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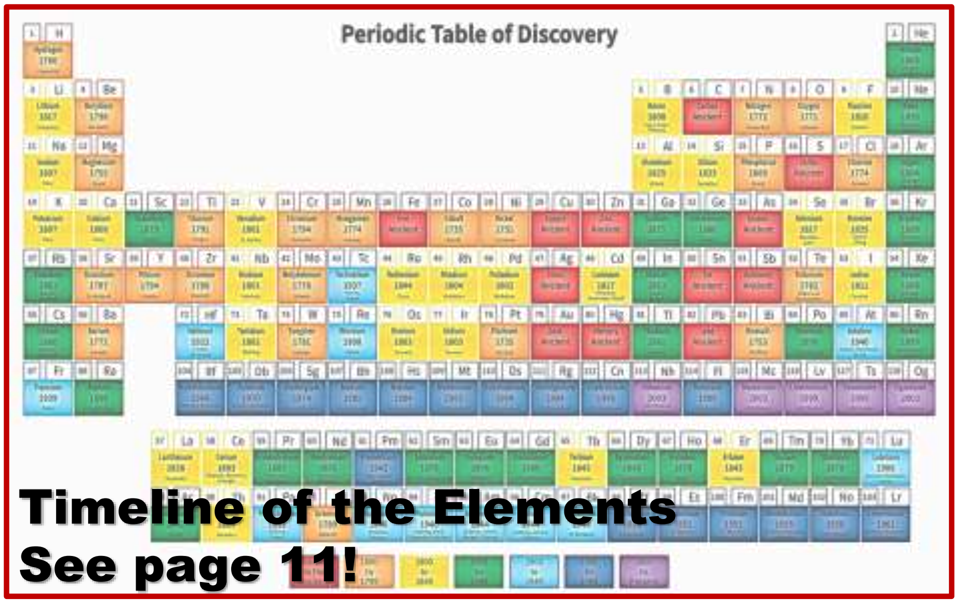
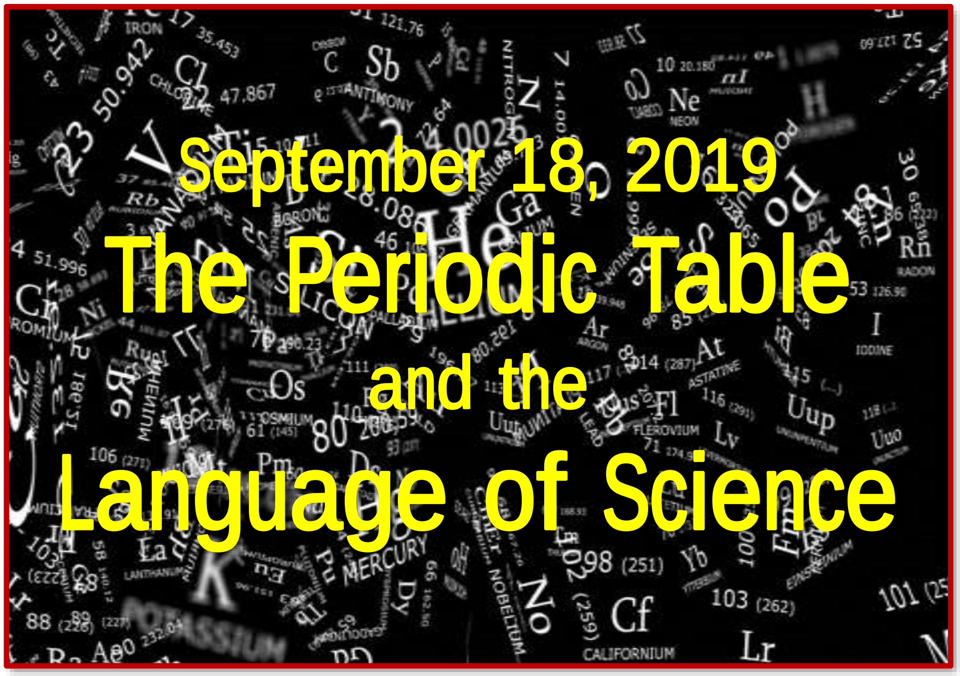


Timeline of the Elements
See page 11!



September 18, 2019

The Periodic Table
and the
Language of Science

CHRISTOPHER OBER

WORLD OF MINERALS

HALIDES

OLD ROCKS & LIFE

OCEAN PARADISE

BANQUET RESERVATION FORM

America's Oldest Gem & Mineral Club

Founded 1886 ◆ Incorporated 1937

Bulletin of the New York Mineralogical Club

Founded 1886 ♦ New York City, New York ♦ Incorporated 1937
Volume 133, No. 9
Celebrating the International Year of the Periodic Table of Chemical Elements
September 2019

September 18th Meeting:
Chris Ober: "The Periodic Table and the Language of Science"

In his lecture, Chris will provide some history of the periodic table, talk about the naming of the elements and discuss the importance of how the periodic table gives us a framework for thinking about the elements.

Christopher Kemper Ober is an America/Canadian materials scientist and engineer. As of 2018, he is Francis Norwood Bard Professor of Materials Engineering at Cornell University, Ithaca, NY, Cornell University and Director of the Cornell NanoScale Science and Technology Facility. Among other posts at Cornell, he has served as Interim Cornell Dean of Engineering and Director of the Cornell Department of Materials Science & Engineering.

Ober was awarded a B.Sc. degree in 1978 by the University of Waterloo (Waterloo, Ontario, Canada), with a major in Honors Chemistry. He received his M.S. (1980) and Ph.D. (1982) degrees in Polymer Science & Engineering from the University of Massachusetts at Amherst.

The 2019 International Year of the Periodic Table is an IUPAC initiative of which Chris is an IUPAC representative, as well as past president of division IV.

IUPAC
INTERNATIONAL UNION OF
PURE AND APPLIED CHEMISTRY

Labradorite Theme Featured at 2019 Annual NYMC Banquet

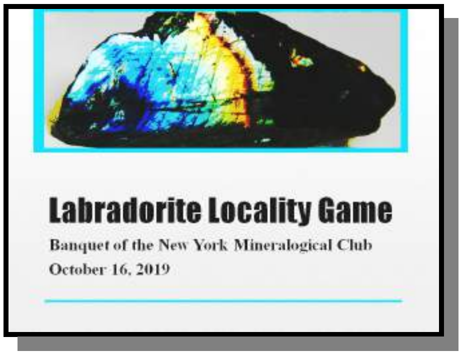
By Mitch Portnoy

This year's banquet, which is taking place on **Wednesday, October 16, 2019** at the Watson Hotel, will center on the theme of "Dazzling Labradorite".

In the past, the banquet's gemstone themes have included colored diamonds (2011), tanzanite (2012), jade (2013), ruby (2014), garnet (2015), opal (2016), amethyst (2017), and most recently, carnelian (2018).

As a result, you can expect to see labradorite blue galore in the:

- ♦ Room Decorations
- ♦ Banquet Posters & Banners
- ♦ Food & Drink
- ♦ Table Centerpieces
- ♦ Banquet Gifts & Postcards
- ♦ Banquet Games & Prizes
- ♦ Banquet Songs
- ♦ Special Note Card Sets
- ♦ Silent Auction Lots
- ♦ Other Surprises!



The registration form for this year's banquet can be found on page 14 in this issue. Get it to me as soon as possible – it helps enormously in the event planning.

