FRIENDS OF MINERALOGY
COLORADO CHAPTER

November 2018 Newsletter

Meeting: *Thursday*, *Nov. 15*, 7:30 p.m.
All are welcome!
At our new meeting place:
Lakeview Event Center, 7864 W. Jewell Ave. Lakewood CO

Chapter's meeting place: Lakeview Event Center, Lakewood CO
At 7864 W. Jewell Ave.; on the south side of Jewell Ave., 1/5 mile west of Wadsworth, west of the King Soopers shopping plaza. Turn south across the street from Wendy's, into Lakewood Village Center; the front entrance of the building faces west. ***NOTE: This month's meeting, previously announced to be on Wednesday, the 14th, will actually be on our regular Thursday meeting date after all: THURSDAY, NOV. 15***

Still Crazy (About Franklin) After All These Years

C.R. (Bob) Carnein

Introduction. Although mining ended in 1986, the zinc deposits of Franklin and Sterling Hill continue to excite the interest of geologists, mineralogists, mineral collectors, and industrial historians and archeologists, both in the U.S. and worldwide. Many of us received our first exposure to minerals at one of Franklin's mineral museums or mine dumps (the writer in the summer of 1954). The obvious appeal of fluorescent minerals (of which the Franklin Mineral Museum listed 98 in 2015; Fig. 1) sometimes obscures the fact that its complex geologic history has cranked out more than 379 minerals (for which the district is the type locality of 72) over 1.3Ga of terrestrial chemical recycling. The result is arguably the most diverse mineral assemblage on any planet in our solar system.

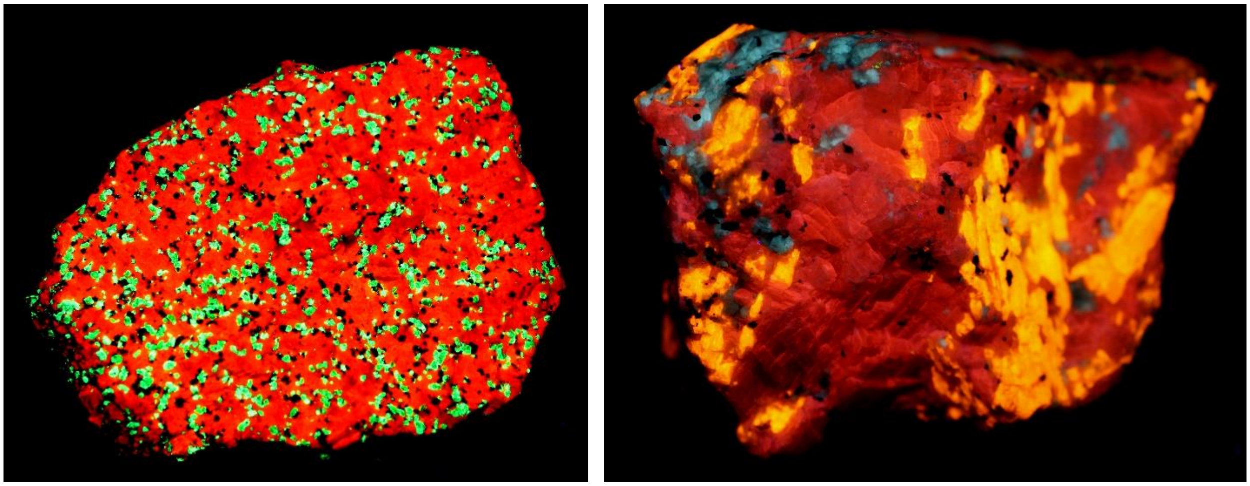

Figure 1. (left): Calcite (red) and willemite (green) in SWUV; (right): Calcite (reddish pink), wollastonite (yellow-orange) and barite (blue) in SWUV; both from Franklin. CRC photos and collection.

Research continues to uncover new minerals there, and a massive book project, now in the final stages of completion, may soon prove to collectors that non-fluorescent Franklin minerals aren't all obscure microscopic coatings and homely brown lumps.

Franklin and Sterling are the two most famous of more than a dozen mines comprising the Franklin mining district of Sussex County, in northern New Jersey (Fig. 2). The district's mines, all of which are now inactive, are strung out in a narrow north-northeast-trending band about 3.5 miles long within a much larger trend that includes dozens of iron deposits as well as the two great zinc deposits. They yielded millions of tons of metals between the late 1730s and 1986.

For the first 150 years, the large numbers of individual mines, combined with difficulties treating the unusual zinc ores and the weird practice of subdividing mineral rights on the basis of commodity type, resulted in inefficiency and nearly constant litigation. This ended in 1897, with consolidation of the Franklin and Sterling Hill properties to form the New Jersey Zinc Company. In a way, this was helped along by the passing of the local iron-mining industry as a result of a lack of nearby coal deposits and the opening of the great iron deposits of the upper midwest.

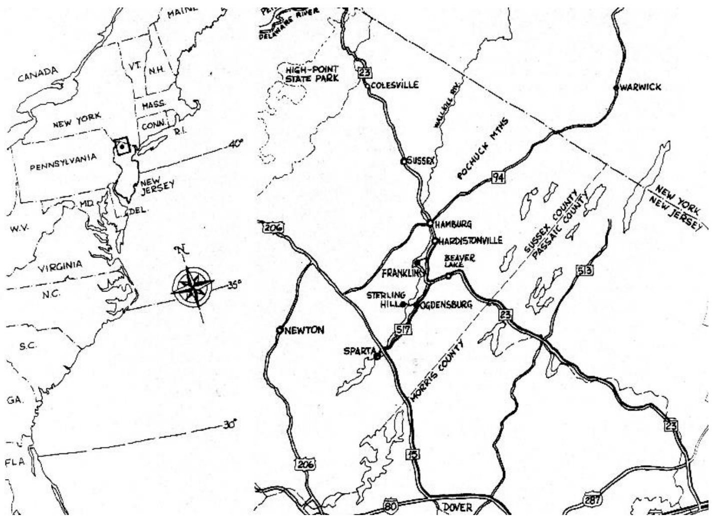

Figure 3. Location of Franklin and Ogdensburg.

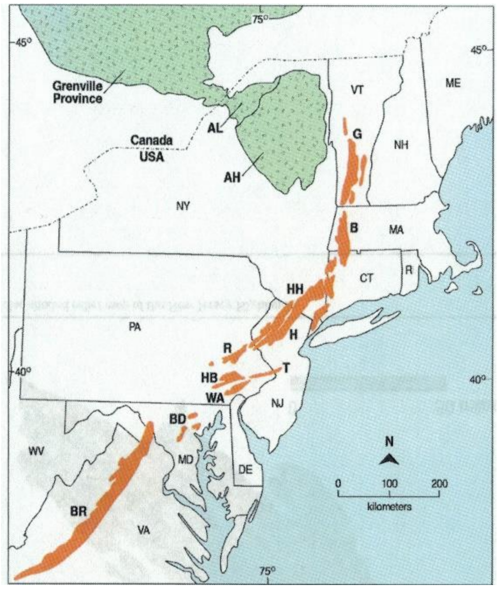

Figure 4. Precambrian rocks of the Appalachians. (Volkert and Witte, 2018)

Location and General Geology. The zinc deposits of Mine Hill (Franklin) and Sterling Hill are located in the New Jersey Highlands section of the Reading Prong, part of a discontinuous band of Precambrian rocks that extends the length of the Appalachians (Figs. 4, 5). In places, these rocks have undergone several deformations related to 3 Wilson plate-tectonic cycles, starting about 1.1Ga (the Grenville orogeny) and including the subsequent Ordovician (Taconic), Devonian (Acadian), and Late Paleozoic (Alleghenian) orogenies of the wider Appalachians. The importance of the later events varies from place to place; At Franklin/Sterling, most of the rocks are high grade gneisses and marbles deformed about 1.1Ga and variously affected by later events. The area exhibits complex folding and faulting of a thick series of proto-sediments and –volcanics, all related to the welding together of the supercontinent of Rodinia (Fig. 6).

