Nittany Mineralogical Society Bulletin

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

Editor (see back page):

March, 2018 **Visit our web site: www.nittanymineral.org** *David C. Glick*

March 21st meeting:

Iron Ores of Kish Valley

by
Paul Fagley, Cultural Educator
PA Department of Conservation and Natural Resources
Greenwood Furnace State Park Complex

Our March meeting will be held Wednesday the 21st in room 114 (the large auditorium) 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 7:45 p.m.: Social hour, refreshments in the lobby
7:45 to 8:00 p.m.: announcements, questions, etc.
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!*

In the 19th century, iron ore was dug in Big Valley (more formally known as Kishacoquillas Valley) to feed several local furnaces. The prospects of mineral wealth led to a push for a railroad in the valley, but it came too late. What kinds of ore were found, how was it formed, where was it dug, and where it went will be presented in this program on a long gone industry of the scenic valley. Samples of ore will be shown as a part of the program. ❄

MINERALS JUNIOR EDUCATION DAY: At last year's event, Penn State student volunteers (left) explain crystal structure and how it influences physical properties of various minerals. *D. Glick photo.*

REGISTER NOW AT
www.nittanymineral.org

Minerals Junior Education Day
Saturday, April 7, 2018

Registration for our Annual Minerals Junior Education Day is **now open**. The event is set for Saturday, April 7, at Central Pennsylvania Institute of Science & Technology at Pleasant Gap, the same location as the last few years. **Please tell your friends and neighbors with kids in grades 1- 8 that they should register and attend!** Please register by Wednesday, April 4.

At this event, kids get an empty egg carton when they check in, then go with a parent to a series of stations, each concerning a different aspect of mineral properties, rocks, fossils, etc. They learn about the topic from a demonstration or discussion, and receive a properly labeled specimen or educational item related to the topic, so they gather a whole collection in their egg carton. Everyone goes through at their own pace and goes to the stations in the order they choose. There is also a sales table with kid-friendly prices. Allow at least an hour and a half or two hours in total.

This year the planned stations are:
- gold panning by GPAA,
- caves & karst by Lincoln Caverns,
- petroleum drilling,
- lapidary (gemstone carving) and oolitic chert,
- grinding and polishing spheres,
- invertebrate fossils (shells),
- flame tests for mineral identification,
- ultraviolet fluorescence (glow in the dark), and
- crystal forms and structure.

TO REGISTER: (Please register by Wednesday, April 4)

The best way to register and pay is by PayPal through our web site at www.nittanymineral.org. Registrants choose their desired time slot and the number of children, pay by Paypal, and it's all taken care of. We have people register for a time slot in order to spread the crowds out through the day. Other registration methods are to follow directions on the web site to send an e-mail to <nittanymineral.org@gmail.com> and wait for a confirmation, then pay at the door; or call 814-321-5309, leave a message requesting a chosen time slot and the number of children, wait for a return call to confirm, and then pay at the door. Only the children who are taking the samples at the stations need to pay; parents come along for free and keep everything under control.

Continued on page 2

Mineral Junior Education Day, continued from page 1

We are **seeking volunteers** to help with various aspects of the event. We also welcome advance donations of identified minerals, tumble-polished material, fossils, books, etc. which can be sold at child-friendly prices. To volunteer or get more details, **please contact Frank J. Kowalczyk:**
frank.j.kowalczyk@gmail.com
or 814-404-9854. ❄

Geo-Sudoku

by David Glick

This puzzle contains the letters ADEGINRTU. One row or column spells one of the major sub-groups of garnets. As usual, if you've read this issue, you've seen the word, or a variation of it. 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.

						R	G	
		U	G				E	
	A				T	D		I
D	I	T			U	N	R	
			N		I	A	D	G
		A					I	
A					R	E	T	
	E		T	D	A		N	
		R		U	G		A	

-Have a mineral word with 9 letters, none repeated, that hasn't been used recently in our Geo-Sudoku?
Please submit it the Editor (see page 8).

More on **Pen Ambler**, 1936-2018

Last month we noted the passing of collector Pen Ambler. Trish Ambler has provided two more items:

I wanted to let you all know that I have closed Pen's "Bridger" e-mail account. There were too many contacts coming in that no longer apply to me. I am trying to simplify my life and try to clear the decks so to speak. Thank you all for understanding and befriending Pen. If you wish to stay in contact with me please send e-mails to Trish at: paa412@atlanticbb.net

Pen's collection has been sold and is in good hands with another local collector and long-time friend of Pen.

