

Nittany Mineralogical Society Bulletin

Nittany Mineralogical Society, Inc., meeting in State College, Pennsylvania
Contact information on back page

May, 2016

Visit our web site: www.nittanymineral.org

Editor (see page 8):
David C. Glick

May 18th meeting:

Local Clay Deposits

by Roger Pollok

Our May meeting will be held Wednesday the 18th in room 114 (larger auditorium) of Earth & Engineering Sciences Building on the west side of the Penn State campus in State College, PA. Maps are available on our web site.

6:45 to 7:45p.m.: Social hour, refreshments in the lobby

7:45 to 8:00 p.m.: announcements, questions, answers

about 8:00 p.m.: featured program

The event has free admission, free parking, and free refreshments, and is open to all; **parents/guardians must provide supervision of minors.** Bring your friends and share an interesting evening!

Roger Pollok is a field geologist and self-taught sculptor from Zion, Pennsylvania. He digs and processes clays which he finds on the job or for which he prospects using his knowledge of stratigraphy and geologic structure. This clay is used to sculpt mainly busts and faces which are then fired in electric and gas kilns.

Roger will discuss the origin, occurrence, chemistry, and mineralogy of clays from Pennsylvania, from Pleistocene to Cambrian age sediments and rocks. There will be a discussion of the working properties, drying and shrinkage properties, and firing and glazing properties of clays as they relate to clay composition.

He will likely finish with a sculpting demonstration; see sculpture photographs below and at right, courtesy of the artist.



Coal miner, sculpture by Roger Pollok



Dragon mug, by Roger Pollok



Apsaroke Chief, sculpture by Roger Pollok

May NMS Meeting Door Prizes

By Bob Altamura

For the May meeting we are fortunate to have some very interesting hydrothermal minerals. All specimens exhibit crystals, including one with exceptionally well-formed saddle-shaped crystals of pink dolomite from East Petersburg, PA. I'm pleased that three of the four samples are from Pennsylvania localities, in line with our club's mission to highlight Pennsylvania earth sciences. The fourth sample contains well-formed apophyllite crystals on quartz (some amethystine) from the classic Upper New Street Quarry near Paterson, New Jersey. The one not illustrated is a 3-inch section of a single calcite crystal from Baker Quarry, York County, PA. Photographs are by David Glick.

Those attending the meeting are also welcome to donate a few above-average quality samples for the door prize drawing, at the table in front of the auditorium. A label providing whatever information is available on the specimen should be included.

Remember that we also have a "freebie table" (in the lobby to the right of the refreshments) where members can share whatever they want. It would be best if these were identified with at least one label per batch of similar specimens (NMS will provide extra blank labels for recipients to copy the information). This will continue the tradition of providing a way for extra, useful but perhaps less impressive specimens to find their way to new owners who would appreciate them.

Comments on this topic can be submitted to Bob Altamura, <raltamura@comcast.net>.

ATTENDING THE MAY MEETING?

Donations of **a few high quality, labeled door prize specimens** are invited.

Your donated snacks and drinks will be welcomed.

Bring a friend!

NMS Picnic - September 11

We are planning the annual NMS picnic for Sunday, September 11 2016, 4 to 7 p.m. at the Bingham's in Pennsylvania Furnace. Watch for details in the August Bulletin.



Dolomite, Binkley-Ober Quarry, East Petersburg, Lancaster County, PA. 2.1"



Calcite and strontianite on limestone, Winfield Quarry, Union County, PA. 4"



Apophyllite with hematite-coated quartz on basalt, Upper New Street Quarry, Paterson, New Jersey. 5.2"

THANK YOU FOR A GREAT JUNIOR ED DAY

from David Glick, NMS President

Our annual event for children on April 9 went very smoothly, and I want to thank all participating individuals and organizations for their efforts in publicizing, preparing, transporting, donating, working, demonstrating, co-sponsoring, and more. Over 160 kids and probably a similar number of parents came through and were grateful for those efforts. Although making money isn't the goal, and final numbers are not in yet, it does look like we came out ahead. As usual, reduced costs in some categories were offset by increases in others, conspiring to prevent us from getting very far from break-even.