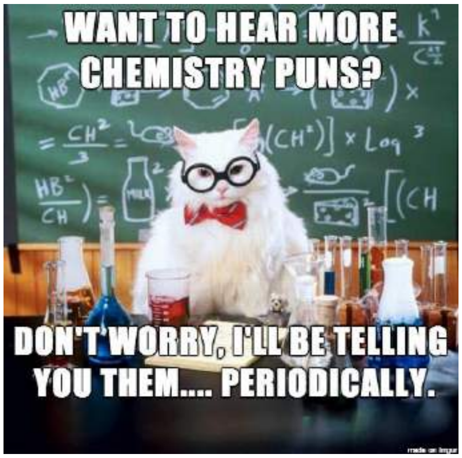
See you at the banquet!

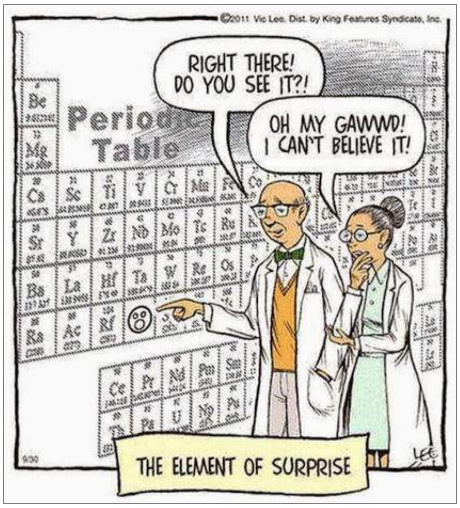
Issue Highlights

President's Message

By Mitch Portnoy

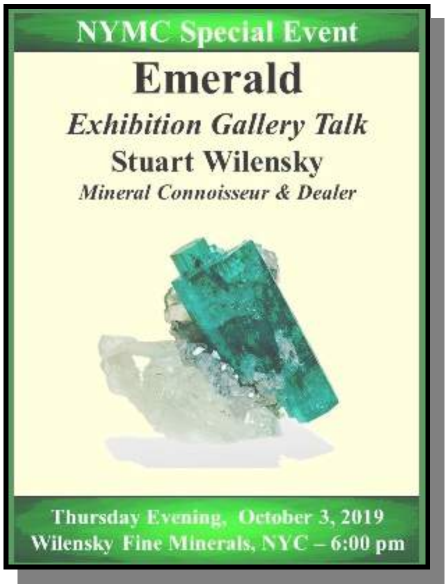
I found these two graphic jokes online and decided to reproduce them here as they relate to this month's special lecture:





Enjoy!

Also Coming in October!



NYMC Special Event

Emerald

Exhibition Gallery Talk

Stuart Wilensky

Mineral Connoisseur & Dealer

Thursday Evening, October 3, 2019
Wilensky Fine Minerals, NYC – 6:00 pm

Club Meeting "Minutes" for Sunday, August 18, 2019

By Vivien Gornitz, *Secretary*
Attendance: 13
President Mitch Portnoy "presided"
Cheryl Neary hosted

Special Social Event: Open House
"Maison Neary, Patchogue, New York"

This year's Open House, held during the afternoon of August 18, 2019, was a delightful time.

Although a small group of only 13, members and friends of the Club braved the hot summer weather and found their way to Cheryl's cozy home and gardens. Some drove and some took the LIRR, but either way it was an easy place to get to.

Cheryl, by the way, is currently our Regional EFMLS Vice President. (We are in Region II.) She is also a past president of the entire EFMLS (2012-2013).

Cheryl did not make a formal presentation of her mineral collection, but we all examined her many collections with total pleasure. I say collections because Cheryl, like most of us, have MANY different collections. Indeed, I found her house to be a virtual cabinet of curiosities!

Besides aesthetic minerals, Cheryl collects geodes, spheres, antique glass bottles, artistic perfume bottles, birds carved out of gemstone materials (!!) and more categories that I am surely forgetting.

What was especially interesting to me was how she placed and displayed these items in many ways, adding visual interest to her home and its objects!

The next highlight of the afternoon was the array of food. There was truly something for everyone including all kinds of salads, appetizers and cheeses as well as several "main" courses which included chicken and hot dogs. The real treat for me was to finally get to enjoy the gourmet vegetarian chili prepared by Elaine Casani. Indeed, I took a quantity home so I could enjoy it again at some time in the near future! The dessert selection was equally as lavish and diverse!

As an outside diversion, Cheryl set up a sluice apparatus in which people could pan for gemstones. Members Lenore Weber and Lois Gareax seemed to especially enjoy this activity. (I liked putting my hands into the cold water on this brutally hot afternoon!)

We sincerely thank Cheryl for sponsoring such a lovely afternoon and a VERY successful Open House!

Members in the News

- **Naomi Sarna** had an article published in Unique Magazine (July) entitled: *It's Not a Ruby: Spinel's Well-Kept Secret in High Jewelry.*

Welcome New Members!

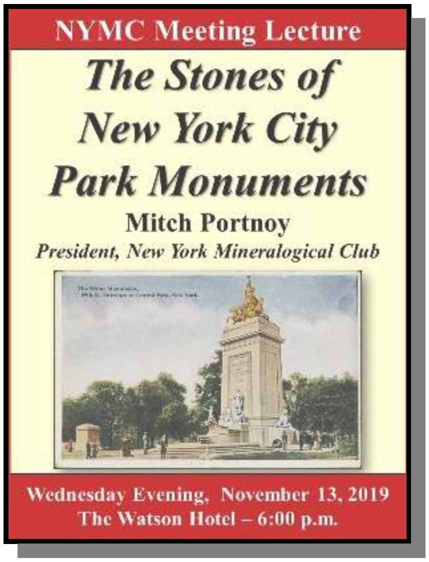
The Dubin Family	Glendale, NY
Catherine Snodgrass	White Plains, NY

Coming in November!

Fall 2019 New York City
Gem, Mineral & Fossil Show
November 9-10, 2019
Watson Hotel 440 West 57th St. New York City

Minerals Gems Meteorites Lectures Geodes Publications
Jewelry Crystals Supplies Fossils Lapidary Rarities

Sponsored by Excalibur Mineral Corp., Charlottesville, VA
Hosted by the New York Mineralogical Club, New York, NY



NYMC Meeting Lecture

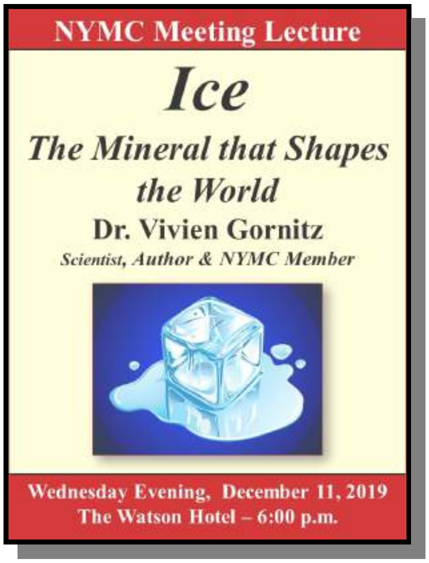
The Stones of New York City Park Monuments

Mitch Portnoy

President, New York Mineralogical Club

Wednesday Evening, November 13, 2019
The Watson Hotel – 6:00 p.m.

Coming in December!