Wilber G. Bemis Jr. 1931-2018

We are saddened to report that our friend and long-time NMS member "Bill" Bemis has died. A full obituary is available at Legacy.com, which reports "Wilber Guy Bemis, Jr., known to friends and family as Bill, passed away on February 18, 2018, at the age of 86 years. Bill was loved by so many; he was a true 'jack of all trades' with a lifelong passion for learning, helping, teaching and singing. He was ... married to Jean Winter Bemis in 1959. He served his country by devoting his career to the armed forces. "

Bill was a regular at our monthly meetings, bringing good stories, good humor, and insightful questions. He will be deeply missed, and we send our sincere condolences to Jean and the family.

There will be a Celebration of Life on Saturday, 21 April, 11:00 a.m., at Zion Lutheran Church, 105 Old Boalsburg Rd., Boalsburg PA 16827. It will have music, prayers, blessings, memory sharing, and greeting family and friends. A "Bill-style' lunch will follow.

FEDERATION NEWS

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 now being distributed electronically; a link is available on our web site **www.nittanymineral.org**. The March issue begins with updates and information on the EFMLS Annual Convention, which will also be the AFMS Convention this year, to be held in Raleigh, North Carolina, April 6-8, with field trip April 9. President Barbara Ringhiser notes some good reasons to attend the big show at the convention, and points of interest, such as the different types and formats of display cases, and the variety of merchandise categories available from the dealers. Ellery Borow's safety article is on mushrooms - not collecting the edible kind, but eliminating the ones that "grow" at the tops of our steel chisels, and then fly off in dangerous little pieces when stuck. Grind them off properly as shown (if you don't have a grinder, use a friend's), and dress the sharp end too. Wildacres Workshops are coming up (Spring, May 21-27, and Fall, Sept. 4-10) and this issue includes registration form and class lists.

Continued on page 8

The World of Minerals

The World of Minerals is a monthly column written by Dr. Vivien Gornitz on timely and interesting topics related to geology, gemology, mineralogy, mineral history, etc.

Author: Dr. Vivien Gornitz
Bulletin of the New York Mineralogical Club, New York, NY
Editor: Mitch Portnoy

2016 AFMS Bulletin Editors' Contest
Adult Article Advanced Award
3rd Place Winner

Part I – Garnet: a Ball of Vibrant Colors

Although common in nature, garnet has been valued since ancient times as a gem, in industry, and more recently as a "tectonic tape recorder"—a role it shares with several other gem minerals, such as tourmaline, diamond, and zircon. Garnets occur in a wide variety of geologic environments, ranging from the Earth's mantle to igneous and metamorphic rocks, and scattered with other heavy minerals in beach sands. Its ubiquitous occurrences make it an "uncommonly useful" mineral.

Garnet: The Mineral

Garnets comprise a group of 32 distinct mineral species, of which the six most common are listed in table 1. The common members of the garnet group are subdivided into the pyralspite garnets—pyrope, almandine, and spessartine, and the ugrandites—uvarovite, grossular, and andradite. The former sub-group lacks Ca in its chemical formula, the latter all contain Ca. The garnet crystal structure consists of isolated SiO_4 tetrahedra held together by interstitial positively charged ions (charged atoms). The general formula for garnet is $A_3B_2(SiO_4)_3$, in which the A and B sites are surrounded by 8 and 6 oxygen atoms, respectively[1]. Occupants of the A sites include Mg^{2+}, Fe^{2+}, Mn^{2+}, Ca^{2+}, whereas B sites are populated by Al^{3+}, Fe^{3+}, Cr^{3+}, V^{3+}, Mn^{3+}, and Ti^{4+}. In nature, ions of similar size and charge often substitute for each other in the crystal lattice. This leads to a wide spread of chemical compositions (and physical properties) among the idealized garnet "end-members" shown in Table 1. Thus, any particular garnet specimen may exhibit a complex chemistry that records the turbulent geological history it has experienced (more of which in Part II).

