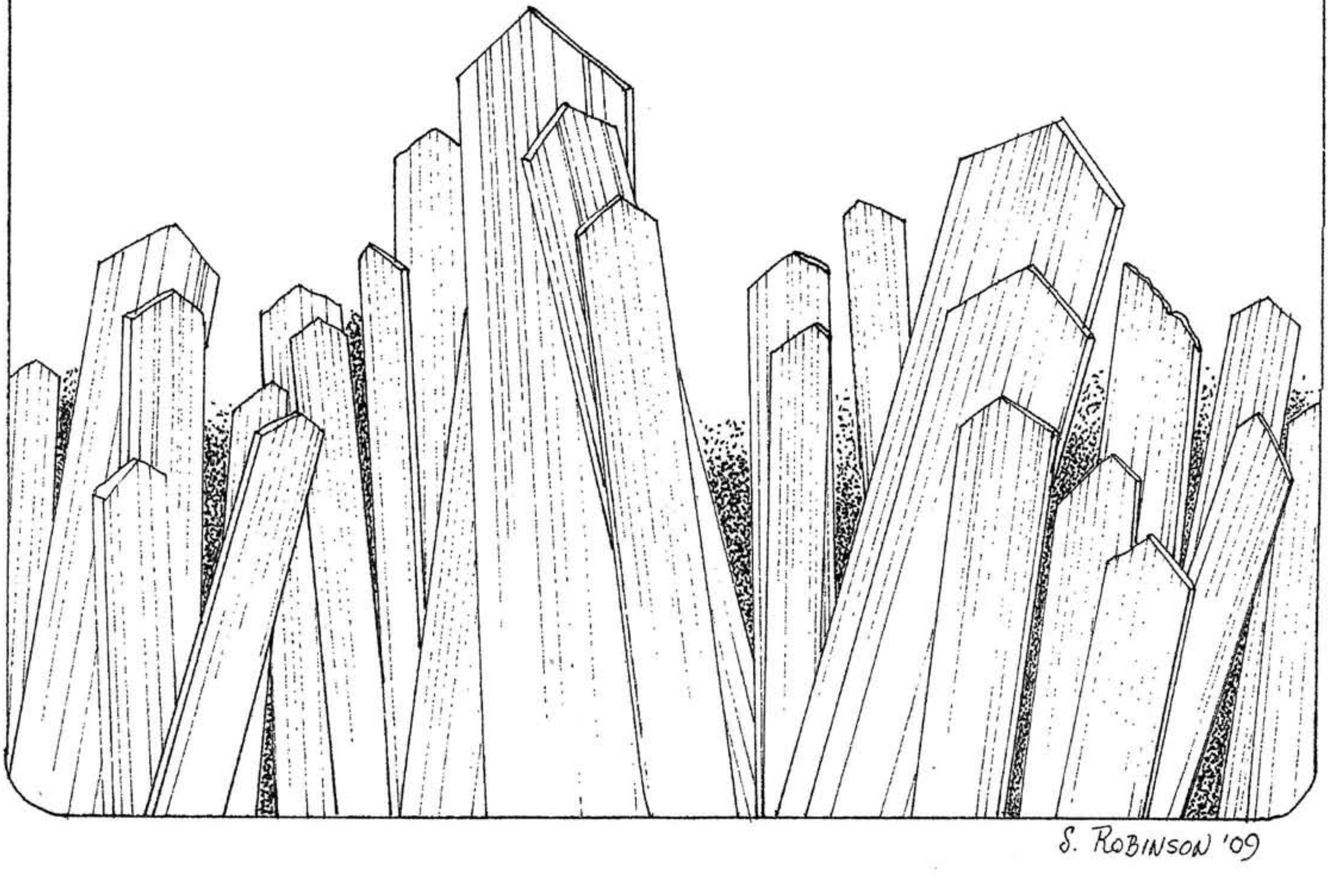
The 38th Rochester Mineralogical Symposium

April 14 – 17, 2011



S. ROBINSON '09

PROGRAM

Thursday Evening, April 14, 2011

PM 4:00-6:00 Cocktails and Snacks – Hospitality Suite 400 (4th Floor)

6:00-7:45 Dinner – Baxter's

8:00-9:15 **THE GUALTERONI COLLECTION: A TIME CAPSULE FROM A CENTURY AGO – Dr. Renato Pagano**

In 1950, the honorary curator of the Museum of Natural History in Genoa first introduced Dr. Renato Pagano to mineral collecting as a Boy Scout. He has never looked back. He holds a doctorate in electrical engineering and had a distinguished career as an Italian industrialist. His passion for minerals has produced a collection of more than 13,000 specimens, with both systematic and aesthetic subcollections. His wife Adriana shares his passion for minerals and is his partner in collecting and curating. An excellent profile of Renato, Adriana, and their many collections appeared earlier this year in *Mineralogical Record* (**42**:41-52). Tonight Dr. Pagano will talk about an historic mineral collection assembled between 1861 and 1908 and recently acquired intact by the Museum of Natural History of Milan. We most warmly welcome Dr. Renato Pagano back to the speakers' podium.

9:15 Cocktails and snacks in the Hospitality Suite on the 4th floor will be available throughout the rest of the evening. Dealers' rooms will be open at this time. All of the dealers are located on the 4th floor.

Friday Morning, April 15, 2011

AM 9:00 Announcements

9:15-10:15 **CRACKING THE CODE OF PHLOGOPITE DEPOSITS IN QUÉBEC (PARKER MINE), MADAGASCAR (AMPANDANDRAVA) AND RUSSIA (KOVDOR) – Dr. Robert F. Martin**

Robert François Martin is an emeritus professor of geology at McGill University in Montreal. He earned a bachelor's degree from the University of Ottawa, a master's degree from Penn State and a doctorate from Stanford. Dr. Martin spent his entire career at McGill University where he pursued research on the mineralogy and petrology of granitic rocks, with an emphasis on granitic and syenitic rocks of anorogenic character in various parts of the world. In addition, he has made extremely important contributions by serving as the editor of *The Canadian Mineralogist*, a top-ranked journal covering the fields of mineralogy, crystallography, petrology, geochemistry, and ore deposits for the past 33 years. Recently he has turned his attention away from feldspars and amphiboles to carbonates in the high-grade metamorphic rocks of the Grenville Province and in similar belts elsewhere. Today his talk features this new research interest. We warmly welcome Dr. Martin to the speakers' platform.

10:15 Coffee Break

10:30-11:30 **THE BALMAT ZINC DEPOSITS OF NEW YORK STATE: ONE OF THE MOST FANTASTIC ORE DEPOSIT STORIES EVER TOLD – William deLorraine**

Bill deLorraine is an experienced structural and economic geologist, research scientist, and mineral collector. Bill was born in Corning, NY, where he spent many hours playing on piles of glacial drift. Finding a small limonite after pyrite crystal at age 6 or 7 set him on his career path. He earned a bachelor's in geology at SUNY Potsdam and got a job as a core logger with St. Joe Minerals Co. at Balmat. It wasn't long before he eased down into an underground job and began his career as an ore deposit geologist by mapping the newly discovered Fowler Ore Body. He then went to the University of Massachusetts at Amherst to earn an MSc degree and returned to the Balmat mines. Bill and his wife, Joanna, (who puts up with rocks in every room and under every bed) enjoy living in the St. Lawrence Valley, and Bill remains fascinated by the scientific research to do on the geologic history of this region. Today, Bill will discuss the origin and mineralogy of one of New York State's best, but perhaps least appreciated, classic localities. We warmly welcome Bill deLorraine to his debut at the speakers' platform.

11:30-1:00 Lunch Break

Friday Afternoon, April 15, 2011

PM 1:00 **CONTRIBUTED PAPERS IN SPECIMEN MINERALOGY - PART I**
Dr. Carl Francis - Moderator

1:00 **Fracture-hosted secondary phosphate mineralization at the Crooker Gem Pegmatite, Newry. Maine, USA –** *V. King, L. Jonaitis, & R. Brown.*

1:15 **A new look at an old locality: The Chickering Mine in Walpole, NH –** *P. Cristofono, T. Mortimer, J. W. Nizamoff, A. Wilken, & R. Wilken.*

1:30 **Rare earth element (REE) and yttrium mineral potential of New York -** *M. Lupulescu, J. D. Price, & J. R. Chiarenzelli.*

1:45 **Phlogopite triplets from the Selleck Road occurrence, West Pierrepont, St. Lawrence County, NY –** *S. C. Chamberlain, M. Walter & R. P. Richards.*

2:00 **Chemical and physical characterization of wavellite, $Al_2(PO_4)_2(OH,F)_3$, from the National Limestone Quarry near Mount Pleasant Mills, Pennsylvania –** *K. Cabaniss & L. E. Kearns.*

2:15 **Chemical characterization of Northern Virginia apophyllite, $(K, Na)Ca_4Si_8O_{20}(OH,F)\cdot 8H_2O$ –** *B. M. Meier & L. E. Kearns.*

2:30 **The morphology and structure of smythite, $(Fe,Ni)_3S_4$, from Bloomington, Indiana –** *C. E. Bon & J. Rakovan.*

2:45 **Chevkinite group minerals from the Wausau Complex, Marathon County, WI –** *T. W. Buchholz, A. U. Falster, & W. B. Simmons.*

3:00 **Investigation of stalactitic manganese oxide from Phillipsburg, Montana –** *H. A. Barrett & M. P. S. Krekeler.*

3:15 **"Allanite-(Nd)": A new mineral from the Kingman feldspar mine in the Mohave Pegmatite District, Northwestern Arizona –** *S. L. Hanson, T. A. Brown, A. U. Falster, W. B. Simmons.*

3:30 **The colors of suolunite from the Lac D'Amiante Mine, Quebec –** *B. C. Hyde & K. T. Tait.*

3:45 **Bobdownsite, a new member of the whitlockite group from Big Fish River, Yukon, Canada** – *K. T. Tait, R. M. Thompson, H. Yang, M C. Barkley, M. Origlieri & S. H. Evans.*

4:00 **Arrojadite group minerals from Rapid Creek and Big Fish River, Yukon Territory, Canada –** *H. Tomes, K. Tait, F. Cámara, B. Downs, M. Back, & I. Nicklin.*

4:15 **Hydroxylherderite and herderite from Brazil, Maine, New Hampshire, and Namibia –** *J. W. Nizamoff, A. U. Falster, & W. B. Simmons.*

4:30 **Hollow galena from Madan, Bulgaria –** *J. S. Simonoff & L. E. Kearns.*

4:45 **A second U. S. location for väyrynenite – the Estes Quarry, West Baldwin, Maine and new data on väyrynenite from Wisconsin and Pakistan –** *A. U. Falster, J. W. Nizamoff, G. Bearss, & W. B. Simmons.*

5:00 End of Technical Session, Part I

5:00-6:30 Shopping Break

6:30-8:00 Dinner – Baxter's

8:15-9:15 **COLLECTING AT CLASSIC EUROPEAN LOCALITIES – Dr. Georg Gebhard.**

Dr. Georg Gebhard has been a frequent attendee of the RMS and a popular speaker. In the past, he has told us about historical European collections, given us a first-hand account of mineral collecting and the mineral trade in China, supplemented his two landmark books on Tsumeb with an informative talk about the locality—among other topics. We are delighted to welcome one of our "regulars" to the speakers' platform.

9:15-??? Continuation of "Shop'til You Drop", spirits, and Fellowship – 4th Floor

Saturday Morning, April 16, 2011

AM 7:30	Fellowship Breakfast – Baxter's
9:00-10:00	**WHAT'S NEW IN MINERALS AND LOCALITIES, PART I – Jeff Scovil** Jeff Scovil, our regular master photographer and compiler of What's New in Minerals, will take a look at the best of the past year.
10:00	Coffee Break
10:15-10:45	**WHAT'S NEW IN MINERALS AND LOCALITIES, PART II – Dr. Lawrence Stifler - Maine Mineral Museum - Opening 2012 Audience Members.** Please bring any slides or digital images you want to show to the projectionist stand during the coffee break and we'll try to accommodate showing them!
11:00	**CONTRIBUTED PAPERS IN SPECIMEN MINERALOGY - PART II Dr. Carl Francis - Moderator**
11:00	**Tracking down the truth of Perovski** – *L. J. Schmidt.*
11:15	**The crystal structure of yofortierite –** *M. A. Cooper, K. Tait, M. Back, & F. C. Hawthorne.*
11:30	**Testing for quartz twinning with a laser pointer –** *B. Morgan.*
11:45	**Pseudomorphic replacement of schultenite by hydroxylmimetite –** *A. R. Taylor & J. Rakovan.*
12:00	**Unusual spiral crystals in crystals** – *J. Rakovan & J. S. White.*
12:15	End of Technical Session, Part II
12:15-2:00	Extended Lunch and Shopping Break

Saturday Afternoon, April 16, 2011

PM 2:00-3:00 **APPLYING BASIC MINERALOGY TO DISCREDIT FRAUDULENT SPECIMENS – Justin Zzyzx**

Justin Zzyzx first became interested in minerals after receiving a box of specimens from Tsumeb. His growing interest in how minerals form was enhanced by his taking a job with Jewel Tunnel Imports under the mentorship of the very knowledgeable, well traveled, and well known Rock Currier. After several years of organizing field trips and producing mineral shows, Justin and his wife Brandi bought The-Vug.com, a popular website, and began publishing *The-Vug.com Quarterly Magazine*. Working at Jewel Tunnel Imports exposed Justin to many different types of faked minerals, from cinnabar crystals glued onto matrix to turquoise made from crushed gypsum. The list of common mineral fakes on The-Vug.com led to a mineral website called FakeMinerals.com. While many mineral scams are trivial and easily spotted, some of them, such as the “Arkansas Diamond Scandal” made their way to news services across the world, onto television, and into magazines such as *National Geographic*. Today Justin will inform and entertain us by discussing this interesting aspect of specimen mineralogy. We warmly welcome Justin to his debut at the speakers’ platform.

3:00 Coffee Break

3:15-4:15 **MINERALS OF THE TILLY FOSTER IRON MINE IN SOUTHEAST NEW YORK - Ted Johnson**

Ted Johnson worked for 30 years as a mechanical engineering specialist for a large New England utility. His expertise was analyzing and interpreting the vibrations that turbine-generators and other large machines make when they are operating. This information is used to help detect problems and develop maintenance programs. Although still in demand as a consultant, Ted, in retirement, has more time for mineralogy pursuits. His passion for collecting began almost 50 years ago in Paterson, NJ. Ted’s keen interests in nature in general, and geology and minerals in particular, have led him to specialize in historic mining areas such as Cornwall, England; Laurion, Greece; and Broken Hill, Australia. A particular passion has long been New England minerals and pegmatite minerals from world-wide localities. He has operated Yankee Mineral and Gem Company since 1984 “to support these obsessions”. Today, Ted is talking about a current passion, the classic Tilly Foster Iron Mine. We warmly welcome Ted back to the speakers’ platform.

Saturday Evening, April 16, 2011

5:15-6:30 **SILENT AUCTION**

7:00-8:30 Thirty-Fifth Annual Symposium Auction Dinner – Main Ballroom

8:30 THIRTY-FIFTH ANNUAL SYMPOSIUM AUCTION

Sunday Morning, April 17, 2011

AM 9:00-10:00 **TWO ESSENTIAL INGREDIENTS: MINERAL SPECIMENS & MINERAL COLLECTORS – Dr. Steven C. Chamberlain**

A serious mineral collector since he was 12, Steve Chamberlain has passed his golden anniversary as a collector, and it’s clearly downhill from here. As he continues, in retirement, to move his 25,000-specimen collection of New York State minerals to the New York State Museum, he has more time to ponder how mineral collecting is changing. As the dollar value of the best mineral specimens has exploded, affluent collectors have tended to focus on the specimens and the dealers from whom they can snatch them. Moreover, many “hot” specimens in recent years have come from far away places where the information about the person who collected the specimen is never recorded. Provenance for such specimens includes the previous owners—dealers and other collectors, but too rarely the original field collector. Yet without a field collector, a mineral specimen wouldn’t exist. Today Steve will explore mineral collectors from field collectors to curators and chroniclers of mineral localities using, of course, New York State for his examples.

10:00-11:00 **NORTHERN ARIZONA VOLCANOES: RECENT VOLCANIC ERUPTIONS THAT CHANGED: THE LANDSCAPE FOREVER – Dr. Sarah Hanson**

Dr. Sarah Hanson has been a regular participant in the Symposium for many years. Initially she was a graduate student member of the

N'Arlins mafia of "pegmatologists" from Skip Simmons' Lab. Then she joined the geology faculty of Adrian College in Adrian, near the southern border of Michigan. She has been a very regular contributor to the Technical Session and last year joined our panel of reviewers. For the past several years, one of Sarah's research interests has been the volcanic activity in northern Arizona. This year we are delighted to welcome Dr. Sarah Hanson to give an invited talk on a hot topic - vulcanology.

11:00 End of the Symposium

See you next year for the 39th RMS: **April 19-22, 2012**

Contributed Papers in Specimen Mineralogy

This year submitted abstracts were reviewed by a committee consisting of Dr. Carl Francis, Dr. Marian Lupulescu, Dr. George Robinson, Dr. Sarah Hanson, and Dr. Steve Chamberlain. Twenty-one abstracts were submitted, accepted, and scheduled for platform presentations on Friday afternoon and Saturday morning. The accepted abstracts follow.

INVESTIGATION OF STALACTITIC MANGANESE OXIDE FROM PHILLIPSBURG, MONTANA. *H. A. Barrett, and M. P. S. Krekeler*. Department of Geology, Miami University-Hamilton, 1601 University Dr., Hamilton, Ohio 45011.

Samples of manganese oxide from Phillipsburg, Montana, from the collection of Miami University-Hamilton have an unusual morphology and a low bulk density of approximately 0.7 to 0.9 g/cm^3. Clusters of this material are approximately 10 cm in length and 4 to 6 cm in maximum diameter. Samples have a black streak color, a Moh's hardness of approximately 2, and have a very dull nonmetallic luster. Comparison with a Munsell soil color chart gives a color of Gley 1 4/N for most samples. Macroscopic crystals are not evident with the unaided eye. The bulk morphology is that of stalactitic columns that are generally circular to oval in cross-section with some irregularities. Individual columns vary in diameter from approximately 2 to 10 mm. Columns appear to be homogeneous at the macroscopic scale.

