

FRIENDS OF MINERALOGY Pennsylvania Chapter NEWSLETTER

VOL. 47 No. 2

SUMMER 2019

Symposium on Pennsylvania Mining and Mineralogy

Mineral Collecting Enthusiasts Meet and Learn

Saturday, November 2, 9:00 - 4:00
Franklin and Marshall College,
Lancaster, PA

Field Trip to Penn/MD Quarry November 3

Please Join Us!

Register in Advance or at the Door

Watch for news at <http://www.rasloto.com/FM/>

The Friends of Mineralogy – Pennsylvania Chapter will hold our 2019 Symposium and field trip on the first weekend in November. Mineral collectors in attendance on Saturday will meet in the Hackman Physical Sciences Building at Franklin & Marshall College, Lancaster, PA., to hear several talks by experts on minerals, geology and mining in Pennsylvania and beyond. Doors open for registration by 8:30 a.m., but anyone wishing to help set up may arrive as early as 6:30. In addition to the talks, there will be select mineral dealers (by invitation only), a silent auction (donations are welcomed!), give-away table, refreshments, and plenty of opportunities for visiting with fellow enthusiasts. We anticipate that professional geologists can receive five (5) Professional Development Hours (PDH) for lecture attendance. Lunch is available at restaurants within walking distance.

The mineral collecting **field trip on Sunday** is planned for H&K Group's Penn/MD Quarry, Peach Bottom, PA, which has now expanded operations into Maryland. The trip is open **only** to symposium registrants (please register by Saturday Nov. 2); non-member field trip attendees must pay the non-member symposium registration fee. Safety equipment will be required; watch for details.

PRESENTATIONS NEEDED!

We are seeking a few additional Symposium speakers to make presentations on minerals, mineral collecting, and mining history, with an emphasis on Pennsylvania. We offer a **\$100 honorarium**. If you are interested in making a presentation, or can suggest a good speaker, please contact President Joe Marchesani (see page 6).

Board Members Sought

The Board of Directors invites any member who would be interested in serving on the Board to contact the President (see page 6). More Board members to provide varied viewpoints and help with Chapter projects would be beneficial. Board terms are for three years, and we typically meet at the Symposium and once during the year.

Shall we have a Chapter Picnic?

Some other groups enjoy holding an annual picnic, sometimes in conjunction with a collecting trip or swap meeting. Members' comments and suggestions for a possible FM-PA Chapter picnic in 2020 are invited. Are you in favor? Would you attend? Do you have any suggestions for a venue? Combination with collecting, a swap, or some other event? And regarding specifics, what time of year (how about June?), and Saturday or Sunday? Please send your comments to Secretary David Glick (see page 6), who will compile the responses.

National Bulletin now coming to Chapter Members

Chapter members should now receive the national Bulletin of Friends of Mineralogy as soon as it is available, via a link in e-mail. This can happen only if the Chapter has your current e-mail address. Please inform Membership Chair Dianne Soccio (see page 6) of any e-mail (or address) changes. Thanks go to Beth Heesacker and Iva Veselinova in the national organization for arranging for this e-mail connection.

The next issue is expected around late September. Issues are posted later on the national web site, <http://www.friendsofmineralogy.org/newsletters/>

Our Chapter Online

Past issues of our Chapter newsletter are available on our web site, www.rasloto.com/FM. Also visit the Facebook page, <https://www.facebook.com/Friends-of-Mineralogy-Pennsylvania-Chapter-1174230635931641>. Members and friends are invited to *Like* the page, post, and generally provide a good level of activity.

Minerals of the Penn/MD Materials Quarry, Fulton Township, Lancaster County, Pennsylvania, Part 2, Clinochlore, Zircon, and Monazite-(Ce)

Ronald A. Sloto, P.G.
West Chester University

INTRODUCTION

The Penn/MD Materials quarry, owned and operated by the H&K Group, produces aggregate from ultramafic rocks of the Baltimore Mafic Complex, known locally as the State Line Serpentinite District. This complex of ultramafic and associated gabbroic rocks is believed to be a remnant from the roots of an island arc complex formed about 490 to 510 million years ago (Smith and Barnes, 1998; Smith and Barnes, 2008).