The garnet group belongs to the isometric (cubic) crystal system. The compact, tight internal atomic structure leads to the high densities, refractive indices, and relatively high hardness characteristic of this mineral group. This atomic arrangement also creates a high degree of internal symmetry manifested macroscopically by the typically equal-sided garnet crystal forms, such as the dodecahedron (12 faces), trapezohedron (24 faces) and hexoctahedron (48 faces), with multiple combinations of these. Because of the toughness, hardness, and fairly high density, garnet weathers readily into rounded reddish grains. In olden days, these were known as *granatus*, after the red seeds of a *pomegranate*, from which the name "garnet" derives. Because of the fiery red color of pyrope, the gem in ancient times was also called *carbuncle* (after the Latin for "little charcoal") and *anthrax* (Gr, charcoal).

A Rainbow of Colors

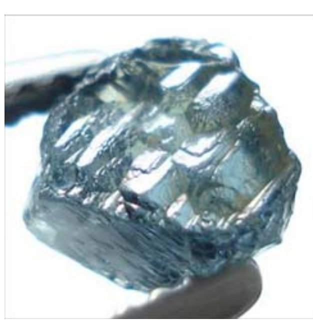
Thanks to nature's sloppiness in growing crystals, the garnets come in myriad colors of the rainbow, ranging from the familiar red and brownish-red to pink, orange, yellow, green, black, and even blue. Garnets acquire their diverse colors from the various metal atoms within the crystal structure. Red and reddish-brown hues derive from ferrous (Fe^{2+}) and ferric (Fe^{3+})iron, orange from Mn^{2+}, pink (Mn^{3+}), and green (Cr, V).

Pyrope garnets owe their deep red hues to the increasing substitution of Fe^{2+} for Mg^{2+} in the A site. A trace of Cr^{3+} replacing Al^{3+} in the B site imparts a pinkish-purple tint. With growing Cr content, pyrope becomes more "fiery-eyed", as in the finest Bohemian garnets. *Rhodolite* lies roughly half-way along the pyrope-almandine solid solution series and grows increasingly purple with additions of Cr^{3+}. *Malaya* garnet, belonging to the pyrope-spessartine series, is pinkish to reddish yellowish orange. Its color is relates to both Fe^{2+} and Mn^{2+} in the A site.

Almandine's red-brown color stems from replacements of Al^{3+} by Fe^{3+} and Ti^{4+}. Andradite, usually dull shades of yellow, brown, green, and black turns a vivid emerald green as Cr^{3+} substitutes for Fe^{3+} in the B site, becoming the highly valued *demantoid* garnet. The presence of Fe3+ accounts for the unusually high refractive index of andradite. Occasionally colorless, *grossular* usually appears some shade of orange, to orange-brown and green.

[1] The 8-fold site forms a distorted cube; the 6-fold site forms an octahedron.


Pyrope, Thailand


Rare Blue Spessartine-Pyrope, Madagascar

The green tsavorite, discovered in Tanzania in association with tanzanite, contains both V and Cr. Bright green *uvarovite*, usually found as tiny drusy crystals, contains Cr as part of its formula. Some andradite, or grossular-andradite garnets display a rainbow-like iridescence. These "rainbow garnets" owe their striking colors to a thin, layered structure, which produces an interference or diffraction effect.

Spessartine, Loliondo, Tanzania

Demantoid, Iran

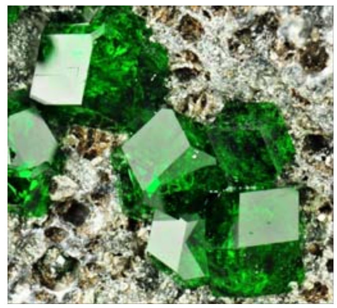
Inside the world of garnets

Gem garnets host a varied assortment of inclusions that reflect the multiple geologic environments in which they formed. Almandine most commonly occurs in metamorphic rocks, such as schists and gneisses. Typical inclusions include biotite, rutile, zircon and apatite. Intersecting networks of thin, needle-like rutile inclusions in almandine produce a star effect. However, unlike the 6-rayed sapphire or ruby stars, almandine stars may show 4 or 6 rays, depending on the orientation of the needles with respect to the crystal symmetry axes and how the stone is cut.

Inclusions in pyrope point to its origin in the Earth's upper mantle, where it forms a significant constituent of peridotites and kimberlites. Typical pyrope inclusions include chromite, diopside, olivine, and rutile. Cr-pyrope may occur as ruby-red inclusions in diamond—offering clear proof of the diamond's periditotic origin.