Several pieces of the material were analyzed using powder X-ray diffraction. Sample material was gently crushed by hand in an agate mortar and pestle. A milled, 2.5 x 2.5 cm plastic tray was used as a sample holder. Powder X-ray diffraction data were collected using a Scintag X-1 powder diffractometer equipped with a Peltier detector, using Cu Kα2 (0.1548 mm) radiation, operated at 30 kV and 35 mA. Samples were scanned from $2\theta = 2°$ to $65°$ with 0.01 degree steps and a count time of 2.5s per step under ambient atmospheric conditions. Minerals were identified using the computer program Jade with standard parameters and the following PDF cards: #012-0716 for pyrolusite, #038-0475 for todorokite, #021-0553 for todorokite, #0040603 for cryptomelane and #012-0760 for cryptomelane.

The powder X-ray diffraction data are characterized by a low and variable number of peaks. Common d-spacing values of the most pronounced peaks are approximately 9.6 Å, 7.4 Å, 3.7 Å, and 3.35 Å. The most intense peak is near 9.6 Å, which is consistent with the data for todorokite. The 3.35 Å peaks are not compatible with the 9.6 Å peak and are interpreted as potential quartz impurities. A definitive identification of all peaks cannot be made and this may be in part due to preferred orientation since todorokite often has a fibrous morphology or to poor crystallinity.

Todorokite has a density of approximately 3.65 g/cm^3, suggesting that about 2/3 of the sample material volume is void space if it is otherwise pure todorokite. These are likely mesopores or micropores. Scanning electron microscopy and further powder X-ray diffraction studies are underway to better understand why the material has such a low density. This naturally occurring low-density manganese oxide material may provide insight into methods of producing low-density synthetic materials for use in pollution removal and catalysis.

THE MORPHOLOGY AND STRUCTURE OF SMYTHITE, (Fe,Ni)$_3$S$_4$, FROM BLOOMINGTON, INDIANA.

C. E. Bon and J. Rakovan. Geology Department, 250 S. Patterson Ave., Rm. 114 Shideler Hall, Miami University, Oxford, Ohio, 45056.

Smythite ($(\mathrm{Fe, Ni})_{3+x}\mathrm{S}_4$, x=0 to 0.3) is a low temperature and pressure iron (-nickel) sulfide that occurs in quartz geodes of the Harrodsburg Limestone as inclusions in calcite and barite. The smythite under investigation was collected from a road-cut at the Harrodsburg exit south of Bloomington on Highway 37. Smythite crystals are dissolved out of calcite with weak hydrochloric acid (1M HCl) and then analyzed by various methods for phase confirmation. Energy dispersive spectrometry data verify iron sulfide with minor nickel. Electron backscatter diffraction data confirm that these crystals are smythite and not the closely related phases of pyrite (FeS_2), pyrrhotite ($\mathrm{Fe}_{1-x}\mathrm{S}$, x=0 to .02), or marcasite (FeS_2). Optical observations of smythite crystals, as visible inclusions in barite, show a range in morphologies; some crystals are sharp, euhedral hexagonal plates with a metallic luster and jet black color. However, many of the crystals have lost some definition in shape and color. Some crystals have altogether disappeared leaving a sparse residual material that is a light gray color. When exposed to air smythite oxidizes rapidly. The transparency and internal clarity of host barite crystals is ideal for in situ study of smythite, including spectroscopy, without exposure to the atmosphere. Raman spectra, the first ever collected on smythite, show peaks at 262, 267, 326, 329, 358, 394 cm^{-1}. Raman spectra of the light gray inclusions could not be obtained. First described by Erd (1957) and later redefined by Taylor (1972), smythite is thought to have cell dimensions of a = 3.4651 Å, c = 34.34 Å and space group $R\bar{3}m$. Single-crystal X-ray diffraction data have been collected and redetermination and refinement of the smythite structure is being pursued. Initial efforts yield a $P6_3mc$ space group with unit cell dimensions of a = 3.4 Å, b=3.4 Å, and c = 5.7 Å. Smythite inclusions in barite and calcite have been collected by JR numerous times over the last 20 years. Due to its close resemblance to other iron-sulfides, smythite from the Harrodsburg exit and other nearby locations has been commonly misidentified by collectors.

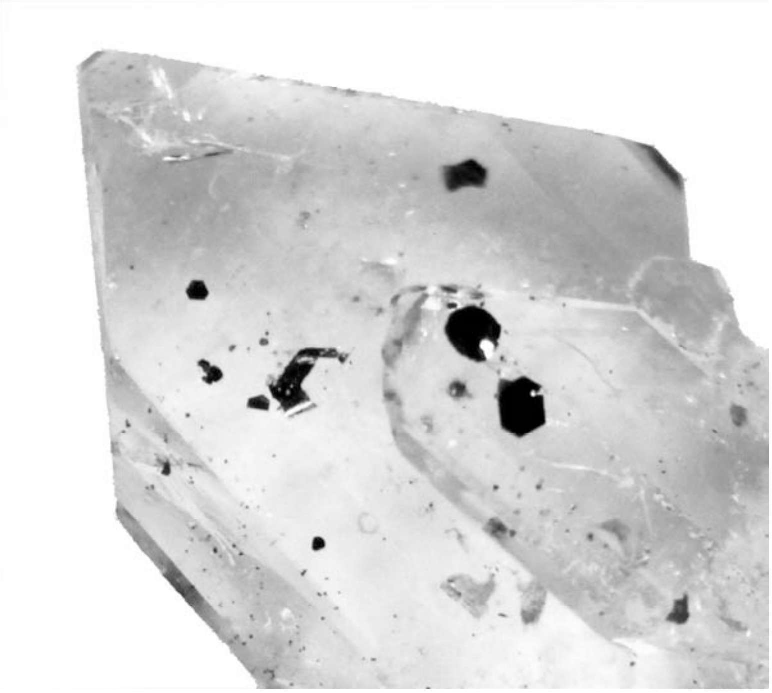


Figure 1. Smythite (black, hexagonal crystals) included in barite. Barite crystal is 5 centimeters in length and smythite crystals are a 0.5 to 3 millimeters in diameter.

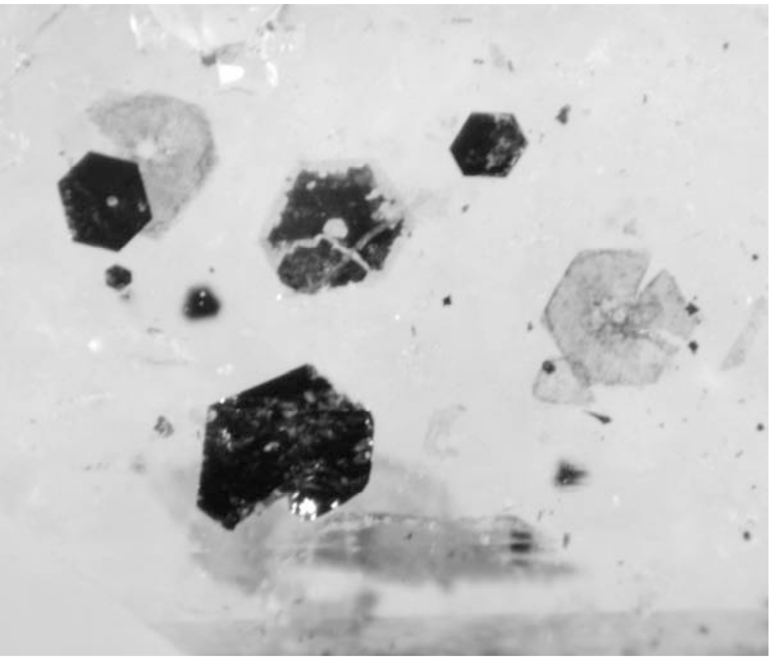


Figure 2. Smythite showing variations in morphology and residual gray matter under investigation.

CHEVKINITE GROUP MINERALS FROM THE WAUSAU COMPLEX, MARATHON COUNTY, WI.

Buchholz, T. W., A, *U. Falster*[2], *and W. B. Simmons*[2]. [1]1140 12th Street North, Wisconsin Rapids, Wisconsin 54494, [2]Department of Earth and Environmental Sciences, University of New Orleans, New Orleans, Louisiana 70148.

The Wausau Syenite Complex (WSC) is composed of four plutons, from the oldest (1565 Ma +3-5) (Van Wyck, 1994), most alkalic Stettin Pluton, through the younger and progressively less alkalic and more silicic Wausau and Rib Mountain Plutons, to the youngest (1505.9 ± 2.7 Ma (Dewane & Van Schmus, 2007), most silicic Nine Mile Pluton. The Nine Mile Pluton is locally cut by younger mafic dikes of several ages.

The first find of chevkinite-group minerals in the Wausau Complex was at a site just north of the Aspirus Hospital in Wausau, where phases of the Wausau Pluton near the contact with a large quartzite xenolith were exposed by quarrying to cut back a hillside. Small pegmatoidal veins and clots are exposed in the approximate center of the cut and are largely composed of feldspars, quartz, an unidentified amphibole, zircon and locally abundant grains of a usually more-or-less altered chevkinite-group mineral. Accessory minerals include apatite, monazite and allanite-(Ce). Both mafic and more felsic phases of the veins carry chevkinite-group minerals. The grains generally present a mottled, altered appearance that is probably the result of post-emplacement hydrothermal alteration. These altered grains range in color from dark yellow through reddish hues to dark glassy black. Highly altered grains are chalky white in color. Careful examination of heavy mineral separates nonetheless resulted in finding unaltered material suitable for analysis.

The second find of a chevkinite-group mineral was in a small long-abandoned and overgrown quarry site located near the SE corner of CTH O and U in the Stettin Pluton. The syenite here is cut by small, poorly exposed pegmatites, containing small glassy brown prismatic crystals of a chevkinite-group mineral associated with quartz, microcline, albite, biotite, aegerine, ilmenite, probable rhabdophane-(Ce), unusually heavy-rare-earth-element enriched xenotime-(Y), an unidentified amphibole, acicular fayalite, an euxenite-like Y-Nb oxide phase, and magnetite.

The final find of a chevkinite-group mineral was in heavy mineral separates prepared from a fine-grained, miarolitic phase of a megacrystic mafic dike cutting Nine Mile granite in the Ladick quarry. Clearly younger than the host granite, the mafic dike may be of similar age as a similar dike in the Koss quarry, classified as meladiorite, with a K-Ar age of 1307.2 +/- 41 Ma (Cordua (2004)). Associated minerals include amphiboles, biotite, chlorite, fluorapatite, and very rare columbite- and monazite-group species.

Most samples examined are metamict, so no determination could be made as to whether these minerals are chevkinite-(Ce) or perrierite-(Ce), two chemically similar members of the chevinkite group. It is, however, unlikely that any other chevkinite-group mineral is present. Electron microprobe analyses show that chevinikite-group minerals from each site exhibit a distinct chemical composition based on the rations of Nb + Ta versus Ti + Fe_{total} (Fig. 1). The most Nb + Ta-depleted samples are from the “Ladick meladiorite”. Samples most enriched in Nb + Ta are from the “Aspirus felsic syenite phase”, whereas those from the “Aspirus melasyenite phase” and the “Stettin syenite” exhibit intermediate Nb + Ta contents. It is interesting to note that although columbite-group minerals, as well as other Nb-Ta species, such as pyrochlore-group species, are abundant in the WSC, they are scarce at these locations. While the range in chemical variation is small, it may reflect the abundance of these elements in the melts, thus the degree of fractionation. Lastly, the “Ladick meladiorite” dike, which is not part of the WSC, is chemically similar and thus may have originated from a similar source as the intrusive centers of the WSC.

References:

Cordua, William S., (2004):. Enigmatic 1300 – 1400 Ma Mafic Pluton from the Koss Pit, Marathon County, WI [abstract]; *Institute on Lake Superior Geology Proceedings, 50th Annual Meeting, Duluth, MN, v. 50, part 1*, p. 48-49

Dewane, T. J., Van Schmus, W. R. (2007): U-Pb geochronology of the Wolf River batholith, north-central Wisconsin: Evidence for successive magmatism between 1484 Ma and 1468 Ma. *Precambrian Research*, V. 157, pp. 215-234.

Van Wyck, N. (1994) The Wolf River A-type magmatic event in Wisconsin: U/Pb and Sm/Nd constraints on timing and petrogenesis. *Institute on Lake Superior Geology, 40th Annual Meeting, Part 1, Program and Abstracts*, p. 81-82

Vlack, Silvio R.F., Gualda, Guilherme A.R. (2007): Allanite and chevkinite in A-type granites and syenites of the Graciosa Province, southern Brazil. *Lithos*, V. 97, pp. 98-121.

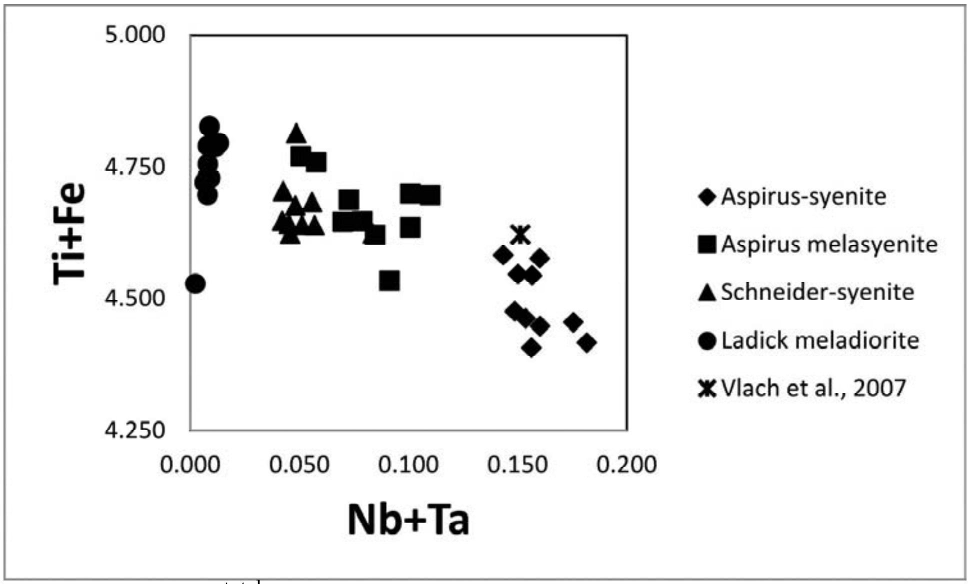


Figure 1. Nb+Ta versus $Ti+Fe^{total}$ for all sampling location and one example from Vlach et al., 2007.

CHEMICAL AND PHYSICAL CHARACTERIZATION OF WAVELLITE, $Al_3(PO_4)_2(OH,F)_3$, FROM THE NATIONAL LIMESTONE QUARRY NEAR MOUNT PLEASANT MILLS, SNYDER COUNTY, PENNSYLVANIA. *Cabaniss, K. and L. E. Kearns.* Dept. of Geology & Environ. Science, James Madison University, Harrisonburg, VA. 22807.

Specimen-quality wavellite occurs as yellowish-green, radiating spherules at the National Limestone Quarry (aka Lime Ridge), located near Mount Pleasant Mills, Pennsylvania. The quarry lies within the Siluria age Tonoloway formation and lower Devonian Helderberg group. This locality is part of a northeast to southwest trending belt of wavellite- rich localities located in eastern Pennsylvania. The original phosphate, probably derived from primary sources such as sedimentary apatite, was later remobilized by fluids in fractures along the Allegheny front, and not from biogenic sources.

Wavellite was first reported in the main limestone quarry in 2000. Quality specimens were collected in 2001 – 2002 after a road was constructed around the back side of the quarry passing through the sandy membe of the lower Helderberg group. The phosphate minerals form along the surface of fractures and within cavities Wavellite is the most common aluminum phosphate mineral found. Other minerals verified by XRD and EDS are variscite, planerite, cacoxenite , vauxite and turquoise. Excellent specimens of strontianite are also found the Sr-rich portions of the Tonoloway limestone.

SEM imaging and EDS analyses were used to examine the nucleation point of the wavellite spherules, and to explore how the crystals accommodate space outward from the nucleation site (point of origin). Individual crystallites of a spherule must either branch or widen to fill the expanding space created by outward growth. Careful measurements of individual crystals indicate that the crystals broaden as they grow outward.

Major chemical variation of wavellite is predominantly involved with the F – OH content. Fluorine ranges from 0% to 13. 6% by weight for end-member compositions. Multiple chemical analyses of 18 samples from this location indicate a relatively consistent composition, with little to no fluorine present. Fluorine was detected in only 6 analyses with a range of 4.75 to 9.16 Wt. % (average 6.85 Wt. %). The detection limit for light elements analyzed for 35 to 50 seconds is estimated to about 0.20 to 0.26 weight percent (Dunham & Wilkinson, 1978). Small amounts of Si, Fe and K often appear in the analyses, and probably originate from cla and/or quartz inclusions within the sample.

Minor chemical variations of vanadium and/or chromium are found to control the color of wavellite (Foster & Schaller, 1966; Hanson, et al., 2009). ICPMS analyses of five wavellite samples, ranging in color from nearly white to yellowish green, showed a Cr range from 1.25-7.8 ppm (avg. 4.5 ppm), V range from 14 - 324 ppm (avg. 99 ppm) and Fe from 73 – 594 ppm (avg. 323 ppm). For comparison, an analysis of a single, dark green sample of wavellite from Montgomery County, Arkansas yielded Cr 1.84 ppm, V 443 ppm, and Fe 61 ppm. The darker green, Arkansas sample had a significantly higher V content than the other five, lighter colored samples from Pennsylvania.

Microscopic examination of the samples shows concentric color banding within the radiating spherules Multiple EDS analyses taken along the length of single crystals showed no particular trend or change in chemical content. Concentrations of the chromophoric elements controlling the color zoning were either below the detection limits of the EDS, or the color variations are the result of variable oxidation states in the transition metals, which cannot be determined using EDS.

References:

Dunham, A. C. & F.C.F. Wilkinson, 1978. Accuracy, precision and detection limits of energy-dispersive electron microprobe analysis of silicates. *X-ray Spectrometry*, V. 7, p. 50-56.