NEWS FROM THE FEDERATIONS

Nittany Mineralogical Society, Inc., is a member of EFMLS, the Eastern Federation of Mineralogical and Lapidary Societies, and therefore an affiliate of AFMS, the American Federation of Mineralogical Societies. We present brief summaries here in order to encourage readers to see the entire newsletters.

The **EFMLS Newsletter** is available through the link on our web site www.nittanymineral.org, or remind Dave Glick to bring a printed copy to a meeting for you to see. The May issue starts with Cheryl Neary requesting donations for the Eastern Foundation Fund auction - specimens, lapidary items, books, and monetary donations are all welcome. The EFMLS convention will be held in Rochester, New York, the annual meeting on Friday, October 21, and the Rochester Lapidary Society show and the rest of the convention, including the EFF auction, on October 22-23. Dr. Gary Lohman, Juniors Chair, writes on "How Rock Collecting Helps Kids: Our Responsibility." Ellery Borow writes on "Safety Matters - Terribly Toxic Treasures" in various aspects of our hobby. Club Rockhound of the Year award and others are discussed. Wildacres Fall session (Sept. 5-11) is introduced. EFMLS Region IV will have a Potluck Picnic and Rock Swap/Sale, open to all EFMLS members, on Saturday June 18 in Charlotte Hall MD, southeast of Washington DC; see page 7 of this Bulletin.

The **AFMS Newsletter** is available by the same methods. In the May issue, it's noted that the American Federation Endowment Fund will have a drawing at the convention in July; tickets can be purchased (\$5 each or \$20 for 5) and donations of specimens, lapidary items, etc., are still welcome. President Matt Charsky writes on "The Gifters" - those who give the gift of knowledge with someone who shares their interest in a particular aspect of our diverse hobby. We also give by sharing with other club or federation members towards our common goals. The AFMS Convention will be held this July 29-31 in Albany, Oregon.

Please see the web sites for the complete Newsletters. There's a lot there! *-Editor*

Penn State Earth & Mineral Sciences Museum & Art Gallery

Museum personnel and the Advisory Board are in the midst of the process of applying for accreditation through the American Alliance of Museums Small Museums Accreditation Academy.

At the Museum, the new Augmented Reality Sandbox to illustrate the principles of topographic maps has become very popular. When a visitor changes the physical landforms in the sandbox, the exhibit digitally detects the new shapes and their elevations, and projects a colored, topographic map onto the sand's surface to show areas of equal elevation. It can also show how rain on the landforms would drain and where the water would form lakes (shown in blue in the photo). <http://news.psu.edu/story/400255/2016/03/29/arts-and-entertainment/new-hands-exhibit-ems-museum-teaches-basics>



A new display by Geosciences graduate students, "Ocean Acidification and its Effect on Marine Life," using 3D printing to show microorganisms, is written up on the web site [3DPrint.com](http://3dprint.com) at <https://3dprint.com/133389/oceanic-microorganisms/>

The fluorescent mineral display was moved to a darker corner; the glowing specimens show up very well.

Classifieds

Ads may be submitted to the Editor (see p. 8)

FOR SALE: Microscope & Accessories, Mineral Specimens, Crystal Models.

----- UPDATE - FEBRUARY 2016 -----

See the listing at www.nittanymineral.org/beall.pdf which has been **updated** to reflect the current list of specimens available. Those already sold since the 2014 listing have been removed, and some additional specimens and other items have been added. The Meiji binocular microscope set up for photomicrography is still available. Contact Frank & Gail Beall, 724-789-7290.

Lapidary Corner

Larimar: A Pectolite Rock & Prized Lapidary Material

By Bob Altamura



Figure 1. Larimar specimen.