All analyses were performed at the West Chester University Center for Microanalysis and Imaging, Research and Training (CMIRT). Imaging and chemical analyses were done using an FEI Quanta 400 environmental scanning electron microscope integrated with an Oxford AZtec X-ray energy dispersive spectrometer (SEM-EDS). Samples were unpolished and uncoated. A Bruker D2 Phaser powder X-ray diffractometer (XRD) was used to determine mineral species.

The author thanks the H&K Group and Jay Lang for access to the quarry.

CLINOCHLORE $(\text{Mg,Fe})_6(\text{Si,Al})_4\text{O}_{10}(\text{OH})_8$

Clinochlore is the most common member of the chlorite group; it forms a series with chamosite. Clinochlore is the magnesium-rich end member, and chamosite is the iron-rich end member of the series. Clinochlore is a hydrothermal alteration product of pyroxene in serpentinite. Clinochlore forms thin to thick pseudo-hexagonal crystals. It can be foliated with flexible laminae, fibrous, granular, earthy, or massive.

Clinochlore is a common mineral at the Penn/MD Materials quarry occurring in a variety of forms and colors, mostly as anhedral to subhedral crystals (fig. 1). The color can be silvery gray, light green, dark green, light brown, or dark brown. Clinochlore exhibits a range in composition (table 1). Although some of the clinochlore can be light to dark brown (RS-3206 and RS-4331) and resemble vermiculite (fig. 2), it contains too little aluminum and too much silicon to be considered vermiculite. It also contains too little iron and too much magnesium to be considered chamosite. In addition, the X-ray diffraction patterns fit clinochlore much better than vermiculite or chamosite.

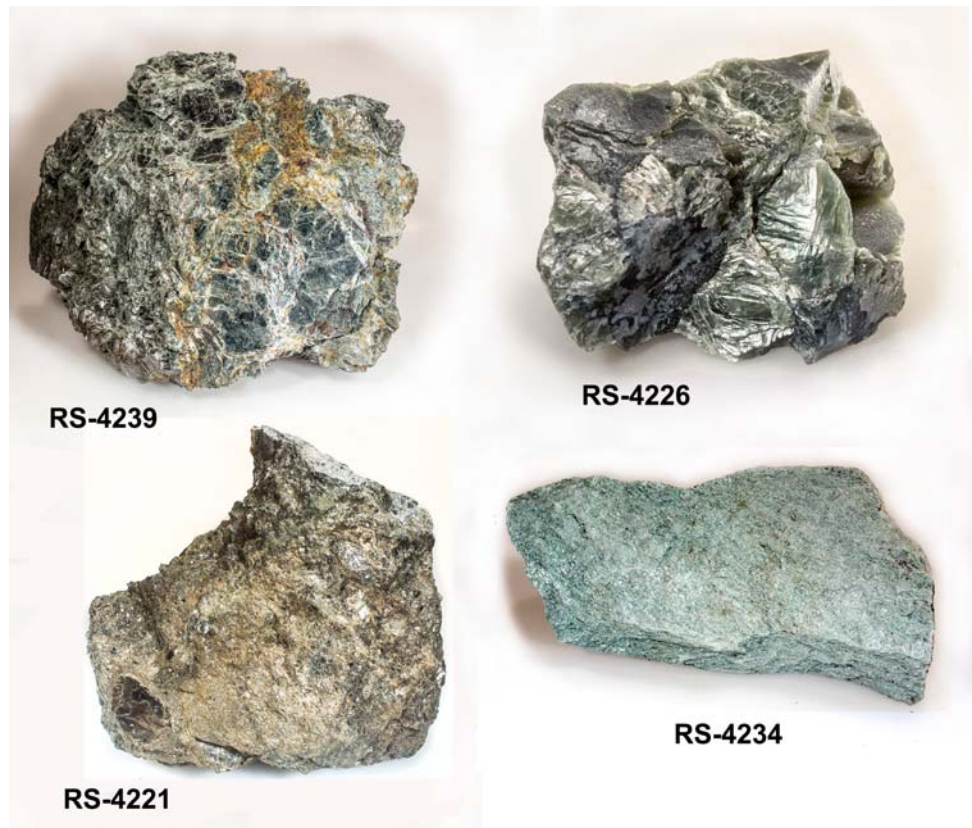


Figure 1. Clinochlore from the Penn/MD Materials quarry.