Foster, M. D. and Schaller, W. T., 1966. Cause of colors in wavellite from Dug Hill, Arkansas. *American Mineralogist*, V. 51, p.422- 428.

Hanson, S. L., Falster, A. U., Simmons, Wm B., 2009. Blue wavellite from the De Linde quarry, Garland, County, Arkansas (abst.). *36th Rochester Mineral Symposium Program*, p. 15-16.

Figure 1. Intergrown wavellite spherules.

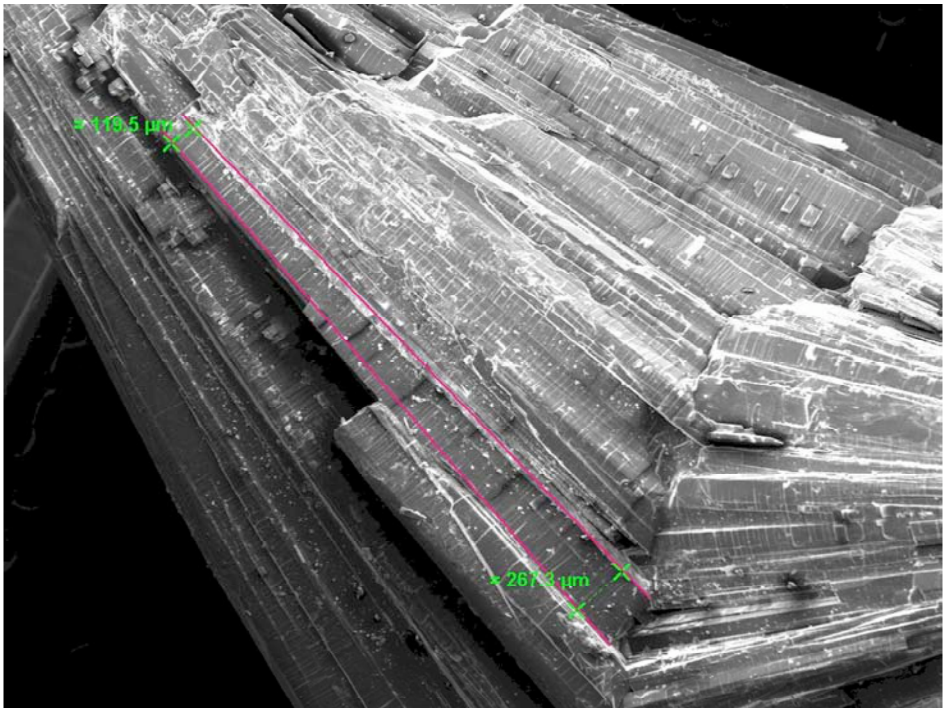


Figure 2. SEM photo of crystallite expansion.

PHLOGOPITE TRIPLETS FROM THE SELLECK ROAD OCCURRENCE, WEST PIERREPONT, ST. LAWRENCE COUNTY, NY.

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During 2010, excavations at the well-known Selleck Road occurrence east of West Pierrepont, NY, revealed a suite of minerals unusual for the locality. Although best known for green tremolite and dark brown uvite crystals, numerous other minerals occur along the contacts between calc-silicate metasediments and Grenville-aged marble. The new collecting occurred several hundred yards east of the parking area at the western base of the first east-west ridge. The various mineralized contacts contained crystals of albite, heulandite-Ca, marialite, microcline as a replacement of marialite, phlogopite, and uvite in addition to the calcite of the marble and the metamorphic reaction calcite along the contacts. The heulandite-Ca, not previously identified from this locality, probably represents a weathering product of the marialite.

Noteworthy are plentiful twins of dark brown phlogopite that resemble 3-bladed propellers or the Mercedes Benz symbol without the peripheral circle (Figure 1). Following the nomenclature of Rex (1964), we are using the term "triplets" to describe these multiple twins rather than trillings. The triplets were found as loose crystals, as matrix specimens, and embedded in calcite. When viewed along the c-axis some are as large as 5 cm, although most were one to two centimeters in diameter. Because of the perfect basal cleavage of phlogopite, many of the loose triplets are tabular. The tabular specimens are typically triplets on one side and untwinned phlogopite on the other or have the three blades of the triplet showing on both sides as part of one continuous triplet. Thicker crystals usually have triplets on both ends of the crystal and a zone of untwinned phlogopite in the center. The orientation of the two triplets reflects the two-fold axis in the point group 2/m to which micas belong. How these variants may relate to the uncleaved original crystal is shown in Figure 2.

These triplets are a variation of the star mica twins that have been found in open pockets in pegmatites in Brazil and Pakistan. They are unusual in that they formed during amphibolite-facies metamorphism while solidly encased in calcite rather than in an open space. They would seem to represent elongation along the *a* axis and twinning by rotation around both the [310] and [-310] axes with suppression of three of the resulting six blades to form a triplet. The three individuals of such twins share common (001) planes, and these are conformable with the (001) planes of the untwinned portion of the crystal aggregate. In addition, the *a*-axis of one twinned individual is parallel to the *a*-axis of the untwinned portion. Nespolo and colleagues (2000) have published a detailed theoretical treatment of this type of twinning in mica. We are uncertain why phlogopite at only one spot at this locality shows this unusual type of twinning given the relative uniformity of regional metamorphism of the area. While triplets of mica were previously unknown in macroscopic mineral specimens, they are apparently relatively common as submicroscopic authigenic mineralization (e.g. Rex, 1964).

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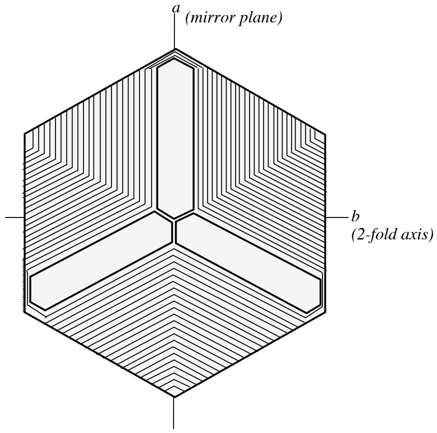

Figure 1. This idealized drawing of a phlogopite triplet shows the prominent three twin members at the termination and the gradual expansion toward the "hexagonal" girdle at the center of the crystal. Most actual crystals do not look very hexagonal in the middle.

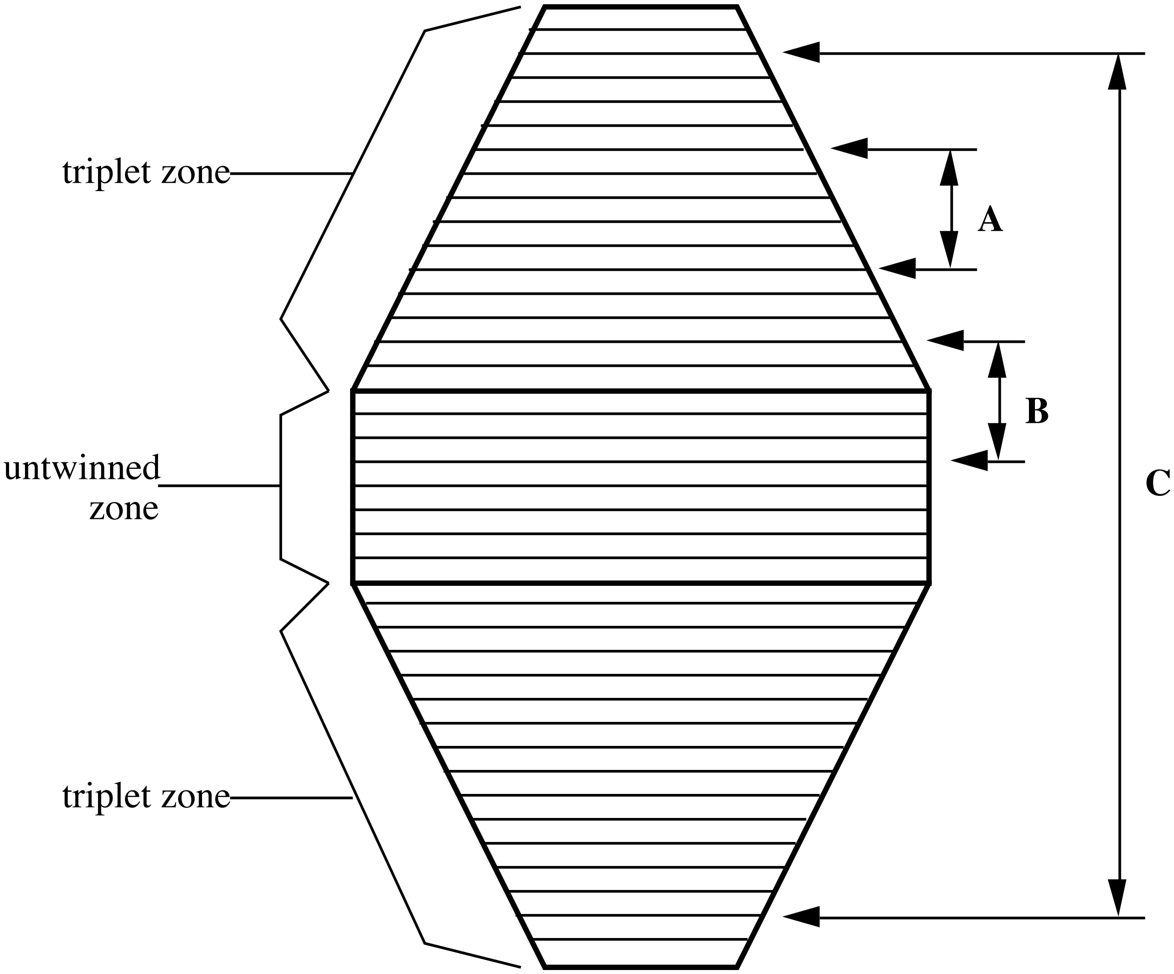

Figure 2. Schematic diagram showing how different cleavage planes produce three different kinds of triplets. The sketch is a tapered phlogopite xl viewed along the plane of cleavage (striations). If a triplet cleaves as indicated in A, then it will be a continuous single triplet from top to bottom. If it cleaves as indicated in B, then one end will be a triplet and the other end will be an untwinned plate of phlogopite. If it cleaves as shown in C, then there will be triplets on both ends, but they will be related by rotation around the *b* axis.

THE CRYSTAL STRUCTURE OF YOFORTIERITE

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Yofortierite was originally described as a new mineral from the De-Mix quarry, Mont St-Hilaire, Rouville County, Quebec. The structural formula proposed was $Mn_5Si_8O_{20}(OH)_2(OH_2)_4 \bullet 4\text{-}5H_2O$ (Perrault *et al*., 1975). This was based on the structure of palygorskite determined by Bradley 1940, and Gard and Follett, 1968. The mineral was found as early as 1969 as very fine, radiating fibers in pegmatite veins in the nepheline syenite, associated with analcime, sérandite, a eudialyte group mineral, polylithionite, aegirine, altered microcline, and albite (Perrault *et al*., 1975). The work on gjerdingenite-Na (Pekov *et al*., 2007) also listed steacyite, thornasite, natrolite, epistolite, thorite, brockite, fluorapatite, calcite, hemimorphite, and earthy Mn oxides as associations in the same environment. While conducting some identifications on Mont St. Hilaire material, one of the authors (M.B.) came across some coarser yofortierite crystals from the original find, registered in the Royal Ontario Museum (ROM) collection under sample number M34865. A single crystal measuring 10 x 20 x 220 microns was isolated and mounted for this determination.

The structure refined in C*2/m* to $R_1 = 4.9\%$ with a formula $Mn_5Si_8O_{20}(OH)_2 \bullet 8H_2O$ (Z = 2), isostructural with tuperssuatsiaite (Cámara, *et al*., 2002), $Na(Fe^{3+})_3Si_8O_{20}(OH)_2 \bullet nH_2O$ (Z = 2), and palygorskite (Post & Heaney, 2008), $(Mg,Al)_2Si_4O_{10}(OH) \bullet 4H_2O$ (Z = 4)**,** (C*2/m*).

The crystal used in the structure determination was cut in half, mounted and polished for Electron Microprobe Analysis. The chemical composition of the sample is consistent with the structural refinement.

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A NEW LOOK AT AN OLD LOCALITY: THE CHICKERING MINE IN WALPOLE, NH.

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The Chickering Mine is located in the Keene pegmatite district of southwestern New Hampshire. Recognized as one of a handful of complex lithium-bearing pegmatites in New Hampshire, the Chickering is an important locality. The pegmatite was mined for potassic feldspar for an unknown period of time prior to 1925 and was described in some detail by Page and Larrabee in the 1962 USGS publication *Beryl Resources of New Hampshire*. These authors noted that the Chickering pegmatite is well-zoned and contains two zones typified by a quartz-cleavelandite-perthite assemblage. The quartz-cleavelandite-perthite zones are the most mineralogically complex with both phosphate (triphylite, apatite and montebrasite) and lithia (spodumene and lepidolite) components. Black, blue and green tourmaline was also reported by Page and Larrabee and this occurrence has made the mine of importance to mineral collectors as colored tourmaline is extremely rare in New Hampshire given the large population of granitic pegmatites in the state.

Recently, a group of dedicated micromineral collectors has significantly augmented the number of reported mineral species from the Chickering pegmatite. Many of these additions are secondary phosphates derived from the alteration of primary phosphates (triphylite, montebrasite, apatite). Secondary phosphates that are likely related to the alteration of triphylite include: ferrisicklerite, heterosite, strunzite, laueite, rockbridgeite, beraunite, whitmoreite, vivianite and ludlamite. Secondary phosphates that are likely related to the alteration of aluminum-rich phases (montebrasite and/or muscovite) include: wardite, brazilianite, goyazite, paravauxite, gormanite and childrenite. Several other secondary phosphates related to the alteration of apatite, beryl or other phases have been identified: autunite, beryllonite, messelite-fairfieldite and moraesite. Late-stage apatite in a multitude of colors and habits frequently occurs in cavities in massive quartz in the quartz-cleavelandite-perthite zones of the pegmatite. Often these apatite crystals exhibit color zoning. In addition, a number of previously unreported accessory phases have been confirmed in this study. These include: cassiterite, pyrite, pyrrhotite, sphalerite, gypsum, rhodochrosite, zircon and opal var. hyalite.

Through the diligent efforts of a group of amateur mineralogists the Chickering Mine has the potential to become a significant pegmatite locality in New England in terms of number and diversity of mineral species.

Reference:

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A SECOND U.S. LOCATION FOR VÄYRYNENITE – THE ESTES QUARRY, WEST BALDWIN, MAINE AND NEW DATA ON VÄYRYNENITE FROM WISCONSIN AND PAKISTAN.

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Väyrynenite, $Mn^{2+}Be(PO_4)(OH)$, is very rare pegmatite mineral and typically occurs as rounded masses. Well-formed crystals are extremely rare and particularly fine examples to several centimeters in length have recently emerged from Pakistan. Väyrynenite was first described from the Viitaniemi pegmatite in central Finland (Volborth, 1954), and has since been found in a small number of other locations (Northern Pakistan and Afghanistan, near Kapelluden in Sweden, in the Bendada pegmatite near Guarda, Portugal, and in the Animikie Red Ace (ARA) pegmatite in Florence Co., Wisconsin. Väyrynenite is a very late-forming mineral, it commonly occurs an alteration product of beryllonite according to this sequence: beryllonite-hurlbutite-hydroxylherderite-väyrynenite (Volborth, 1954). Common associated minerals may include the following: beryllonite, hurlbutite, hydroxylherderite, amblygonite-montebrasite, fairfieldite, and eosphorite-childrenite, microcline, muscovite, tourmaline, quartz, topaz and cassiterite.

Recently, väyrynenite has been discovered in a pegmatite at the Estes Quarry, West Baldwin, Maine. Väyrynenite from the Estes Quarry is associated with siderite, a roscherite group mineral, childrenite-eosphorite, microcline, albite and quartz.

Microprobe analyses of väyrynenite from U.S. and worldwide locations (Fig. 1) indicate that all samples are Mn-rich, the Estes and Pakistani samples have the lowest Mn content, the ARA sample is the Mn-richest, and the type material falls approximately between the others. Both the Viitaniemi and the ARA sample show a slight enrichment in Ca. In the ARA, this follows a common trend, the spessartine is here also Ca-rich, which is likely related to partial assimilation of marble stringers in the country rock. It is unknown what the cause of Ca substitution is in the Finnish sample.

Representative analyses, based on electron microprobe analyses for all except the Finnish sample, are given below. Be and OH were calculated based on stoichiometry.

Estes, Maine: $(Mn_{0.709}Fe_{0.315})_{1.014}Be_{1.000}(PO_4)_{0.990}(OH_{0.969}F_{0.031})_{1.000}$
Shigar, Pakistan: $(Mn_{0.739}Fe_{0.274})_{1.013}Be_{1.000}(PO_4)_{0.993}(OH_{0.974}F_{0.026})_{1.000}$
Gilgit, Pakistan: $(Mn_{0.748}Fe_{0.240}Ca_{0.003})_{0.991}Be_{1.000}(PO_4)_{0.998}(OH_{0.999}F_{0.001})_{1.000}$
ARA, Wisconsin: $(Mn_{0.991}Fe_{0.032}Ca_{0.021})_{1.044}Be_{1.000}(PO_4)_{0.986}(OH_{0.980}F_{0.020})_{1.000}$
Viitaniemi, Finland: $(Mn_{0.84}Fe_{0.14}Ca_{0.02})_{1.00}Be_{0.98}(PO_4)_{0.99}(OH)_{0.96}$ (Mrose & von Knorring, 1959).

References:

Mrose, M. E and O. von Knorring (1959). The mineralogy of väyrynenite, $(Mn,Fe)BePO_4(OH)$. Zeits. Krist., **112**:275-288.

Volborth, A. (1954). Väyrynenit, $BeMn(PO_4)(OH,F)$, ein neues Mineral. Anzeigen der Österreichischen Akademie der Wissenschaften, Wien, Math. Naturwiss. Kl., **91**:21-23.