NYMC Meeting Lecture

Ice

The Mineral that Shapes the World

Dr. Vivien Gornitz

Scientist, Author & NYMC Member

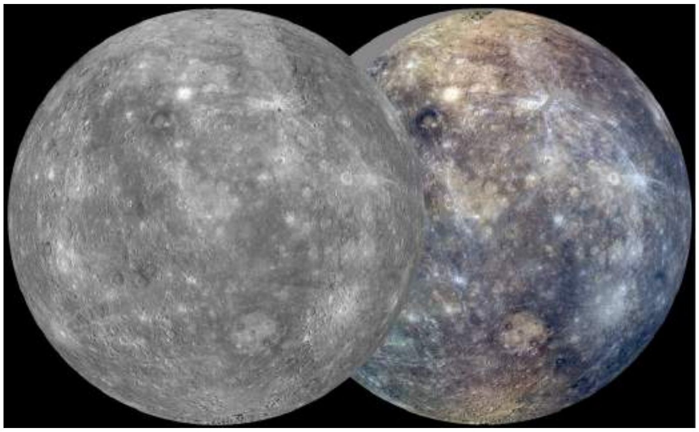
Wednesday Evening, December 11, 2019
The Watson Hotel – 6:00 p.m.

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.

Mercury Revealed

Part1: The Exploration of Mercury



MESSENGER's First Day Image

Mercury, the smallest and innermost of the Solar System's planets has been slow to reveal its secrets. *Mercury 10*, the first spacecraft to fly past Mercury in 1974-1975 saw a heavily-cratered planet—at first glance, a boring replay of our impact-battered Moon. But NASA's *MESSENGER* space probe, launched in 2004, tells a more exciting tale and has brought many unexpected findings to light. Closer examination between 2011 and 2015 reveals extensive lava flows that smoothed out large surface tracts in between craters during and subsequent to the period of heavy bombardment that ended around 3.8 billion years ago. Volcanic activity persisted to a lesser extent, but finally died out by 3.5 billion years ago.

Mercury is more iron-rich than the other rocky planets. Its relatively high density (5.43 g/cm^3 Mercury vs. 5.515 g/cm^3 Earth), given its small size, suggests an iron core that occupies 55% of its volume, as compared to only 17% for the Earth. Furthermore a large fraction of the core consists of molten iron, probably alloyed with lighter elements such as silicon and/or sulfur. Like Earth, Mercury also has a magnetic field, although much weaker than ours. Possessing no atmosphere, mercurial temperatures soar from a low of -173°C (-280°F) at night to 427°C (800°F) during the day near the equator. Deep craters at the poles, never exposed to direct sunlight, stay perpetually cold enough to hold an ice mass estimated at roughly 1/1000th that of the Antarctic Ice Sheet.

Another surprising discovery is that Mercury's radius shrank by some 5-7 km (mi) as its interior slowly cooled. Numerous, long, winding, cliffs, wrinkled like a dried prune, crisscross the plains and craters. These represent compressional fault scarps that delineate the planetary shrinkage.

(Continues next month)

Table 1. Mercury—Basic Facts

Property	Mercury	Earth
Axial Tilt	0.034°	23.27°
Radius	2440 km (1516 mi)	0.383 relative to Earth
Mass	3.30×10^{23} kg	0.055 relative to Earth
Mean Density	5.427 g/cm^3	5.515 g/cm^3
Length of Day	58.6 Earth days	1
Length of Year	88 Earth days	365.24 Earth days
Planetary Interior		
Crust-Mantle Boundary	35 km (22 mi)	40 km (av.) (25 km)
Mantle-Core Boundary	420-435 km (266 mi av.)	2980 km (1850 mi)
Planetary Center	2440 km (1516 km)	6370 km (3958 mi)

Vanishing Ice: *Glaciers, Ice Sheets, and Rising Seas*

By Vivien Gornitz (Columbia University Press, 400 pages)

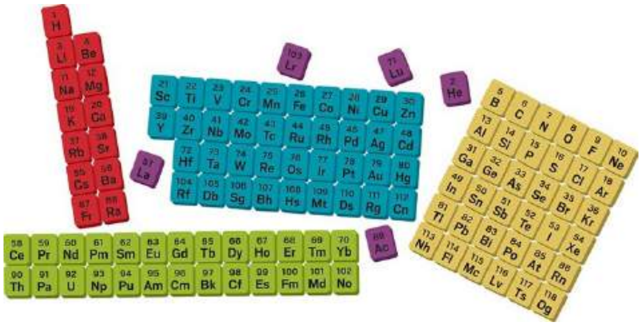
The Arctic is thawing. In summer, cruise ships sail through the once ice-clogged Northwest Passage, lakes form on top of the Greenland Ice Sheet, and polar bears swim farther and farther in search of waning ice floes. At the opposite end of the world, floating Antarctic ice shelves are shrinking. Mountain glaciers are in retreat worldwide, unleashing flash floods and avalanches. We are on thin ice—and with melting permafrost's potential to let loose still more greenhouse gases, these changes may be just the beginning.

Vanishing Ice is a powerful depiction of the dramatic transformation of the cryosphere—the world of ice and snow—and its consequences for the human world. Delving into the major components of the cryosphere, including ice sheets, valley glaciers, permafrost, and floating ice, Vivien Gornitz gives an up-to-date explanation of key current trends in the decline of ice mass. Drawing on a long-term perspective gained by examining changes in the cryosphere and corresponding variations in sea level over millions of years, she demonstrates the link between thawing ice and sea-level rise to point to the social and economic challenges on the horizon. Gornitz highlights the widespread repercussions of ice loss, which will affect countless people far removed from frozen regions, to explain why the big meltdown matters to us all. Written for all readers and students interested in the science of our changing climate, *Vanishing Ice* is an accessible and lucid warning of the coming thaw.

The Periodic Table Is an Icon. But Chemists Still Can't Agree on How to Arrange it!

New data about the elements and their relationships have led to debate over the 150-year-old table's optimum ordering

By Sam Lemonick



One hundred fifty years after Russian chemist Dmitri Mendeleev published his system for neatly arranging the elements, the periodic table it gave birth to hangs in every chemistry classroom in the world and is one of the field's most recognizable symbols. But the solid squares and familiar patterns of today's table mask one of its fundamental characteristics: "the" periodic table does not exist.

It's been mutable from the beginning. Not only has it grown as new elements have been discovered; it has also added columns and changed shape as we've gained new understanding of the elements' properties and their relationships to one another. And scientists are still debating its optimum configuration.

Some believe chemical properties should dictate how the elements line up on the periodic table. Others think a more fundamental principle is needed, like electronic configuration or simply atomic number. Partisans are clashing over which elements belong in group 3, where helium should go, and how many columns the periodic table should have. They follow a long line of chemists and physicists who have worked and reworked the elements into a semblance of order.

"What I find interesting about the current debate is there are people who insist on there being one right table," says Michael D. Gordin, a Princeton University historian who has written about Mendeleev, Julius Lothar Meyer, and other creators of early periodic tables. "It would have struck people like Mendeleev and Lothar Meyer as weird." Gordin says the periodic table pioneers understood their tables to be a reflection of natural laws but recognized that different tables could represent those laws in different ways. That might be hard to imagine for those of us used to seeing the familiar shape of the table on our coffee mug or shower curtain.

Setting the Table

Mendeleev wasn't the first to recognize patterns in the elements, nor was he the first to try to depict those patterns in a diagram. Chemist Johann Wolfgang Döbereiner, for instance, identified triads of elements with shared properties in 1829. Today we'd recognize these as members of the same group or column of the periodic table, like chlorine, bromine, and iodine.

