The Lake George Gem and Mineral Club -

Club News, October 2007

Meeting Time 9:00 AM!

Field trip for the month:

Rich Fretterd is generously letting us collect on his Godsend Claim Oct 13th. The Holy Moses pocket on this claim has yielded world-class smoky quartz crystals, possibly the largest in North America. Significant amazonite has also been found.

Rich will lead this trip. It will be EXTREMELY IMPORTANT to car pool to this field trip, as there is room for only about 8 VEHICLES at the claim. This locality is also 4-wheel drive only.

There will be some areas which are "off limits" to collecting. These will be marked with a lath and pink flagging. Bring your pegmatite digging tools, food and water. If you are new to pegmatite rock busting, call or e-mail one of the officers for suggestions.

Silent Auction:

For the silent auction, please bring items you are willing to contribute to the club, and a few dollars to buy things with!

Hartesl Barite Claim
Lake George Field Trip, September '07

Photo by John Rakowski

Coming Events

Lake George Gem and Mineral Club Meeting and trip to the Godsend claim … **October 13, 2007**

The Lake George club has been invited to Rich Fretterd's - Godsend claim, where numerous pockets of smoky quartz and amazonite have been found found. This is north of Lake George and requires a high clearance vehicle or carpooling.

"The Mining Camps Speak". … **November 8, 2007**

Western Museum of Mining & Industry, 8:00 PM
Beth and Bill Sagstetter, will highlight their highly praised book: The Mining Camps Speak. Through their photography and lecture, the Sagstetters provide a virtual tour of abandoned mining camps and ghost towns throughout Colorado, Idaho, and California...." Lake George Gem and Mineral Club members admitted free (must show current membership card). 225 North Gate Blvd. (at I-25 Gleneagle exit #156A); 719-488-0880; www.wmmi.org.

Lake George Gem and Mineral Club Meeting … **Nov 10, 2007**

Bob Carnein, a new member of the Lake George Club, will give a talk, topic to be determined. Mr. Carnein formerly ran a geologic field camp in the region in the 1970's and 80's.

New Mexico Mineral Symposium … **November 10 – 11**

28th annual Symposium at the New Mexico Institute of Mining & Technology in Socorro, New Mexico. One of the classic annual events in the SW United States! For further info log on to http://geoinfo.nmt.edu/museum/minsymp/home.html or call Dr. Virgil Leuth at vwlueth@nmt.edu

Changing Mines in America, A Photography Exhibit by Peter Goin … **Continues through Dec. 29, 2007**

Western Museum of Mining & Industry, Colorado Springs. Through the 24 photographs on display at the museum, Goin reveals that mines are more than physical degradations; they are evolving cultural artifacts on the American landscape. 9 a.m. - 4 p.m. daily; customary admission applies. Lake George Gem and Mineral Club members admitted free (must show current membership card). 225 North Gate Blvd. (at I-25 Gleneagle exit #156A); 719-488-0880; www.wmmi.org.

Science and nature writing workshop (k-12) … **February 2, 2008**

9:00am-5:30pm, Cripple Creek Park & Recreation. Instructors Steven Veatch and Don Miranda, local authors. Registration Fee: $49, includes certificate of completion. To register or for more information, contact Cripple Creek Park & Recreation, 719/689-3514

Panorama from Hartsel Barite Locality

Photo by Ingrid Hamilton

News from the Colorado School of Mines

In late August, Dr. Bruce Geller was appointed the new director of the Colorado School of Mines (CSM) Geology Museum. For those of you who have not taken the opportunity to visit the superb collection of minerals on display at this museum, you are missing a wonderful experience!

Dr. Geller provided a synopsis of his goals for the Museum. In his brief tenure, Dr. Geller has taken a number of steps to increase public access to and involvement with the Museum.
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To date, Dr. Geller has:

- Created a Suggestion Box, where visitors are encouraged to submit constructive criticism in writing, while remaining anonymous.
- Generated a Mailing list of interested patrons – visitors can simply drop a business card, or write their contact information on a form and drop it in the box.
- Submitted a grant proposal to install signage leading to the Museum, upgrade the Museum's website, and improve the Museum's brochures.
- Organized an Advisory Council which has been charged with establishing a Museum mission statement and policy standards with respect to loans, volunteers, donations, de-accessioning, collection management; and strive for accreditation by the American Association of Museums, and
- Begun enlisting a small group of volunteers to help with Museum projects.