Public domain photo by Vassil, retrieved May 11, 2016 from <https://commons.wikimedia.org/wiki/File:Larimar.jpg>

Larimar is a sea-blue semi-precious gemstone that is popular in the jewelry trade. It has been identified as the mineral pectolite, a sodium-calcium silicate hydrate, $\text{NaCa}_2\text{Si}_3\text{O}_8(\text{OH})$ (Woodruff, 1986, Sullasi et al., 2010, Kloprogge and Wood, 2016), but other minerals may occur with it and may be included in a finished larimar gemstone. Pectolite is usually white to gray, but in larimar it is blue. The blue pectolite occurs as spherulites and botryoidal masses of radiating crystals that are associated with white needles and sometimes reddish-brown areas (e.g., Figure 1). Larimar's only known occurrence is as a secondary deposit lining amygdules and open fractures in basalts of the Dominican Republic. Low concentrations of sodium atypical of pectolite have been reported in some chemical analyses of the blue material, suggesting considerable variability in chemical composition. Analyses of white needles in larimar reveal a high aluminum content, suggestive of the zeolite mineral natrolite (Woodruff, 1986). Flecks of native copper also have been reported (Woodruff, 1986) as well as chalcocite (copper sulfide) crystals (Woodruff and Fritsch, 1989). With more than one mineral species making up larimar, it technically is a rock (an aggregate of one or more minerals). Scenes of reddish-brown shapes (iron oxyhydroxide?) on a blue background (blue pectolite) and white "clouds" (natrolite?) make this an inspiring lapidary material (see Figure 1). Hardness ranges from 5 to 7 on the Mohs scale, very suitable for lapidary.

Many years ago I worked as a geologist for TILCON traprock (basalt) quarries in New England. Basalt has many excellent engineering properties such as resistance to abrasion, anti-skid properties, and acid resistance making it valuable as aggregate, especially for highways. Basalt historically has been aggressively quarried for this reason. At the same time as I worked for active basalt quarries, I was hired by the State Geological & Natural History Survey of Connecticut to compile a statewide historical and active mines and quarries map (Altamura, 1987). From these work experiences I became especially knowledgeable of many mineral localities and had opportunities to collect pectolite and associated zeolites such as analcime, chabazite, heulandite, natrolite (Figure 2), and stilbite from cavities within the basaltic lava flows in both Connecticut and New Jersey. While the geological setting for New England pectolite is similar to that for blue pectolite in the Dominican Republic, no blue pectolite was ever observed. One pectolite locality, the O & G Quarry near Southbury, CT, is actively quarried for basalt during 2016 and known for having been a mineral collecting locality of Benjamin Silliman nearly two centuries ago. Pectolite from Connecticut and New Jersey is white and tends to be splintery, not an ideal lapidary material.



Figure 2. Natrolite, Nasik District, India (11x9x7cm). Photo by Didier Descouens, CC-BY-SA-4.0 license, retrieved May 11, 2016 from <https://commons.wikimedia.org/wiki/File:Natroliteinde1.jpg>

Pectolite is akin to pyroxenes in crystal structure, both being single chain silicates. Pectolite, wollastonite and rhodonite are all classified as pyroxenoids (Klein and Hurlbut, 1993). While pyroxenoids share a silicon: oxygen ratio of 1 : 3 and have a single chain crystal structure, as do pyroxenes, the chains in pyroxenoids are characterized by a twist of silicate tetrahedrons (Klein and Hurlbut, 1993).

The blue color of larimar has been inferred to be due to substitution of calcium atoms by copper atoms within the crystal structure (Woodruff and Fritsch, 1989). Although the Dominican Republic is reported to be the only known locality

in the world for blue pectolite, if substitution of calcium by copper in pectolite is the cause of the blue color, then it potentially could occur at other basalt localities where pectolite precipitated from solution in the presence of copper.