Geologist Alexandre-Émile Béguyer de Chancourtois published a kind of periodic table in 1862 in which the elements spiraled up a cylinder according to atomic weight. Each column of elements shared properties.

Mendeleev published his table, which he called a "periodic system," in 1869. It included all 56 elements then known, and if you squint, it has a somewhat similar shape to the periodic table we see today, only tipped 90° on its side. Mendeleev arranged the elements in order of increasing weight and broke them into rows such that elements in each column shared valence, the number of other atoms they combined with, as well as other properties.

What made Mendeleev's table special was his recognition that the periodic system was strong enough to predict undiscovered elements, which he left holes for, and even their properties. Lothar Meyer was independently working on an almost identical table, but Mendeleev beat him to publication by a few months and secured his place in history.

One can trace today's controversies over how the periodic table should look to the discovery of quantum mechanics and atomic numbers. Mendeleev ostensibly organized his table by increasing atomic weight, but he gave chemical properties a deciding vote. For example, tellurium is slightly heavier than iodine, but Mendeleev put tellurium first because it has the same valence as oxygen, sulfur, and other elements in its group. Tables have retained that ordering. Mendeleev didn't know that tellurium has one fewer proton—and thus is one atomic number less—than iodine, which explains why they each belong where they do. "When you get atomic number, it provides logic" to the periodic table, Gordin says.

Along with protons came the discovery of electrons and the quantum-mechanical idea of atomic orbitals. These findings provided a whole new kind of logic for the periodic system. Although the organization of Mendeleev's system didn't change, scientists could now see that it was electronic structure that largely dictated elements' properties and explained why members of the same group were similar. The Madelung rule, or aufbau principle, that dictates that electrons fill the 1s orbital first and then the 2s and the 2p and so on, further explained how the elements were ordered.

That brings us to the tables we see today, which don't look that different from the versions famed chemist Glenn T. Seaborg drew in the 1940s. Seaborg moved the f-block elements—also called the lanthanide and actinide series—out of the main table to leave them floating below. This decision is generally understood as a concession to convenience; if those elements were in line with the others, the table would be too wide to fit on a standard sheet of paper or the type would be too small to read.

Seaborg included 15 elements in his f-block. That doesn't make a lot of sense from an electronic configuration point of view, since the f orbitals hold only 14 electrons. But many tables—including the table on the website of the International Union of Pure and Applied Chemistry (IUPAC), which has the last word on naming elements and molecules—share this feature. It's a way of avoiding one of the most controversial questions about the periodic table: What elements belong in group 3? No one disputes scandium and yttrium. But which elements come below those two? Lanthanum and actinium? Or lutetium and lawrencium?

Group Decision

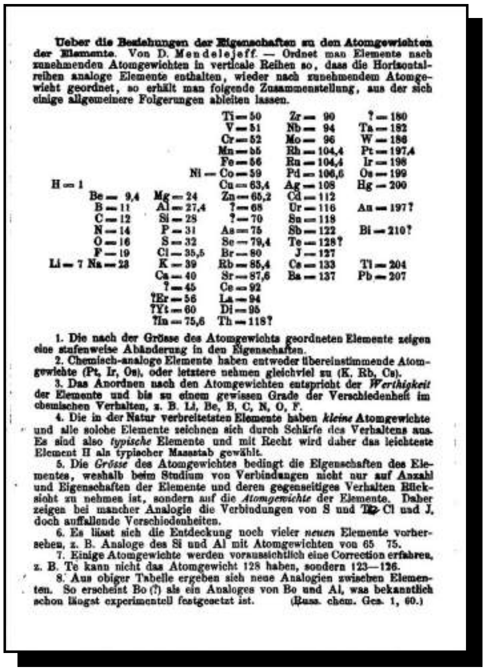
Today there's no standardization in the periodic tables found in classrooms, labs, and textbooks. Some avoid the group 3 question and use a 15-element f-block. Others put La and Ac in group 3, and still others have Lu and Lr, with the remainder of the f-block floating below.

IUPAC has convened a working group to make a definitive recommendation one way or the other. One motivation for forming the task group, according to IUPAC's website, is to clear up confusion among students and teachers about which table is correct.

Philip Ball, a science writer and member of the working group, says the debate comes down to a fundamental question of whether physics or chemistry shapes the table. Put another way, he says the group is debating whether to side with the quantum physics that determines elements' electronic configurations or with the way elements behave chemically.

On the side of chemical behavior is Guillermo Restrepo, a mathematical chemist at the Max Planck Institute for Mathematics in the Sciences. Restrepo takes a historical view of how the table should be organized. He points to Mendeleev and his contemporaries, who found their periodic systems by studying elements' properties, often through their binding behavior. "At the core of the periodic system, what you have is chemistry," Restrepo says, "and you need chemical reactions."

Restrepo and colleagues analyzed some 4,700 binary compounds containing 94 elements to determine how chemical reactions inform the periodic system (MATCH Commun. Math. Comput. Chem.2012, 68,417). The molecules could consist of more than one atom but only two elements. The researchers created a map that groups elements near those that form similar compounds. For example, fluorine, chlorine, and the other halogens sit next to each other because they all bind to similar elements.



Ueber die Beziehungen der Eigenschaften zu den Atomgewichten der Elemente. Von D. Mendelejeff. — Ordnet man Elemente nach zunehmenden Atomgewichten in verticale Reihen so, dass die Horizontalreihen analoge Elemente enthalten, wieder nach zunehmendem Atomgewicht geordnet, so erhält man folgende Zusammenstellung, aus der sich einige allgemeinere Folgerungen ableiten lassen.

			Ti — 50	Zr — 90	? — 180
			V — 51	Nb — 94	Ta — 182
			Cr — 52	Mo — 96	W — 186
			Mn — 55	Rh — 104,4	Pt — 197,4
			Fe — 56	Ru — 104,4	Ir — 198
			Ni — Co — 59	Pd — 106,6	Os — 199
H — 1			Cu — 63,4	Ag — 108	Hg — 200
	Be — 9,4	Mg — 24	Zn — 65,2	Cd — 112	
	B — 11	Al — 27,4	? — 68	Ur — 116	Au — 197?
	C — 12	Si — 28	? — 70	Sn — 118	
	N — 14	P — 31	As — 75	Sb — 122	Bi — 210?
	O — 16	S — 32	Se — 79,4	Te — 128?	
	F — 19	Cl — 35,5	Br — 80	J — 127	
Li — 7	Na — 23	K — 39	Rb — 85,4	Cs — 133	Tl — 204
		Ca — 40	Sr — 87,6	Ba — 137	Pb — 207
		? — 45	Ce — 92		
		?Er — 56	La — 94		
		?Yt — 60	Di — 95		
		?In — 75,6	Th — 118?		

1. Die nach der Grösse des Atomgewichts geordneten Elemente zeigen eine stufenweise Abänderung in den Eigenschaften.

2. Chemisch-analoge Elemente haben entweder übereinstimmende Atomgewichte (Pt, Ir, Os), oder letztere nehmen gleichviel zu (K, Rb, Cs).

3. Das Anordnen nach den Atomgewichten entspricht der *Werthigkeit* der Elemente und bis zu einem gewissen Grade der Verschiedenheit im chemischen Verhalten, z. B. Li, Be, B, C, N, O, F.

4. Die in der Natur verbreitetsten Elemente haben *kleine* Atomgewichte und alle solche Elemente zeichnen sich durch Schärfe des Verhaltens aus. Es sind also *typische* Elemente und mit Recht wird daher das leichteste Element H als typischer Maasstab gewählt.