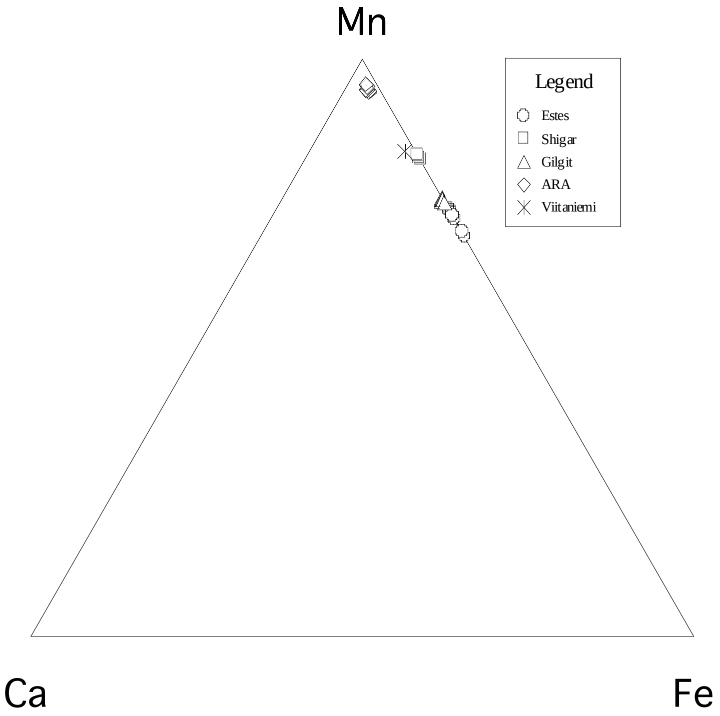

Figure 1. Ternary diagram of divalent cations in väyrynenite. (Based on electron microprobe analyses)

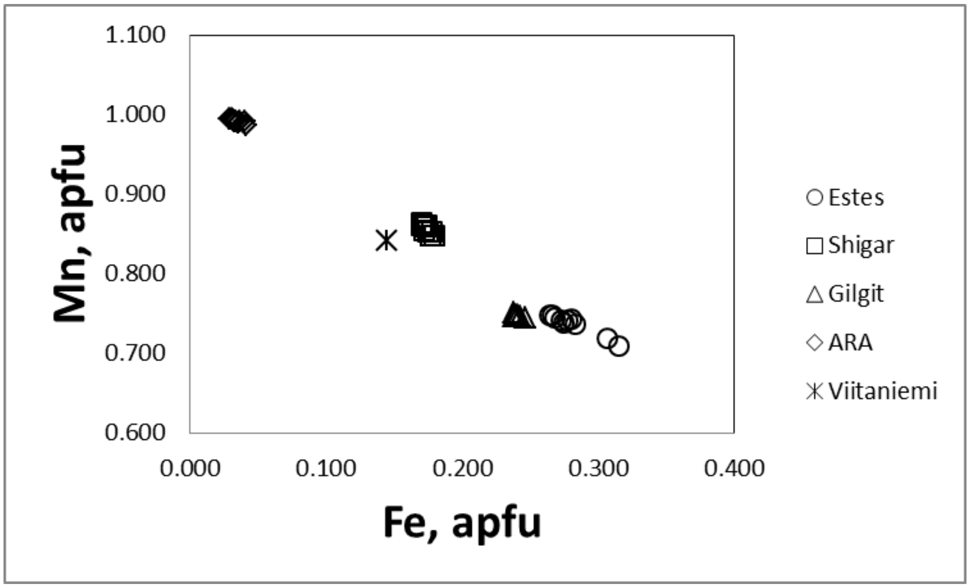

Figure 2. Mn versus Fe for the väyrynenites of this study, including data from Mrose and von Knorring, (1959).

"ALLANITE-(Nd)": A NEW MINERAL FOM THE KINGMAN FELDSPAR MINE IN THE MOJAVE PEGMATITE DISTRICT, NORTHWESTERN ARIZONA.

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The Kingman Feldspar pegmatite, located in the Mojave Pegmatite district in northwestern AZ, intrudes syn- to post-collisional Paleoproterozoic metamorphic and granitic rocks. This large, sill-like body trends N50-65°E, dips 60-75°NW, is ~460 m in length, and ranges in thickness from 20 to 60 m (Heinrich, 1960). Feldspar mining circa 1950's removed much of the pegmatite material, in some places down to the country rock leaving behind only minimal exposures of the wall and core zones. There are three large open cuts referred to as the A, B and C cuts with A being the northernmost cut.

This post-orogenic pegmatite is a rare-earth-element (REE)-enriched pegmatite that is strongly enriched in light-rare-earth-elements (LREE) and depleted in F, Nb and the heavy-rare-earth-elements (HREE). This is atypical of classic NYF pegmatites and has led to an unusual REE mineral assemblage. Allanite, [CaREE $Fe^{2+}Al_2(Si_2O_7)(SiO_4)O(OH)$] is the only REE mineral present and occurs as large, extensively fractured, pods or crude crystals up to nearly a half meter in size in the wall along the south face of cuts B and C. The individual crystals are dark brown to black in color, euhedral to subhedral, and reach ~25 cm in length. All of the exposed surfaces of allanite are coated with a reddish iron oxide crust and Nd-enriched bastnäsite-(Ce). Within the allanite are microscopic inclusions of thorogummite.

Electron microprobe analyses were initially recalculated on the basis of 6 M + T sites. Water was calculated to yield a total by stoichiometry (OH + F = 1). Subsequently, Fe^{2+}/Fe^{3+} was partitioned to yield a total of 25 positive charges. The species affiliation was confirmed using the combined expressions for the A2- and M3-sites as suggested by Ercit (2002) (Figure 1). Based on REE distribution, there are currently three allanite species recognized; allanite-(Ce), allanite-(La) and allanite-(Y). A plot of the three most abundant REE's (Figure 2) shows that allanite from the Kingman pegmatite is predominantly Nd-rich allanite-(Ce). However, some of the samples are Nd dominant, thus indicating a new species in the allanite group; "allanite-(Nd)". An average of 5 analysis of a Nd-dominant sample yields the following formula:

$$(Ca_{0.90}Mn_{0.05}\square_{0.05})_{\Sigma 1.00}(Nd_{0.30}Ce_{0.24}Ca_{0.16}La_{0.15}Pr_{0.07}Sm_{0.04}Th0_{0.02}Yb_{0.01}Y_{0.01})_{\Sigma 1.00}$$
$$(Fe^{2+}_{0.99}Mn_{0.05}Mg_{0.04})_{\Sigma 1.08}(Al_{1.53}Fe^{3+}_{0.44}Ti_{0.04})_{\Sigma 2.01}(Si_{2.99}Al_{0.01})_{\Sigma 3.00}O_{12}(OH_{0.99}F_{0.01})_{\Sigma 1.00}$$

This leads to the general formula [$CaNdFe^{2+}Al_2(Si_2O_7)(SiO_4)O(OH)$].

The unusual extreme LREE enrichment and HREE depletion of the Kingman pegmatite may be the result of either (a) having been formed by partial melting of within-plate granites where the HREE were sequestered into residual garnet, thus these elements remained in unmelted mantle residuum and are depleted in the pegmatitic melts or (b) HREE were partitioned into a late-stage fluid that was subsequently lost to the system. The former process is favored because, while the latter is common in pegmatites, the absence of fluorine to act as a HREE complexing agent, as well as the absence of HREE-enriched minerals in either the quarry or the dump material, suggests that they were never present. Furthermore, the significant Nd enrichment likely reflects the source composition of the protolith but is poorly understood.

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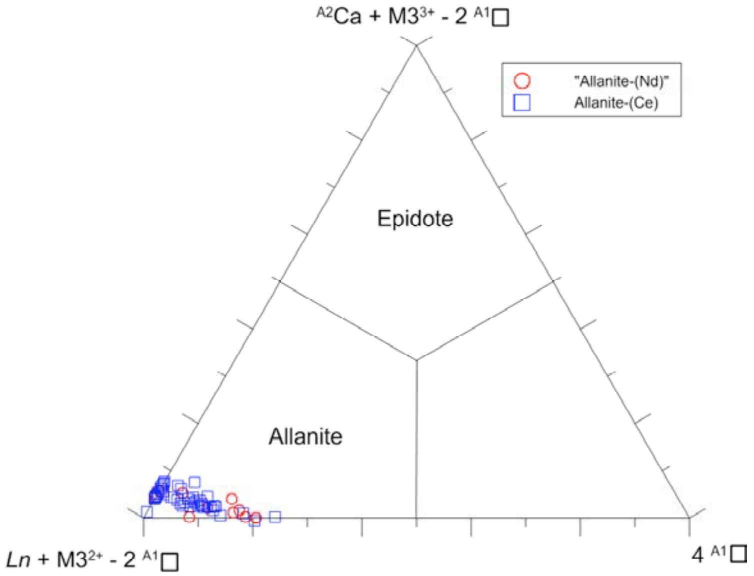

Figure 1. Chemical variations in Kingman Feldspar Mine allanite based on the discrimination variables for REE bearing members of the epidote group. After Ercit (2002).

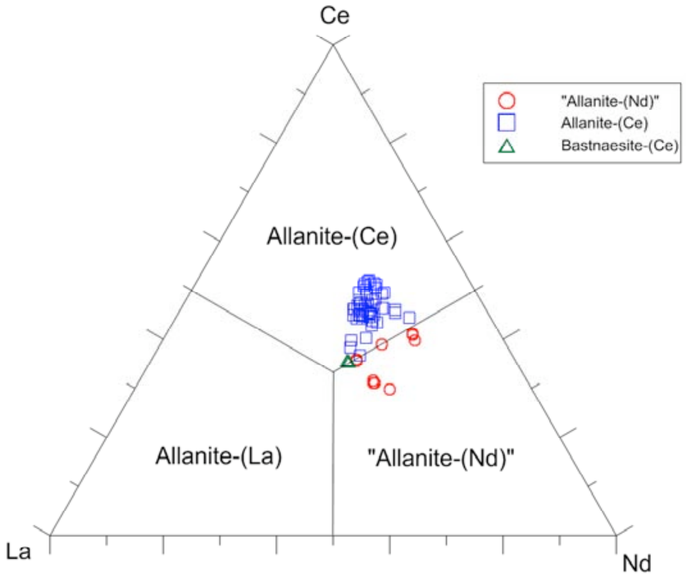

Figure 2. Distribution of the three dominant REE in the A-2 site of allanite from the Kingman Feldspar Mine.

THE COLORS OF SUOLUNITE FROM THE LAC D'AMIANTE MINE, QUEBEC.

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The Royal Ontario Museum (ROM) mineral collection contains the largest quantity of suolunite [$Ca_2Si_2O_5(OH)_2 \cdot H_2O$] of any known collection. Currently there are 27 registered specimens with the largest piece measuring 50x30x10 cm. The specimens were acquired in 2000 and originated from the Lac d'Amiante mine, Quebec, Canada. Well known as an asbestos mine, the locality is also home to many colorful varieties of suolunite (see Amabili et al. 2009).

The locality contains the metasomatized remnants of ultramafic rocks, thought to be part of an ophiolite sequence (Amabili et al. 2009). Minerals found directly associated with the suolunite include: tobermorite [variable; $Ca_{5-x}Si_6O_{17-2x}(OH)_{2x} \cdot 5H_2O$], andradite [$Ca_3Fe_2(SiO_4)_3$], aragonite [$CaCO_3$], wollastonite [$CaSiO_3$], akermanite [$Ca_2MgSi_2O_7$] and serpentine group minerals.

The range in suolunite colors includes white, gray, purple and a magnificent blue variety. The cause of color in suolunite has never been studied in past work. X-ray maps of suolunite thin sections, obtained from scanning electron microsope (SEM) energy dispersive spectroscopy (EDS), and electron probe microanalysis (EPMA) suggested a possible correlation between minor or trace element content and coloration. However, observations of the trace element content at the parts per million (ppm) level were required to confirm these observations.

Trace element analysis was accomplished using laser ablation inductively coupled plasma mass spectrometry (LA ICP-MS). A Thermo Elemental (VG) PlasmaQuad PQ ExCell ICP-MS coupled to a Nu-Wave UP-213 Laser Ablation Microscope was used at the University of Toronto. Six line scans were run on three colors of suolunite. We were able to measure concentrations of Na, Mg, Al, K, Mn, Fe and Sr. Figure 1 shows the most striking differences in trace element composition. White suolunite tends to be relatively high in Mn and Al. Purple soulunite is the only color to show significant Sr content. Gray suolunite is the only color to show no observable Na. Although the exact mechanism for coloration is unknown, these differences in Na, Al, Mn and Sr show obvious correlations with color.

Distinct crystals of suolunite in such a variety of colors have not been observed from any other locality. This collection offers a wide variety of beautiful specimens for display purposes and provides a unique opportunity to study the cause of color variability in minerals.

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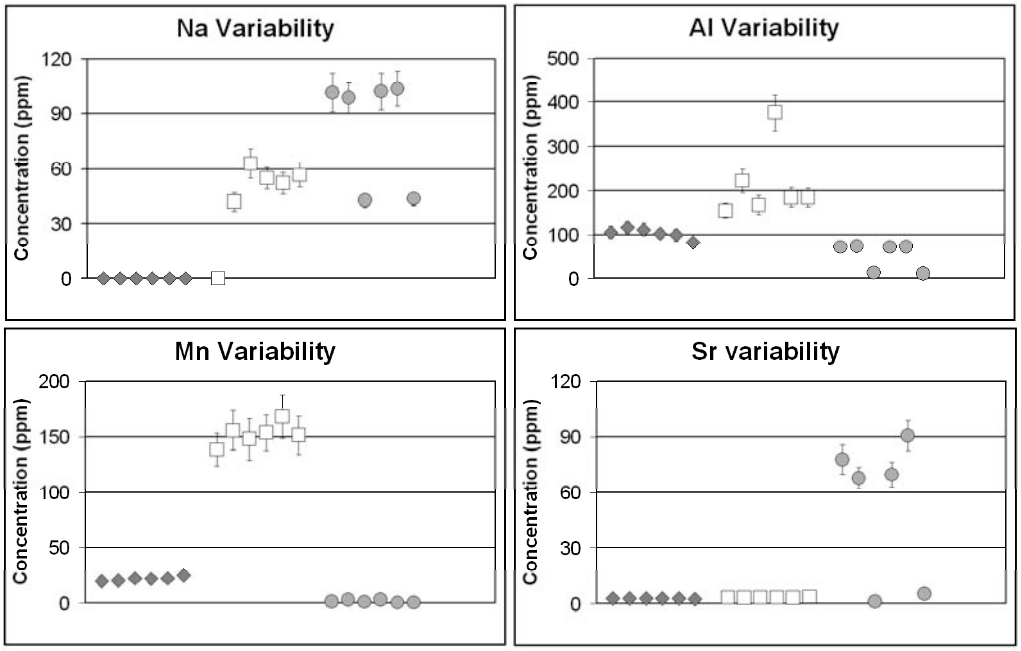

Figure 1. Variability in trace element composition correlated with color. Filled diamonds represent gray suolunite, white squares represent white suolunite and filled circles represent purple suolunite. Each data point denotes a single line scan.

FRACTURE-HOSTED SECONDARY PHOSPHATE MINERALIZATION AT THE CROOKER GEM PEGMATITE, NEWRY, MAINE, USA.

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The Crooker Gem Pegmatite, Newry, Oxford County, Maine has been mined sporadically since 1930. Starting in 2004, it has been mined by Plumbago Timber and Quarries LLC. During the exploration and recovery of gem tourmaline, the pegmatite yielded a large number of species heretofore unknown for the locality, including several that are known from only several other worldwide locations and several species whose identities remain unknown.

The Crooker Gem Pegmatite is exposed at the summit of Halls Ridge a small knoll downslope from Plumbago Mountain-Puzzle Mountain. The pegmatite was core-drilled and mapped by Barton and Goldsmith (1970). The pegmatite has extensive development of horizontal fractures interpreted as post-Pleistocene sheeting. The fractures are extensively coated by drusy to coarsely crystalline dark blue vivianite and by earthy to waxy botryoidal medium olive brown mitridatite. Autunite formed thin films on many fractures although that mineral was generally seen only in ultraviolet investigations at night. There is little obvious source material to yield autunite: uraninite, uranophane, and schoepite are very rare. This is the first reported occurrence of extensive fracture hosted phosphate mineralization in the northern Appalachian Mountains.

Chemical analyses of the secondary phosphates are few. King and Foord (1994, 2000) report a small phosphate suite with the most notable species being zanazziite (EDAX and XRD), which occurred in world-class specimens uncovered in the early 1990's. Recently observed species exposed by new work of Plumbago Timber and Quarries LLC have expanded the mineral list to 68 of which over 55 are separate species.

Primary phosphate masses which have been observed in the pegmatite include triphylite (to 10 cm), fluorapatite (to 1 cm), and montebrasite (to 15 cm). Both triphylite and montebrasite occur in last-stage cleavelandite bearing zones, while fluorapatite is volumentrically the most important. Because of the widespread occurrence of fluorapatite in the pegmatite, it is interpreted to be the most important source of re-mobilized phosphate. Because the pegmatite is extensively sheeted, the mineralization owes its diversity to groundwater action.

The fractures which host vivianite are mineralogically simple and rarely have another phosphate species associated. The mitridatite coated fractures are phosphate species-rich. Paragenetically, the mitridatite is the first developed phosphate in the fracture followed by jahnsite, laueite, phosphosiderite, pseudolaueite, rockbridgeite, stewartite, strunzite, whitmoreite, and xanthoxenite. The latter phosphates are essentially coeval with overlapping formation. Fluorapatite, eosphorite, hydroxylapatite, hydroxylherderite, and zanazziite are found in the Crooker Gem Pegmatite, but are not found in late fractures.

The most important mineralization in the mitridatite coated fractures may be a large suite of presently unidentified species. The species are composed of flat lying tightly intergrown crystals. Unknown A consists of light tan to light yellow brown blocky striated rod-like to prismatic crystals with waxy luster in flat-lying groups. Unknown B consists of orange brown angular to blocky crystals with subviteous luster in tight clusters. Additional minerals are present in small quantities which are under investigation.

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RARE EARTH ELEMENT (REE) AND YTTRIUM MINERAL POTENTIAL OF NEW YORK.

