Nittany Mineralogical Society Bulletin

Nittany Mineralogical Society, Inc.
P.O. Box 10664
State College PA 16805

April, 2010 **Visit our web site: www.ems.psu.edu/nms/** *Editor (see page 8): David C. Glick*

April 21st meeting:

Color in Tourmaline

by
Bruce Fry

Our April meeting will be held Wednesday the 21st in the room 114 auditorium of Earth & Engineering Sciences Building on the west side of the Penn State campus in State College, PA. Maps are available through our web site.
6:30 to 7:30 p.m.: Social hour, refreshments in the lobby
7:30 to 8:00 p.m.: announcements, questions, answers; door prize drawings
about 8:00 p.m.: featured program

The event has free admission, free parking, and free refreshments, and is open to all – ***Bring up to two or three tourmaline specimens for analysis as mentioned in the article, and share the fun.*** *-Editor*

Tourmaline is a group of minerals that is greatly appreciated by all branches of the earth sciences. Color in tourmaline is as complex as the group's chemistry. At the meeting, I hope to present a reasonable picture of the elements which act as chromophores when present in tourmaline, and the role of radiation in the color of tourmaline. The talk will focus on cuprian tourmaline, as it is the most recent development in the wonderful world of color in tourmaline. I will have colorful examples of gems from my extensive collection, beautiful pictures taken by Jeff Smith "The Geode Guy" as shown here, and a brand new, state of the art, spectrometer. The spectrometer will be available to investigate color in members' tourmaline, both rough and cut. Please limit your number of specimens to two or three. The spectrometer is particularly useful in determining if the tourmaline contains copper as a chromophore.

Junior Rockhounds Meeting April 22

Junior Rockhounds meetings are scheduled for 7:00 p.m. on the fourth Thursday of the month, January through May, so the remaining meetings are April 22 and May 27. The location is room 118 of Earth & Engineering Sciences Building, on White Course Drive, Penn State's University Park "West Campus," with free parking.

Each month's Junior Rockhounds meeting has a new topic or topics with fun, hands-on learning. Youngsters who have not yet received their collection storage boxes courtesy of NMS should come to the meetings and pick one up. Those who already have them should bring them to the meetings to hold the specimens which will be given out.

We encourage those who attend to become NMS members, but it's not required. Just $7.00 covers a whole year (through October 2010) of student membership. Parents may get a lot out of the meetings, too! Check the web site for news, or contact Dr. Andrew Sicree (see page 8).

Another Fun Minerals Junior Education Day

by David Glick, Chair

Our 14th annual event for children and their parents, Minerals Junior Education Day, went smoothly and successfully on April 10. The attendance was 208, not as high as the 275 we had planned for, but a very manageable number. There were eight stations for the students to visit, each with at least one "take-away" for them to keep:

1. Mineral Hardness & Lapidary
   Pendant (tumble polished, drilled, threaded)
2. Gems & light: Chatoyancy & Asterism
   Tiger's-eye or satin spar
3. Invertebrate fossils (particularly Ordovician)
   Horn coral; crinoid, brachiopod, nautiloid
4. Vertebrate fossils
   Turtle, manatee shell/ bone
5. Micromounts
   Crystalline specimen in magnifier-top box
6. Iceland Spar & double refraction
   Iceland spar calcite
7. Gold panning by GPAA Bald Eagle Chapter
   Gold flakes
8. Sphere making
   Marble spheres

Continued with photos on page 3

ATTENDING THE APRIL MEETING?
Donations of door prize specimens are invited.
NMS will provide ice, soft drinks, and water;
your donated snacks will be welcomed.
Refreshments Coordinator Needed!

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.ems.psu.edu/nms/** or remind Dave Glick to bring a printed copy to a meeting for you to see.

The April issue reports on the 60th EFMLS convention hosted by Delaware Mineralogical Society in March: meetings, meals, presentations, awards. President Loren Patterson suggests that if we can't get out on a collecting field trip, we can take a trip to a mineral show as a temporary substitute, or a trip to the garage to clean and label last season's specimens and sharpen tools to get ready for this year. The 2010 EFMLS Citation Award goes to Matt Charsky, a past president who continues to be active in many capacities. Fall Wildacres (September 6-12) is described, with a list of classes. Milestones in AFMS Scholarship support by EFMLS clubs are reported; Nittany Mineralogical Society is noted with our new level of 300% (three dollars per member over the lifetime of our club). Cathy Patterson starts a step-by-step series on compiling an All American Club yearbook for the 2010 competition.