The hypothesis of the blue color of larimar being "due to copper replacing calcium" in pectolite interested me, because from my crystal chemistry and mineralogy classes I recalled that calcium ion has a quite large atomic radius (~1 angstrom [Å]) and copper ion has a relatively small atomic radius. (One (1) angstrom equals 10^{-10} meters or 0.1 nanometers.) When I looked up the actual atomic radii of calcium and copper, I found that they are 0.99 Å and 0.73 Å, respectively. Atoms of similar radii and valence charge substitute well for each other, so substitution of calcium by copper is not an even match. However the atomic hole for calcium in the pectolite crystal structure should certainly be large enough to accommodate a copper atom.

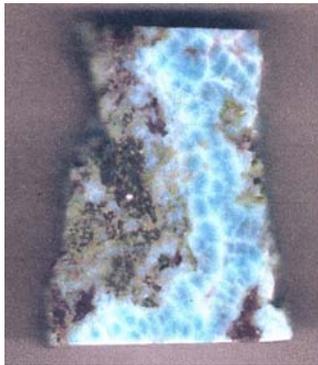


Figure 3. Larimar slab brought to me to for lapidary work. Dimensions: ~ 1" x 1.8".

Photo by the author.

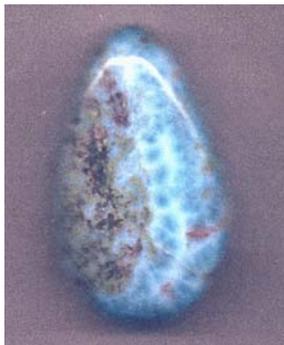


Figure 4. Larimar cabochon carved from the slab in Figure 2. The reddish-brown material was included according the specifications of my client in order to maximize the size of the pendant. The maximum dimensions of cab are 0.8" X 1.5".

Photo by the author.

Larimar is not discussed in any of my college textbooks (Manual of Mineralogy after Dana (1993) or Deer, Howie and Zussman (1966)) nor the more recent mineralogy books in my personal library. I had first heard of larimar through my lapidary hobby. A decade ago a young man approached me with a relatively small slab of the material (Figure 3) that he wanted carved into a pendant for his wife as a Christmas gift. He told me that he had purchased it in the Dominican Republic during their honeymoon. He said that he had always wanted to make a piece of jewelry out of it for her and many years had passed. I showed him some pendant necklaces that I had made, and he commissioned me to make a pendant necklace of the slab to his specifications. He decided on a teardrop shape that utilized as much volume of the slab as possible. He indicated that he had paid a considerable sum for the slab.

The slab had a considerable amount of the reddish-brown material and trimming it out as waste would have left an irregular shape of pure blue material of approximately one-half the original slab volume. This was unacceptable to him, and he chose to have me include the reddish-brown phase along with the blue pectolite into the teardrop cab (Figure 4) - apparently not an uncommon practice in the larimar trade for lower grade pieces.

Since larimar was not covered in my college or other mineralogy books in my personal library, I had to look elsewhere for more information on the source of its color. One Google hit indicated that the blue color of larimar was due to substitution of calcium by cobalt (atomic radii = 0.74 Å). Cobalt blue glass- and dishware came to my mind, and I considered cobalt as a plausible coloring agent for blue pectolite until I read further - and learned that the author was a student of mystical healing with minerals. I didn't imagine that a scientific approach reliably would have been used to arrive at such a conclusion. In general articles in professional peer-reviewed journals, or articles published by a university or a government agency are best. Most of the Google hits that I got through my online search were for businesses with larimar jewelry for sale.

A paper in Lapidary Journal by Woodruff (1986) was the earliest that I found to describe larimar. Apparently during 1974 a Peace Corps volunteer, helping out in the Dominican Republic, found some blue stones along the coast that were traced first to a nearby stream (Woodruff and Fritsch, 1989) and then later to the source bedrock a few kilometers inland - and soon, voila, the only larimar mine in the world.