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Though REE deposits are abundant in many countries around the globe including the U.S., China has dominated production over the past 20 years. Despite containing only 37% of proven global REE reserves, China provides 97% of the world's supply. If China cuts its export quotas for rare-earth minerals by more than 11% in the first half of 2011, new or revised sources of REE need to be found. The mineralogical survey of New York State shows three potential sources for the REE and yttrium minerals: Grenville-age magnetite, pegmatite, and vein deposits.

The iron deposits from the eastern Adirondacks have a complex mineralogy and contain magnetite, hematite (martite), *fluorapatite*, *stillwellite-(Ce), allanite-(Ce), monazite-(Ce)*, edenite, actinolite, ferro-actinolite, scapolite, titanite, and zircon in the main ore. Minor tiny (micron size) phases of secondary thorite, *allanite-(Ce), parisite-(Ce)*, and *monazite-(Ce)* in some apatite crystals were recognized under the polarizing microscope and by SEM – EDAX in thin/polished sections. *Bastnaesite-(Ce)* was previously reported but not identified by the authors. *Lanthanite-(Ce)* was detected based on the electron microprobe and structural data.

Fluorapatite, as a REE-bearing mineral, displays distinctive concentric zoning or dissolution under SEM and CL. Backscattered electron images highlight four major types of *fluorapatite - monazite-(Ce)* relations as result of the fluid-rock interaction: *a)* fractured *fluorapatite* with tiny secondary *monazite-(Ce)* and thorite developed along fractures; *b) fluorapatite* grains mantled *by monazite-(Ce)*, *monazite-(Ce)* intergrown with magnetite or *allanite-(Ce)*; *c)* tiny patches of zoned *fluorapatite* more or less with the same crystallographic orientation in larger *fluorapatite*, and *d)* areas with relatively low back scattered electron (BSE) intensities within brighter *fluorapatite* or along crystal rims. *Monazite-(Ce)* is low in *xenotime-(Y)* component but large amounts of La and Nd substitute for Ce. Yttrium is largely retained in the *fluorapatite*. We consider that *monazite-(Ce)* formed at T of 700˚C-800˚C (based on Zr-in-titanite and Ti-in-zircon temperatures).

Stillwellite-(Ce) has a unique occurrence in the USA at Mineville (Essex County). The mineral was identified in a sample collected from the "Old Bed" in the vicinity of a fault on the 2100-feet level, where it occurs as 1-2-mm-wide tabular crystals with waxy luster and pink to reddish color. It is associated with *fluorapatite* and magnetite.

Pegmatite deposits of New York contain REE bearing minerals such as *allanite-(Ce)*, *chevkinite-(Ce), fergusonite-(Y)*, *monazite-(Ce)*, *polycrase-(Y)*, *xenotime-(Y),* and *zircon.*

Allanite-(Ce) is not an astonishing mineral, but it has to be mentioned here because is common in the pegmatites from the Adirondack Mountains. The largest crystals were described at Mineville in small pegmatite dikes as 20 – 25 cm long, 6 to 20 cm wide and 2.5 to 5 cm thick crystals.

Chevkinite-(Ce) occurs as rounded isometric or elongated, dark red-brown patches from 1 mm to 1 cm in size surrounded by a very thin, white rim mainly composed of cryptocrystalline silica and a mixture of Ti oxide.

Fergusonite-(Y), collected from the Roe Spar pegmatite occurs as clusters of crystals from 3 to 6 cm in length, with a fan-shaped radial sections, adamantine luster and brown color. It also forms intergrowths with *allanite-(Ce).*

Monazite-(Ce) was found at Batchellerville and Overlook Quarry in the southern Adirondacks and in some small pegmatite bodies at Bear Mountain (Hudson Highlands). *Monazite-(Ce)* from Batchellerville contains up to 18.70 % ThO_2.

Polycrase-(Y) was described from Day pegmatite, Saratoga County. It occurs as small dark greenish to brown black tabular crystals associated with quartz, feldspar and /or tourmaline. It shows as dominant forms pinacoids and domes and rare prisms and pyramidal faces.

Hydrothermal veins containing *kainosite-(Y)* associated with *Ce-bearing epidote* and *bastnaesite-Ce* with quartz were found near Long Lake, Hamilton County and Trout Brook Valley, Essex County in the Adirondacks.

CHEMICAL CHARACTERIZATION OF NORTHERN VIRGINIA APOPHYLLITE, $(K, Na)Ca_4Si_8O_{20}(OH, F)\cdot 8H_2O$.

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The Northern Virginia, Triassic-Jurassic diabase sheets of the Newark-Gettysburg-Culpeper Basin were emplaced during the rifting event that accompanied the opening of the Atlantic Ocean. Hot thermal fluids accompanying these intrusions deposited minerals along existing fracture and joint surfaces. The outstanding specimens of white to clear apophyllite crystals on bright green prehnite are among the world's finest.

Apophyllite is separated into three species - apophyllite-(KOH) (hydroxyapophyllite), apophyllite-(KF) (fluorapophyllite), or apophyllite-(NaF) (natroapophyllite) - by chemical composition. Substitution of Na for K is not common, and F can range from 0% to 2.09% by weight for ideal compositions. Previously, there has been little work done on the chemistry of the northern Virginia apophyllites. Work done on Centreville quarry apophyllite by Dunn (1978) suggested that the crystals were a physical mixture of apophyllite-(KOH) and apophyllite-(KF) with both end-members occurring as phases within a single crystal. Numerous references and labels list northern Virginia specimens as apophyllite-(KF), but we do not find that to be the case. Only a few samples from the Centerville quarry and the Bull Run Quarry contained any detectable fluorine. The detection limit for light elements analyzed with the EDS for 100 second count time is estimated to about 0.05 to 0.26 weight percent (Dunham & Wilkinson, 1978). With a count time of 30 to 50 seconds, the detection limit for F would be closer to 0.20-0.26.

Apophyllite samples were selected from 8 northern Virginia quarries including locations in Loudon, Fairfax, Fauquier, and Culpeper counties. Chemical analyses of more than 60 samples were obtained using polished samples and an Oxford, Inc. energy dispersive X-ray spectrometer (EDS) working on the INCA platform. Individual crystals were generally analyzed 3 to 5 times across the crystal from rim to core to rim to gather evidence for potential chemical zoning. All analyses were mathematically adjusted to compensate for the 16 to 17 hydrogen atoms per formula unit that are not included in the initial, normalized EDS analysis. Atoms per formula unit were then calculated using the adjusted weight percent data.

No significant compositional difference was found between white, clear or tan crystals. There was also no significant difference between fluorescent and non-fluorescent samples. Overall, the data showed consistently low values for O. We speculate that these lower oxygen values might result from partial dehydration, either *in situ* or after collection. The analytical data indicate that the northern Virginia apophyllites are relatively consistent in composition from quarry to quarry, and are almost entirely apophyllite-(KOH). Sodium was detected in very small amounts in only two analyses.

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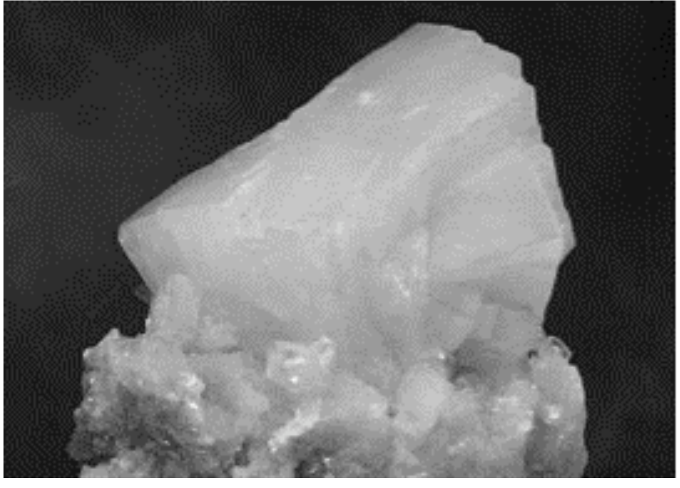

Figure 1. Apophyllite-(KOH) from the Centreville Quarry, Fairfax Co., VA. The specimen is 7 cm across.

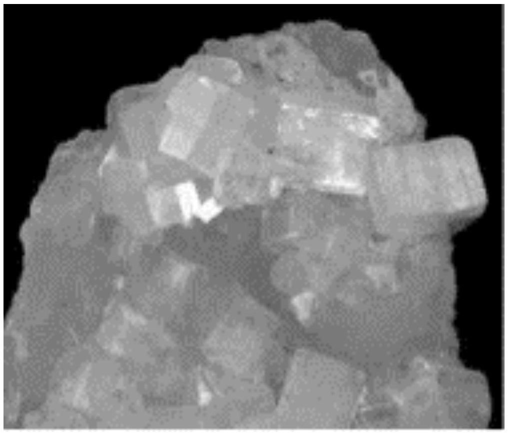

Figure 2. Apophyllite-(KOH) crystals on prehnite from the Centreville Quarry, Fairfax Co., VA. The specimen is 3 cm across.

TESTING FOR QUARTZ TWINNING WITH A LASER POINTER. <u>B. Morgan</u>.

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Crystal faces can be identified using reflections from a laser pointer provided two of them are adjacent and reflect enough light. There are, however, circumstances where the faces to be compared are not adjacent, one of which is that of rare inclined c-axes quartz twinning. Many of those twin laws require a plane of the surface of one individual to be parallel to a plane of a surface of the other individual. These are key morphological features for confirming the twin relationship, even though such faces rarely are adjoining.

In order to test such relationships a milling table was used to shift specimens sideways from the face of one individual to the face of the other before a laser beam. Intervening faces or gaps between the two faces were bridged while not changing the orientation of the specimen in any other way. The reflections of the two faces were marked and compared. Results were best when the first reflection could be arranged to be right above the laser pointer on a screen perpendicular to the laser beam and parallel to the motion of the milling machine.

For quartz this method is aided when a reflection off a prism face is involved, because the striation pattern on the prism face results in a streak parallel to the crystal c-axis (perpendicular to the striations). Thus in testing for the Goldschmidt, Breithaupt or Zwickau Laws which (like the Japan Law) have parallel prism faces, two streaks can be marked that should intersect at the angle of the twin law. At the intersection there should be a bright spot on each streak.

When pyramid face reflections are to be tested for parallelism, as in two pairs of faces of the wide, complementary angle of the Japan Law or of one pair of the Reichenstein-Grieserntal Law, the spot of one should coincide with that of the other. And when the parallel relationship of a prism face of one individual is to be tested for parallelism with the pyramid face of the other, as in the Zinnwald Law, the spot of the pyramid face should appear on the brightest part of the streak from the prism face.

Results:

Two specimens with parallel prism faces proved not to have twinning. Both involved overgrowths of one smaller crystal on another. Though the prism faces were roughly parallel (some twisted and blocky growth was evident) their reflections did not intersect at the angle of a twin law.

A very sharp Japan Law y-twin from Peru had pyramidal face reflections that coincided exactly. A rather skewed specimen from Arkansas had reflections that deviated enough to doubt twinning.

A specimen from Nevada had slight deviations in reflections from those required by the Zinnwald Law.

These latter two specimens raise a problem in using this method. The faces involved are rather far from their twin boundaries. One circumstance leading to twinning (relatively high supersaturation) also leads to greater distortions in crystal growth and possible slight changes in orientations of the tested faces. Some Japan Law twins show such distortions in reflections further away from the twin boundary.

The other significant limitation is the lack of clear reflections from faces that have been etched either naturally or in cleaning. Their reflections result in large diffuse spots with no apparent center. One Reichenstein-Grieserntal twin from Montana thus goes unconfirmed.

HYDROXYLHERDERITE AND HERDERITE FROM BRAZIL, MAINE, NEW HAMPSHIRE, AND NAMIBIA.

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Herderite, $CaBePO_4(F)$, and hydroxylherderite, $CaBePO_4(OH)$, are the two endmembers in this series. Whereas hydroxylherderite is abundant in many pegmatites, herderite is notoriously elusive. Herderite was first reported by Haidinger in 1828 from the pegmatites around Ehrenfriedersdorf in Saxony, Germany. The first report of true herderite is an analysis of a cut gem (Dunn & Wight, 1976), said to have been found in Brazil. A find of herderite with up to 7.25 wt. % F from the Yichun granite in China (Huang et al., 2002) was the first modern and reliable evidence that herderite does exist. In 2008, Harlow and Hawthorne reported herderite from Mogok, Myanmar with over 8 wt. % F. Greater than 5.86 wt. % F is needed to cross over into the herderite field, thus the Mogok and Yichun samples are definitely herderite.

A recent study of CaBe phosphates from several locations in Maine (Emmons, DumperDew, Bennett, and Mount Mica quarries), New Hampshire (Palermo # 1 pegmatite), Namibia (Erongo Mtns.) and one location in Brazil (Medina), yielded both hydroxylherderite and herderite. The samples from Medina consist in part of herderite. There is evidence that the F-rich portions are on the interior of the grains and hydroxylherderite forms the rims. Among the other samples studied, the Erongo samples are the next highest in F content, followed by the Emmons, Bennett, Mount Mica, Palermo #1, and DumperDew locations.

Hydroxylherderite, and presumably, herderite, are typical miarolitic cavity minerals which rely on the F supply essentially from the fluids present in the cavities. Typical associations include fluorapatite, muscovite, tourmaline, topaz and fluorite.. The presence of these species can indicate very high F activity at the time of formation. It is possible that competition for F occurs among these species and as hydroxylherderite forms late, most of the F may have been consumed by the other F-bearing mineral species. Thus, only in those rare cases where F is left over after all other F-bearing species have finished growing, will herderite have a chance to form.

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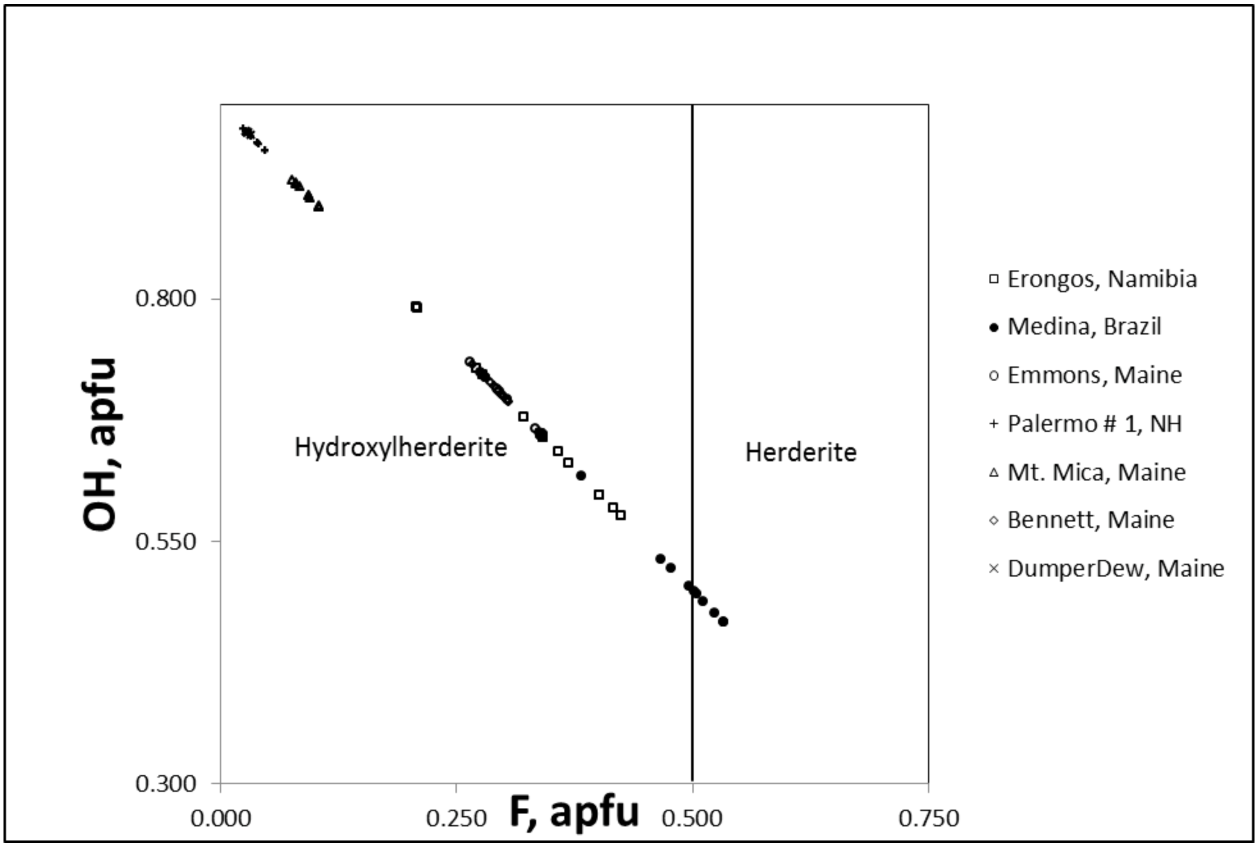

Figure 1. Plot of OH^- versus F^- in herderite and hydroxylherderite samples from seven localities.

UNUSUAL SPIRAL INCLUSIONS IN CRYSTALS.

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Numerous crystals have been observed by the authors that exhibit interesting spiral inclusions; some quite spectacular. These include beryl, topaz, and spodumene. Many of these inclusions are visible without magnification, with lengths up to many centimeters and widths in millimeters. In certain cases, most common in emerald, the morphology is that of a double helix (Vuillet and Rotlewicz 2001). Some authors have referred to these as screw dislocations, however, the lateral dimensions and morphology of these inclusions is atypical for screw dislocations. Although dislocations can have lengths on the order of centimeters their lateral dimensions are usually in the Angstrom or nanometer range. Thus, optical detection is usually not possible. Furthermore, most screw dislocations are straight features. Although they are commonly observed to change orientation along their length, generally due to movement (creep) as a result of strain, screw dislocations do not generally form a helical morphology.

There are, however optically observable manifestations of screw dislocations in crystals. The microtopography on crystal faces may exhibit growth spirals and hillocks that are the result of a growth mechanism associated with screw dislocations. Another example is the preferential etching along dislocations. Etch pits and the less common etch channels can be macroscopic signs of dislocations (Authier and Zarka 1977). The lateral dimensions of these features can be many orders magnitude larger than the associated dislocations, thus making them optically visible.