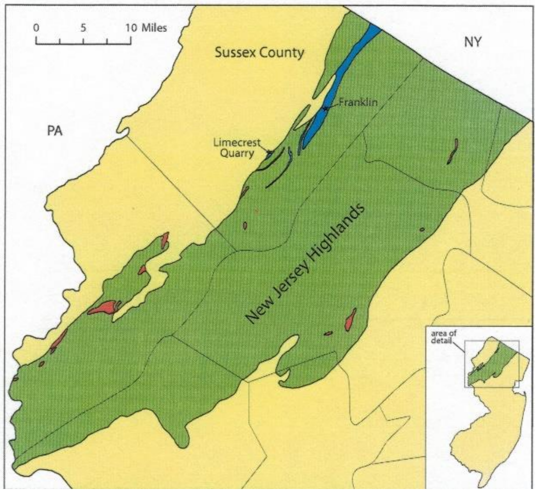

Figure 5. New Jersey Highlands; blue is Franklin Marble. (Volkert and Witte, 2018)

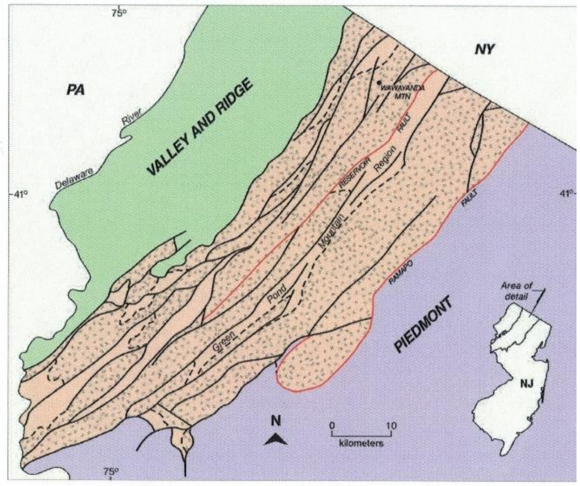

Figure 6. Faults of the New Jersey Highlands section of Reading Prong. (Volkert and Witte, 2018)

Stratigraphy. The rocks in the vicinity of Franklin and Sterling are a high grade sequence of Mesoproterozoic (Precambrian Y; approximately 1.3Ga) metasedimentary and metavolcanic rocks, unconformably overlain by Lower Cambrian clastic sediments (the Hardyston Quartzite) and Cambro-Ordovician carbonates (the Kittatinny Dolostone) (Fig. 7, 8). In northern New Jersey, the

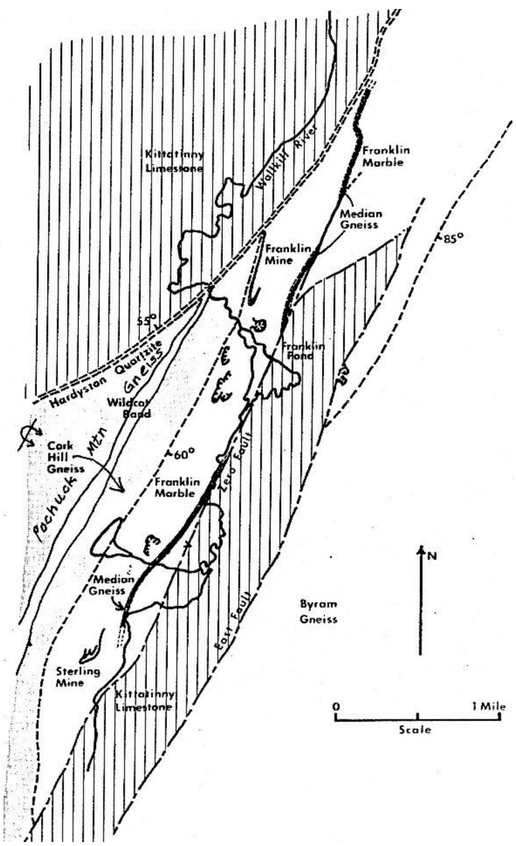

Figure 7. Generalized geology, Franklin/Sterling area. (modified from Pinger, 1950)

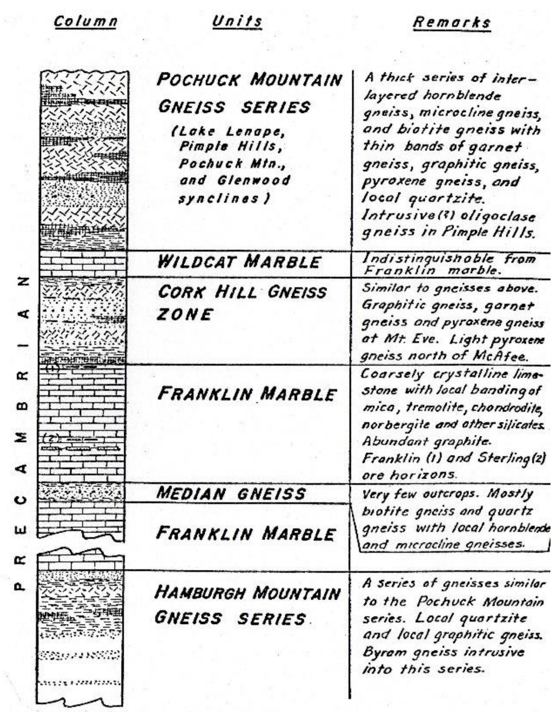

Figure 8. Stratigraphy, Mesoproterozoic rocks. (Hague, *et al.*, 1956)

metamorphic section begins with the Losee Suite (~1.35Ga), consisting of a basal unit of metamorphosed spilites and other metavolcanics (interpreted as oceanic crust) overlain unconformably by metasediments thought to have formed along the east edge of the Laurentian craton. Overlying the Losee Suite are quartzofeldspathic metasediments (locally containing clasts from the Losee) (the Hamburg Mountain Gneiss series); the lower Franklin Marble; a biotite-quartz-plagioclase gneiss (the Median Gneiss); and the upper Franklin Marble (which hosts the zinc deposits) (Fig. 8). The top of the metamorphic sequence is a thick (up to about 1300 m) section of younger gneisses (Cork Hill and Pochuck Mountain Gneiss series), separated by a relatively thin marble (the Wildcat Marble), which is lithologically similar to the Franklin Marble. All of these rocks underwent high grade metamorphism and intrusion by comagmatic, synkinematic, granitoid gneisses (Byram Gneiss and Lake Hopatcong Intrusive Suite) at about 1.09Ga. To the north, the whole sequence is cut by the Mt. Eve Granite, which, at 1.02Ga, represents the youngest Grenville unit in the area.

The stratigraphic section described above can be interpreted as (1) metamorphosed oceanic crust (lower Losee complex) overlain by (2) a sequence of continental-margin (shelf) sediments and graywackes (upper Losee complex, Franklin Marble, Median Gneiss, Cork Hill Gneiss, Wildcat Marble, and Pochuck Mountain Gneiss). It also contained what some workers interpret as rare, exhalative metal rich sediments that accumulated in at least two locations as dense Red-Sea-type brines in the upper Franklin Marble. The latter became the two zinc deposits.

The whole sequence is on the order of 2000 to 3000 m thick and probably represents a wedge of sediments built eastward from ancestral North America. Sediments of volcanic origin were involved, but it is unclear whether volcanism occurred in a discrete arc separated from the continent by an oceanic back-arc basin or as a supracontinental arc with an adjacent subduction zone and failed rift (Fig. 9). Geochemical work supports the latter concept (Volkert and Drake, 1999).