Dr. Geller plans to collaborations with other local geology museums such as the DMNS, Dinosaur Ridge, and Morrison, as well as non-geology museums, libraries, and professional societies. Dr. Geller has also been allerted to the mineral collection at the Pikes Peak Historical Society Museum in Florissant, and their desire to expand their collection of minerals from Park and Teller counties and from surrounding areas of the Pikes Peak batholith.

Dr. Geller has invited our club to a private night at the CSM Museum. Simply pick three nights or weekends that your club would like to visit the Museum by itself and have a club representative contact Dr. Geller at 303-273-3823, and he will try to accommodate our club on one of those nights. Members are also welcome to visit on your own during our normal hours: Monday – Saturday 9 A.M. to 4 P.M., Sundays 1P.M. – 4 P.M. There is no admission fee!

Editor's Note:
The Denver Museum of Nature and Science has, beginning early this year, offeres a similar program where clubs can go "behind the scenes" to view the Museum's shelves, drawers and vaults of specimens. Arrangements can be made by contacting Paul Morgan, Ph.D., Chair of the DMNS Earth Sciences Department and Curator of Geology, (303) 370-6445

I am very pleased to announce that I have been selected as one of eight volunteers at the School of Mines, working under the supervision of Dr. Ed Raines. Our task will be to go through the Museum's warehoused materials to determine which specimens should be actively displayed, which should be made a part of the Museum's reference collection, and to find appropriate ways to dispose of the remainder. What fun!

The Importance of Molybdenum and its Impact on Colorado

Jay Zimmerman

Molybdenum, pronounced **meh-LIB-deh-nem,** is a rare, but important element that can be mined in a few locations around the world. Molybdenum (Mo) is element 42 on the periodic table and has important physical and chemical properties, which allow it to be identified by geologists and rock hounds. However, Molybdenum, like many other elements, does not exist in its pure form in nature. As a result, mining companies identify suitable locations to mine the Molybdenite, the compound that contains "Moly" (Molybdenum). The Colorado Rocky Mountains are an ideal place for Molybdenite; the *Climax* and

Henderson are Colorado's largest Molybdenum mines, which have placed the United States as the lead country in the world's Molybdenum production. Therefore, Coloradoans impact the important products, like lubricants, steel alloys and protein bars, produced from Molybdenum.

Properties

By observing the periodic table many important physical and chemical properties are noticed about this element. The first is the symbol (Mo) and name (Molybdenum), which are derived from the Greek word ***molybdos***, meaning lead. This is due to the fact the Molybdenum was discovered in 1778 by Carl Welhelm Scheele, a Swedish chemist, who thought he had a sample of lead. However, he was wrong and Molybdenum was later isolated and verified by Peter Jacob Hjelm in 1781, yet the name stayed even though it was not lead (Powell, 1999). Another important characteristic is the atomic Number of 42, showing that this element contains 42 protons and 42 electrons. Of those 42 electrons it is important to know that 6 of them are valence electrons. In its elemental state (pure Mo), it is a silvery-white element (See figure 1) that melts at 2890 Kelvin (2617^{o}C and 7473 ^{o}F), which is about twice the temperature required to melt steel (~1800 Kelvin, 1527^{o}C and 2781^{o}F), and vaporizes at 4912 Kelvin (4639^{o}C and 8382^{o}F). In addition, this element is located in the "d" block of the periodic table, otherwise known as the transition metals. This is very important because the "d" block elements have multiple oxidation numbers, which are used to predict the chemical bonding that will occur between elements. As a result, Mo can form compounds like, Mo_2O_3 (+3 oxidation number) and MoS_2 (+4 oxidation number), and it often found as the polyatomic ion Molybdate (MoO_4^{-2}), which has the most common oxidation number of +6. Moreover, being a transition metal makes Molybdenum chemically stable and does not react with many elements. There are a few exceptions to this since pure Molybdenum does not occur in nature; it is found in the mineral Molybdenite (Molybdenum (IV) sulfide, MoS_2). Molybdenum can also be found in the minerals Wulfenite (Lead (II) molybdate, $PbMoO_4$) and Powellite (Calcium molybdate, $CaMoO_4$) (Ganon, 2007). These minerals differ from a dull gray Molybdenite to the shiny yellow crystals of Wulfenite (See Figure 2 and Figure 3). Consequently, Molybdenum minerals must be mined and processed in order to obtain the pure element or to concentrate the Molybdenite "Moly" ore.