Although less common, dislocations with a helical morphology have been observed, and an extensive physics and materials science literature about these exists. Observations of helical dislocations minerals, including fluorite, cuprite, olivine, garnet and sapphire, have been published (Amelinckx et al. 1957; Caslavsky, and Gazzara 1971; Veblen and Post 1983). The mechanisms of their formation are debated, however, most authors propose that helical dislocations form from movement, climb and glide, of previously straight screw dislocations due to thermal or compositional stresses (Weertman 1957).

Microscopic observations of spiral inclusions in several samples (Fig. 1 and 2A) indicate that these are hollow and may be partially filled with some other solid phase. In the case of the hollow spiral in the topaz pictured in Fig. 2A there is a very fine and detailed microtopography on its inner surface. Precise repetition is observed not only in the helical repeat but also in the microtopography on adjacent segments of the spiral.

Although speculative, the authors propose that the observed, macroscopic spirals are the result of natural post growth etching or decoration, coeval with growth, of helical dislocations and the strained region of the crystal structure around them. If the dislocation offset (Burgers vector) and associated strain is large then etching may occur only along the defect with little affect to the rest of the crystal.

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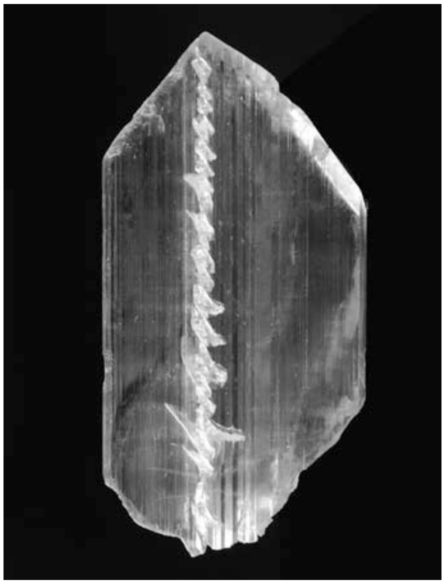

Figure 1. Spodumene crystal with spiral inclusion, approximately 12 cm long, from Laghman, Afghanistan.

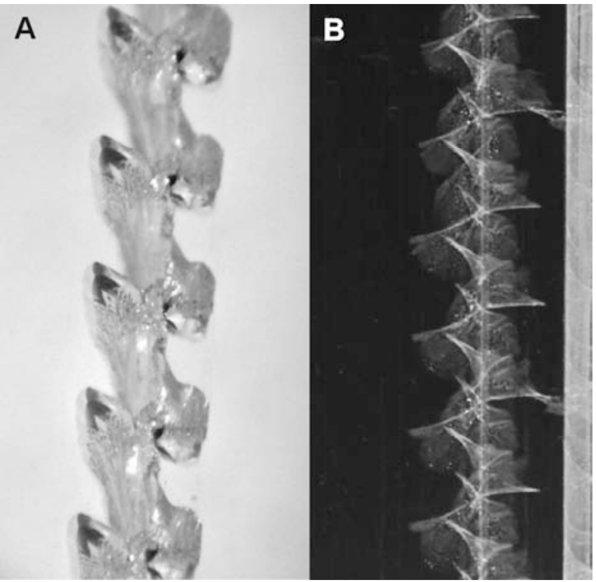

Figure 2. Magnified images of spiral inclusions in A) topaz B) beryl. The repeat distance on the topaz spiral is 0.632(11) mm. Note the repetition of fine structure.

TRACKING DOWN THE TRUTH OF PEROVSKI.

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Recently, I was assigned the question: "Who is the mineral perovskite named after, and why is he important in mineralogy?"

A quick internet search of perovskite brings up Wikipedia's entry noting that the mineral was discovered "by Gustav Rose in 1839 and is named after Russian mineralogist L. A. Perovski (1792–1856)." Mineral Data Publishing says the mineral was so named "to honor Count Lev Alekseevich Perovskii (1792–1856), Russian mineralogist." And the quote "named it after the famous Russian mineralogist Count Lev Aleksevich von Perovski" is repeated word-for-word in dozens of papers, texts, and websites: "Ceramics for catalysis" in the *Journal of Material Science*, *Micromechatronics*, and education websites belonging to Florida State University, Brock University, San Jose State University, and University Hannover, just to name a few.

What was Count Lev Aleksevich von Perovski famous for exactly?

Why was he important in mineralogy?

Marina L. Moisseeva at the Fersman Mineralogical Museum in Moscow wrote in her paper "Petr A. Kochubei and his Mineral Collection" that "Lev Alekseevich Perovskii, Vice-President of the Appanage Department (1852–1856), contributed to development of mining industry in Russia, inspected supplies and working of lapidary works; many new deposits started to be mined by his initiative. At the same time, he was an ardent collector; one of his hobbies was minerals and precious stones. He used to take advantage of his rank to fill his collection." Moisseeva cites (Semenov, Shakinko, 1982), referring to V.B. Semenov and I.M. Shakinko who co-authored the book "Ural Gemstones: from the History of Gemstone Cutting Business in the Urals."

Another text, "Four Centuries of Geological Travel: The Search for Knowledge on Foot, Bicycle, Sledge and Camel." written by P.J Wyse, and published by the Geological Society Vol.287 (2007) gives this information:

> "...four of which he gave names to honour people he had met in Russia who had been most supportive of the expedition; Perovskite (after Vice President Lev Aleksejevic von Perovski

(1793-1866) of St Petersburg)..."

Wyse provides this firsthand source from Rose himself: (Rose 1837-1842, 1, p524), probably referring to "Mineralogischgeognostische Reise nach dem Ural, dem Altai and dem Kaspische Meere" (1837) Vol. 1. The closest I have been able to find this text in anything other than German is an article in "The Foreign Quarterly Review Vol 20".

Further research brought me to Prof. Dr. Arkady E.Glikin of St. Petersburg State University. He sent me the following excerpt from the Great Soviet Encyclopedia:

"Russian count Lev Perovsky was a famous statesman of the emperor Nikolay I time, and an officer of the Ministry of Regions at the time Gustav Rose named the mineral perovskite after him."

So, it appears that the truth is Gustav Rose named the mineral after a helpful local bureaucrat with noble lineage who would later become famous for paving the way for advancements in the mineralogy field as well as putting together a valuable collection of precious gems.

HOLLOW GALENA FROM THE SEPTEMVRI MINE, MADAN ORE FIELD, RHODOPE MOUNTAINS, SMOLYAN OBLAST, BULGARIA.

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Crystals of hollow galena from Madan, Bulgaria first appeared at the Denver and Munich mineral shows in 2008. In these crystals, the faces and center are not present, only the edges and corners. In October 2009, a message was posted to mindat.org asking for opinions on whether these pieces could be fakes, created using micro-abrasion. At the Houston mineral show in April-May 2010, mineral dealer Edward Rosenzweig had several specimens of hollow galena, which he stopped selling as soon as he heard about the controversy surrounding them. He provided five reportedly natural specimens to use in this investigation. Another person anonymously donated two samples that were created through a micro-abrasion process.

The five specimens thought to be natural were soaked in acetone for 48 hours and microscopically examined. The samples were also examined under short, medium, and long wave ultraviolet light. No indication of glue was observed. Most specimens have at least one crystal face located close to another crystal or to the matrix. Invariably, these faces were left untouched, suggesting human-assisted formation. Two of the specimens thought to be natural had chlorite inside the hollowed interior, and another had a small calcite crystal protruding into the center – suggesting that the pieces could be natural. All five of the supposedly natural samples have a series of parallel, curved ridges on the interior surfaces of the galena crystals. The two pieces that are definitely man-made also have the same pattern of curved lines, which again suggested human-enhanced formation.

The interior surfaces of three different samples (one man-made, two reported as natural) were examined using a Scanning Electron Microscope at the James Madison University SEM/EDS Regional Facility. At high magnification the interior surfaces of both the man-made and "natural" pieces were extensively covered by tiny spherical indentations, presumably formed by a micro-abrasion process. Undisputable evidence was further provided by the presence of tiny (15 – 20 um), multiple glass spheres partially embedded on the interior surface of the galena. One of the "natural" samples examined with the SEM retained small (20um), euhedral crystals of an aluminum silicate. These small crystals were presumably used as the micro- abrasive.

The two reportedly natural specimens examined with the SEM, were definitely fakes. This does not prove that all hollow galena crystals from this locality are fakes. There are extremely skeletal or hoppered galena crystals that are real, and there are also natural ones that are only hollow down one axis. An insufficient number of crystals were tested to draw a conclusion about all of the pieces. It is quite possible that there are similar natural specimens in existence, but for now, it is known that some skeletal galena crystals from the Madan, Bulgaria locality are fake.

BOBDOWNSITE, A NEW MEMBER OF THE WHITLOCKITE GROUP, FROM BIG FISH RIVER, YUKON, CANADA.

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A new mineral, bobdownsite, ideally $Ca_9Mg(PO_3F)(PO_4)_6$ the F-analogue of whitlockite has been found on a sample from Big Fish River, Yukon, Canada associated with lazulite and siderite. It is found in the Lower Cretaceous bedded ironstones and shales exposed on a high ridge on the west side of the river, upstream from phosphatic nodule slopes. The paragenesis appears to be kulanite followed by bobdownsite with accessory arrojadite and minor quartz. It has also been found at a second location from the Tip Top mine, Custer County, South Dakota, USA.

Bobdownsite, $Ca_9Mg(PO_3F)(PO_4)_6$, belongs to the whitlockite group, which includes whitlockite $Ca_9Mg(PO_3OH)(PO_4)_6$, strontiowhitlockite $Sr_9Mg(PO_3OH)(PO_4)_6$, and merrillite $Ca_9NaMg(PO_4)_7$. It is also isostructural with cerite-(Ce) [and cerite-(La)] $(Ce,La,Ca)_9(Mg,Fe^{3+})(SiO_4)_6(SiO_3OH)(OH)_3$. The electron microprobe analyses (25 points) at 15 kV and 10 nA yielded an average composition (wt.%) of P_2O_5 46.40(33), CaO 45.86(19), MgO 2.70(5), FeO 0.28(2), Fe_2O_3 0.93(8) [Fe^{2+} and Fe^{3+} by charge balance], Na_2O 0.70(5), Al_2O_3 0.51(13), F 1.89(28), to sum up to 100.07(69). Based on 27.5 O^{2-} atoms, we obtain an empirical formula of $(Ca_{8.76}Na_{0.24})_{\Sigma=9}(Mg_{0.72}{Fe^{3+}}_{0.13}Al_{0.11}{Fe^{2+}}_{0.04})_{\Sigma=1}(P_{1.00}O_3F_{1.00})(P_{1.00}O_4)_6$; which can be simplified as $Ca_9Mg(PO_3F)(PO_4)_6$.

Bobdownsite (Figure 1) is colorless, transparent with white streak and vitreous luster. It is brittle, with a Mohs hardness of 5.0; there is no cleavage or parting observed. Fracture is irregular, uneven and subconchoidal and no twinning is observed macroscopically. It is trigonal with space group *R*3c and unit-cell parameters $a = 10.3224(3)$, $c = 37.070(2)$ and $V = 3420.7(6)$ Å^3. Its structure is characterized by the $[Mg(PO_4)_6]^{16-}$ ligand, referred to as the "Mg-pinwheel". The Mg-pinwheels are flattened in the *c* direction and can be thought of as defining oblate ellipsoids whose short axes are parallel to *c* and that form a regular packing arrangement. The isolated, non-polymerized pinwheels form layers perpendicular to *c* held together by high-coordination number intralayer Ca cations. The interlayer cations are also calcium atoms. Bobdownsite represents the first known, naturally-formed phosphate mineral in which F^- is bonded to P^{5+} to form the (PO_3F) tetrahedral group, though several synthetic phosphate compounds have been reported to contain PO_3F groups, such as $NaK_3(PO_3F)$ (Durand et al., 1975) and $LiNH_4(PO_3F)$ (Durand et al., 1978).

This mineral is named after Dr. Robert T. Downs, a professor in mineralogy at the Department of Geosciences, University of Arizona, for his outstanding contributions to mineralogy in general and to the American Mineralogical Crystal Structure Database (AMCSD) and the RRUFF project (an integrated database of Raman spectra, X-ray diffraction and chemistry data for minerals) in particular. He lived and worked in the Yukon Territory in 1974 and 1978-1980, where this mineral was found.

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Figure 1. Bobdownsite from Big Fish River, courtesy of the RRUFF Project.

PSEUDOMORPHIC REPLACEMENT OF SCHULTENITE BY HYDROXYLMIMETITE. *A.R. Taylor, T.A. Marchlewski, and J. Rakovan*, Department of Geology, Miami University, Oxford, OH 45056.

In an attempt to synthesize hydroxylmimetite an experiment was conducted that resulted in the formation of three dominate mineral phases; prismatic hydroxylmimetite $Pb_5(AsO_4)_3OH$, and comparatively large platy crystals of schultenite $PbHAsO_4$ and potassium arsenate $KAsO_4$. The phases were identified by powder X-ray diffraction (XRD) and confirmed by scanning electron microscopy (SEM) revealing the morphology and chemistry of each phase present. After initial precipitation, the sample was then left in solution at room temperature for approximately one year. Subsequently, the sample was analyzed again by XRD and SEM, revealing an interesting change. As the figures illustrate, the schultenite and potassium arsenate appear to have been pseudomorphically replaced by hydroxylmimetite.

Understanding of the molecular scale mechanisms of mineral replacement reactions has advanced significantly in recent years (e.g. Putnis, 2009). The processes proposed for the replacement of schultenite and potassium arsenate by hydroxylmimetite are dissolution and precipitation. There are several significant characteristics of dissolution-precipitation in mineral replacement reactions. First, the reactions must be closely coupled in space and time in order to preserve the parent's external morphology. This can be seen in figure one as the newly precipitated hydroxylmimetite maintained potassium arsenate's original platy morphology (pseudomorphic replacement). Second, if the structure of the parent phase is similar to that of the product and if the kinetics of dissolution, diffusion and precipitation are conducive then the two phases may be structurally oriented (i.e. epitaxic).

Finally, the product phase must display porosity such that the solution can maintain contact with the reaction front. This can be observed in both figures where porosity exists among hydroxylmimetite grain contacts. Initially, the presence of the porosity increases the free energy in the system by an increase in surface area. However, given the opportunity the system will move towards textural equilibrium where porosity is minimized.

The degree of initial porosity is a function of the relative molar volumes of the parent and product phases as well as the spatial coupling between the two phases. This latter property is affected by their relative solubilities. The replacement of potassium arsenate by hydroxylmimetite shows a course spatial coupling and high degree of porosity (Fig. 1). Comparatively, the replacement of schultenite by hydroxylmimetite exhibits a much finer spatial coupling, possibly epitaxic, and a lower degree of porosity. This is consistent with the relative solubilities of the three phases. Potassium arsenate is readily soluble, schultenite is slightly soluble, and hydroxylmimetite is very insoluble. The rate of hydroxylmimetite formation and hence its degree of spatial coupling with the parent phase is controlled by the rate of dissolution of the parent. This is most rapid for potassium arsenate. This explains the textural differences in figures 1 and 2. Since schultentite is less soluble than potassium arsenate, the resulting replacement reaction for schultenite to hydroxylmimetite will have smaller pore spaces (figure 2) than those in the potassium arsenate to hydroxylmimetite reaction (figure 1).

Studying these reactions can provide insight to the kinetics of mineral replacement reactions that link processes such as chemical weathering, leaching, metamorphism, and diagenesis (Putnis, 2009), and give us a much more detailed picture of mineral pseudomorphs.

Reference.

Putnis, A. 2009. Mineral Replacement Reactions. In *Thermodynamics and Kinetics of Water-Rock Interaction,* E. H. Oelkers and J. Schott, Editors. Reviews in Mineralogy and Geochemistry v. 70, p. 87-124. Washington D.C. Mineralogical Society of America.

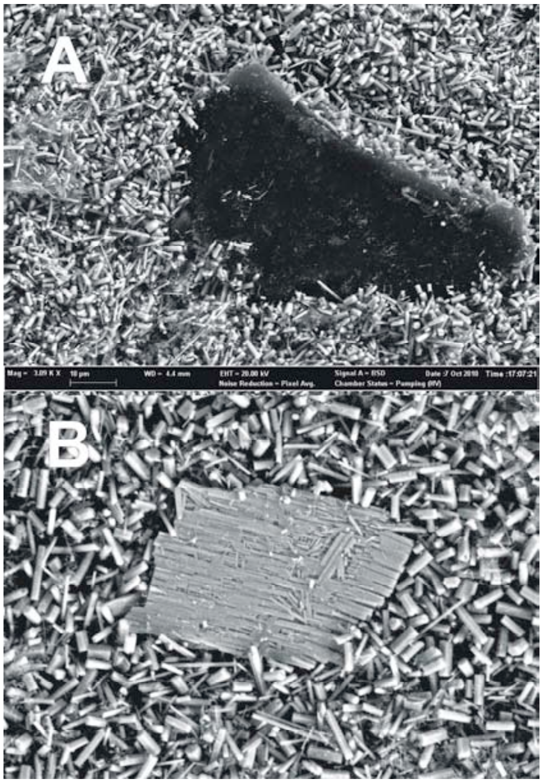

Figure 1. A) SEM image of potassium arsenate plate surrounded by hydroxylmimetite prisms. B) Hydroxylmimetite replaced potassium arsenate after 1 year.