The **AFMS Newsletter** is available by the same methods. The April issue begins with details of the AFMS / California Federation convention and show coming in June. Six field trips are planned, including two to tourmaline mines. President Emerson Tucker reports that he enjoys reading both paper and electronic newsletters from the many member clubs, even though there are a lot of them! The Junior activities column requests that each club send a rock, mineral or fossil to two juniors-only clubs, one in New York and one in California. AFMS Endowment Fund drawing prizes are described; tickets are $5 and the deadline to enter is May 31. Two inter-regional collecting trips are planned for 2010: petrified wood in SW Wyoming over Labor Day weekend in early September, and agate in New Mexico August 28 through September 6 (Labor Day weekend), with more details to come. The Conservation & Legislation committee report covers public input opportunities in March, April, and May concerning changes in management plans for US Forest Service lands, and proposed increases in restrictions on use of 13 million acres of Bureau of Land Management (BLM) lands. American Lands Access Association President Dick Pankey discusses the general process of writing (including the "Little Rockhound Sticker") to the BLM and Forest Service, as well as some specific current proposals in California.

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

Planning for Nittany Gem and Mineral Show

By David Glick

For the **Show on June 26-27**, we need donations for the silent auction, and volunteers for a wide variety of activities including table set-up on Friday morning, June 25, and food service. Please plan to enter the Best of PA specimen contest. Now that other events are finished, details really will be coming soon.

Please contact Dave Glick to volunteer or to get more information.

Dealers: Spaces are still available; contact David Glick, Show Chair (see page 8). *- Editor*

Field Trips Approaching!

Friends of Mineralogy - Pennsylvania Chapter is kindly including NMS in a heavy-duty (backhoe!) trip to a classic Lancaster County, Pennsylvania, locality; a small fee for the backhoe work will be required from each participant. If you are interested in this or other trips, you should be signed up on Field Trip Chairman Ed Echler's (see p. 8) e-mail list.

Mexican Minerals on Display at Penn State's E&MS Museum

NMS recently installed a display of Mexican minerals in the Earth and Mineral Sciences Museum on the ground floor of Deike Building on Penn State's University Park campus. The specimens are on loan from members. We are still planning to have information and photographs in a future issue. The museum gallery is generally open during business hours on weekdays when the University is in session.

Mineral specimen photographs by NMS member John Passaneau are also on display in the hallway outside the museum galleries. *- Editor*

Got Cutting Oil?

Lapidaries! Do you use cutting oil with your diamond blades or grinders? See the classifieds on page 8 for Jim Garthe's note about organizing a group purchase. *- Editor*

Upcoming NMS Meetings

May 19: Seismic Exploration for the Marcellus Shale, by John Peeples

June: No meeting, please help prepare for Show June 26-27

August 18: Monthly meetings resume

NMS is on Facebook!

See our public Facebook page at <http://www.facebook.com/group.php?gid=293993550756>

Minerals Junior Ed. Day *continued from page 1*

I want to extend my sincere thanks to everyone who volunteered, either in preparation or at the event, or provided services or materials for us to use. I think we do a great job with this event, and this years's seemed to go very smoothly. It not only provides fun and education for kids (and parents) but shows off our Society very well.

Thanks to recent donations by Skip Colflesh, Scott Snavely, and Jeff Smith, as well as earlier donations from Ruth Park, Jean Carpenter, Mike and Barbara Sincak, and many others, we had plenty of items for the sales table. We also selected five door prizes from among the donations.

The Earth and Mineral Sciences Museum in Deike Building was open for several hours so that participants could walk over and see it as well.

Please think about volunteering for next year! If you know of opportunities to get about 300 similar specimens (particularly fossils) which we could use as the basis for a station, please let me know.