Mining History

The mining of Molybdenum has had an interesting history, especially in Colorado. In 1884 a small settlement, named Climax, was established near Fremont pass. During the next 10 years Molybdenum was added to steel to make it harder and more resistant to chemical change. As a result, the little settlement of Climax enlarged with extra prospectors and businessmen trying to make a fortune. Since Molybdenum was not extensively used, prospecting for this metal did not produce a lot of ore or money. This caused many prospectors to bust and leave the area.

As World War I approached, the military needed Molybdenum to strengthen machinery for the war. The result was that Molybdenum mines sprang up to provide the needed materials. In Colorado, this boom for Molybdenum originated in the Leadville area, in Lake County, CO., in the early 20th century. (Hagen, 2004)

As time passed, larger sources of Molybdenum were needed for strengthening armored equipment. Consequently, geologists searched and the Climax Molybdenum deposit was rediscovered. Subsequently the *Climax* mine began production in 1918. The supply, demand and profit for Molybdenum fluctuated for many years until the onset of World War II. Consequently, the mine experienced profit and growth beginning in the early 1940's (Cappa, 2001).

Production increased as technology advanced for mining and as the US experienced population growth and war. Miners continued to find "Moly" (the mining term for Molybdenum or Molybdenite), which made profits for themselves and for the *Climax* mine. The mine continued to grow until 1977, where production peaked just over 60,000,000 pounds in one year. After this peak came a sharp decline, and in the next 7 years production steadily decreased, until 0 pounds were produced in 1984 (Mentzer et al., 2006).

The demand decreased, the supply was supersaturated with "Moly" and the market price was too low for economical mining to continue. According to Kaufmann, "It has abandoned its resources and closed most of its operations" (Kaufmann, 1990). *Climax* was affectively dead, at least for a while. During *Climax*'s prosperous growth and decline other ore bodies were being discovered.

The Phelps Dodge Corporation identified the Henderson ore body in 1965 near Berthoud Pass. By 1976 the *Henderson* mine was born and began extracting Molybdenite from *Red Mountain*.
In the past twenty years the Henderson mine has become the World's largest producer of Molybdenum. This is due to the mines unique "Block Fault" mining procedures, the conveyor (used to transport ore over 10 miles underground to the concentrator) and the *Henderson Concentrator,* which uses the rough ore and concentrates it into "pure" Molybdenite through a series of crushing, floatation, leaching and grinding.

The success of the mine may also be attributed to the World's growth and demand for Molybdenum, especially in China. This high demand and increased value of Molybdenum has also arisen a "dead" mine. The *Climax* mine, which is now operated by Phelps Dodge, the same company that owns the *Henderson* mine, plans to reopen in 2009 (Starr et al., 2006).

This would continue Colorado's dominance as a major player in the World's Molybdenum market. Currently, the United States also has major mines in Arizona, Utah, Idaho and New Mexico (*Molybdenum, Ferromolybdenum and Ammonium Molybdate*, 2007). As a result of these mines, the United States is the leading producer of Molybdenum and Molybdenum products with Chile, China, Peru and Canada following close behind. Moreover, these countries have over 16,000,000 metric tons of "Moly" in reserves, of which over 8,000,000 metric tons can be found in the US (*Mineral Commodity Summaries, 2005)*. From this data, it is evident that Colorado will have a large future impact on Molybdenum mining and the products that are produced from it.

Uses of Molybdenum
There are numerous uses for pure Molybdenum and the mineral Molybdenite. Historically, it was used to make alloys stronger and resistant to chemical change. This includes steel used to erect buildings and armor built for military equipment.

In modern times, Molybdenum is still used to strengthen alloys, but it also used for other products. One of these products is burners for stoves, which lengthens the life of the heating elements. Molybdenum is also used in light bulbs, since it has such a high melting point and as a chemical catalyst used in to eliminate sulfur from petroleum refineries. Pure ground Molybdenite is used for a lubricant for machinery (Moore, 2005).

Molybdenum is also an essential trace element that is required for all biological organisms; it is an important coenzyme that is needed to transform chemicals in the carbon, nitrogen and sulfur cycles (Hidgon, 2001). Therefore, Molybdenum must be a part of our diets and can be found in legumes, grains and nuts (these obtain Mo from the ground) or through vitamins and nutrition bars (molybdenum is artificially inserted into these).