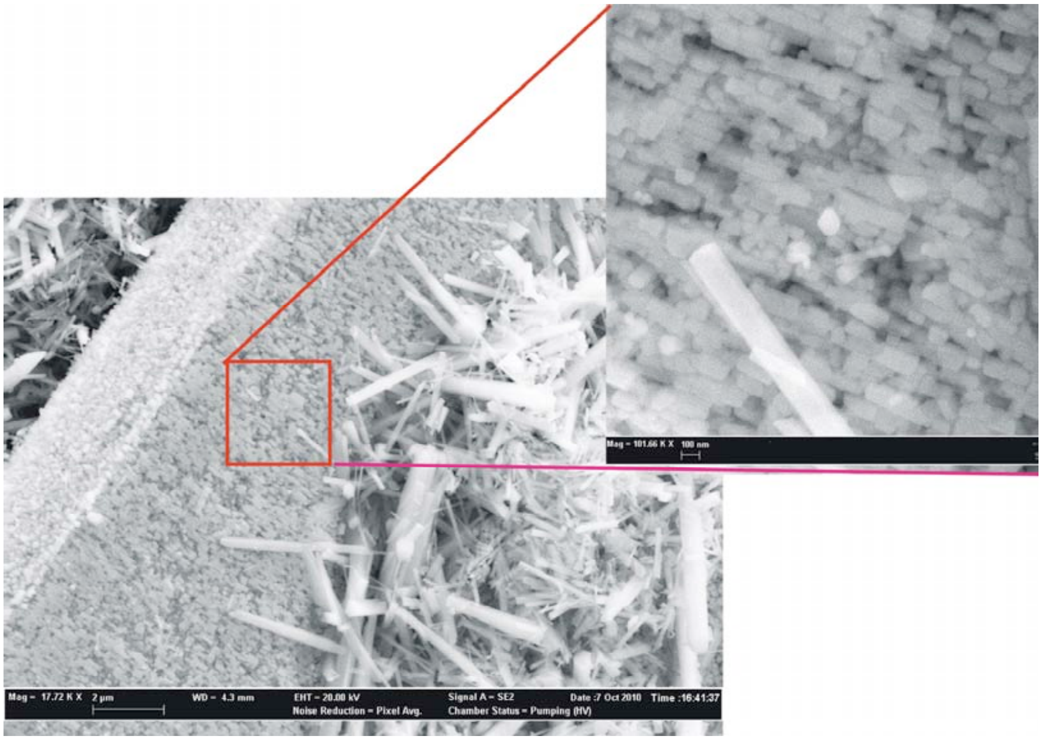

Figure 2. SEM image of hydroxylmimetite replaced schultenite after 1 year. Note the differences in replacement texture compared to figure 1.

ARROJADITE GROUP MINERALS FROM RAPID CREEK AND BIG FISH RIVER, YUKON TERRITORY, CANADA.

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The Rapid Creek-Big Fish River phosphate occurrence, located in the Yukon Territory, Canada, is well known for its rare mineral assemblages. Although exceptional crystals of lazulite were the first to be identified, in 1962, it wasn't until 1974 that the locality's potential was fully realised (Campbell, 1962). At that time, Al Kulan and Gunar Penikis brought specimens of lazulite, wardite, and arrojadite to the Royal Ontario Museum (ROM) for identification (Robinson et al., 1992). In subsequent years, several collecting trips were made by mineralogists from the museum, gathering world-class specimens for display and study.

To date, the occurrence is the type locality for twelve minerals in total, many of which form excellent crystals. The Royal Ontario Museum also has the world's largest collection of samples from these localities; many specimens have never been analyzed. Many were analyzed in the 1970s-1980s, but modern analytical techniques such as single-crystal X-ray diffraction, raman spectroscopy, electron microprobe analyses (EMPA) were not as readily available, or not used as they are today. For example, bobdownsite (IMA2008-037) was recently described as the new fluorine end-member of the whitlockite-group during an investigation of this group. A combination of this large collection of samples from this area and new analytical equipment provides us with a unique opportunity to reinvestigate this important assemblage of minerals.

To this end, a research project was initiated that focuses on the arrojadite group minerals. In 2006, Cámara et al. (2006) and Chopin et al. (2006) introduced a new nomenclature scheme for the arrojadite group, classifying them on the basis of their crystal chemistry; as all of the ROM samples of arrojadite were described many years ago, these were analysed to properly classify them. For instance, Rapid Creek is the type locality for arrojadite-(KNa), as it was redefined in 2006 (Cámara et al., 2006) but many of the hypothetical end-members remain theoretical and have not been identified in nature.

In this study, single-crystal X-ray diffraction, electron microprobe and raman spectroscopy have been performed on 30 samples previously classified as "arrojadite". The work has shown that the chemistry of these crystals is varied, with compositional zoning throughout. Several end-member varieties of the arrojadite-group have been identified and are currently being submitted as new phases. We report our progress on this mineral-group from this important locality.

References:

Cámara, F., Oberti, R., Chopin, C., and Medenbach, O. (2006) The arrojadite enigma: I. A new formula and a new model for the arrojadite structure. *American Mineralogist*, 91, 1249-1259.
Campbell, F.A. (1962) Lazulite from Yukon, Canada. *American Mineralogist*, 47, 157-160.
Chopin, C., Oberti, R., and Cámara, F. (2006) The arrojadite enigma: II. Compositional space, new members and nomenclature of the group. *American Mineralogist*, 91, 1260-1270.
Robinson, G.W., van Velthuizen, J., Ansell, H.G., and Sturman, B.D. (1992) Mineralogy of the Rapid Creek and Big Fish River area, Yukon Territory. *Mineralogical Record*, 23, 1-47.

THE GUALTERONI COLLECTION. A TIME CAPSULE FROM A CENTURY AGO

F. Pezzotta, and R. Pagano

A significant mineral collection was assembled by Camillo Gualteroni (1861-1908), a gentleman of means who lived in Ornica, a small town on the mountains of the Bergamo area in Northern Italy. Most of Gualteroni's acquisitions were made between 1890 and 1900. In that year Gualteroni married and soon had children, so his mineral activity was greatly reduced, although the collection was carefully preserved.

Gualteroni tried to obtain a sample of all the species known at the time, His collection, which today would be considered a species collection, included more than 2,000 mineral specimens; each of them was placed in a pasteboard tray with a summary external label and a neatly handwritten label with full details inside the tray. Original dealers' labels were also saved in the tray under the specimen along with Gualteroni's own labels.

The collection was preserved in the original state in the residence of the Gualteroni family for almost 120 years, and was complete with its catalogue and original letters from most of the European dealers and Italian collectors of that time (Krantz of Bonn, Egger and Böhm of Vienna, etc.). Various other significant mineralogical items (Gualteroni's books, instruments, crystal models, etc.) were also kept with the collection.

The entire mineral collection, including the original cabinets, has been purchased by the Museum of Natural History of Milan from the Gualteroni family. The specimens and their labels are now being restored and studied.

The Gualteroni holdings provide a very unusual insight in the activity of a collector of that time – a real time capsule worthy of being preserved for the future generations.

The Balmat Zinc Deposits of NYS: One of the Most Fantastic Ore Deposit Stories Ever Told!

by William deLorraine

The world class Balmat zinc deposits describe a truly epic journey through deep burial and high grade metamorphism in the core of the longest mountain chain on the face of the globe, the Grenville Orogenic Belt. Their saga began with deposition as presumed massive sedimentary exhalative sulfide lenses over 1.3 bya. in profoundly hypersaline evaporitic marine waters. Some 200 million years later the Balmat zinc deposits were deeply buried in a continental collision plate tectonic setting. Under extreme P-T conditions waferlike “daughter” orebodies formed as nearly pure sphalerite ore dikes squeezed away from massive sulfide “parent” orebodies into extensive cracks or “macrofractures” cutting across the metamorphic strata. A typical daughter orebody is long and narrow, measuring 6000 feet long by several hundred feet wide. It is not uncommon for daughter orebodies to be sliced into even thinner wafer-like halves separated by hundreds, even thousands of feet, due to subsequent thrust faulting along the pre-existing macrofractures. The longest mineable daughter orebody trend is 14,000 feet with mineralization traceable for a total of nearly 20,000 feet. This distance of sulfide mobilization as sphalerite dikes may be unmatched worldwide. Prograde metamorphism, retrograde metamorphism, and post-metamorphic alteration have produced in their turn spectacular arrays of specimen mineralogy in the Balmat-Edwards mining district.

The list of beautiful or rare prograde metamorphic minerals is impressive partly because of the high grade of metamorphism and partly because of the chemistry of the rocks before deep burial and metamorphism. There are several for which the type locality is located right at Balmat! Emerald green chrome tremolite and exquisite lavender to strawberry hexagonite are familiar “old standbys”. Rose blush rhodonite is a relative newcomer to the repertoire of Balmat minerals. Type locality minerals include Donpeacorite and Parvomanganoedenite.

Perhaps the most stunning crystal clusters come from vugs in the environs of the orebodies at relatively shallow depths. These are generally comprised of calcite but include celestine, gypsum, barite, anhydrite, realgar and gemmy yellow sphalerite. At depths much below 900 foot level and further away from the orebodies, vugs become much less common. The reason for this may be that post-metamorphic hydrothermal fluids gained access to orebody sulfides via faults and fractures. In doing so they became acidic as they dissolved some of the sulfide they came in contact with. These newly acidified fluids in turn dissolved vuggy networks and caverns in the host rock carbonates immediately surrounding the orebodies. As temperatures dropped conditions were ripe for precipitation because ground conditions were prepared and the fluids were saturated, ready to drop their crystal load! At greater depths, the ground is “tighter” so that in general there was much less fluid circulation.

Specimens of royal blue lazurite have been found in geologically rare situations in the mines requiring precise combinations of rock chemistry and retrograde metamorphic environment.

Mineralogy
of the
Tilly Foster Iron mine

Ted Johnson

Summary:

1. There will be an abbreviated history of the Tilly Foster Iron mine
2. There will be a brief discussion of researchers and collectors that have contributed to the knowledge of Tilly Foster mineralogy.
3. This will lead into the contribution that has been made by Ronald Januzzi
4. The focus of this presentation is the mineralogy of the Tilly Foster Iron mine, highlighting the collection of Ron Januzzi. Many rarely seen micro's will be shown.
5. A discussion will cover many of the species and varieties:
    - Silicates- (approx. 50)
    - Carbonates- (approx. 10)
    - Sulphides- (approx. 10)
    - Elements- (3)
    - Halides- (1)
    - Oxides- (approx 11)
    - Sulfates- (approx 12)
    - Phosphates- 3
6. There will be a discussion on Tilly Foster pseudomorphs for which the mine is famous.
7. The presentation will conclude with a dedication to Ron Januzzi for his life long study of Tilly Foster mineralogy.

Minerals
of the
Tilly Foster Iron mine

References: 1. Matrix Magazine (2001)
2.Januzzi (1994)
(pg 1 of 2)

SILICATES

Actinolite	Amphibole Group	Monoclinic	✓
Albite	Feldspar Group	Triclinic	✓
Allanite	Epidote Group	Monoclinic	✓
Apophyllite	Zeolite Group		
Augite	Pyroxene Group	Monoclinic	
Axinite	Axinite Group	Triclinic	✓
Biotite	Mica Group	Monoclinic	
Chondrodite	Humite Group	Monoclinic	✓
Chrysocolla		Orthorhombic	
Chrysolite	Olivine Group	Orthorhombic	✓
Clinochlore	Chlorite Group	Monoclinic	✓
Clinohumite	Humite Group	Monoclinic	
Danburite		Orthorhombic	
Datolite	Gadolinite-Datolite Group	Monoclinic	✓
Diopside	Pyroxene Group	Monoclinic	✓
Enstatite	Pyroxene Group	Orthorhombic	✓
Epidote	Epidote Group	Monoclinic	✓
Grossular	Garnet Group	Isometric	✓
Hedenbergite	Pyroxene Group	Monoclinic	
Heulandite	Zeolite Group		✓
Hisingerite		Monoclinic	
Hornblende	Amphibole Group	Monoclinic	✓
Humite	Humite Group	Orthorhombic	

SILICATES (cont.)

Kaolinite	Serpentine Group	Triclinic	
Laumontite	Zeolite Group	Monoclinic	✓
Leuchtenbergite	Variety of Clinochlore	Monoclinic	✓
Microcline	Feldspar Group	Triclinic	✓
Muscovite	Mica Group	Monoclinic	
Natrolite	Zeolite Group	Orthorhombic	✓
Oligoclase	Feldspar Group	Triclinic	
Opal			✓
Palygorskite		Monoclinic	✓
Pectolite			
Phlogopite			✓
Prehnite			✓
Quartz			✓
Riebeckite			✓
Scapolite			✓
Serpentine	Serpentine Group		✓
Sphene (Titanite)	Titanite Group	Monoclinic	✓
Stilbite	Zeolite Group		
Talc	Pyrophyllite-Talc Group	Triclinic	✓
Thomsonite	Zeolite Group		
Thorite	Zircon Group	Tetragonal	
Tourmaline(Schorl)	Tourmaline Group	Trigonal	✓
Tremolite	Amphibole Group	Monoclinic	✓
Zircon	Zircon Group	Tetragonal	✓

Minerals
of the
Tilly Foster Iron mine

References: 1. Matrix Magazine (2001)
2.Januzzi (1994)
(pg 2 of 2)

CARBONATES

Ankerite	Dolomite Group	Trigonal	
Aragonite	Aragonite Group	Orthorhombic	✓
Calcite	Calcite Group	Trigonal	✓
Cerussite	Aragonite Group	Orthorhombic	✓
Dolomite	Dolomite Group	Trigonal	✓
Hydromagnesite		Monoclinic	
Hydrotalcite	Hydrotalcite Group	Trigonal	
Magnesite	Calcite Group	Trigonal	
Malachite	Rosasite Group	Monoclinic	✓
Siderite	Calcite Group	Trigonal	

SULPHIDES

Arsenopyrite	Arsenopyrite Group	Monoclinic	
Bornite		Orthorhombic	
Chalcopyrite	Chalcopyrite Group	Tetragonal	✓
Galena	Galena Group	Isometric	✓
Linnaeite	Linnaeite Group	Isometric	✓
Marcasite	Marcasite Group	Orthorhombic	
Molybdenite	Molybdenite Group	Hexagonal	✓
Pyrite	Pyrite Group	Isometric	✓
Pyrrhotite	Pyrrhotite Group	Monoclinic	✓

ELEMENTS

Gold	Copper	Isometric	

OXIDES

Brucite	Brucite Group	Trigonal	✓
Goethite	Diaspore Group	Orthorhombic	✓
Hematite	Hematite Group	Trigonal	
Ilmenite	Ilmenite Group	Trigonal	✓
Lepidocrocite	Dimorphous w/ Goethite	Orthorhombic	✓
Limonite		Amorphous	
Magnetite	Spinel Group	Isometric	✓
Psilomelane			
Pyrolusite	Rutile Group	Tetragonal	
Rutile	Rutile Group	Tetragonal	✓
Spinel	Spinel Group	Isometric	✓

SULFATES

Anglesite	Barite Group	Orthorhombic	
Barite	Barite Group	Orthorhombic	
Brochantite		Monoclinic	✓
Hexahydrite	Hexahydrite Group	Monoclinic	
Jarosite	Alunite Group	Trigonal	
Linarite	Linerite-Chenite Group	Monoclinic	
Melanterite	Melanterite Group	Monoclinic	
Posnajakite		Monoclinic	
Scheelite	Scheelite Group	Tetragonal	✓
Selenite		Monoclinic	✓
Serpierite	Develline Group	Monoclinic	
Szomolnokite	Kieserite	Monoclinic	✓

	Group		
Graphite		Hexagonal	
Sulfur	Sulfur Group	Orthorhombic	

HALIDES

Fluorite	Fluorite Group	Isometric	✓

	Group		

PHOSPHATES

Fluorapatite	Apatite Group	Hexagonal	✓
Autunite	Autunite Group	Orthorhombic	
Erythrite	Vivianite Group	Monoclinic	✓

Northern Arizona Volcanoes: Spectacular Volcanic Eruptions that Changed the Landscape Forever

Sarah L. Hanson

The San Francisco Volcanic Field (SFVF), located in northern Arizona, is one of several late Cenozoic volcanic fields located along the southern margin of the Colorado Plateau. Volcanic activity in the SFVF began approximately 6 million years ago in the western portion of the field and continued intermittently, culminating in the eastern portion of the field approximately 900 years ago with the eruption of Sunset Crater Volcano. Thus, through time, the locus of activity in the SFVF has progressed eastward producing over 600 basaltic cinder cone volcanoes.

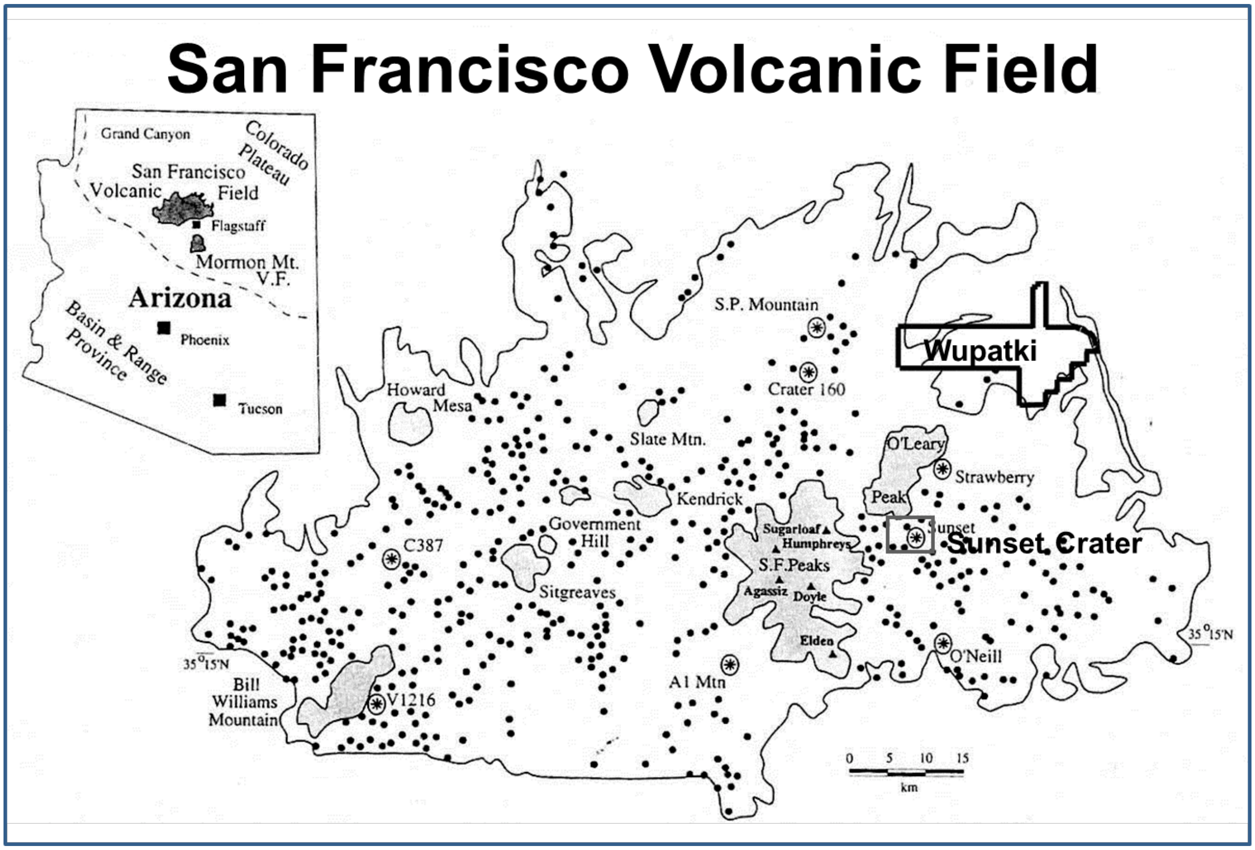

Figure 1. Map of the San Francisco Volcanic Field. Inset shows location of the SVSF. Symbols are as follows: major silicic centers (shaded areas), basaltic cinder cones and craters (circles), the more important of these and small differentiated vents (circled stars). After Arculus and Gust (1995).