5. Die *Grösse* des Atomgewichtes bedingt die Eigenschaften des Elementes, weshalb beim Studium von Verbindungen nicht nur auf Anzahl und Eigenschaften der Elemente und deren gegenseitiges Verhalten Rücksicht zu nehmen ist, sondern auf die *Atomgewichte* der Elemente. Daher zeigen bei mancher Analogie die Verbindungen von S und Te, Cl und J, doch auffallende Verschiedenheiten.

6. Es lässt sich die Entdeckung noch vieler *neuen* Elemente vorhersehen, z. B. Analoge des Si und Al mit Atomgewichten von 65 75.

7. Einige Atomgewichte werden voraussichtlich eine Correction erfahren, z. B. Te kann nicht das Atomgewicht 128 haben, sondern 123—126.

8. Aus obiger Tabelle ergeben sich neue Analogien zwischen Elementen. So erscheint Bo (?) als ein Analoges von Bo und Al, was bekanntlich schon längst experimentell festgesetzt ist. (Russ. chem. Ges. 1, 60.)

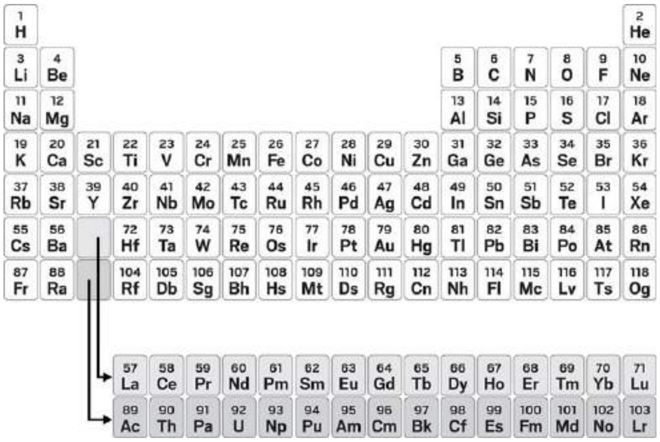
Dmitri Mendeleev's first published table included all the known elements and open space for the elements his system predicted were still undiscovered.

Restrepo says this similarity landscape shows that lanthanum is more similar to scandium and yttrium than lutetium is, so it should be in group 3. But the analysis doesn't provide a good answer about Lr versus Ac. Restrepo says the problem is there isn't much data on how Lr and Ac bind to other entities. While there are tens of thousands of compounds one can use to study the similarities of Sc, Y, La, and Lu, Ac provides only about 70 data points, and Lr, fewer than 40, according to Restrepo.

Eric Scerri, a philosopher of science at the University of California, Los Angeles, and the chair of the IUPAC task group, disagrees. He believes Sc, Y, Lu, and Lr should be the group 3 elements. Scerri thinks a focus on chemical or physical properties is misguided. He compares it to early botanists' classification of flowers by their color or petal number.

"You've got to go for something fundamental," Scerri says, like electronic configuration. "Just to amass properties is never going to give you a definitive answer."

Not that electronic configuration is perfect either, as Scerri will tell you. Exceptions have been made for some elements in the periodic table in terms of how their orbitals are filled, like copper. By the periodic table's logic, all d-block elements should have filled s orbitals. But copper defies that logic. It should have the electron configuration [Ar] 3d9 4s2. Instead, its 4s atomic orbital remains unfilled, and one electron goes in its 3d shell, leading to the configuration [Ar] 3d10 4s1, which is more stable.



1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og
			57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
			89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

The periodic table on the website of the International Union of Pure and Applied Chemistry avoids making a decision about whether La and Ac or Lu and Lr are group 3 elements.

Scerri does prefer electronic configuration to what he calls "gross physical characteristics" for organizing the table. But he sees an even simpler logic to solve the group 3 problem: arrange by atomic number. If Scerri has his way, we'll all have to get used to a newly arranged table.

Going Wide

"My suggestion is simply this," Scerri says. "Represent the periodic table in a 32-column format."

Scerri calls 32 columns a more natural form for the periodic table and attributes the current dominance of 18 columns to convenience only. A 32-column table uses the atomic numbers as its logical foundation. Not only would it solve the group 3 question, but Scerri says 32 columns would be more correct because it puts the f-block in its rightful place: inside the table rather than floating below for convenience.

In a 32-column table arranged by ascending atomic number, lanthanum (atomic number 57) follows barium (number 56) to start the f-block, with actinium below it. That makes lutetium the first element in the third row of the d-block, with scandium and yttrium above it and lawrencium below to form group 3. Strict adherence to atomic number satisfies Scerri's desire for a fundamental organizing principle and neatly sidesteps questions about chemical or physical properties.

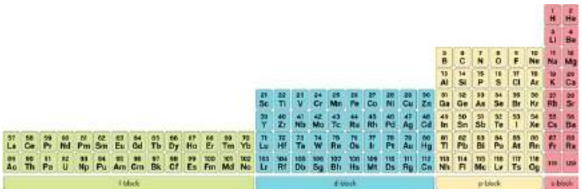
Another table similar to the 32-column version has been proposed, but it uses electronic configuration rather than atomic numbers as its primary guide. French scientist Charles Janet's left-step periodic table, devised in 1928, isn't likely to make it into textbooks anytime soon, however. Janet moves the s-block to the right side of the table and includes helium at the top of group 2 because its s orbital, like other elements in that group, is filled.

Most tables place helium atop the noble gases. Scerri thinks helium's demotion in the left-step table is one reason the table never got more traction, though recent experiments showing helium can form stable bonds help Janet's argument that it belongs in a group with other reactive, rather than inert, elements.

Regardless, read from top to bottom and left to right, the left-step table more correctly conforms to the Madelung rule, which states that electrons must first fill the lowest-available electron levels before filling higher ones, Scerri says. It has a regularity that current tables don't: two periods of 2 elements, two of 8 elements, two of 18, two of 32. And when element 121 is discovered, it will begin the g-block and two new periods of 50 elements.

Relative Difficulty

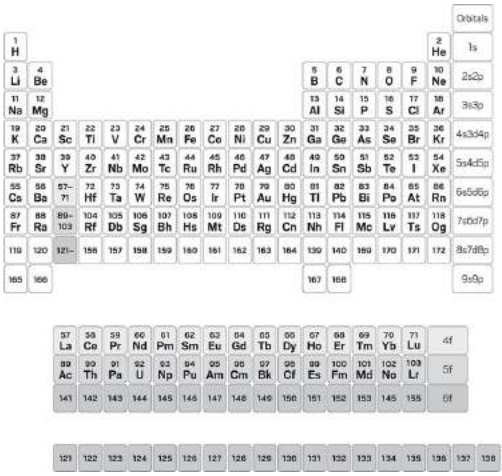
The filling order that most chemists are used to might not hold up for much longer, however. Some calculations show the Madelung rule breaks down at higher atomic numbers because of relativistic effects. Electrons in large atoms move so fast that their behavior—and the properties of the atoms they belong to—begin to change.



The left-step periodic table, invented by Charles Janet, is strictly based on atomic orbitals and electron-filling order.