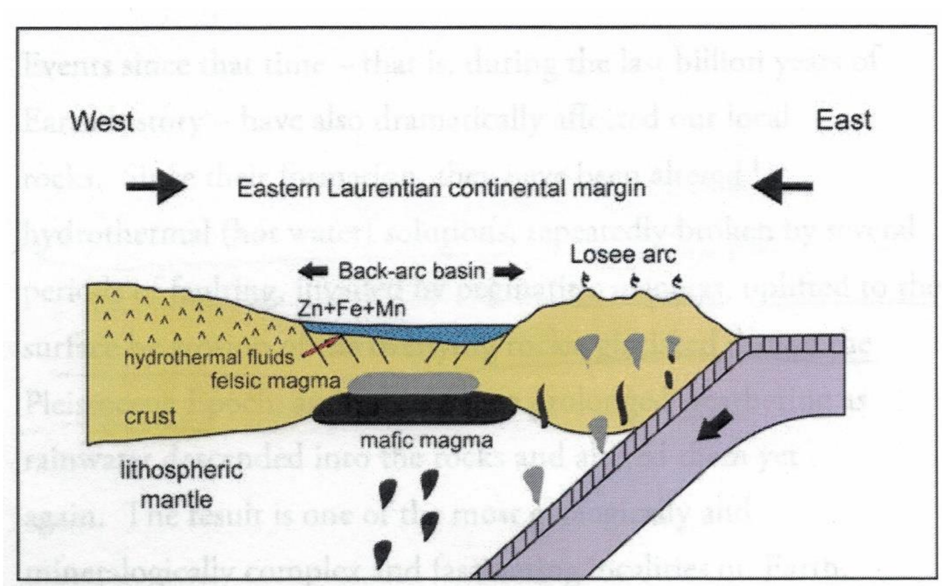

Figure 9. Possible plate-tectonic framework for deposition of Franklin Marble. (Volkert, *et al.*, 2010)

The conventional paleogeography suggests a failed rift (back-arc basin) with a wedge of continental-shelf sediments on the west side and a volcanic arc to the east. The arc shed sediments westward that intermingle with those of the shelf. To the east of the volcanic arc, a west-dipping subduction zone formed as Amazonia approached the volcanic arc. Eventually, the ocean separating Laurentia from Amazonia closed (ending the "first" Wilson cycle), and the arc was driven westward into the former back-arc basin and its contained sediments.

Deformation of the intervening volcanic arc, the former sedimentary and volcanic rift-filling sequence, the former eastern edge of Laurentia, along with the west edge of Amazonia, with its accompanying shelf-sediment prism, consolidated the local part of supercontinent Rodinia in the Grenville orogeny about 1.2 to 1.05Ga. In the process, former sedimentary and volcanic rocks were deeply buried (to perhaps 11-16 km) and heated to temperatures variously estimated as 650 to 780ºC (hornblende granulite facies). Anatexis was probably involved in some places. This produced the basic framework for the Franklin and Sterling zinc deposits.

Structural Geology. The Franklin Marble, which hosts both zinc deposits, exhibits local banding, but traceable stratigraphic horizons are rare and poorly exposed. As a result, structural features are difficult or impossible to trace in the massive marble. However, detailed mapping of the thinner and stratigraphically higher (but lithologically nearly identical) Wildcat Marble indicates that the major structure in the Franklin/Sterling area is a first-order synform (the Pimple Hills synform) (Fig. 7), with northeast-trending second- and third-order folds superimposed. The limbs are overturned to the northwest (Fig. 10). The synform is cut by several major high angle faults (from west to east, the Hamburg, Zero, and East faults; Fig. 7).

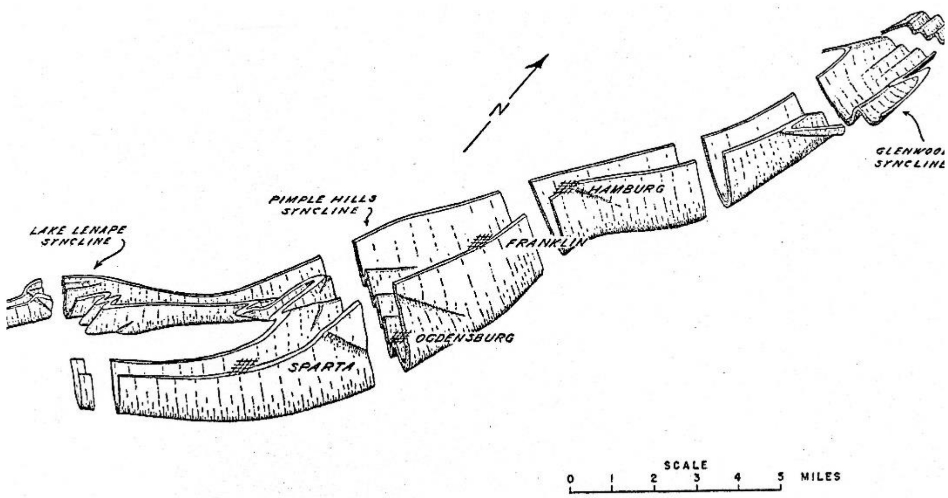

Figure 10. Pre-fault structure of the Wildcat Marble. (Hague, *et al.*, 1956)

The zinc-rich orebodies at Franklin and Sterling are both hook-shaped in map view (Fig. 7). This reflects the fact that both deposits are themselves NE-plunging asymmetric (Franklin) to isoclinal (Sterling) synforms whose limbs and axes parallel those of the surrounding folds.

The Franklin orebody is a simple synform whose west limb dips about 55°ESE and whose east limb is roughly vertical to steeply overturned. The fold axis plunges, on average, 25°NE, and the orebody has a maximum depth of 1215 ft (400 m). The thickest and most continuous ore followed the fold axis, or "keel", for over 3500 ft. (1.1 km). Rocks in the "keel" show complex folding that may reflect fluidization of the surrounding Franklin Marble during metamorphism (Fig. 11).

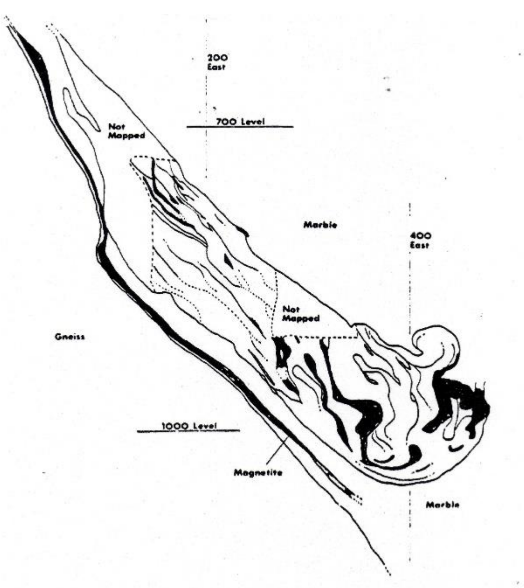

Figure 11. Structure in the Franklin orebody, Palmer shaft support pillar. Black units within orebody are lime-silicate layers. Black unit beneath orebody is the "Furnace magnetite bed", near the border separating the Franklin Marble from the Cork Hill Gneiss. (Frondel and Baum, 1974)

The west limb is continuous for about 0.5 mi (0.9km) before disappearing beneath the Hardyston Quartzite to the north. The east limb, which, in places, is double the thickness of the west limb, dies out at the surface against a thick NW-trending mica diabase dike that cuts both limbs. This dike is post-Ordovician in age, but its exact age is unknown. It contains xenoliths of typical Franklin gneissic ore.