4-Star Almandine, India

Almandine, Ötztal, Austria



Uvarovite, Urals, Russia

Grossular, Jeffrey Mine, Canada

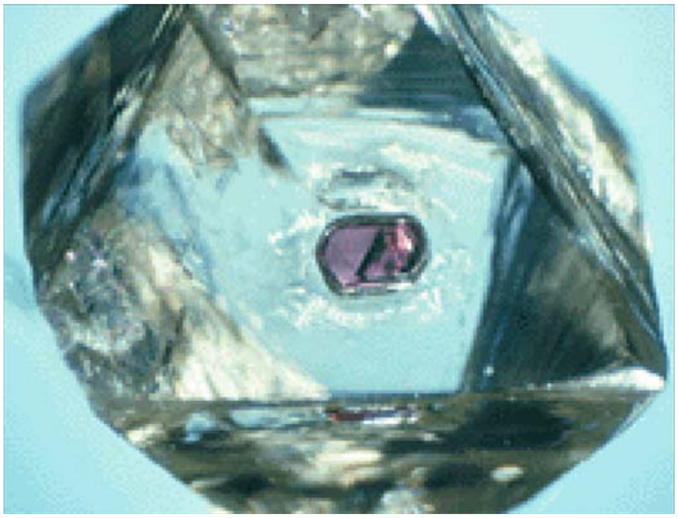
By contrast, garnets of eclogitic origin consist of yellowish to bright orange and reddish-orange almandine-pyrope. Demantoid, the gemmy green variety of andradite, displays hairlike radiating inclusions of chrysotile or tremolite-actinolite. These are characteristic of Russian demantoid, but are absent in crystals from other localities. Spessartine occurs mainly in granitic pegmatites. Unlike the other garnets, it often contains 2- and 3-phase inclusions.

Part II takes a closer look at how and where garnets form and the important keys they hold in unraveling the Earth's lengthy, complex history.

Table 1. The Garnet Group

Species	Chemical Formula	Mohs Hardness	Density	Refractive Index
Pyralspites				
Pyrope	$Mg_3Al_2(SiO_4)_3$	7-7 ½	3.58	1.714
Almandine	$Fe_3Al_2(SiO_4)_3$	7-7 ½	4.32	1.830
Spessartine	$Mn_3Al_2(SiO_4)_3$	7-7 ½	4.19	1.800
Ugrandites				
Grossular	$Ca_3Al_2(SiO_4)_3$	6 ½ - 7	3.59	1.734
Andradite	$Ca_3Fe_2(SiO_4)_3$	6 ½ - 7	3.86	1.887
Uvarovite	$Ca_3Cr_4(SiO_4)_3$	6 ½ - 7 ½	3.82	1.865

Adapted from P.W. Pohwat, 2008. The Garnet Group, In: Gilg, H.A. et al., eds., *Garnet: Great Balls of Fire*. East Hampton, CT: Lithographie, LLC, p. 4-7.



A purple pyrope garnet, an indicator of garnet harzburgite, in a brownish diamond octahedron from the Udachnaya pipe, Sakha Republic, Russia (about 0.8 mm across).

Further Reading

Baxter, E. F., Caddick, M. J., and Ague, 2013. Garnet: Common mineral, uncommonly useful. *Elements* 9:415-419.

Galoisy, L., 2013. Garnets: from stone to star. *Elements* 9:453-456.

Gilg, H.A. et al., eds., 2008. *Garnet: Great Balls of Fire*. East Hampton, CT: Lithographie, LLC.

Newman, R., 2011. *Exotic Gems*, vol. 2, Chaps. 11-16. Los Angeles: International Jewelry Publications.

Part II – Garnet: A Geologic "Tape Recorder"