Figure 2. Clinochlore from the Penn/MD Materials quarry, 7 cm. Sloto collection 3206.

All samples listed in table 1 were verified as clinochlore by XRD. The brown clinochlore contained more iron than the silvery gray and green clinochlore. Some of the clinochlore contained potassium, possibly substituting for magnesium, and some contained titanium. One sample (RS-4234 in fig. 1) was light green, very soft, fine grained, and slippery, resembling fine-grained talc; it contained trace nickel and chromium.

A dike of clinochlore was exposed on the north side of the quarry several years ago. The dike was several feet across and contained dark green (RS-4239 in fig. 1) and soft, dark brown clinochlore (RS-4221 in fig. 1). However, this material was unsuitable for aggregate, and the dike was backfilled and is no longer accessible.

ZIRCON $Zr(SiO_4)$

Zircon is a silicate mineral (zirconium silicate); however, hafnium is almost always present in quantities ranging from 1 to 4 percent, and rare-earth elements may be present. Zircons were found in the dark brown, fine-grained clinochlore (RS-4221 in fig. 1) in the dike described above. They were identified as zircon by their orange fluorescence.

The zircons occur as small (4 mm or less), transparent, orange crystals and fragments (fig. 3). The

zircons described here were provided by Tom Pankratz, who separated them from the clinochlore. Analysis by SEM-EDS (table 2) shows that the zircons contained 0.81 to 2.09 weight percent hafnium.



Figure 3. Zircon crystals from the Penn/MD Materials quarry. Crystals are 4 mm or less in length. Collected by Tom Pankratz.

Table 1. Results of X-ray energy dispersive spectrometer (EDS) analysis of 12 clinochlore specimens from the Penn/MD Materials quarry. Values are mean values in weight percent.

Sample ID	Description	O	Mg	Al	Si	Fe	K	Mn	Ti	Ni	Cr
RAS-3179	Dark green	48.13	21.54	7.19	17.42	2.96	2.48		0.27		
RAS-3206	Large, light brown crystal	48.33	11.52	8.19	16.96	8.55	4.64		1.81		
RAS-4103	Dark brown, fine grained	47.44	13.20	8.41	15.86	10.79	3.05	0.26	0.99		
RAS-4204	Silvery gray	50.28	19.12	7.18	17.02	5.18	0.17		1.14		
RAS-4205	Light brownish green	53.80	21.95	3.25	17.91	2.76			0.35		
RAS-4220	Silvery gray	53.52	23.77	1.70	19.18	1.65			0.18		
RAS-4221	Dark brown, fine grained	47.27	12.25	7.73	15.59	8.90	7.11	0.24	0.92		
RAS-4226	Silvery gray; associated with semi-transparent antigorite	50.20	22.52	3.12	21.64	2.03			0.48		
RAS-4227	Silvery gray	50.74	24.13		23.60	1.53					
RAS-4234	Soft, light green, fine grained	51.40	20.84	5.82	15.97	5.34	0.12			0.42	0.09
RAS-4237	Silvery gray; associated with picrolite	48.21	23.68	0.36	21.87	5.88					
RAS-4239	Dark green; from the dike	50.93	22.87	4.13	19.44	2.30			0.32		

Table 2. Results of X-ray energy dispersive spectrometer (EDS) analysis of five zircon specimens from the Penn/MD Materials quarry. Values are mean values (except zircon 3) in weight percent.

	Zr	Hf	O	Si	Mg	Ca	Ti	Fe
Zircon 1	50.11	1.23	32.91	14.83		0.43	0.26	0.24
Zircon 2	46.94	1.04	36.85	14.19	0.29	0.71		
Zircon 3	48.40	1.00	36.22	14.16		0.22		
Zircon 4	44.27	0.81	41.26	13.39		0.28		
Zircon 5	44.56	2.09	35.51	14.42	0.93	1.95	0.56	

MONAZITE-(Ce) (Ce,La,Nd)(PO₄)

Monazite is a phosphate mineral containing rare-earth elements. There are at least four different kinds of monazite, depending on the dominant rare-earth element; the most common is monazite-(Ce). The chemical formula for monazite indicates that cerium, lanthanum, and neodymium can substitute for one another in the mineral's structure. Other rare-earth elements and thorium may be present, and substitution of silica (SiO₂) for phosphate also occurs. The first element listed in the parenthesis is the rare-earth element with the greatest percentage in the mineral; monazite-(Ce) is enriched in cerium. Monazite is part of several solid-solution series with other minerals.