Gold panning, demonstrated by the Bald Eagle Chapter of the Gold Prospectors Association of America, has been a major attraction at Minerals Junior Education Day for many years. *A. Sicree photo.*

10 years ago in NMS

In April 2000, our meeting program was Appraising Gems, by Karen Bonnano DeHaas, Master Gemologist Appraiser. We were preparing for a field trip to the "Teeter" quarry (by that time it was officially Valley Quarry's Gettysburg quarry). Our fifth Symposium, on Fluorescence, Light and Color in Minerals, was coming up in late May. - *Editor*

Jim Garthe demonstrates and discusses his home-made sphere making machine with students and parents at Minerals Junior Education Day. *Pat Garthe photo.*

15 years ago in NMS

In April 1995, our monthly program was our first "Open Demo Night" of specimens, photographs, etc., which we have more recently been calling Show and Tell. We were preparing for our first Minerals Junior Education Day, and collecting specimens to be given away - happily, some things never change. - *Editor*

110 years ago in The Mineral Collector

The lead story of the April 1900 issue recounts the history of the Kimberley diamond mines in South Africa. The Lewis C. Beck mineral collection, th eoldest part of the Rutgers museum collection at that time, was described in detail. "Quartz and its varieties fill 119 trays with over 425 specimens. All of the various forms of crystals, clear and colorless, milky, ferruginous, amethystine, smoky, etc., are shown; massive – white, black, rose-colored, etc.; cryptocrystalline – chalcedony, flint, jasper, and so on. The most interesting crystals are from St. Lawrence and Herkimer counties, New York. The former are dodecahedrons, and the latter the celebrated 'Little Falls diamonds.' " Ward's advertisement offered celestine from the "Strontian Cave" at Put-in-Bay, Ohio: crystals from 3 to 5 inches in diameter, $1.00 to $5.00 each. - *Editor*

POPULAR MINERALOGY

Fascinating mineralogy and earth science for the amateur mineralogist and serious collector - #33

Lunar Mineralogy

by Andrew A. Sicree

A dearth of samples

Mineralogists who would study lunar mineralogy face a dearth of samples. Apart from tripping to the Moon by yourself in your own private spacecraft, there are only two sources of lunar minerals: samples returned by the American and Russian lunar missions, and lunar meteorites.

Lunar meteorites are meteorites that have their origin on the Moon. Blasted off the Moon by the impact of a "bolide," a large asteroid that impacted on the Moon, some lunar rocks picked up enough speed to escape the Moon's gravity. Lobbed into outer space by the force of the impact, some lunar rocks are swept up by the Earth's gravitational field and fall to the ground as lunar meteorites. Several of these meteorites are known and they command hefty prices when sold. We only know that they are of lunar origin because we have other lunar minerals with which to compare them.

For example, pieces of the meteorite known as NWA 4734 were purchased from nomadic Bedouins in Erfoud, Morocco. The Bedouin found it somewhere in the trackless deserts of Northwest Africa. The Bedouin have learned that meteorites can be sold for a good price, and they have begun picking up black rocks in the desert that they otherwise would have ignored. They have become the world's most accomplished meteorite finders. (Although it had been customary to name meteorites after towns near which they fell, the Bedouin have found so many meteorites in the uninhabited wastelands of North West Africa that meteorite specimens found in the desert are given the "NWA" tag followed by a serial number.) NWA 4734 is composed of highly fractured pyroxenes with plagioclase laths and minor amounts of silica and silica-feldspar glass. Accompanying minerals include ilmenite, baddeleyite, zirconolite, tranquilityite, and pyrrhotite – enough to make it a pretty interesting rock even if it didn't come from the Moon.

Six Apollo missions reached the Moon and returned with samples. Nearly 2200 samples weighing a total of 842 pounds (382 kg) were collected by American astronauts between 1969 and 1972. Russian robotic landers returned about 0.75 pounds (0.3 kg) of lunar rocks. The mineralogy of the collected lunar rocks and soils has been studied extensively and from these studies we can draw up a preliminary mineralogy of the Moon.

Lunar minerals are like Earth's

Some new minerals, such as tranquilityite and armalcolite, were first encountered among the Apollo samples. Tranquilityite, $(Fe,Ca)_8(Zr,Y)_2Ti_3(O_4SiO_4)_3$, hexagonal, is named after its discovery locality, the Sea of Tranquility on the Moon. The mineral armalcolite, $(Mg,Fe)Ti_2O_5$, orthorhombic, is derived from the surnames of Apollo 11 astronauts Neil Armstrong, Edwin Aldrin, and Michael Collins, who collected the first specimens. Subsequently, some of these unusual "lunar" minerals have also been found on Earth. For instance, armalcolite is reported from the Kerguelen Islands in the southern Indian Ocean.