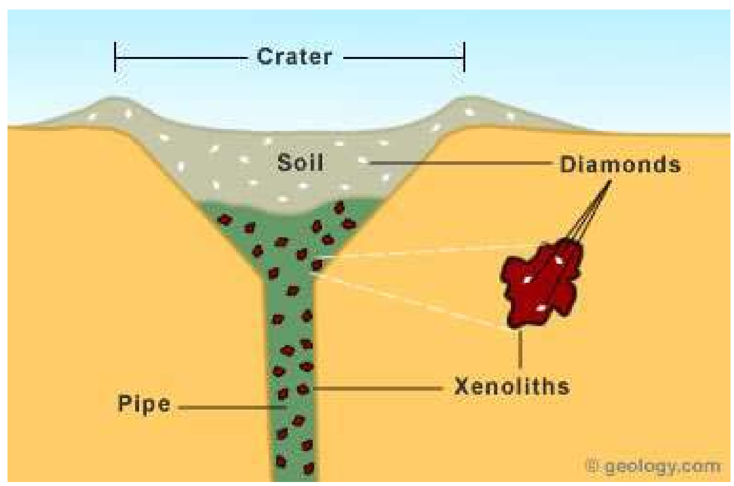
Garnets Everywhere

Mineral collectors and gemologists alike love garnets for their attractive colorful crystals and wide array of gemstones. To geologists, however, garnets store a vast archive of information about past Earth conditions. Garnets are everywhere. They form over a broad range of geologic environments: deep in the Earth's upper mantle, to igneous intrusions in the crust, and rocks caught in the upheavals of colliding tectonic plates.

Thanks to their toughness, hardness, and high density, garnets survive attack by wind and water and weather into rounded reddish grains that concentrate in river beds and in beach sands. A beachcomber on Fire Island, among other places, can often see alternating stripes of dark reddish-brown and cream to buff-colored sands at the water's edge. Closer inspection reveals tiny grains of almandine garnet mixed with hornblende, magnetite, ilmenite in the dark bands, while quartz, feldspar, and finely pulverized shell fragments make up the lighter bands. The sands were once granites, schists, and gneisses of New England, ground up and left behind by the glaciers of the last Ice Age on the south shore of Long Island. The metamorphic rocks, in turn, constitute the roots of lofty mountains heaved up in ancient plate collisions.

Garnets from the Depths

Garnet is a common constituent of the Earth's upper mantle and lower crust, found in rocks such as peridotites, eclogites, and less commonly in crustal igneous rocks. Peridotites consist mainly of olivine, pyroxenes, and garnet, whereas eclogites contain a mix of garnet and pyroxene. However the garnets and pyroxenes differ significantly between these two rock types, which provides useful clues in tracing the origins of diamonds that bear these inclusions. Peridotitic garnets are predominantly a bright ruby-red Cr-rich pyrope, with small amounts of almandine and grossular. Eclogitic garnet, on the other hand, is a Cr-poor, Ca-rich orangey-red pyrope-grossular-almandine. Eclogites also harbor a distinctive type of pyroxene—green omphacite, which has a composition between that of jadeite and diopside. The mineralogical differences between these two rock types reflect quite different origins. Peridotites are true igneous rocks, crystallized from a magma, whereas eclogites began their journey as ocean basalts dragged down subduction zones into the upper mantle, where the high temperatures and pressures transformed their mineralogy.



Simplified cross-section of a diamond pipe and residual soil deposit showing the relationships of xenoliths and diamonds with the pipe and residual soil.

Garnets have become an important "pathfinder" for diamond exploration. (Other "pathfinder", or indicator minerals include bright green chrome diopside, chromite, olivine, ilmenite, and Cr-spinel). More specifically, the "G10" category flags the Ca-poor, Cr-rich pyrope of harzburgite peridotite origin in diamond-bearing kimberlite pipes. Eclogitic "G3" garnet also signals a good diamond-bearing potential.

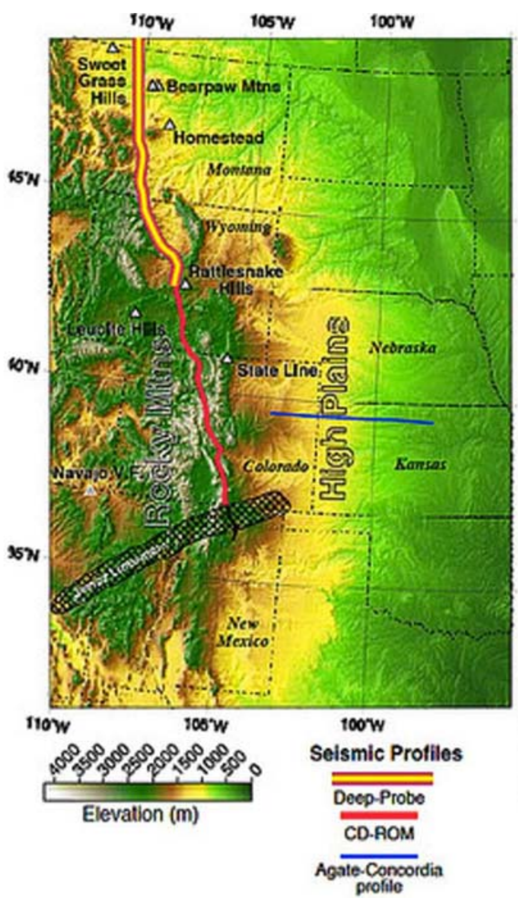
Some of the world's finest pyropes come from Bohemia, weathered out of volcanic rocks containing upper mantle rock fragments. A most unusual pyrope source is "anthill" garnet—small dark red grains from Garnet Ridge on the Navajo Reservation, northeastern Arizona. The garnets were literally excavated by industrious ants from a weathered, but non diamond-bearing, kimberlitic pipe.