Monazite-(Ce) was identified during analysis of dark brown, fine-grained clinocllore (RS-4221 in fig. 1). While imaging and analyzing the clinocllore, grains of other minerals were apparent. A solid state (backscatter) detector was used to produce an SEM image (fig. 4) that showed the other minerals as bright white grains standing out in contrast to the dark clinocllore. Backscattered electrons are high-energy electrons originating in the electron beam that are reflected or back-scattered out of the specimen interaction volume by elastic scattering interactions with specimen atoms. Heavy elements (high atomic number) backscatter electrons more strongly than light elements (low atomic number) and appear brighter in the image. Backscatter electron detectors are used to highlight contrast between areas with different chemical compositions.

Analysis of the mineral grains showed them to be, in decreasing order of abundance, monazite-(Ce), a titanium-iron oxide (ilmenite or an alteration product of ilmenite), and zircon. Cerium was the most abundant rare-earth element (table 3). Most mineral grains were

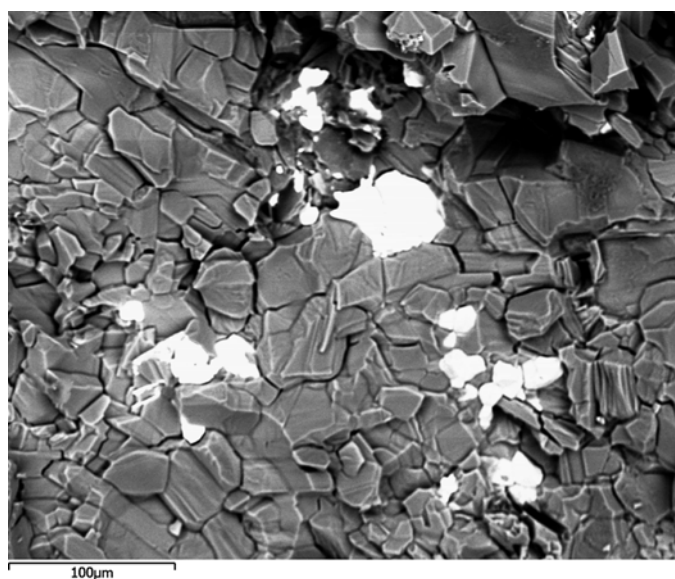


Figure 4. Backscatter scanning electron microscope image of dark brown, fine-grained clinocllore from the Penn/MD Materials quarry. Magnification is approximately 660 X.

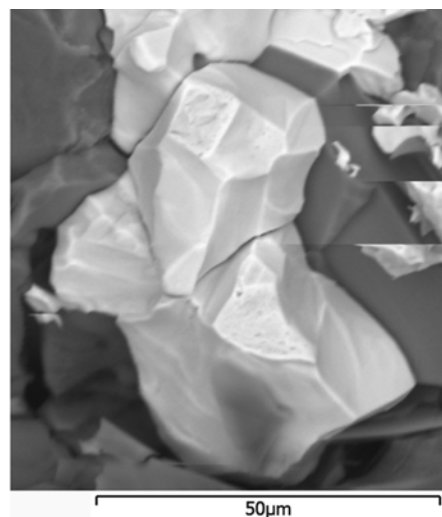


Figure 5. Backscatter scanning electron microscope image of monazite-(Ce) from the Penn/MD Materials quarry. Magnification is approximately 2100 X.

anhedral, but one mineral grain (fig. 5) showed somewhat of a crystal shape. Rare-earth elements present included cerium (Ce), lanthanum (La), neodymium (Nd), and praseodymium (Pr) (table 3). In addition, thorium (Th) was detected in three mineral grains. Silver occurred in trace amounts in most mineral grains. Some silica substituted for phosphate in all samples.