Generally speaking, most minerals found on the Moon are also found on the Earth, but not vice-versa. The absence of water and an atmosphere prevent the formation of common Earth minerals such as goethite (FeOOH). But this does not mean that there are no oxides on the Moon.

Lunar mineralogy

Oxide minerals found on the Moon include ilmenite, spinels, armalcolite, and chromite. Ilmenite is worth noting because it occurs in some lunar rocks in much higher concentrations than in similar Earth rocks.

Lunar silicates include pyroxenes, plagioclase feldspar, olivine, zircon, tranquilityite, and garnets. Pyroxenes such as augite and pigeonite are among the most abundant minerals in the Moon's crust.

Crystalline silica in the form of quartz, tridymite, and cristobalite is found on the Moon, but quartz is much less common than it is in Earth rocks. The crust of the Moon is

less evolved than the Earth's crust. There has been much less magmatic activity on the Moon and thus less opportunity for quartz to be formed by magmatic differentiation, i.e., to segregate as quartz crystals from a magma – the way quartz forms in granites, for instance. Although not technically minerals, silica and silica feldspar glasses are also found. They formed due to rapid cooling of molten rocks produced by meteorite impact or lunar volcanism.

Olivine is a common mineral on the Moon. Olivine's general formula is $(Mg,Fe)_2SiO_4$ and it exists as a solid solution series ranging from the magnesium-rich end member forsterite (Mg_2SiO_4) to the iron-rich fayalite (Fe_2SiO_4). Lunar olivines have a wide range of compositions but most tend toward the forsterite end of olivine series. But almost pure fayalite has been found on the Moon, too.

Troilite is a common lunar sulfide mineral. Native iron and other metals (such as nickel) also occur. Other lunar minerals include schreiberite, cohenite, niningerite, and lawrencite. Interestingly, the phosphate minerals apatite and whitlockite were also found.

Extreme age of lunar minerals

Lunar rocks are extremely old. Samples have been radiometrically dated at between 2.8 and 4.5 billion years old. Rocks this old are rare on Earth. Among the oldest non-meteoritic Earth materials are 4.03 billion year old rocks from northwestern Canada. Tiny crystals of zircon from Western Australia are thought to be at least 4.38 billion years old – making them the world's oldest minerals. The antiquity of lunar rocks gives planetary geologists the opportunity to study actual samples of rocks that formed at the time the crust of the Moon solidified (presumably the same time that the crust of the Earth formed).

A Cometary Mineral

How can you catch a comet? And if you could catch a comet, what minerals would you find in it?

As a comet approaches the Sun, solar radiation spalls off particles of ice and dust. These dust particles fall behind the comet and get strung out all along the path of the comet's orbit. Comets orbit the Sun in highly elliptical orbits that cross the orbits of planets like the Earth. When the Earth crosses the orbit of a comet, the Earth's gravity field sweeps cometary particles. Larger particles burn up in the Earth's uppermost atmosphere as meteors, but smaller particles slowly filter downward into the stratosphere. Dust particles found in the stratosphere are usually more likely to be filtering down from comets and disintegrating meteoroids than rising up from volcanoes and dust storms (the effects of which are usually confined to the troposphere).

In 2003, as the Earth crossed the orbital path of the comet "26P/Grigg-Skjellerup," NASA sent up a high flying research plane equipped with dust collectors. Much of the dust collected on these flights is assumed to have come from the comet. Analysis of the dust led to the discovery of a new mineral, *brownleeite*.

Brownleeite (MnSi, cubic) has a unique chemical composition: manganese silicide. The fact that this mineral has not yet been found on the Earth (or for that matter, on the Moon) is evidence that the mineral formation environment of comets is drastically different than terrestrial environments. Brownleeite is named for Donald Brownlee, a University of Washington astronomer who is best known for his book *Rare Earth: Why complex life is uncommon in the universe*. Brownlee has been a pioneer in the study of cometary dust, so the naming of a new cometary mineral after him is quite appropriate.