Closer to the Earth's surface, granitic pegmatite from the roof of the world in the western Himalayas yield lovely orange to dark brownish-red spessartine crystals, associated with schorl, quartz, and albite. In the Tongbei District of Yunxiao County, Fujien Province, China, orangey spessartine crystals make striking specimens perched on white albite or coating dark smoky quartz. These crystals were extracted from small pockets and pegmatitic veins within granite.

Garnets in Earth's Upheavals

The stability of garnet over a wide range of temperatures and pressures enables geologists to decipher how the Earth's crust has evolved at plate boundaries. As mentioned in Part I, the "A" site of garnet holds various ions that are largely interchangeable, such as: Mg^{2+}, Fe^{2+}, Ca^{2+}, and Mn^{2+}. Each of these is surrounded by 8 oxygen ions in a cage-like distorted cube. However, the proportions of these ions changes during metamorphism. As garnet is subjected to increasing temperatures and pressures, magnesium and iron increase at the expense of calcium and magnesium. These compositional changes are faithfully recorded in a series of growth zones from core to rim of the crystal. The exact growth sequence, however, may be complicated by "inheritance" of fragmentary histories from earlier metamorphic events that have not been erased or "reset" by the latest heating cycle.

In northern Pakistan, the spessartine crystals from pegmatites in granitic rocks formed during the collision of continental crust that raised the Himalayas. In the Italian Alps, on the other hand, the rather nondescript pyrope from the Dora-Maira massif offers evidence of crustal subduction taken to an extreme. There, pyrope coexists with quartz, kyanite, and coesite, an extremely high-pressure polymorph of quartz. Inferred conditions of crystallization are 700° to 800°C (1290-1470°F) and depths of 120 km (75 mi). Closer to home, a quiet stroll in Central Park reveals a multitude of highly weathered almandine garnets embedded in the quartz-feldspar-biotite Manhattan schist. A sharp eye can infer the turbulent history of these rocks revealed in the sharp contortions and folds made by alternating light and dark bands. Some of these can grow quite large, as in the famous football-sized "Subway Garnet."



Because of its ability to preserve the diverse stages of growth during major tectonic episodes, garnets have come a powerful geologic "tape recorder." In addition to its wonderful variety of colorful specimens and gemstones, garnet also finds many useful applications in industry and technology. These attributes make garnet an "uncommonly useful" mineral.

Further Reading

Caddick, M.J. and Kohn, M.J., 2013. Garnet: Witness to the evolution of destructive plate boundaries. *Elements* 9:427-432.

Gilg, H.A. et al., eds., 2008. *Garnet: Great Balls of Fire*.Lithographie, LLC, East Hampton, CT.

Wood, B.J., Kiseeva, E.S., and Matzen, A.K., 2013. Garnet in the Earth's mantle. *Elements* 9:421-426.