The Sterling orebody is an overturned isoclinal synform whose limbs dip 55°ESE and whose axis plunges about 45°NNE. In detail, the structure is more complex than that at Franklin, with intricate minor folds and abundant fractures. A "cross member" joins the two limbs (Fig. 12). The fold is cut, at the 1500 level on the east limb and beginning at 1600 ft on the west limb, by the Zero fault to the east. This results in a "lost" orebody that may (or may not) be present in the subsurface to the east. This depends on whether the rocks to the east occupy a graben (as most have believed) or a horst. A drilling program carried out before the mine closed failed to intersect it. If the body of Paleozoic rocks east of the Zero fault is a horst, as believed by some workers, the "lost" orebody may long since have eroded away. Another added complexity is that, at the north end of the orebody, the east limb is separated from the rest of the orebody by the Zero fault. The deepest ore in the Sterling deposit is located in this "north orebody", on the 2550 (800 m) level.

Within both orebodies, the ore is arranged in discontinuous, tabular or lensoid masses between 1 ft and 30 ft (0.3 to 10 m) thick and 10 to 2000 ft (3 to 700 m) long. They are elongate parallel to the strike of the whole. At Franklin, much of the ore was fine grained (average 1-3 mm) and showed gneissic banding parallel to the walls of the orebody (Fig. 13). At Sterling, gneissic banding is more poorly developed, and individual mineral grains tended to be coarser, in proportion to the amount of calcite present (Fig. 14).

Because both deposits probably suffered 2 or more episodes of subaerial erosion, there is no way to reconstruct their original shapes and aerial extents. Indications are that they were stratiform and may have occupied two separate, relatively small depressions on the sea floor of a back-arc basin. Metsger (1990) proposed that the structures of both deposits resulted from negative diapirism. The idea is that, during Grenville metamorphism, the Franklin Marble was heated and squeezed between gneisses on both sides, becoming ductile enough so that the relatively dense ore beds (average over 4 gm/cm^3), along with accompanying rocks, sank into the "gooey" marble (density 2.7 gm/cm^3). This might explain what seems to be the more complex structure of the orebodies, compared with the enveloping marble. Evidence also includes disaggregation and brecciation of the ores.

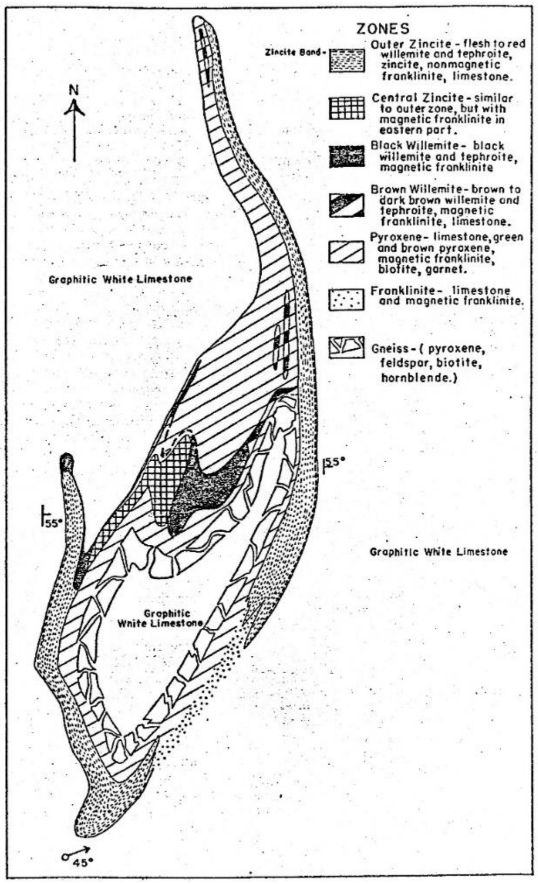

Figure 12. Geologic sketch map of the Sterling Hill orebody, showing major units. (Metsger, *et al.*, 1958)

Metsger's hypothesis is attractive, considering the "intricate" structures in parts of both deposits. However, because of the lack of well defined bedding in much of the Franklin Marble, it is difficult or impossible to establish whether the orebodies cut across bedding and whether the structures of the ore bodies are truly incongruent folds.

Isachsen (1964) proposed that the Reading Prong is an allochthon in which a huge mass of metamorphosed Proterozoic rocks slid westward, possibly for 10s of km, along a variable number of low angle overthrusts or detachments. In some places, including northwestern New Jersey, relations with underlying Cambro-Ordovician sedimentary rocks suggest a Taconian (Late Ordovician) age for the deformation, though later movement is possible. In the past, fault-bounded exposures of Cambro-Ordovician rocks, such as those near Franklin and Ogdensburg, were interpreted as graben, but some recent work suggests that they may actually be horsts, bringing younger rocks up from below the detachments so that they "poke through" the Proterozoic sequence.

In summary, though early workers thought Paleozoic orogenesis had little effect on the Mesoproterozoic orebodies, it is now apparent that this may not be the case. Occurrence of detrital franklinite in the Hardyston Quartzite confirms that the orebodies were in in place by the end of Grenville tectonism and were exposed to erosion by the Early Cambrian. But it is very likely that they were impacted by reactivation of earlier faults and/or formation of new faults and fractures during the closing of the Iapetus Ocean in the Paleozoic. These fractures probably acted as pathways for hydrothermal solutions that deposited some of the rare secondary minerals that collectors love.

Mineralogy. The Franklin deposit was exhausted and closed in 1954, after producing 22 to 23 million tons of ore bearing 19.6% zinc, 8.7% manganese, and 17% iron. The Sterling mine closed in 1986, having produced 11 million tons of similar ore. When it closed, the Sterling deposit had about 5 years of reserves left. Closure related to a tax dispute with the Borough of Ogdensburg.

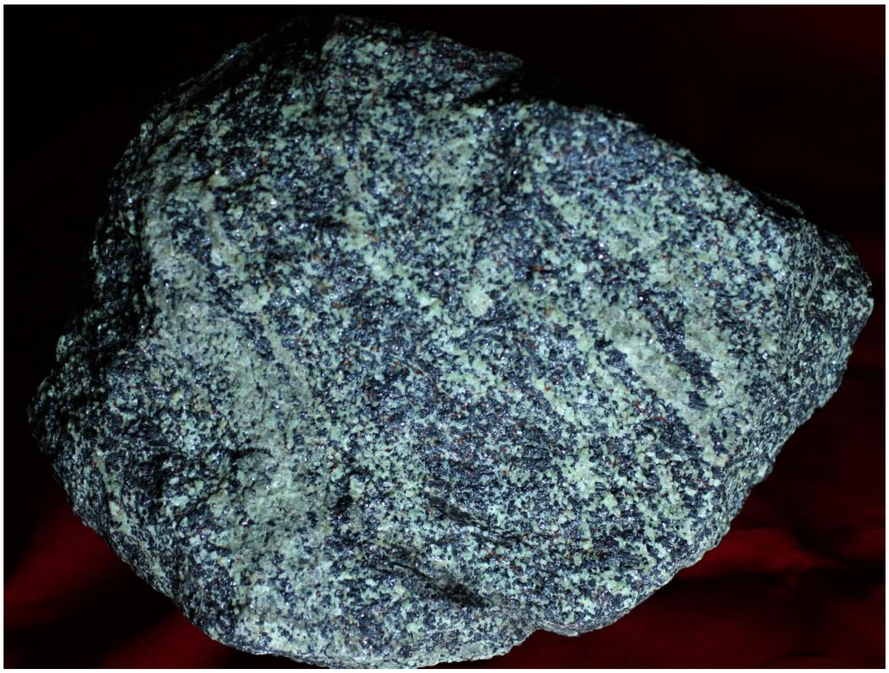

Figure 13. Typical Franklin gneissic ore, consisting of willemite (gray-green), franklinite (black), and minor zincite (red). Sample is 23 cm across. (Carnein specimen and photo)

At both deposits, the primary ore minerals are franklinite, willemite, and (minor) zincite, but the proportions varied somewhat. Ore at Franklin averaged 40% franklinite, 23% willemite, and less than 1% zincite. At Sterling Hill, the corresponding proportions were 33:16:1%. The remainder was mostly calcite, which was more common at Sterling Hill than at Franklin. Common accessories at Franklin included garnet, tephroite, hardystonite, and Mn-humite; tephroite and Mn-humite were especially common at Sterling. Sphalerite was only important at Sterling.