Discovered Among the Fragments

Abbé René-Just Haüy (1743-1822) is rightfully known as one of the founders of modern crystallographic mineralogy because of his discovery of the "law of rational intercepts." The law of rational intercepts states somewhat formally that each crystal has a set of axes, known as **crystal axes**, that allows a crystal face to be characterized in terms of intercepts of the face with these axes and that the reciprocals of these intercepts are small rational numbers. That definition is a bit hard to wrap one's mind around, so let me offer some background to Haüy's discovery:

Haüy, ordained a Catholic priest, developed a strong interest in botany. In the plant world, he observed order: each species of tree or flower always produced the same type of leaves or petals. It made sense to Haüy that God's creation should be ordered. But evidence of order was lacking in the mineral world. Calcite crystals might be found as "dog-tooth spar" or rhombohedrons. Pyrite might come as cubes or pyritohedrons. Hundreds of forms were known. Haüy remained puzzled by the apparent lack of order.

A famous story is told in which Haüy, while viewing the mineral collection of a colleague, accidentally dropped a prize

specimen of calcite. The calcite shattered when it hit the floor, breaking into hundreds of rhombohedral cleavage fragments. Stooping to examine the scene of misfortune, Haüy is said to have suddenly exclaimed, "*Tout est trouvé*" ("all is discovered" – the French equivalent to "Eureka!").

At that instant, Haüy realized that the calcite was built up from a basic unit that he called an "integrant molecule." Each "integrant molecule" was identical and each was the smallest possible portion of the calcite crystal. The calcite crystal was built up by stacking these "integrant molecules" side-by-side and one on top of the next in a three dimensional array.

Haüy hurried home to take hammer and chisel to specimens in his own mineral cabinet. He smashed dog-tooth spars, barrel-like crystals, and poker-chip calcite crystals. No matter what its exterior habit was, each calcite crystal broke into identically-shaped rhombohedrons. Haüy noticed that each calcite cleavage fragment could be cleaved again and again producing smaller and smaller rhombohedrons, each with the same angular shape.

Haüy thought that, for calcite, the "integrant molecule" was the shape of a cleavage fragment. Present-day crystallography varies in details from Haüy's theory, but in general his ideas led to the modern concept of the three-dimensional "unit cell" – the smallest repeating unit of a crystal.

"Unit cells" or "integrant molecules" stack up to form crystals and the edges of the stacks define the faces of the crystals. Just as one can take rectangular sugar cubes and neatly stack them into a four-sided pyramid with triangular faces (doesn't everyone do this in grade-school?), so also are the faces of crystals defined by the edges of its unit cells. Haüy could explain how the same basic unit could be stacked to yield forms as different as the "dog-tooth spar" and the rhombohedral crystal.

Before Haüy, mineralogy was largely an exercise in collecting various specimens with interesting but unrelated forms. After Haüy, mineralogy had become a science as precise and methodical as astronomy.

Dr. Andrew A. Sicree is a professional mineralogist and geochemist residing in Boalsburg, PA.

Geo-Sudoku

by David Glick

This puzzle contains the letters ABCILORST, and one row or column spells out the root of the name of a silica mineral which is found on the moon. 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.