Fans of relativistic effects will be happy to know there's a table for them too. Pekka Pyykkö, a theoretical chemist at the University of Helsinki, calculated electron configurations up to element 172 and made a table for them (Phys. Chem. Chem. Phys. 2010, DOI: 10.1039/c0cp01575j). Pyykkö doesn't bother with the group 3 question. His table leaves a hole under yttrium and has three 15-element rows in an f-block floating beneath the main table. Nor is he so constrained by atomic numbers. For instance, element 164 is followed by elements 139, 140, and then 169. According to Pyykkö's calculations, 139 and 140 are the first elements with electrons in the 8p orbital.

This table is, of course, largely hypothetical. Scientists have not yet synthesized any elements beyond 118, and while several groups are working to do so, it's possible we will reach the limits of our abilities to forge new elements well before element 172 or even 139.



																		Orbitals
1 H																	2 He	1s
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne	2s2p
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	3s3p
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	4s3d4p
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	5s4d5p
55 Cs	56 Ba	57–71	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn	6s5d6p
87 Fr	88 Ra	89–103	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og	7s6d7p
119	120	121–	156	157	158	159	160	161	162	163	164	139	140	169	170	171	172	8s7d8p
165	166											167	168					9s9p

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	4f
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	5f
141	142	143	144	145	146	147	148	149	150	151	152	153	145	155	6f

121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	5g

Pekka Pyykkö proposes a periodic table that goes all the way up to atomic number 172 and is based on electronic configurations, which he calculated by taking relativistic effects into account.

"This is open land," says Peter Schwerdtfeger, a theoretical chemist at Massey University studying superheavy elements. He calls Pyykkö's calculations a "very good approximation" of the electron configurations but says more calculations are needed to pin down the precise characteristics of these elements. Pyykkö agrees. He too is waiting for more detailed calculations to show how wrong or right his table is.

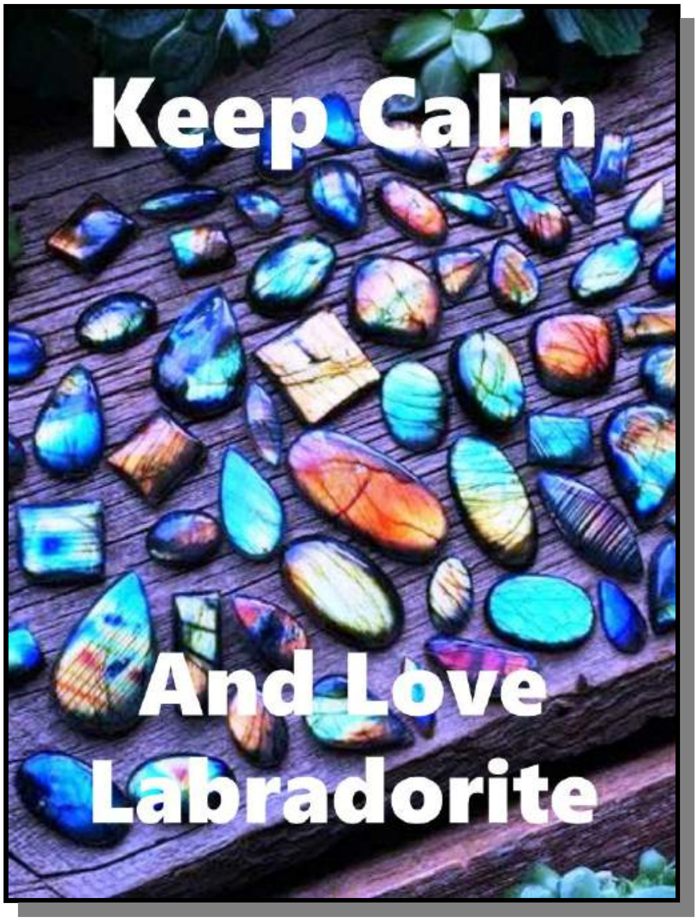
And there are still other configurations of the elements that scientists are arguing for. Some tables look like rings or spirals. Some are 3-D, with lobes or stacks of element blocks. It seems less likely any of these will challenge the basic shape of the current table.

Gordin agrees on historical grounds. The periodic tables of the 19th century, he says, were made "to be flexible." But he understands the resistance to radically different periodic tables, comparing new periodic tables to Pluto's demotion from the ranks of planets. "The table you grew up with is the table you like."

That raises a question about how much scientists and others should worry about these debates. "There's a little group that argues over which [periodic table] is best," Ball says. He believes the IUPAC group's work is important because the current situation, with several competing tables, is confusing. But Ball says there's no reason to think one table can capture the whole picture. "This notion of periodicity was so important for chemistry when the periodic table was first put forward and in the subsequent decades to make sense of this chaos of elements," he says.

But today it should be more of a rule of thumb rather than a law of nature, Ball adds, arguing that there's room for more than one periodic table: "Chemistry is about compromise."

Source: *Chemical & Engineering News* (January 7, 2019: Appeared in Volume 97, Issue 1)

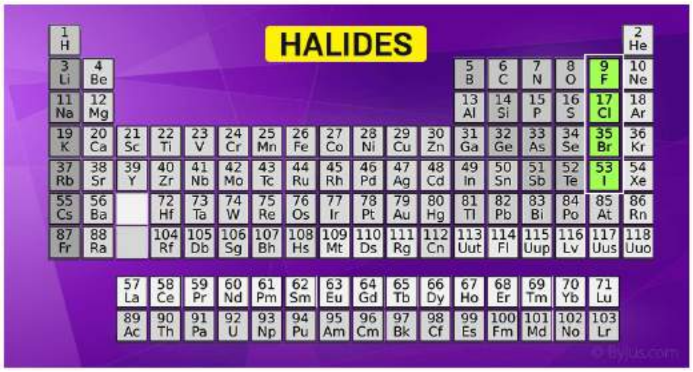


It’s Elemental

It’s Elemental is a series of columns by Bill Shelton written this year in recognition of the United Nations’ International Year of the Periodic Table of Chemical Elements.

Halides

Here, we find a group of five elements that do not rank high in collector ratings based on several different schemes. Yet, we also find one sample that suggests the most common, beloved species belongs within this category. We also will include one source that is based on about 200 more or less common mineral species. By my standards, I find no common examples for three of the five elements in this category. One element seems to be essentially unknown in terms of mineral specimens.



HALIDES

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Uut	114 Fl	115 Uup	116 Lv	117 Uus	118 Uuo
		57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu	
		89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

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Fluorine. We consider F to be #17 in terms of crustal abundance, i.e., it is more common than most others we include here [and that would be 92 naturally occurring elements]. According to my database, there are 415 species with F present in the formula. That means 16 other elements have more than 415 minerals species. The collectors’ favorite, **fluorite** belongs here [see *Mineral News*, 2015]. Based on Dennon [1960], the noted species at that time include amblygonite series, **topaz**, apatite series, hornblende series, arfvedsonite, glaucophane, lepidolite group, tourmaline group, cryolite, humite group, and apophyllite. Some of the terms are no longer valid [see Back, 2018] but I am sure you get the general idea even based on a somewhat outdated list.

Fluorite – CaF_2

Topaz – $Al_2SiO_4(F, OH)_2$

Chlorine. I have Cl down as #15 in terms of crustal abundance. There are 395 species in my database regarding species currently accepted. So, only 17 other elements have more examples known. Perhaps one of these will be among the most well-known species even among non-collectors. That would be common table salt which is **halite** to a mineral collector. Dennon [1960] has scapolite series, carnallite, vanadinite, cerargyrite, sylvite and **sodalite** as examples for Cl minerals. Mindat.org, as of 4-15-19, chooses halite, pyromorphite and chlorargyrite as three very important examples for this element. As you may have noticed in the past, the source you choose may or may not reflect the same choices for a given search.