REFERENCES

- Back, M.E., 2018, Fleischer's glossary of mineral species: Tucson, Arizona, Mineralogical Record, Inc., 410 p.
- Smith, R.C. II, and Barnes, J.H., 1998, Geology of Nottingham County Park: Pennsylvania Geological Survey, 4th ser., Trail of Geology 16-009.0, 41 p.
- Smith, R.C. II, and Barnes, J.H., 2008, Geology of the Goat Hill Serpentine Barrens, Baltimore Mafic Complex, Pennsylvania: Journal of the Pennsylvania Academy of Science, v. 82, no. 1, p. 19-30.

Table 3. Results of X-Ray energy dispersive spectrometer (EDS) analysis of monazite-(Ce) from the Penn/MD Materials quarry. Values are in weight percent.

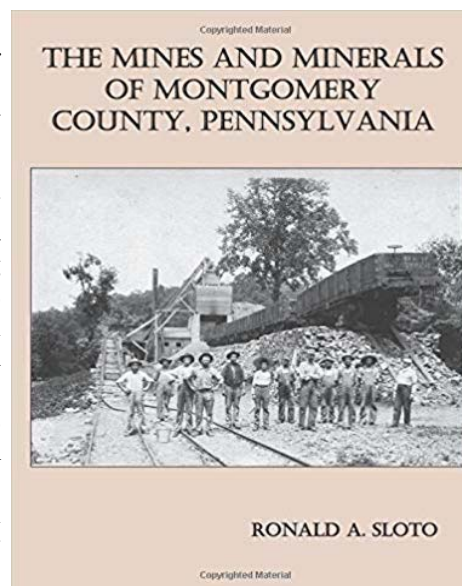
Sample ID	O	Si	P	Ag	La	Ce	Pr	Nd	Th	
R2-1-Spectrum 1	50.53	19.80	0.30		4.41	15.34	1.82	7.79		
R2-1-Spectrum 3	33.89	4.51	9.93		13.57	27.85	2.63	7.63		
R2-1-Spectrum 4	30.54	6.68	9.56	0.29	15.28	29.60	1.90	6.15		
R2-2-Spectrum 15	28.01	6.11	6.42		15.09	31.24	2.51	8.64	0.93	
R2-3-Spectrum 19	30.94	4.51	10.92	0.23	14.93	29.25	2.41	6.63		
R1-5-Spectrum 21	31.54	7.58	9.50	0.15	13.01	28.59	2.40	6.67		
R1-5-Spectrum 22	38.32	2.66	12.61	0.20	11.43	25.20	2.43	6.75		
R2-4-Spectrum 27	42.28	7.62	5.92	0.84	0.48	25.68	3.63	3.76	9.74	
R2-4-Spectrum 29	31.09	5.83	9.72	0.99	13.55	29.25	2.53	6.80		
R1-8-Spectrum 31	39.36	2.40	12.71	0.32	12.26	25.39	1.66	5.80		
R1-8-Spectrum 32	29.01	5.66	6.53	0.20	12.50	34.74	3.29	8.08		
R1-8-Spectrum 33-36 ¹	33.92	4.19	9.67	0.17	12.46	29.12	2.54			

¹ Average of three spectra.

Montgomery County book now available

Ron Sloto has followed up his Chester County and Berks County books with one covering Montgomery County. It is now available from Amazon.com.

The Mines and Minerals of Montgomery County, Pennsylvania, provides a comprehensive description of the mining history and mineralogy of the county. It pulls together over 300 years of mining and mineral history under one cover. It is richly illustrated with 510 figures — old and new photographs, old maps, mine surface plans and cross sections, and photographs of minerals from museum, university, and private collections. Many of the old photographs have never been published before. This book describes nearly 200 mines and mineral localities. It includes



the known history of each mine and locality and a list of reported minerals. The locations are shown on a set of USGS topographic maps. Because many of the mines had several names over the course of their history, a comprehensive cross-index is provided. An extensive bibliography also is included. One hundred twenty six mineral species have been reported from Montgomery County, plus an additional 13 mineral species that were reported, but not verified. Extensive coverage is provided for the two most prolific mineral localities in the county—the Perkiomen-Ecton lead-copper-zinc mines near Audubon and the Kibblehouse (Perkiomenville) quarry in Perkiomenville.