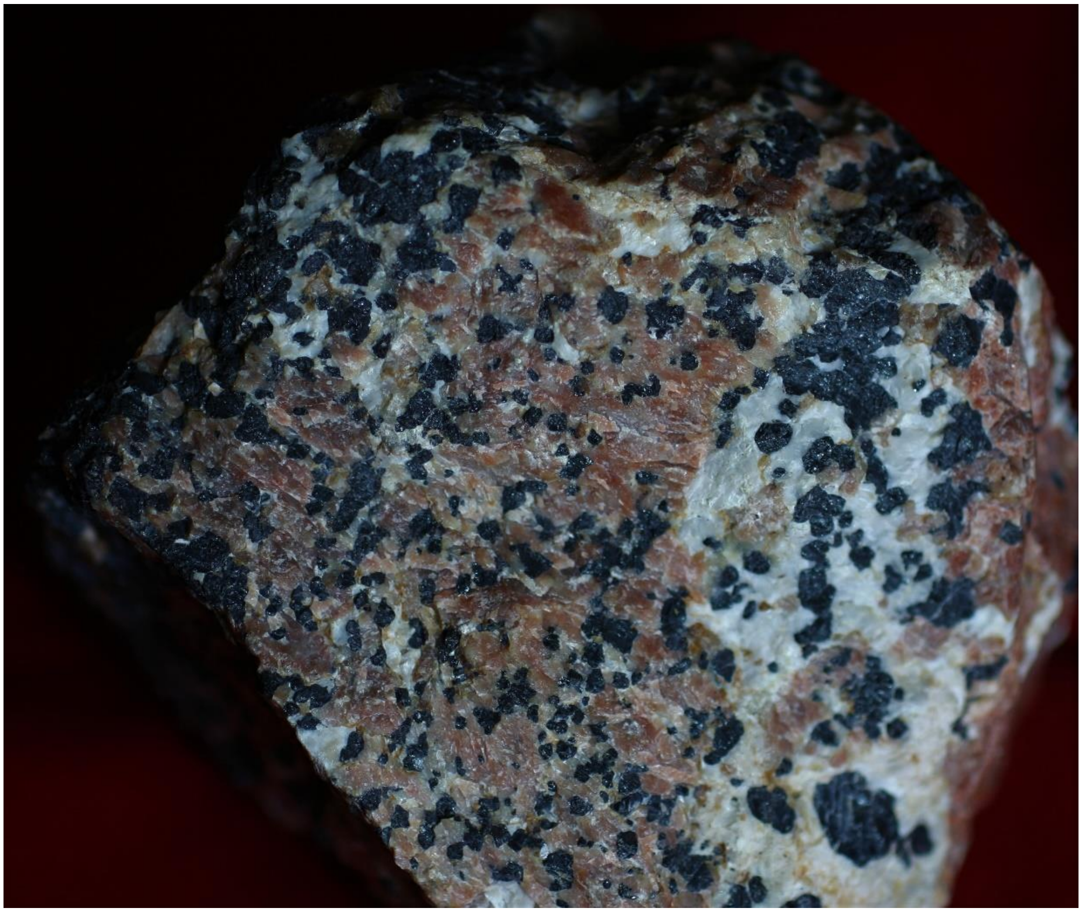

Figure 14. Typical Sterling Hill ore sample, consisting of willemite (pinkish brown), franklinite (black), and calcite (white), from the 1400 level, Sterling mine. Sample is 10 cm across. (Carnein specimen and photo)

Myriad peculiar mineral assemblages occur at both Franklin and Sterling Hill. Some of the many rare minerals of collector interest are associated with:

- Feldspathic silicate "skarns" (really lime-silicate rocks): mainly orthoclase, hyalophane, celsian, pyroxenes, amphiboles, garnet, and calcite; also hendricksite, johannsenite, petedunnite, tirodite, rhodonite. The "Parker-shaft minerals", including barysilite, esperite, ganomalite, kentrolite, larsenite, nasonite roeblingite, margarosanite, charlesite, marsturite, cahnite, and franklinfurnaceite, mostly with manganaxinite, microcline, and andradite, constitute a very special and localized concentration of lead-containing silicates. There are also peculiar assemblages that include glaucochroite, vesuvianite, bustamite, hyalophane, gahnite, minehillite, wollastonite, allanite, fayalite, realgar, and arsenopyrite (not all together).
- Discontinuous hydrothermal veins associated with joints and faults: calcite, rhodochrosite, kutnahorite, secondary willemite, pyrochroite, wurtzite, friedelite, leucophoenicite, manganpyrosmalite, bementite, and serpentine; very rare manganese arsenosilicates occur at both deposits, including schallerite, nelenite, kraissilite, mcgovernite, kolicite, and holdenite.
- Oxidation zone (especially at Sterling Hill): hemimorphite, goethite, chalcophanite, hetaerolite, various other Mn and Mn-Zn oxides; local hydrozincite, copper sulfates, azurite, chrysocolla, etc. (Various post-mining minerals also occur.)
- Franklin Marble: graphite (except near ore), phlogopite, tremolite, chondrodite/norbergite, calcite;
- Alteration or replacement of primary minerals: tephroite, serpentine, talc, "caswellite", etc. (there are many local and individual cases of replacement)
- Magnetite deposits (especially underneath the Franklin west limb and south of Sterling Hill): magnetite, fluorite, apatite;

- Cross-cutting camptonite (mica diabase) and pegmatite dikes, which post-date regional metamorphism. A peculiar occurrence in the Parker mine, near the contact between the orebody and what was a volatile-rich pegmatite, included caswelliite, ganophyllite, clinohedrite, esperite, larsenite, willemite, vesuvianite, datolite, cahnite, thomsonite, xonotlite, hodgkinsonite, manganaxinite, prehnite, cuspidine, pectolite, and others.

Origin of the Ore Deposits. Most modern theories on the origin of the Franklin/Sterling ores and accessories depend on sophisticated knowledge of geochemistry and thermodynamics that is beyond the author's expertise and interest. The material below summarizes a detailed discussion by Dunn (1995). The major theories start with the idea that the protore metals were in place before Grenville metamorphism (that is, they were deposited at about 1.3Ga). Most theories focus on may be analogous metal concentrations discovered in the Red Sea in the 1960s.

Squiller and Sclar (1976, 1980) suggested an original Zn-Fe-Mn dolomite mixed with a mud containing Fe and Mn oxides and gelatinous silica. Their hypothesis suggests that the chemistry would reorganize, during high grade metamorphism and "dedolomitization", to form calcite and oxide solid solutions that, in turn, formed franklinite (from sediments containing abundant Fe and Mn oxides) or zincite (where Fe and Mn oxides were absent). If gelatinous silica occurred where Zn-dolomite (or smithsonite) was breaking down, willemite formed. One problem with this hypothesis is that it doesn't explain the highly localized occurrence of the zinc orebodies.

Johnson, *et al.* (1990a and b) and Johnson (1990) took a different approach, suggesting models in which deposition occurred either as sulfides, possibly from "black smoker-type sea-floor vents, or as Red Sea-type hot brines. The latter idea is favored by more recent isotopic data. Either hypothesis might explain the localization of the orebodies.