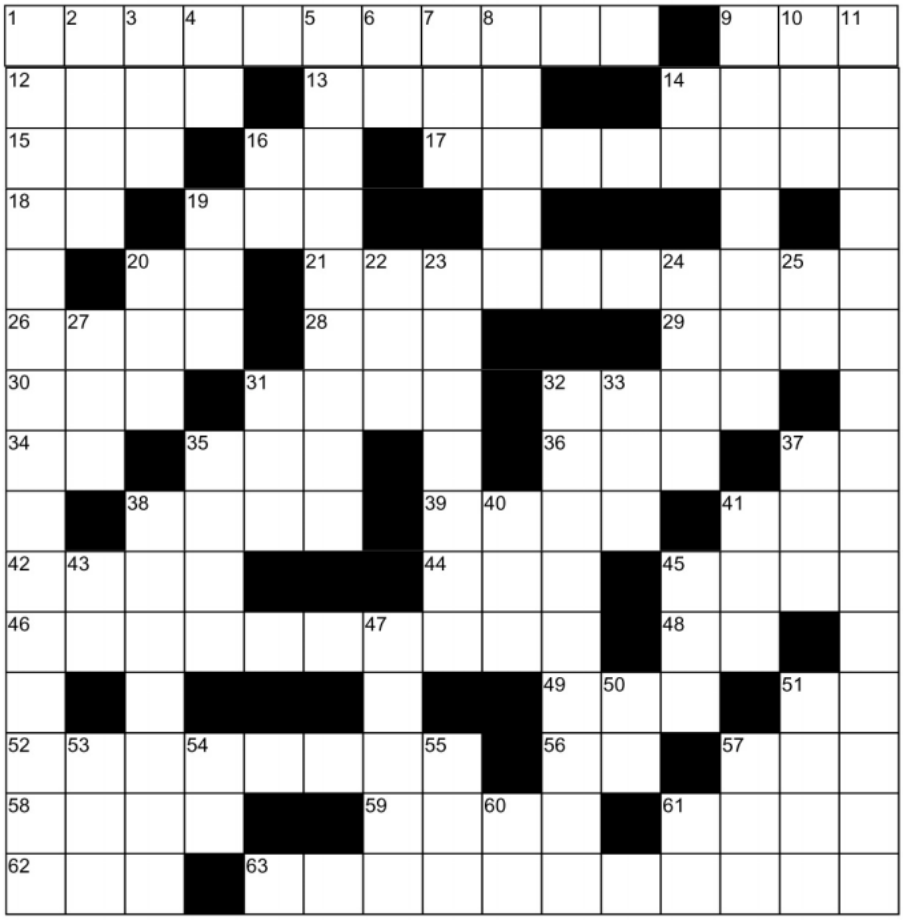
A	B							
T	S		L					
				S			O	
	I		A					B
	L	C			T			A
				O	L			
C					O			
				C		S		T
		B					I	

This puzzle contains the letters ACILMNOSV, and one row or column spells out a process that might melt rocks on the moon. 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.

	O				L			
	A			M		N	S	
		S			N		I	L
	N		O					C
	V	I					L	A
			V		I	S		N
	M	O					A	
						C		S
	S		I	N	A	L	O	

Crystal Matrix Crossword

Crystals Time and Space



ACROSS

1 habit of chalcopyrite
9 Arabian market
12 made of mineral grains
13 grayish pale-yellow shade (beige)
14 volcanic island
15 year
16 owned by Tin Woodman
17 Cousteau's world
18 Nova Scotia
19 period of time (geological)
20 iridium
21 studies Moon rock chemistry
26 legbone of a mastodon
28 row rows your boat
29 follows a Mercedes
30 man's name
31 against
32 river in Austria
34 long-play record
35 snake around the neck
36 sent from Titanic
37 found in celestine
38 used in timbering mine
39 a really long time
41 Japanese fish
42 trigonal crystal (ab)
44 a Mayan language
45 yellow mineral/element
46 yttrium-bearing silicate
48 scale for oxidation state
49 transmission electron microscope
51 in morning
52 path we took notes along
56 radium
57 International Gemological Institute
58 Caesar said to Brutus
59 a type of fruit
61 entrance to a mine
62 seat of a bishop
63 astronauts' mineral

DOWN

1 placid lunar mineral
2 periods of time
3 total cost of ownership
4 radial keratotomy (ab)
5 system for beryl, quartz
6 European Commission
7 nickname for Drew
8 written by Vikings
9 fresher
10 ultra high energy (ab)
11 two silica minerals
14 Oregon Trail state
16 Diamond state
19 another geological time
20 no room at the ___
22 do it in a restaurant
23 folded paper art
24 business majors
25 element in stannite
27 used to polish slabs
31 Japanese for "colored"
32 crystal with 3 equal axes
33 opposite of a daughter
35 Czech for "digger"
37 our sun
38 darapskite, niter, etc.
40 ___ at Joe's
41 potassium hydroxide
43 right (ab)
45 sought after stone
47 a place-holder
50 each (ab)
51 shake, stir
53 route (ab)
54 another new
55 thermogravimetric analysis
57 former Ugandan dictator
60 equals C
61 aluminum