Recall that the general chemical formula for pectolite is $\text{NaCa}_2\text{Si}_3\text{O}_8(\text{OH})$. Chemical analyses (Table 1) of larimar obtained by electron microprobe (Table 1) provide major element oxides, but CuO is revealed only in trace amounts. Because the amount of copper oxide measured was 0.01 weight percent and too low to be determined accurately by the 'probe', a different method, wavelength dispersive X-ray fluorescence, was used and revealed 46.5 ppm copper (Woodruff and Fritsch, 1989). Is it possible that such minute amounts of copper can cause pectolite to be blue?

Turquoise (copper aluminum phosphate hydrate) is a similar color of blue to larimar, but copper is a major constituent of turquoise (9.78 weight percent). It is interesting to note that one sample studied by Woodruff and Fritsch (1989) revealed the presence of minute crystals of chalcocite (copper sulfide) intergrown with larimar, suggestive that copper can be present above parts-per-million amounts. However the causation of the color of larimar

remains controversial and might be due to other coloring agents.

Table 1. Chemical Composition of Larimar, as percent oxides (Woodruff and Fritsch, 1989)

Oxide	Light Blue	Dark Blue
MnO	0.06	nd
FeO	nd	nd
SiO ₂	53.74	52.36
Al ₂ O ₃	0.07	0.04
CaO	35.5	36.27
MgO	nd	nd
CuO	0.01	0.03
TiO ₂	nd	nd
Cr ₂ O ₃	nd	nd
Na ₂ O	8.10	8.13
P ₂ O ₅	0.11	0.11
K ₂ O	0.02	0.02
H ₂ O		
Total	97.61	96.95

Kloprogge and Wood (2016) confirmed that larimar is pectolite by X-ray photoelectron spectroscopy (XPS) as had previously been proposed (e.g., Woodruff, 1986) - and also specifically analyzed for suspect coloring agents including copper, iron, lead and antimony. They reported that trace elements such as copper and iron varied per sample, and they stated no conclusions about those elements causing color in larimar. Measurable lead was determined and is interesting, because lead in very small amounts can act as a coloring agent in the blue-green variety of feldspar, amazonite (Kloprogge and Wood, 2016). Plumbogummite (lead oxide hydrate) is another lead-bearing mineral that is blue-green in color.

Regardless of the cause of the color in larimar, its beauty and rarity probably will continue to keep it among the most prized lapidary materials.

References cited:

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Deer, W.A., Howie, R.A., and Zussman, J., 1966, An introduction to the rock-forming minerals: John Wiley and Sons, New York, 528 p.

Klein, C. and Hurlbut, C.S., 1993, Manual of mineralogy (after J.D. Dana): John Wiley & Sons, Inc., 681 p.

Kloprogge, J.T. and Wood, B.J., 2016, X-ray photoelectron spectroscopy study of so-called "Larimar", blue pectolite

form the Dominican Republic: SDRP Journal of Earth Sciences and Environmental Studies, volume 1, issue 2, pp. 1-5, retrieved from

[http://www.openaccessjournals.siftdesk.org/articles/pdf/X-ray-Photoelectron-Spectroscopy-study\(4\)20160322003316.pdf](http://www.openaccessjournals.siftdesk.org/articles/pdf/X-ray-Photoelectron-Spectroscopy-study(4)20160322003316.pdf) on May 5, 2016.

Sullasi, H.L., Khoury, H.J., Barros, V., Libonati, R., Guzzo, P.L., Asfora, V., De Araujo, R.E., Capriles, M., and Reyes, J., 2010, Thermoluminescence response of the larimar rocks: Radiation Measurements, volume 45, number 3-6), pp. 540-542.

Woodruff, R.E., 1986, Larimar, beautiful, blue - and baffling: Lapidary Journal, volume 39, pp. 26-32, retrieved from

<http://www.jmarcano.com/mipais/recursos/larimar2.html> on May 5, 2016.

Woodruff, R.E. and Fritsch, E., 1989, Blue pectolite from the Dominican Republic: Gems & Gemology, Winter volume, pp. 216 - 225.