Neither of the foregoing hypotheses adequately explains (1) why there aren't a few more deposits like Franklin/Sterling, considering the prevalence of oceanic rift, back-arc-basin and failed-rift deposits worldwide; (2) the lack of significant copper, which typically occurs with zinc and iron, as well as other elements, in ocean-floor sediments and black smokers associated with sea-floor spreading.

Dunn (1995) noted that, whatever their origin, the occurrence together of a zinc oxide (zincite), a zinc silicate (willemite), and a zinc-iron-manganese oxide (franklinite) is unique. Even Långban, Sweden, which shares many rare minerals found, especially, at Franklin, contains very little zinc (franklinite and willemite both occur there but in minor quantities, compared with Franklin/Sterling). Several other predominantly Mn deposits share minerals with Franklin, but there are few other similarities.

Final Note. One of the first things to strike anyone studying these deposits is likely to be how often major researchers use terms such as "hasn't been studied in detail", or "conflicting theories", or "requires further study". This is true even in Pete Dunn's monumental 977-page work published by the Franklin-Ogdensburg Mineralogical Society in 1995-96. Considering the abundant unanswered questions, both deposits are still ripe for research. Unfortunately, money is scarce, and, with the exception of a few hundred feet of passages at the Sterling Hill Mining Museum and some local surface exposures, not much rock is available for direct study.

References. There are probably 1500 references for Franklin/Sterling Hill. Only a few that were used by the author to compile this summary are listed here. For a more complete list, go to Dunn, 1995, Part I.

Baker, D.R., and A.F. Buddington, 1970, Geology and Magnetite Deposits of the Franklin Quadrangle and Part of the Hamburg Quadrangle, New Jersey: United States Geological Survey Professional Paper 638.

Callahan, W.H., 1966, Genesis of the Franklin-Sterling, New Jersey orebodies: Economic Geology, vol. 61, p. 1140-1141.

Degens, E.T., and D.A. Ross (eds.), 1969, Hot Brines and Recent Heavy Metal Deposits in the Red Sea: New York, Springer-Verlag New York, Inc.

Dunn, Pete J., 1995, Franklin and Sterling Hill, New Jersey: The World's Most Magnificent Mineral Deposits, five parts and 2 supplements: Franklin, NJ, Franklin-Ogdensburg Mineralogical Society.

Frondel, C., and J.L. Baum, 1974, Structure and mineralogy of the Franklin zinc-iron-manganese deposit, New Jersey: Economic Geology, vol. 69, p. 157-180.

Hague, J.M., J.L. Baum, L.A. Herrmann, and R.J. Pickering, 1956, Geology and structure of the Franklin-Sterling area, New Jersey: Geological Society of America Bulletin, vol. 67, p. 435-474.

Isachsen, Y.W., 1964, Extent and configuration of the Precambrian in the northeastern United States: New York Academy of Sciences, Transactions, vol. 26, p. 812-829.

Johnson, C.A., 1990, Petrologic and stable isotopic studies of the metamorphosed zinc-iron-manganese deposit at Sterling Hill, New Jersey: PhD. Dissertation, Yale University, New Haven, Connecticut.

------, D.M. Rye, and B.J. Skinner, 1990a, Unusual oxygen isotopic compositions in and around the Sterling Hill and Franklin Furnace ore deposits: Symposium on character and origin of the Franklin-Sterling Hill orebodies, Lehigh University, Proceedings, p. 63-76.

------, ------, and ------, 1990b, Petrology and stable isotope geochemistry of the metamorphosed zinc-iron-manganese deposit at Sterling Hill, New Jersey: Economic Geology, vol. 85, p. 1133-1161.

Metsger, R.W., C.B. Tennant, and J.L. Rodda, 1958, Geochemistry of the Sterling Hill zinc deposit, Sussex County, New Jersey: Geological Society of America Bulletin, vol. 69, p. 775-788.

Palache, C., 1935, The Minerals of Franklin and Sterling Hill, Sussex County, New Jersey: United States Geological Survey Professional Paper 180.

Pinger, A.W., 1950, Geology of the Franklin-Sterling Hill area, Sussex County, New Jersey, *in* K.C. Dunham, editor, Symposium on the geology, paragenesis, and reserves of the ores of lead and zinc: Report No. 7, 18th Session, International Geological Congress, London, p. 77-87.

Squiller, S.F., and C.B. Sclar, 1976, Geochemistry of franklinite, willemite, and zincite from the Sterling Hill ore body, New Jersey: Geological Society of America, Abstracts with Programs, vol. 8, p. 1116-1117/

------, and ------, 1980, Genesis of the Sterling Hill zinc deposit, Sussex County, New Jersey: Proceedings, Fifth Quadrennial IAGOD Symposium, p.759-766.

Volkert, 2013, The Franklin Marble: One of New Jersey's Most Famous Geologic Formations: New Jersey Geological and Water Survey Information Circular.

------, and A.A. Drake, Jr., 1999, Geochemical and Stratigraphic Relations of the Middle Proterozoic Rocks of the New Jersey Highlands: United States Geological Survey Professional Paper 1565-C.

------, J.N. Aleinikoff, and C.M. Fanning, 2010, Tectonic, magmatic, and metamorphic history of the New Jersey Highlands: New insights from SHRIMP-U-Pb geochronology: Geological Society of America Memoir 206, p. 307-346.

------, and D.H. Monteverde, 2013, Bedrock Geologic Map of the Franklin Quadrangle, Sussex and Morris Counties, New Jersey: New Jersey Geological and Water Survey, Map GMS13-3.

------, and R. Witte, Geologic History and Virtual Field Trip of the New Jersey Highlands: https://www.state.nj.us/ Accessed November 3, 2018.

Wilson, J.T., 1966, Did the Atlantic close and then reopen?:
Nature, vol. 211, p 676-681.

C.R. (Bob) Carnein

Bob started life in Pennsylvania and started collecting minerals as a 12-year-old in Danbury, Connecticut. His collection now numbers over 2000 cataloged specimens, with emphases on Franklin/Sterling, NJ, Cripple Creek, CO, and Chuquicamata, Chile, as well as twins and crystallography. He is a 3-time Ohio State grad, having received a masters degree in glaciology in 1967 and a Ph.D. in structural geology and metamorphic petrology in 1976. Starting in 1970, his teaching career spanned 37 years, first at Waynesburg College (in Pennsylvania) and then at Lock Haven University of Pennsylvania. He and his wife Nell retired to Florissant, CO, in 2007.

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Message from the President, Jeff Self

Hello all,

Due to the Socorro symposium taking place this weekend our meeting will be postponed one week. We will all meet on Wednesday the 14th instead of Thursday the 8th. Our speaker will be Bob Carnein, presenting a talk on the minerals and history of the Franklin and Sterling Hill mines, New Jersey. These mines were operated by New Jersey Zinc Company which brings us to my next subject.

On October 27th, Mark Jacobson, Don Bray, Donna Ware and myself met to start the process of documenting, cataloging and photographing the collection of Gilman pictures that FMCC has been given. We were joined by Ken Paulsen, a former employee of New Jersey Zinc, at Gilman. He provided us with a wealth of information, helping us put many of the photos into context and providing many additional facts for us to include in the database. Progress was slow but steady and by the end of the day we had accomplished far more than we anticipated. We will need more sessions like this to complete the project. Additional volunteers would be very welcome. We will be notifying the members, in the newsletter or by an extra email, the next time we have another work session. Also, the pizza was excellent.