Halite – NaCl

Sodalite – $Na_8(Al_6Si_6O_{24})Cl_2$

Bromine. It appears that there are only 12 species in my database but Mindat.org has 8. well, the crustal data places Br at #55, so I will consider it to be uncommon. The mineral data looks like it is very unusual. Br may be absent as a species due to rarity, lack of appeal and availability if specimen samples, or possibly other factors. Bromargyrite and chlorargyrite are a couple of species of note. Mindat.org also includes kuzminite and grechishchevite. Dennon [1960] has no entries on his list.

Iodine. According to my data, I is #63 in rarity for crustal data and that is somewhat rare in my mind. I have 28 minerals on my database but Mindat.org has 24. Dennon does not have any. So, the place you look may influence your opinion as to rarity or importance of a given element. Species that belong here do not seem to have a lot of collector appeal. Marshite, miersite and iodargyrite are my choices. Mindat.org includes perroudite and schwartzembergite as well. At least one proofreader said they were not familiar with any of the species.

Astatine. If you think things looked bad so far, here is the end of the earth. Astaine is very rare in terms of crustal data; I do not have any species listed for At. In fact, it may be the rarest element of all the 92 elements on my list. If we try to find even a trace in a mineral, it will probably be in either uranium or thorium minerals. If any At were present in a mineral, it would not last very long. This radioactive element has a very short half life. But, it is part of the decay series so an atom or two might be present; can you even detect it without extreme measures?

As with any group we study, there may be some interesting outcomes. There are 500 to 1000 species depending on the source consulted. Yet, we as collectors seem to be inclined to have only a handful in our collections. As has been pointed out to me, the crustal data does not reflect the number of species we find in a consistent manner. This group shows us an example that illustrates that idea.

Have an idea for a story?
Write for the *Bulletin of the NYMC.*

Elements Can Be Solid and Liquid at the Same Time in Newly Discovered State of Matter

By Rosie McCall

It sounds paradoxical but scientists say they have discovered that an element can be both liquid and solid at the same time.

In a study soon to be published in the Proceedings of the National Academy of Sciences, scientists have achieved a very particular state of matter whereby potassium atoms display properties of both a liquid and a solid simultaneously.

So, how exactly does this work? It all comes down to the structure of potassium.

In its solid form, potassium has a pretty basic crystal lattice-type structure. But put the element under extremely high pressure and that structure will shift. It will become more complex, reshuffling so that five cylindrical tubes made up of atoms form an X-shape while four long chains assemble between them.

The two arrangements are loosely connected – so much so that when the temperature is turned up, the chains start to disappear as the tubes stay intact. The researchers describe it as a "chain-melting transition".

"It would be like holding a sponge filled with water that starts dripping out, except the sponge is also made of water," Andreas Hermann, study co-author and a condensed matter physicist at the University of Edinburgh, told National Geographic.

To find out what is going on here, Hermann and his colleagues employed a neural network, a type of AI based on the human brain and nervous system that "learns" from a bank of previous examples.

In this case, it was taught quantum mechanics using computer simulations of small groups of potassium atoms. Post-training, it was able to create simulations involving 20,000 atoms and confirmed that under the right circumstances, potassium can achieve this chain-melted state.

This occurs at pressures between 20,000 and 40,000 times higher than atmospheric pressure and only when temperatures have reached 400 to 800 Kelvin (127-527°C or 260-980°F). At this point, the weaker chains in the potassium dissolve but the stronger tubes remain solid – creating this bizarre part solid, part liquid state.

According to National Geographic, this is the first time scientists have been able to show it is possible to achieve this state and for it to be stable – for any element, which is very exciting stuff. There are over half a dozen other elements (including sodium and bismuth) that, like potassium, are thought to be able to achieve this strange state under the right circumstances.

"Potassium is one of the simplest metals we know, yet if you squeeze it, it forms very complicated structures," Hermann said in a statement.

"We have shown that this unusual but stable state is part solid and part liquid. Recreating this unusual state in other materials could have all kinds of applications."

This is just the latest experiment to show things aren't always as simple as they seem, particularly when it comes to states of matter. Despite what most of us learned at school, materials can exist in states other than solid, liquid, and gas. As well as plasma, scientists have discovered dropletons, the Jahn-Teller metal, Bose-Einstein condensate – even supersolids and superfluids.

Join Us
at the
Annual Banquet Meeting
of the
New York Mineralogical Club
Wednesday, October 16, 2019
6:00 pm Silent Auction
7:00 pm Dinner & Meeting
Watson Hotel

Theme: Labradorite
Tickets: $35.00 Each
RSVP Requested

silent
Auction
SOLD TO THE HIGHEST BIDDER

Wednesday
Evening
October 16, 2019
Watson Hotel
6:00 pm to 7:00 pm

Shhhhhh . . .

To Benefit the New York Mineralogical Club

Followed by the
Annual Banquet Meeting of the
New York Mineralogical Club

Topics in Gemology

Topics in Gemology is a monthly column written by Diana Jarrett, GG, RMV, based on gemological questions posed to her over the years by beginners and experts alike. Contact her at diana@dianajarrett.com.

Dream a Little Dream

For consumers, the idea of naturally colored diamonds is still not universally understood. Even the trade's nomenclature, referring to diamonds as being '*produced'* in such and such colors or carats unintentionally makes it seem like someone is manufacturing the stuff in a covert lab somewhere.

Ocean Dream 5.51-carat Diamond
(Courtesy Christies Geneva Magnificent Jewels)

Colors on Parade

By now, however, thanks in great part to celebs donning glitzy jewels on the red carpet in Hollywood, many consumers have caught on to the fact that diamonds do come in colors and are very pricey. Pinks have shot up through the stratosphere—baby blues have toppled previously held prices, and reds—well—there are so few that they remain an enigma, don't they?

Ocean Dream

Some colors are so hypnotic that they can startle even jaded industry insiders. Consider the alluring teal blue-green diamond that fascinated tradespeople ever since its debut. Even on those rare incidences when a blue diamond turns up—it's nothing like the teal triangular shaped wonder that diamantieres dream about. The sumptuously rich blue green Ocean Dream diamond weighing 5.51-carats which was color graded as Fancy Vivid Blue-Green (SI1) by GIA. It sold at Christie's Geneva Magnificent Jewels auction in 2014 for $7,764,694.14-US.

Its crowd-stirring charisma is the result of its rarity. The Ocean Dream, from Central Africa is the first and one of the only natural diamonds known to GIA with that exact blue-green combination. Besides Brazil's smaller oval shape 1.6-cts Ocean Paradise Diamond owned by the Nahshonov Group, it remains one of the rarest diamonds in the world. Gorgeous as it is, the Ocean Paradise diamond has a distinctly lighter tone and a different tint than the richly hued Ocean Dream; it is classified as Fancy Green-Blue.

Up Close and Personal

Los Angeles based Guild Labs president Charles Carmona, is a highly respected gemologist-appraiser with four decades of experience. He's examined some extraordinarily rare jewels during his career, many of which have gone on to sell for record-breaking prices. Of the Ocean Dream which he had the opportunity to examine, Carmona said, "It's not only exceptional for its size but also for its nearly equal mix of green and blue." For all his background, handling a diamond like the Ocean Dream has never become commonplace for this industry pro. "The chances of examining such a diamond are rare" he reflects. "It is truly a pleasure to see such a stone."