LAST MONTH'S SOLUTION:
Iridium and Friends

S	■	C	U	P	R	O	I	R	I	D	S	I	T	E
H	A	U	N	T	■	P	■	A	G	U	■	R	A	Y
O	K	■	L	■	C	H	E	N	G	D	E	I	T	E
W	A	C	O	■	R	I	■	S	■	■	■	D	■	■
M	■	H	A	■	A	R	R	O	W	H	E	A	D	S
A	C	A	D	■	Z	■	U	M	■	A	T	R	I	P
N	E	L	■	T	I	P	■	I	R	■	A	S	A	E
S	■	C	O	L	L	E	C	T	I	B	L	E	■	R
H	L	O	I	■	Y	R	■	E	P	I	■	N	I	R
I	M	P	L	Y	■	S	M	■	O	■	O	I	L	Y
P	H	Y	S	I	C	I	S	T	S	■	X	T	■	L
■	■	R	■	■	■	M	■	O	T	■	Y	E	T	I
I	R	I	D	O	S	M	I	N	E	■	G	■	A	T
T	U	T	■	R	K	O	■	G	■	G	E	O	D	E
S	T	E	P	P	I	N	G	S	T	O	N	E	■	S

Some Upcoming Shows and Meetings

Our web site http://www.ems.psu.edu/nms/ has links to more complete lists and details on mineral shows and meetings around the country.

April 17 - 18, 2010: Monongahela Rockhounds Gem Mineral and Fossil Show. West Mifflin PA. See <www.monongahelarockhounds.org>

April 24-25, 2010: 38th Annual NJ Earth Science Gem & Mineral Show (with Outdoor Swap) Co-sponsored by the Franklin-Ogdensburg Mineralogical Society, New Jersey Earth Science Association and Sterling Hill Mining Museum. Franklin School, Franklin, NJ

May 1 - 2, 2010: "Treasures of the Earth" show and sale by Mineralogical Soc. of Northeastern PA; Oblates of St. Joseph, 1880 Hwy. 315, Pittston, PA. Sat. 10-5, Sun. 10-4.

June: 5, 2010: Spring Mineralfest sponsored by the Pennsylvania Earth Sciences Association. Macungie Memorial Park Building, Macungie, PA.

June 26 - 27, 2010: Nittany Gem & Mineral Show, State College, PA. <www.ems.psu.edu/nms/>

2011: EFMLS & AFMS July 7-10, Syracuse, NY
2012: EFMLS Sept.16-17, Harrisburg, PA ❄

For sale / trade: Equipment & Materials

Combined purchase: Need **rock cutting oil**? Help me determine interest in purchasing 55-gallon drum, approx. $8.50 per gallon. Contact Jim Garthe -- jwg10@psu.edu

For sale: Large mineral collection; will sell all or part. Tumble polisher with three 12-lb. and one 6-lb. drum plus grits, polishes and pellets. My phone number is (570) 672-2325. Leave a message if I'm not in.

For sale: Jade in various types & colors; mostly rough, plus some slabs; some fine Coober Pedy opal. Also equipment and jewelry making supplies from jewelry studio and production shop. Contact Daniel G. Reinhold in Mill Hall, PA; phone 570 726-8091 after lunch every day, or e-mail: dreinhold1@comcast.net ❄

GeoSudoku Solutions from page 6

A	B	R	O	I	C	T	L	S
T	S	O	L	A	R	I	B	C
I	C	L	T	S	B	A	O	R
O	I	T	A	R	S	L	C	B
R	L	C	I	B	T	O	S	A
B	A	S	C	O	L	R	T	I
C	**R**	**I**	**S**	**T**	**O**	**B**	**A**	**L**
L	O	A	B	C	I	S	R	T
S	T	B	R	L	A	C	I	O

cristobal (cristobalite)

M	O	N	S	I	L	A	C	**V**
I	A	L	C	M	V	N	S	**O**
V	C	S	A	O	N	M	I	**L**
A	N	M	O	L	S	I	V	**C**
S	V	I	N	C	M	O	L	**A**
O	L	C	V	A	I	S	M	**N**
N	M	O	L	S	C	V	A	**I**
L	I	A	M	V	O	C	N	**S**
C	S	V	I	N	A	L	O	**M**

volcanism

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). Your dues are used for programs and speakers, refreshments, educational activities, Bulletins, and mailing expenses. Please fill out a membership form (available on the web site), make checks payable to "Nittany Mineralogical Society, Inc." and send them to

Nittany Mineralogical Society, Inc.
P.O. Box 10664
State College, PA 16805

or bring your dues to the next meeting.

We want to welcome you!

SOCIETY OFFICERS

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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:

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Newsletter submissions are appreciated by the first Wednesday of the month. If you include photographs or graphics, 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.