Geo-Sudoku

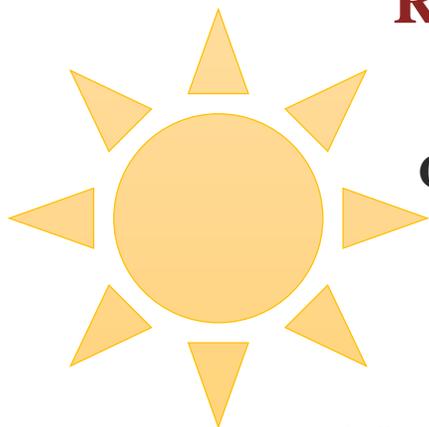
by David Glick

This puzzle contains the letters ADEGLMSUY. One row or column spells one of the places in which pectolite may occur. As usual, if you've read this issue, you've seen the word. Each block of 9 squares, each row, and each column must contain each of the nine letters exactly once. The solution is on page 8.

G	L	D					M	A
			G	D				S
	U	E	M	L		G		
			D					M
	S			U	Y			
	Y		A				U	G
U			Y			S		
			U			D	A	Y
		A		S	D	M		U

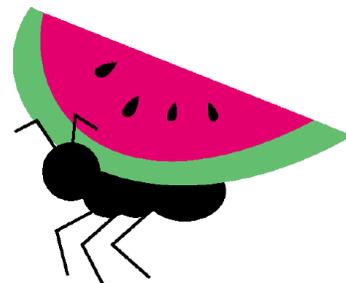
The Southern Maryland Rock & Mineral Club is proud to sponsor the 2016
Eastern Federation of Mineralogy and Lapidary Societies (EFMLS)

Region IV Potluck Picnic and Rock Swap/Sale



Gilbert Run Recreational Park
Charlotte Hall, MD

Saturday, June 18, 2016
9 am - 5 pm



Admission to the Park is \$5 per carload
(No charge for swapping or selling)

"This is an old-fashioned rock swap where people who collect rocks, minerals and fossils will be selling and trading specimens"

Details

This is a free event for all EFMLS rock club members and their families and friends. In addition to minerals, fossils and lapidary for swap/sale each attendee/family is asked to bring a potluck dish to share, and one labeled specimen donation for an auction that will take place after lunch. The auction will help defray the cost of the event. There is ample parking for tailgate swapping/selling. Please bring your own tables and chairs. There are onsite restrooms and handicap access. Donations of excess rocks and related tools to the "Treasure Box" are welcomed and are free for anyone to take. The Southern Maryland Rock and Mineral Club will provide plates, cups, plasticware, sodas, and bottled water.

Schedule of Events
9:00 - 12:00 Swap and sell
12:00 - 1:30 Potluck Lunch and Auction
1:30 - 5:00 Swap and sell

Contact Person: Dave Lines (240)-427-7062

Dave.Lines@earthlink.net

Address:
**Gilbert Run
Recreational Park**
13140 Charles Street
Charlotte Hall, MD,
20622

Directions:

From the D.C. Beltway:

Take Rt. 5 South (Exit 7A) towards Waldorf
Go 12.3 miles and turn left onto Mattawoman Beantown Rd. (Rt.5)
Go 3.2 miles and turn left onto Leonardtown Rd. (Rt.5).
Go 4.9 miles and turn right on Olivers Shop Rd.
Go 5.9 miles and turn left onto Charles St. (Rt 6)
Go 1 mile and turn left into Gilbert Run Recreational Park

OR

Take Rt. 301 to La Plata, turn left onto Charles St (Rt 6 East) and go 8.6 miles to Gilbert Run Recreational Park
Turn left into Gilbert Run Park and follow the signs to the Hilltop Pavilion Parking lot.

From La Plata, Md

From Rt. 301, take Rt. 6 East (Charles St) 8.6 miles
Turn left into Gilbert Run Park and follow the signs to the Hilltop Pavilion Parking lot.