On my way to Socorro, for the symposium. I hope to see many of you there!
Jeff Self, Friends of Mineralogy, Colorado Chapter, President

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September 19, 2018 FMCC board meeting minutes
Village Inn, Wadsworth Blvd and Alameda Avenue
Meeting called to order: 5:40 PM
Attendees: Jeff Self, Ed Pedersen, Larry Havens, Don Bray, Mark Jacobson and Peter Modreski
Late attending: Gloria Staebler and David Bunk

Motion 1. Peter Modreski recommended that he create a membership list with names, addresses, phone numbers and email addresses and provide as a separate booklet/pdf file to all members, separate from the newsletter. The motion was seconded by Ed Pedersen. A vole was called and passed with positive votes by Jeff Self, Ed Pedersen, Larry Havens, Don Bray, Mark Jacobson and Peter Modreski. Gloria Staebler and David Bunk had not arrived yet. Peter Modreski will compile all data sources for a reliable list of paid 2018 members and distribute as a pdf.

Treasurer's report: provided the balance of funds for the year to date.

Motion 2. FMCC Badge design and costs. Ed Pedersen made the motion to require that if new FMCC badges are made, the costs of these badges were to be recovered by members purchasing them at their own expense. The fee charged would be only to recover the costs. Peter Modreski seconded the motion. The motion passed unanimously.

Motion 3. Ed Pedersen made the motion that Jeff Self and Mark Jacobson to be charged with finding a business that will create the sort of desired badge containing our amazonite logo specimen, the name of the society, and the member's name at a price that felt to be realistic. They are to present such to the board for their approval of the design and price. Gloria Staebler seconded the motion. The motion passed unanimously.

Gilman photos work session: Chose either October 27 or 28 (Saturday or Sunday). Workshop at Mark Jacobson house with FMCC providing pizza for lunch and paying for the archival holders for the pictures. Mark Jacobson will provide project plans and email call for volunteers. This write-up to be distributed by Peter Modreski via email. Archival folders cost will be provided to board members but should be less than $100 for this first work session.

Nominees for 2019 FMCC officers:
Bob Hembree- President
Gloria Staebler – Vice President
Ed Pedersen – Secretary
Mark Jacobson – Treasurer

Board members (5) –
Don Bray, David Bunk, Larry Havens, Pete Modreski, Jeff Self

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Election of 2019 officers: *We will vote to elect 2019 officers & directors at our November meeting. You may send us a proxy vote if you don't expect to be present.* *Please see p. 15 of this newsletter.*

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Dues for 2019! *Now is the* ***PERFECT*** *time to pay dues for the coming year! A membership form is attached as the last page of this newsletter, or, see our website,* ***https://friendsofmineralogycolorado.org/*** .

Fred Olsen, 1943-2018

I have a sad note to report in this newsletter. As many of you have already heard, Fred Olsen, a member of Friends of Mineralogy as well as of several other Denver area mineralogical clubs, died an untimely death in a boating accident on the Oregon coast on October 12, 2018, at the age of 74.

In fact, I had been planning to print a note about Fred in our newsletter, congratulating him on having been honored by the International Astronomical Union – Minor Planet Center (IAU-MPC) by having had an asteroid name after him. The statement by the MPC reads (September, 2018):

"Frederick Olsen (b. 1943) worked all over the world as a hydrogeologist, mining exploration geologist, paleontologist, and teacher about the earth, the solar system and the universe. He also has an extensive collection of minerals, fossils and meteorites, and was a founding member of Colorado Meteorite Society. [Ref: ***Minor Planet Circ.*** 110639]"

The asteroid (minor planet), formerly catalogued as object 2012 VN106, was discovered by a Russian team (lead by T.V. Kryachko) at the Zelenchukskaya Astrophysical Observatory in 2011-2012. It has now been officially named "Frederickolsen", MPC catalog #437192, to honor Fred for his work with meteorites. You can read about minor planet Frederickolsen and access its detailed orbital information (it is in the main asteroid belt) at: https://minorplanetcenter.net/db_search/show_object?object_id=437192 .

In his career, Fred taught geology and physical sciences at Santa Fe College, Gainesville, FL, for some 15 years. He moved to Colorado in 1985, where he taught geology for several years at Metro State College. He founded Mineral and Fossil Supply, Inc., and, with John Curchin, established MeteoriteThinSections.com. Fred was widely known for his extensive collection and his knowledge and study of meteorites, and as noted above, he was a founder of the Colorado Meteorite Society (COMETS). Fred had a special interest in the Berthoud meteorite, which fell in Colorado on October 5, 2004. It is a eucrite, a stony meteorite of basaltic composition which belongs to the HED (howardite-eucrite-diogenite) group of meteorites, and which has been correlated with, by its composition, an inferred origin on the asteroid Vesta. Fred was instrumental in working with others from the Colorado Meteorite Society in purchasing and donating a 50-gram slice of the Berthoud Meteorite to the Colorado School of Mines Geology Museum, where it is now on display.

Fred was very much liked and respected by his many friends and colleagues (among which I count myself one) and he will be very much missed. Fred's wife, Debbie Baldwin, is also a member of FMCC.

---Pete Modreski

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Calendar of Coming Events, November-December 2018

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

Thurs., Nov. 15, 7:30 p.m., **Friends of Mineralogy, Colorado Chapter** bimonthly meeting; **"Still Crazy (about Franklin) after all these years: The minerals of Franklin and Sterling Hill, New Jersey**", by Carl (Bob) Carnein. Lakeview Event Center, 7864 W. Jewell Ave., Lakewood CO; all welcome. ***Date changed—to the 15th, not 14th !***

Thurs., Nov. 15, 3:00 p.m., Denver Museum of Nature & Science, Earth Science Colloquium, **Mammals Inherit the Earth: How the K/Pg Mass Extinction Killed off Dinosaurs and Opened the Way for Mammals** ,by Greg Wilson, University of Washington. VIP Room, 3–4 p.m. Museum admission not required.

Thurs. Nov. 15, 7:00 p.m., Colorado Scientific Society November meeting, **Geothermal Energy**, by Jeff Winick, and **Geothermal Energy Potential of Colorado**, by Jen Livermore, Solstice Geothermal and Geothermal Resources Council. Shepherd of the Hills Church, 11500 W. 20th Ave., Lakewood. Social time at 6:30, program at 7:00. All are welcome!

Sun., Nov. 18, noon, Florissant Scientific Society meeting: **Lithium**, by Howard "Cork" Hayden. UCCS (University of Colorado at Colorado Springs), Osborne Center, Room B215. Optional shared potluck lunch, 12 noon – 1:00 p.m., presentation 1:00-2:30. All are welcome; the FSS is an informal state-wide organization of geologists and anyone interested in geology; there is no membership requirement. For details of how to find this building and room, contact Bob Knapp, rknapp@uccs.edu, 719-260-7178, or Beth Simmons, cloverknoll@comcast.net, cell 303-902-1708. Abstract: **"Lithium:** We're all stardust --- remnants of a bygone supernova explosion that created all of the elements from hydrogen. Why, then, is there so little lithium on the earth? Why do we find it where we do? What makes Li so wonderful --- and occasionally so dangerous --- as a component in batteries? Are lithium batteries a good storage mechanism for the electric grid? How about back-up for wind and solar and "other"?"

Thurs., Nov. 29, 4:00 p.m., **The Vital Role of Mudstone/Shale Studies in Advancing Sequence Stratigraphy**, by Kevin Bohacs; Weimer Distinguished Lecture at Colorado School of Mines, 241 Berthoud Hall. All are welcome.

Mon., Dec. 3, 3:00 p.m., Denver Museum of Nature & Science, Earth Science Colloquium, **The Improbable Fossil Record of Jellyfish and Their Kin**, by Graham Young, Manitoba Museum. VIP Room, Museum admission not required.

Fri.-Sat.-Sun., Dec. 7-9, Flatirons Rock and Mineral Show, "Rocks & Rails"; Boulder County Fairgrounds, Exhibit Building, 9595 Nelson Rd., Longmont CO. The Flatirons Mineral Club Rock & Mineral Show is combined with the Boulder Model Railroad Club Model Railroad Exposition. 10 a.m. – 5 p.m. each day, adult admission $5. See https://flatironsmineralclub.org/about/annual-fmc-gem-and-mineral-show/ .