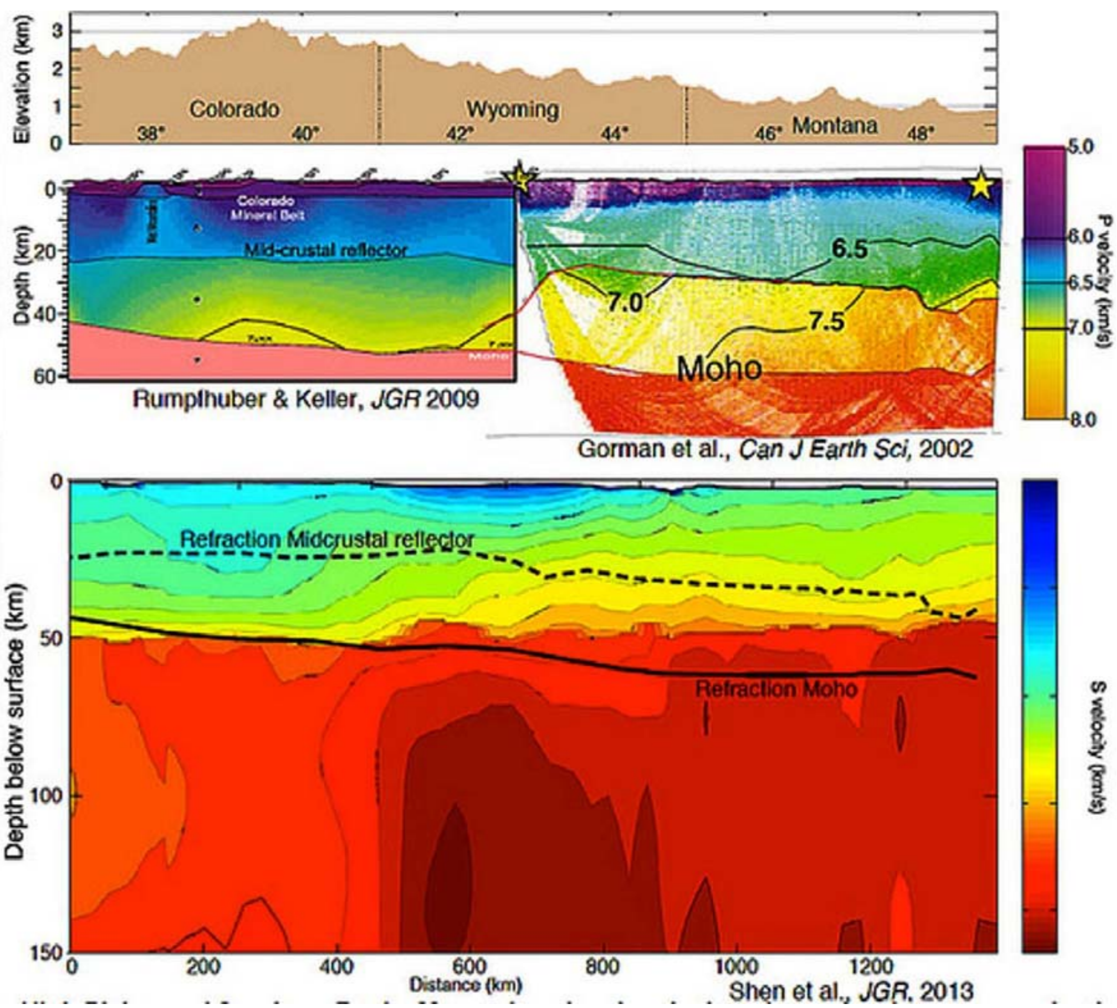
Part III – Garnet and the Rise of the High Plains

Beyond the 100th meridian, near the western end of the Great Plains, the corn and wheat fields of eastern Kansas, Nebraska, and the Dakotas gradually give way to cattle country, as the land rises imperceptibly toward the foothills of the Rockies. The gently inclined belt of the High Plains eventually reaches elevations of over 1,500 meters (5,000 ft). Why this belt of undeformed sedimentary rocks sits so high has long puzzled geologists. But now, some researchers have put forth a bold explanation in which garnet plays an important role.

Prior to ~70 million years ago, a giant seaway extended deep into the interior of North America. What is now northern New Mexico, Colorado, western Wyoming and southern Montana lay close to sea level. Subsequently, an oceanic tectonic plate began to plunge beneath western North America at a fairly shallow angle, leading to an active period of mountain building (the Laramide Orogeny) that changed the landscape of the West. Large parts of the western states underwent extensive buckling, bending, faulting and igneous intrusions that ultimately culminated in the uplift of the Rockies. But eastern Montana, Wyoming, and Colorado—the core of the High Plains—escaped this geologic turmoil. Conventional explanations for the high elevation of this region proved inadequate. The High Plains lack major thrust faults that could have pushed one thick slab of rock up over another. The region also lacks massive igneous intrusions that could have thickened the crust. The High Plains were tilted eastward during the regional arching of the Rockies. Streams then began to erode and cut down the rising mountains, depositing sediments in the east. However, most of the erosion occurred much later—during the wetter periods of the Pleistocene ice ages. Furthermore, thick piles of sediment are missing from the southern High Plains.