Some Upcoming Shows and Meetings

Our web site <http://www.nittanymineral.org> has links to more complete lists and details on mineral shows and meetings around the country. See www.mineralevents.com for more.

May 21, 2016: The Earth Science Show & Sale, by Rock & Mineral Club of Lower Bucks County. First United Methodist Church, 840 Trenton Road, Fairless Hills, PA, 9a.m. - 4 p.m. www.mineralevents.com/flyers/2016lowerbucks1.pdf

June 4, 2016: Spring Mineralfest, by Penna. Earth Sciences Assoc., Memorial Park, Poplar St., Macungie, PA Sat. only, 8:30 - 3:00. <http://www.mineralfest.com/>

June 17-18, 2016: Natural Wonders of the World, Lancaster County Fossil and Mineral Club Show, Solanco Fairgrounds, 172 South Lime St., Quarryville, PA. Friday noon-8, Sat. 9-4. <https://www.facebook.com/LancasterFossilandMineralClub/>

July 27-Aug 1, 2106: AFMS and NFMS Convention & Show, Albany, Oregon. <http://www.amfed.org/nfms/FederationShow.asp>

Sept. 17-18, 2016: Central Pennsylvania Rock & Mineral Club Gem, Mineral and Jewelry Show. Zembo Shrine, 2801 N. 3rd St., Harrisburg PA www.rockandmineral.org/annualshow.htm

October 1, 2016: Autumn Mineralfest, by Penna. Earth Sciences Ass'n. Macungie Memorial Park, Poplar St., Macungie PA. Sat. only, 8:30-3:00. www.mineralfest.com

October 21-23, 2106: EFMLS Convention & Show, Rochester, NY. <http://www.rochesterlapidary.org/show/>

Geo-Sudoku Solution

G	L	D	S	Y	E	U	M	A
A	M	Y	G	D	U	L	E	S
S	U	E	M	L	A	G	Y	D
E	A	U	D	G	L	Y	S	M
M	S	G	E	U	Y	A	D	L
D	Y	L	A	M	S	E	U	G
U	D	M	Y	A	G	S	L	E
L	G	S	U	E	M	D	A	Y
Y	E	A	L	S	D	M	G	U

Visit us at www.nittanymineral.org

INVITE A FRIEND TO JOIN THE SOCIETY

The Nittany Mineralogical Society prides itself on having among the finest line-up of speakers of any earth sciences club in the nation. Everyone is welcome at our meetings. If you'd like to be part of our Society, dues are \$20 (regular member), \$7 (student rate), \$15 (seniors), \$30 (family of two or more members, names listed). Those joining in March or later may request pro-rated dues. Your dues are used for programs and speakers, refreshments, educational activities, Bulletins, and mailing expenses. Please fill out a membership form (available at www.nittanymineral.org), make checks payable to "Nittany Mineralogical Society, Inc." and send them in as directed, or bring your dues to the next meeting.

We want to welcome you!

CONTACT INFORMATION

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Membership Chair: David Glick (see above)

Programs: Dr. Duff Gold 865-7261(o), 238-3377(h)
 e-mail: gold@ems.psu.edu

Door Prizes: Dr. Bob Altamura (see above)

Facebook & Publicity: John Dziak: jjd264@psu.edu

The **Bulletin Editor** will welcome your submissions of articles, photos, drawings, cartoons, etc., on minerals, fossils, collecting, lapidary, and club activity topics of interest to the members. Please contact:

David Glick E-mail: xidg@verizon.net
 209 Spring Lea Dr. phone: (814) 237-1094 (h)
 State College, PA 16801-7226

Newsletter submissions are appreciated by the first Wednesday of the month. Photographs or graphics are encouraged, but please do not embed them in word processor files; send them as separate graphics files (TIF, or good to highest quality JPEG files, about 1050 pixels wide, are preferred). Please provide captions and name of photographer or artist.