Conclusion
Molybdenum is an important element that plays and important role of every Coloradoans life. It does not occur in its pure form in nature, but it exists in different compounds due to the fact that it has many oxidation numbers. The ionic compounds that contain Molybdenum are Molybdenite, Wulfenite and Powellite. These minerals, discovered in the 1780's, are mined from ore bodies in several locations around the world.

Colorado is one of those excellent sources of Molybdenum; the *Climax* and *Henderson* mines, owned by the Phelps Dodge Company, have been two of the best "Moly" mines in the world. With these mines, the United States is the World's leading producer of Molybdenum and Molybdenum products followed by Chile, China, Peru and Canada. In the early 1900's, Molybdenum was used for improving military equipment for World War I and World War II, which spurred the mining growth. Now the mined Molybdenite has many other important uses, including lubricants and catalysts. When purified, the whitish-grey Mo has an extremely high melting point, which allows it to still be used as an alloy strengthener, but is also used as a component of light bulbs. In addition, Molybdenum is a vital trace element that biological organisms need to survive, which we can get from grains, nuts and protein bars. As the population of the Earth continues to exponentially climb, it is important that ore bodies of Molybdenum be mined and processed in order to enhance life with its products.

Figures

Sample of Molybdenite.

Sample of Wulfenite.

Pictures courtesy of the Mineral Information Institute.

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Metamorphic Rocks: Part I

by John F. Sanfaçon

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This month we will begin our survey of the major metamorphic rocks by discussing those which were originally igneous in character, i.e. formed from the underground cooling and crystallization of magma (granites, syenites, diorites, etc.) or by the release of that magma to the surface as lava flows (basalts, rhyolites, etc.) or into the atmosphere via volcanoes (obsidian, pumice, scoria, etc.). Such igneous species were later subjected to pressure and/or additional heat, acquiring, for the most part, a different texture without appreciable chemical change.

In general, igneous rocks show little evidence of metamorphic change other than the characteristic streaking or layering of the mineral components. Thus, *gneiss* differs from granite only in its layered or streaked appearance of the ferromagnesian minerals against a background of light-colored minerals (quartz, feldspars, muscovite). Little change in the chemistry of the host rock is noted. *Gneisses* are home to disseminated pods, lenses and stringers of various minerals, and also play host to the occasional isolated crystal. Familiar examples would be the Gore Mountain, NY deposit of massive, industrial grade *almandite garnet*, also known as *almandine*, $Fe_3^{2+}Al_2(SiO_4)_3$, widely used as an abrasive. The Lime Crest Quarry in Sparta produced a very gnarly gneiss chock full of lenses containing *almandite*. Anybody who remembers trying to break up those rocks on a sultry May field trip knows all too well how exasperatingly tough a rock can be. Other tough minerals often embedded in the gneiss are *corundum, kyanite, staurolite, andalusite* and *cordierite*. It should be noted that *gneissic banding* is not restricted to igneous rocks per se, but also affects *mineral assemblages* such as the Franklin-Ogdensburg zinc ore of *franklinite, willemite* and *zincite*. The Franklin Mineral Museum houses several outstanding examples of *gneissic ore* with its green-black-red banding. Banding is thought to occur because heat and pressure applied to the original material causes the various minerals to segregate themselves by their different densities or chemical affinities.

The next metamorphic rock of igneous origin would be *schist*, which displays greater structural change than gneiss: instead of mere banding and streaking, *schist* shows foliation, sometimes to the point of flaking and disintegration. In addition to the aforementioned minerals found in gneiss, *schist* often contains *graphite, talc, pyrophyllite* (all of which are important as industrial lubricants), *serpentine, chlorite, magnetite, tremolite, actinolite, epidote,* etc. Perhaps the best known examples would be the classic *garnet schists* of Fort Wrangell, Alaska and Roxbury, Connecticut, and the jumbo *almandite garnet dodecahedra* embedded in the *chlorite schist* of *S*alida, Colorado which can measure several inches on an edge.

(Next month) we will look at the metamorphic rocks, which were once sedimentary: *quartzite, slate, phyllite, marble* and *marble skarn.*

<u>Sources, & Suggestions for Further Reading</u>:

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Lake George Gem and Mineral Club
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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 an opportunity to learn about earth sciences, 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 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 10:00 AM. From April through September, we meet at 9:00 AM, to allow more time for our field trips.**

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

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