A group of geologists from the University of Colorado in Boulder have therefore come up with a novel idea. The High Plains are high because they are buoyed up by lighter minerals. Water released by the sinking oceanic plate reacted with dense, lower crust minerals to form less dense ones. The resulting increase in buoyancy lifted up the region. "Garnet is the magic mineral", says Gene Humphrey, a geologist from the University of Oregon. Dense minerals, such as garnet, pyroxene, and plagioclase, would have been altered by the water to amphibole, mica, and other less dense minerals. Water released by the descending ocean plate could have extended far inland, creating fluids that interacted with lower crustal rocks beneath the High Plains that otherwise were unscathed by deformation, thereby contributing to their uplift.

Close examination of xenoliths[1] from various localities by microscope clearly illustrates the transformation of garnet, pyroxene , and plagioclase to an altered, secondary assemblage of micas, chlorite, albite, and calcite. While the exact age of the xenoliths has yet to be conclusively determined, one specimen dated to the time of the Laramide Orogeny, or later, contains plagioclase that has undergone the same type of aqueous alteration that destroyed the garnet elsewhere. Furthermore, seismic wave velocities that correlate strongly with rock density show a progressive decrease going from Montana in the north to Colorado in the south. This closely corresponds to the increase in land elevation from north to south. Calculations suggest that the reduced crustal density due to the mineral transformations could largely account for the changes in topography.



Although studies of xenoliths and seismic waves are still incomplete, the data gathered so far support the notion of water interacting with and altering the mineral composition of the lower crust beneath Wyoming and Colorado. The resulting decrease in rock density could readily account for the topographic change of up to 2 kilometers (6,600 ft). However, more work would be needed to further tie down the age of the proposed hydration event and to check whether other possible mechanisms related to tectonism may not have also been involved. Craig Jones, the chief author of the paper doesn't mind the criticisms. He admits that he is "not so much reaching a conclusions as suggesting an idea." This is the way scientists work. They come up with new theories and see how far they can push them.

Further Reading

Jones, C.H., and other, 2015. Continental uplift through crustal hydration. *Geology* 43(4):355-358.

Rosen, J., 2015. Did crustal chemistry buoy Western Plains? *Earth* July/Aug. 2015, p. 25.

[1] Exotic rock fragments from the lower crust carried to the surface by volcanic eruptions.

Federation News, *continued from page 2*

The **AFMS Newsletter** is available by the same methods. The March issue starts with the safety article on why and how to deal with "mushroomed" chisels (described above). President Sandy Fuller writes on the structure of AFMS and the upcoming AFMS / EFMLS convention.

The Federations encourage everyone to see the web sites for the complete Newsletters. There's a lot there!

-Editor

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/

March 24-25, 2018: 40th Annual Mineral and Fossil Show, by Franklin County Rock & Mineral Club. Hamilton Heights Elem. School, 1589 Johnson Rd. Chambersburg PA 17202. Sat 10-5, Sun 10-4.

March 24-25, 2018: Philadelphia Mineral Treasures and Fossil Fair, by Phila. Min. Soc. & Delaware Valley Paleo. Soc. LuLu Temple: 5140 Butler Pike, Plymouth Meeting, PA 19462 http://www.phillyrocks.org

March 24-25, 2018: 49th Annual Gem and Mineral Show sponsored by the Che-Hanna Rock & Mineral Club. Wysox Vol. Fire Co Social Hall, 111 Lake Rd; Wysox, PA www.chehannarocks.com

April 6-8, 2018: EFMLS / AFMS Annual Convention & Show, Raleigh NC.

May 12, 2018: South Penn Rock & Mineral Swap & Sale, by CPRMC & Franklin Cty RMC. South Mtn Fairgrounds, 1.5 mi NW of Arendtsville off PA 234 (for GPS: 615 Narrows Rd., Biglerville PA 17307). Sat. Only, 8-3.

Geo-Sudoku Solution

E	T	D	**U**	I	N	R	G	A
I	R	U	**G**	A	D	T	E	N
G	A	N	**R**	E	T	D	U	I
D	I	T	**A**	G	U	N	R	E
R	U	E	**N**	T	I	A	D	G
N	G	A	**D**	R	E	U	I	T
A	D	G	**I**	N	R	E	T	U
U	E	I	**T**	D	A	G	N	R
T	N	R	**E**	U	G	I	A	D

-Have a mineral word with 9 letters, none repeated, that hasn't been used recently in our Geo-Sudoku? Please submit it to the Editor (see next column).

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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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)
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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.