From the Editor

David Glick

THANK YOU to everyone who has been providing material for the Newsletter! Everyone else - join the fun! Feel free to contact me at xidg@verizon.net, or 814-237-1094 days and evenings. Mail can be sent to 209 Spring Lea Dr., State College PA 16801. Materials for the Fall issue should be submitted by September 20.

Materials related to Pennsylvania mineralogy, collecting or collectors are invited for this newsletter: articles, long or short; announcements from FM-PA committees; photographs of specimens, field localities, collections, etc.; reports on publications about PA minerals or by PA authors, or actual book reviews; or other items within the mineralogy and mineral collecting areas of interest. Photographs should be of good resolution (at least 1000 pixels across) without much JPEG compression, so that they will look good in print. Please provide captions including photographers' names.

We are producing four issues each year; your material is needed! If you know people who have interesting material, please encourage them to submit it.

DONATIONS WELCOMED

The FM-PA Chapter is a 501(c)(3) nonprofit organization; donations are gratefully accepted and should qualify for deduction from your federal income tax. Donations of any size help to offset the general operating costs of the Society, helping to keep dues low.

UPCOMING EVENTS

See www.mineralevents.com for more

Sept. 14-15, 2019: Annual Gem, Mineral & Jewelry Show, by Central Pennsylvania Rock & Mineral Club. Harrisburg Consistory, 2701 North 3rd St., Harrisburg PA 17110. Sat. 10-6, Sun. 10-5.
<http://www.rockandmineral.org/annual%20show.htm>

Sept. 28-29, 2019: Franklin-Sterling Hill Gem & Mineral Show. Littel Community Center (formerly known as the Armory), 10 Munsonhurst Rd #12, Franklin NJ 07416.
<https://franklinmineralmuseum.com/event/61st-annual-franklin-sterling-gem-mineral-show/>

October 5, 2019: Autumn Mineralfest, by PA Earth Sci. Ass'n. Macungie Mem. Park, Poplar St., Macungie, PA. One hundred tables overloaded with minerals, fossils, gems, jewelry, crystals and geodes from six continents, & more. Sat. only, 8:30-3. www.mineralfest.com

October 26, 2019: Ultraviolation: Fluorescent Minerals Show, by R&MC of Lower Bucks County PA. First United Methodist Church, 840 Trenton Rd., Fairless Hills PA 19030. Sat. only, 9-4.
<https://sites.google.com/view/lowerbucksparocks/shows>

October 26, 2018: South Penn Fall Rock and Mineral SWAP & Sale: South Mountain Fairgrounds, 1.5 miles West of Arendtsville, PA. Sat. only, 8-3.

Nov. 2-3, 2019: FM-Pa Symposium & Field Trip; see p. 1. Saturday Symposium at Franklin & Marshall College, Lancaster, PA. Sunday Field Trip for Symposium registrants only. Please register in advance.
<http://www.rasloto.com/FM/>

FM on the WWW

Please explore the FM-PA Chapter web site at www.rasloto.com/FM/ and facebook: Friends of Mineralogy Pennsylvania Chapter

National News

The Bulletin of Friends of Mineralogy, links to other chapters, and much more can be found on their web site:

www.friendsofmineralogy.org

Friends of Mineralogy Pennsylvania Chapter Directory of Officers

OFFICERS and BOARD OF DIRECTORS members

President	Joe Marchesani	Jmarch06@comcast.net	(609) 433-5129
Vice President	Dianne Soccio	dianne.soccio@gmail.com	(302) 388-6720
Treasurer	Ron Sloto	rasloto@aol.com	(610) 469-0626
Secretary	David Glick	xidg@verizon.net	(814) 237-1094
	Mike Dunton	pocono1mike@yahoo.com	(570) 629-1246
	William Kochanov	wejsk@verizon.net	(717) 571-5015
	Bill Stephens	bstephens@stephensenv.com	(302) 286-0406

COMMITTEE CHAIRS

Membership Chair	Dianne Soccio	dianne.soccio@gmail.com	(302) 388-6720
Field Trip Chair	Tom Pankratz	TjPankratz@verizon.net	
Web Manager	Ron Sloto	rasloto@aol.com	(610) 469-0626
Newsletter Editor	David Glick	xidg@verizon.net	(814) 237-1094

Friends of Mineralogy Pennsylvania Chapter Web Site: <http://www.rasloto.com/FM>