andalusite. Sillimanite is a metamorphic index mineral for high temp./pressure metamorphism. It is particularly common where clay-rich sedimentary rocks (e.g. shale, mudstone) are caught up in tectonic collision zones—where one piece of continental lithosphere collides with another. In our area, this is exemplified by the Idaho Springs Fm. This extensive unit occurs at various locations—it is the host rock for much of the Pikes Peak Granite and the other granites of central Colorado. The high grade rocks of the Idaho Springs Fm. commonly contain knots and streaks of sillimanite. You can recognize it by using your hand lens and looking for silky fibers with cracks going across them.

Eckel, E.B., 1997, *Minerals of Colorado, Updated and Revised by R.R. Cobban, et al.*: Golden, Colorado, Fulcrum Publishing.



**The Lake George Gem and Mineral Club** is a group of people interested in rocks and minerals, fossils, geology 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 normally 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). New memberships and renewals are only accepted Jan 1 through March 31 each year.

### **Our Officers for 2022 are:**

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