Tues., Dec. 11, 5:30 p.m., Rocky Mountain Map Society, monthly meeting, **"How maps reveal (and conceal) our history"**, by Susan Schulten, University of Denver; Denver Public Library, 5th floor, Gates Room, free to the public.

Nov. 16-18, **Denver Area Mineral Dealers Show,** Jefferson County Fairgrounds, Golden CO**.** Free admission, public welcome. 10 a.m. – 5 p.m. Fri. & Sat., 11-4 Sun.

For more lecture series during the year see:
Colorado Beer Talks (2nd Tuesday, 6-8 p.m.), Windy Saddle Café, 1110 Washington Avenue, Golden, "Golden's grassroots version of TED talks, Expand your mind with a beer in your hand", http://goldenbeertalks.org/
Colorado Café Scientifique in Denver, monthly lectures on science topics held either at Blake Street Station or Brooklyn's, Denver; open to the public, no charge other than refreshments you may choose to purchase; see http://cafescicolorado.org/ .
Colorado Scientific Society (3rd Thursday, 7 p.m.), see http://coloscisoc.org/ . Meets at Shepherd of the Hills Church, 11500 W. 20th Ave., Lakewood CO, except when noted.
CU Geological Science Colloquium (Wednesdays, 4 p.m.) see http://www.colorado.edu/geologicalsciences/colloquium
CSU Dept. of Geoscience Seminars (Fridays, 4 p.m.), see https://warnercnr.colostate.edu/geosciences/geosciences-seminar-series/
Van Tuyl Lecture Series, Colorado School of Mines, (Thursdays, 4 p.m.): https://geology.mines.edu/events-calendar/lectures/
Denver Mining Club (Mondays, 11:30), see http://www.denverminingclub.org/ **.**
Denver Museum of Nature and Science, Earth Science Colloquium series, 3:00-4:00 p.m., VIP Room unless noted, day of the week varies. Museum admission is not required; see http://www.dmns.org/science/research/earth-sciences/
Denver Region Exploration Geologists Society (DREGS; 1st Monday, 7 p.m.), http://www.dregs.org/index.html
Florissant Scientific Society (FSS); meets monthly in various Front Range locations for a lecture or field trip; meeting locations vary, normally on Sundays at noon; all interested persons are welcome to attend the meetings and trips; see http://www.fss-co.org/ for details and schedules.
Nerd Night Denver is a theater-style evening featuring usually 3 short (20-minute) TED-style talks on science or related topics; held more-or-less monthly at the Oriental Theater, 4335 W. 44th Ave., Denver; drinks are available; for ages 18+. Admission is $6 online in advance, $10 at the door. See https://www.nerdnitedenver.com/ .
Rocky Mountain Map Society (RMMS; Denver Public Library, Gates Room, 3rd Tuesday, 5:30 p.m.), http://rmmaps.org/
Western Interior Paleontology Society (WIPS; Denver Museum of Nature & Science, 2nd Monday, 7 p.m.), http://westernpaleo.org/ . Meetings are held either in the Ricketson Auditorium or the Planetarium at the Denver Museum of Nature & Science, unless otherwise noted.

FM Colorado Chapter meetings:

Meetings are normally held at 7:30 p.m. on the 2nd Thursday of alternate (odd-numbered) months. Our meeting place for 2018 and as planned at this time for 2019 will be the Lakeview Event Center, 7864 W. Jewell Ave., Lakewood CO. Our meeting dates are often shifted in September and November so as not to conflict with the Denver Gem & Mineral Show or the New Mexico Mineral Symposium. Visitors are *always* welcome at our meetings!

Planned meeting dates for 2019 will be:

Thursday, Jan. 10, FM meeting
Thursday, Mar. 14 FM meeting
Thursday, May 9, FM meeting
Sunday, May 19, FM Silent Auction, Clements Community Center, Lakewood
Sept. 13-15, Denver Gem and Mineral Show; 2019 show theme, "Minerals of Canada" (52st annual show)
Thursday, Sept. 19, FM meeting (date adjusted to not conflict with Denver Gem and Mineral Show)
Thursday, Nov. 14, FM meeting

Friends of Mineralogy, Colorado Chapter, 2018 officers:

President: Jeff Self, selfawareminerals@gmail.com, 303-898-7539
Vice President: presently vacant
Secretary: Mark Jacobson, markivanjacobson@gmail.com,1-337-255-0627
Treasurer: Gloria Staebler, gastaebler@aol.com, 303-495-5521
Denver Museum N&S Liaison: Alan Keimig, alan.keimig@gmail.com, 303-755-9604
DG&MS Council Trustee: David Bunk, dave@davebunkminerals.com; Alternate, Mark Jacobson
Newsletter editor: Peter Modreski, pmodreski@aol.com, 303-202-4766
Field trip planner (not field trip leader): unfilled
FMCC Website: unfilled
Postings for the FM national facebook page: unfilled
At-large Directors: Larry Havens, lwrnchavens@comcast.net, 303-757-6577
Don Bray, don_bray@copper.net , 303-681-3646
Ed Pederson, mineraljeep@aol.com
David Bunk, dave@davebunkminerals.com
Peter Modreski, pmodreski@aol.com, 720-205-2553

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Election of FMCC officers & directors for 2019

Proposed candidates for 2019 Officers and Directors: nominees (including any additional new "write-in" candidates) will be voted on at our November 15 meeting:

Bob Hembree- President
Gloria Staebler – Vice President
Ed Pedersen – Secretary
Mark Jacobson – Treasurer

At-large Board members (FM by-laws specify a minimum of 3 to a maximum of 5):

Don Bray
David Bunk
Larry Havens
Pete Modreski
Jeff Self

If you do not expect to be present at the November meeting and would like to vote, you may send a proxy vote, which must be received by November 15, by email to the current Secretary, Mark Jacobson, at markivanjacobson@gmail.com, or by U.S. Mail to Friends of Mineralogy, Colorado Chapter, P.O. Box 234, Arvada CO 80001-0234. You may include write-in nominees.

Prospective members for the Colorado Chapter, please send this form with your check to the address below. This form may also be used to renew your membership. Membership in the local chapter includes membership in the National Society. A local chapter member does not need to live within the area. Membership lists are not shared outside of the organization. Membership in the local chapter provides membership in the Rocky Mountain Federal of Mineralogical Societies (RMFMS) with its associated group 3rd party liability insurance for field trips.

Please mail annual dues of $15 for an individual, or $25 for a family made out to Friends of mineralogy, Colorado Chapter to:

Ms. Gloria Staebler

Friends of Mineralogy - Colorado Chapter
P.O. Box 234
Arvada, CO 80001-0234

Please complete the following for new members.

Last Name:____________________ First name: ________________________

Middle name (optional): ____

Street Address (used for mail): ____________________________________

City: ______________________ State or Province: ____________________

County:______________________ Zip or Postal Code: __________________

Telephone (land line):_________________ Telephone (Cell phone): __________

Email address: ____

Signature: ______________________________ Date: ___________________

My primary area of interest is: _____________________________________

Chapter and National newsletters will be sent to you by email unless you request a paper copy to be mailed. _______Please note that mail newsletter as sent as a black and white paper copy.

Friends of Mineralogy Colorado Chapter is affiliated with the Mineralogical Record Magazine, The Mineralogical Society of America (MSA), the American Geological Institute (AGI), Rock and Minerals magazine, the American Federation of Mineralogical Societies and the Rocky Mountain Federation of Mineralogical Societies.

Friends of mineralogy, INC. is composed of member of local chapters, of which in 2014, seven chapters existed. Members may affiliate with any chapter or none. Local chapters issue newsletters as does the national organization.