Volcanoes here are unusual because, rather than forming along a plate boundary, they form a large, dominantly basaltic field, within the North American plate. For this reason, the cause of this volcanic activity is a subject of considerable debate. Several different models have been proposed for the origin these large within plate volcanic fields (Tanaka et al., 1986 and Duffield, 1997). The most recent, suggests that juxtaposition of crustal blocks with differing thickness may perturb the convectional flow of the Earth's mantle material, a process that can lead to adiabatic melting (Smith and Keenan, 2005; Humphreys et al., 2000). While the abrupt change in crustal thickness between the thin Basin and Range crust to the south of the SFVF and the thicker Colorado Plateau crust to the north is consistent with this origin, the jury is still out.

VOLCANOES SHAPE THE LANDSCAPE

The cinder cone volcanoes, along with San Francisco Peaks composite volcano, dominate the high country landscape from Williams, AZ to just east of Flagstaff, AZ. Eruptions have created much of the beautiful scenery the Flagstaff area is famous for. A few examples are given below. Approximately 20,000 years ago, The Sproul cinder cone produced a lava flow that spilled into Little Colorado River canyon forming a 60 meter thick lava dam (Hanson et al., 2008a). This flow continued downstream for about 25 km where its remnants today make for a rough river crossing onto the Navajo Indian Reservation from Wupatki National Monument. When the lava dam first formed, water flow in the Little Colorado River was impeded and a reservoir formed on the upstream side. This reservoir eventually filled with sediment and today the Little Colorado River, an intermittent stream, meanders across the sediment fill until it reaches the lava flow. There it diverts around the flow before cascading into the original pre-dam channel at Grand Falls (Figure 2). For most of the year, the Grand Falls are not very "grand." Only during the late summer monsoons (July and August) and when the snow is melting in the spring does this waterfall flow. But when it does, water tinged red with sediment from the Moenkopi sandstone cascades down the falls producing a magnificent sight!

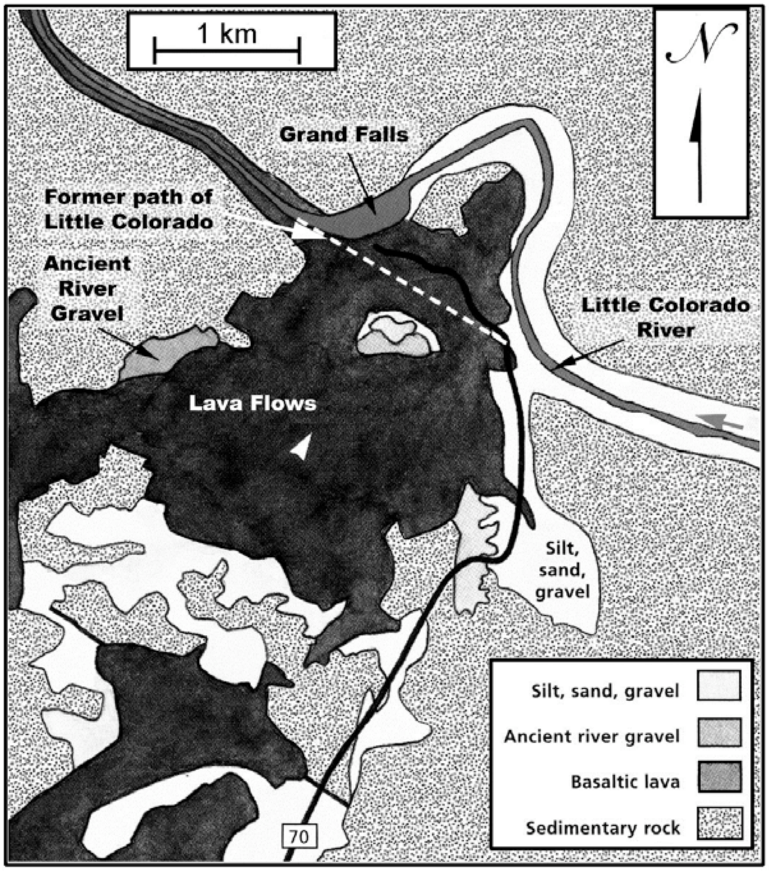

Figure 2. Geologic sketch map showing the distal edge of the Grand Falls lava flow at Grand Falls lava dam. (From Hanson et al., 2008a)

More recently, circa 1085 AD (Elson et al. 2009), Sunset Crater volcano, a 300 m (1000') tall cinder cone was born. A thousand years ago, the landscape in and around Sunset Crater Volcano National Monument was very different. The prominent cinder cone had not yet formed and the stark lava flows had yet to pour onto the surface. Instead a forested valley was occupied by settlements of hunters and gatherers, called the Sinagua, who lived in pit houses and grew corn to supplement their diet. The Sinagua, ancestors of today's Pueblo Indians of the Four Corners area, most certainly witnessed the eruption. The lava fountain, perhaps several thousand feet high, would have been visible from quite a

Figure 3. Corn Rock: Sunset Crater lava with corn impressions excavated from a nearby pithouse. Photo Credit: Helga Teiwes, courtesy Desert Archaeology, Inc.

distance, perhaps 30 to 50 kilometers. The ash plume would have reached heights of several miles and would have been visible for hundreds of kilometers (Elson and Ort, 2003).

For several months prior to the eruption, a series of unsettling earthquakes would have warned residents that something was amiss. When the eruption began, the Sinagua would have first seen a 10 km (6 mile) long, fissure begin to spew lava and steam forming a "curtain of fire." This NE-SW trending fissure eruption produced a series of coeval vents including Rows of Cones, Gyp Crater, and Vent 512. Shortly after this fissure eruption began, activity ceased as the eruption became focused on the northern terminus of the fissure. For a few months to perhaps several years, fountains of lava (called Stromblian eruptions) built Sunset Crater Volcano and blanketed an area of at least 2000 km^2 with cinders. During this time, the Kana'a flow extruded from the eastern base of the volcano and continued in a northeasterly direction down Kana'a wash for about 5 miles (8 km) (Holm and Moore, 1987). The Bonito flow effused from the northwestern base of the volcano where it ponded in a basin accumulating lava up to 30 m thick in the center of the basin (Moore, 1974 and Holm, 1987).

When the eruptive eruption ended people began to return to the area. While the area near the volcano was devastated, a thriving community began to flourish 20 miles to the north at Wupatki. Archaeologists have speculated the sudden population growth may have been related to a thin layer of ash covering the area which, if just the right thickness, would have acted as a water retaining mulch that temporarily enhanced farming in this otherwise arid area (Hooten et al., 2001).

MINERALS ON MOUNTAINTOPS

Most of the minerals in basalt are generally small, usually not more than several millimeters in size, and include olivine, pyroxene and plagioclase. They occur most commonly as subhedral to anhedral phenocrysts (crystallized from the melt) and more rarely as xenocrysts (residual crystals left behind during partial melting of mantle material). They occur embedded in fine grained ground mass, thus while they are of great importance to volcanologists, they do not generate much interest among collectors. There are, however, some notable exceptions. One of the most famous of these is the peridot deposit where olivine xenocrysts occur in an alkali basalt lava flow on the San Carlos reservation in Arizona.

The composition of olivine, clinopypyroxene (generally diopside) and plagioclase phenocrysts from Sunset Crater volcano and fissure basalt reveal much about the eruption. The high Fo (molar Mg/ molar Mg + molar Fe) contents in olivine (87-71) represent values that are in equilibrium with peridotite suggesting the magma originated within the Earth's mantle and ascended quickly to the surface without much evolution. The presence of plagioclase as a crystallizing phase, coupled with the absence of a whole rock Eu anomaly, suggests plagioclase was not involved modifying the melt composition through fractional crystallization, thus magma must have been stored near the base of the crust at pressures greater than ~8 kb (30 km in depth). Clinopyroxene from the fissure eruption is enriched in Na and Al relative to those found in lava from Sunset Crater volcano. This suggests that the fissure eruption was derived from a smaller percentage melting within the mantle, thus likely represents the early stages of the eruption which grew in size and vigor as melting continued and Sunset Crater volcano began to grow.

Perhaps of more interest to collectors are the minerals that often form on the summits of cinder cones during fumarole (steam) activity. These highly corrosive steam emanations are commonly composed of H_2O, SO_2, CO_2, HCl and HF and have highly variable temperatures ranging from 900°C to as low less than 100°C. (Stoiber and Rose, 1974). Minerals are precipitated directly from the vapor as well as from alteration of minerals in the wall rock. At lower temperatures, the alteration of wall rock is enhanced by the formation of sulfuric acid (Stoiber and Rose, 1974).

The most common sublimate minerals include sulfur, gypsum, opaline silica, ralstonite and thenardite although the number of species reported from fumaroles is large and almost as varied as the vents they occur on. Fumarole deposits on basaltic volcanoes have been reported Iceland (Jakobsson and Moore, 1986), Hawai (Naughton et al., 1976), Paricutin (Luhr and Simkin, 1993) and many others. One of the most productive fumaroles was associated with the Great Tolbachik fissure eruption in Kamchatka which lasted from July 1975 to December 1976. More than 120 mineral species have been reported from the Tolbachik cones including 22 new species, some that are extremely rare (Vergasova et al., 2000). Just to the southwest of Kamchatka, in the Kurile Islands, a fumaroles on Kudryavy Volcano precipitated a rare rhenium sulfide; rheniite (ReS_2) (Znamensky et al., 2005).

At Sunset Crater late-stage fumarole activity oxidized cinders on the rim to a red scoria and cemented them together with silica, gypsum and iron oxide. Five distinct fumarole incrustations are present near the central vent of the volcano. These incrustations are composed predominantly of gypsum which is locally overgrown with opal or a thin coating of sulfur. Numerous accessory minerals, including voltaite, jarosite, magnetite and hematite, occur throughout (Hanson *et al.*, 2008b and Hanson *et al.*, 2002). The magnetite is unusual as it exhibits a dominantly cubic {100} morphology with rare trisoctahedral {321} modifications. It is likely that many of the cinder cones in the area had similar incrustations at their summits. However, because these minerals are soft, and many soluble in water, they have long since weathered away.

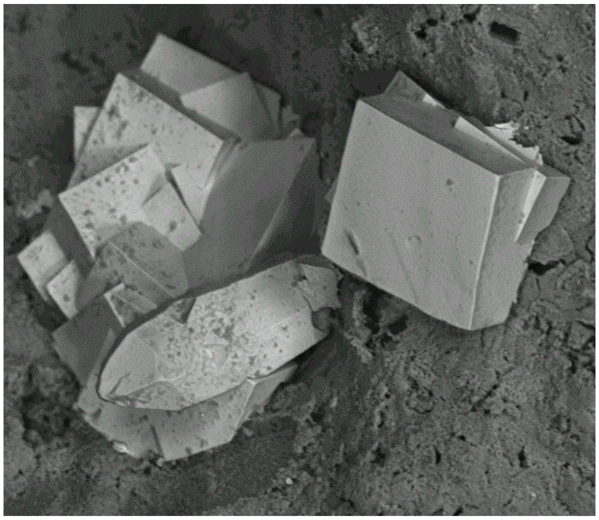

Figure 4. Cubic magnetite with hematite on altered basalt.

These minerals are generally extremely small (< 1 mm) and notoriously difficult to collect (particularly if the fumaroles is still active), thus are not generally attractive to collectors and have no economic value. The cinders from cinder cones, however are commonly quarried for use in landscaping (many McDonalds around the US use them), as a base to generate uniform for heat in gas barbecue grills, on icy roads for traction, and as road-bases. Several of the cinder cones in the San Francisco Volcanic Field have been almost completely removed, and most certainly will be gone in the near future.

WHAT'S NEXT FOR NORTHERN ARIZONA?

As geologists improve age dating techniques on young volcanic rocks, the number of recent eruptions in the San Francisco Volcanic field continues to grow. These include Merriam Crater, two nearby unnamed cinder cones, and The Sproul (all ~20 ka) (Duffield *et al.*, 2006), SP Crater (between 2,000 – 4,000 years ago) (Kennedy et al., 2008) and Sunset Crater Volcano (circa AD 1085 CE) (Elson et al., 2009). Additionally, there are several other undated young cinder cones that most likely lie within this age range. As the number of confirmed young events grows, the recurrence interval (time elapsed between eruptions) shortens. While there is no way to predict just when or where the next eruption will occur, and likely won't happen in our lifetimes, it may during the lives of our descendants. Just how would an eruption impact contemporary modern-day inhabitants of northern Arizona?

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Presentation of the Carnegie Mineralogical Award, 12 February 2011

Dr. Samuel E. Taylor presented the Carnegie Mineralogical Award to the Rochester Mineralogical Symposium on 12 February 2011 at the Tucson Gem and Mineral Show. Rev. Bob Morgan and Dr. Steve Chamberlain were on hand to receive the award on behalf of the RMS.

Remarks Made by Dr. Samuel E. Taylor

A 8 PM on Thursday, 14 April 2011, the thirty-eighth consecutive Rochester Mineralogical Symposium will officially begin. The convener will open the Symposium, welcome the participants, and introduce the first invited speaker. A bit over an hour later after all the audience questions have been answered, the activities will move upstairs to the dealer floor and hospitality suite and to the exhibit room and to the micromounters playroom adjacent to the lecture hall. Attendees will have ample opportunity to shop, chat, and exchange information and ideas for just as long as they wish.

Friday brings two invited lectures in the morning and an extended break for lunch and shopping, followed by the annual technical session of contributed short papers in specimen mineralogy. After dinner, an invited lecture ends the formal part of the program, but the informal activities extend late into the night.

What's New in Minerals begins Saturday with an organized photographic survey of the noteworthy new finds of minerals of the past year, worldwide. Then there is an exciting period for audience participation to make announcements, show brief powerpoint presentations, raise issues of concern to collectors, and the like. After another extended break for lunch and shopping, two more invited lectures complete Saturday afternoon. A silent benefit auction then precedes the annual auction banquet, and a voice auction follows it. The final period for shopping at the dealers and looking at the exhibits follows the auction.

Sunday morning has two invited lectures. Just before noon, the convener thanks all the participants, announces the dates for the next year, and officially closes the Symposium.

Our major mission has always been to advance the community of amateur and professional mineralogists through education. Our philosophy is to emphasize what is successful and evolve to be more and more effective at our mission. From the beginning, the RMS included invited lectures and exhibits. In the past thirty-seven years, we have offered more than 340 invited lectures, more than 75 of which have been given by international speakers. Topics include an extremely wide range from mineral art to the history of mineralogy to crystallography to species mineralogy to locality mineralogy to field collecting and beyond. DVDs of the past two decades of lectures are available, and each year the RMS donates a complete set of DVDs of the new lectures to the library of the Eastern Federation of Mineral and Lapidary Societies for use by mineral clubs. We present 24 exhibits each symposium, which in 37 years amounts to over 800 different exhibits.

Dealers have always been an important part of the RMS. Participation by dealers is completely open and only subject to the rule that no selling may occur during the conduct of our formal program. This restriction and the fact that attendance is by registration only, i.e. the dealers are not open to the public, makes the RMS an educational activity and not a mineral show. It also allows the dealers to participate in the lectures and technical session.

In 1984, we first introduced the technical session for invited short papers to give professional mineralogists, amateur mineralogists, and graduate and undergraduate students a common forum to present and discuss the results of their mineralogical investigations. Since we added these short talks, nearly 400 have been presented as either platform talks or posters and their abstracts have been published in *Rocks & Minerals*. More than a decade ago, we added cash prizes for the best undergraduate and best graduate student presentations in the technical session each year.

In 2000, we added the micromounters' playroom, which has been a success from its inception. This facility, adjacent to the exhibits room, gives micromounters a chance to exchange specimens and information as well as giving non-micromounters a chance to experience the world of microminerals directly with expert advisors.

Beyond the annual symposium itself, we have endeavored to advance specimen mineralogy as opportunities became available. In 1988, we initiated the successful fundraising campaign that permitted the Canadian Museum of Nature to purchase a major American collection. More recently, we enabled the New York State Museum to acquire the New York State portion of the minerals sold by the Philadelphia Academy of Natural Sciences. We have also made occasional research grants to university faculty and students.

The RMS has also developed an active program of publications. Besides the Program Notes that accompany each symposium, we have reprinted a number of mineralogical references over the years. Most significant of these was our reprinting of the entire Goldschmidt's *Atlas der Krystallformen* in 1986.

Our success in all these endeavors has critically depended on the full range of people involved in our activities. Attendees, speakers, short paper contributors, exhibitors, dealers and all the volunteers who work behind the scenes make up one big mineralogical family. This produces a whole that seems much greater than the sum of its parts and goes far to explain the warm vitality and longevity of the RMS.

Organizationally, the Rochester Mineralogical Symposium is an autonomous activity of the Rochester Academy of Science <http://www.rasny.org>. The yearly meeting is organized and conducted by a group of volunteers constituting the Symposium Committee whose members fully appreciate that our continuing success depends strongly on the fact that we are standing on the shoulders of those who have served before us.