Imaginative Tastes—on a Budget

By the way, the ubiquitous affordable blue-green diamonds sold on jewelry shopping channels, and across the Caribbean are enhanced diamonds, whose color is derived by irradiation treatment. Plenty of people can have the feeling of owning a blue-color diamond for a few thousand dollars, in some cases just hundreds. It's a way for jewelry fans with modest discretionary funds to enjoy an unusual variety of diamond.

The Real Deal, Darling

Serious collectors consider the search for a rare fancy colored diamond to be a wonderful vocation. If you think that something as winsome as the blue-green Ocean Dream diamond is a thing of the past, you might be in for a pleasant surprise. Genuine fancy color diamonds are naturally occurring, so we actually don't know when and where the earth will yield its next wonder.

Ocean d'Amour Pear-Shaped 0.55-carat Diamond
(Courtesy Leibish & Co.)

Ocean d'Amour

Expert fancy color diamond merchant, Leibish Polnaur, president of Leibish & Co. acquires exceptional stones for a knowledgeable diamond collector. They understand that certain things in life are worth the wait, and when you find it–you've found your dream. After acquiring a one-of-a-kind 0.55-carat pear-shaped blue-green fancy color diamond, they gave it a beautiful name, Ocean d'Amour.

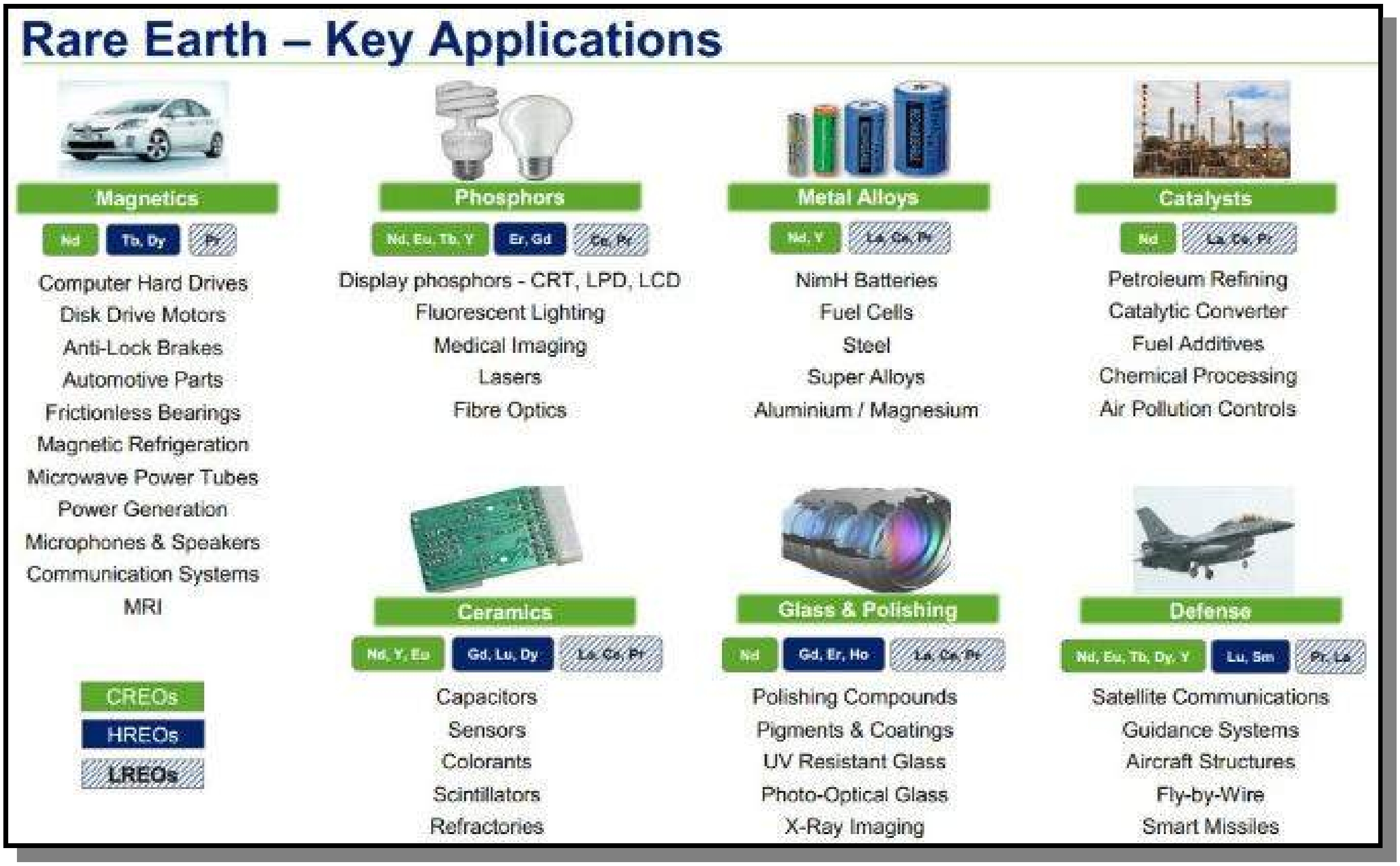
Drawing inspiration from the larger Ocean Dream, Leibish's blue-green pear looks like a color-match for that famous larger diamond. "The color resembles the deep aquamarine shades of the ocean." Leibish reports. GIA classified the Ocean d'Amour as 'fancy deep blue green', giving it the distinction of "being among the rarest diamonds in the world."

The very rich depth of color, also resembling the deep aquamarine shades of the ocean, combined with the unique 'pear modified brilliant' shape of the stone, Leibish says, "makes it hard to ignore the resemblance between this diamond and the Ocean Dream."

What's Your Dream?

Not only are these unique diamonds extraordinary to behold, but they spur the imagination in all of us. You may have dreamt about a certain rare color diamond. What is it? Let your dreams embolden you to search for the diamond of your lifetime

Ocean Paradise 1.6-carat Diamond (Source: Wikipedia)



Rare Earth – Key Applications

Magnetics

🟩 Nd | Tb, Dy | ▨ Pr

Computer Hard Drives
Disk Drive Motors
Anti-Lock Brakes
Automotive Parts
Frictionless Bearings
Magnetic Refrigeration
Microwave Power Tubes
Power Generation
Microphones & Speakers
Communication Systems
MRI

Phosphors

🟩 Nd, Eu, Tb, Y | Er, Gd | ▨ Ce, Pr

Display phosphors - CRT, LPD, LCD
Fluorescent Lighting
Medical Imaging
Lasers
Fibre Optics

Metal Alloys

🟩 Nd, Y | ▨ La, Ce, Pr

NimH Batteries
Fuel Cells
Steel
Super Alloys
Aluminium / Magnesium

Catalysts

🟩 Nd | ▨ La, Ce, Pr

Petroleum Refining
Catalytic Converter
Fuel Additives
Chemical Processing
Air Pollution Controls

Ceramics

🟩 Nd, Y, Eu | Gd, Lu, Dy | ▨ La, Ce, Pr

Capacitors
Sensors
Colorants
Scintillators
Refractories

Glass & Polishing

🟩 Nd | Gd, Er, Ho | ▨ La, Ce, Pr

Polishing Compounds
Pigments & Coatings
UV Resistant Glass
Photo-Optical Glass
X-Ray Imaging

Defense

🟩 Nd, Eu, Tb, Dy, Y | Lu, Sm | ▨ Pr, La

Satellite Communications
Guidance Systems
Aircraft Structures
Fly-by-Wire
Smart Missiles

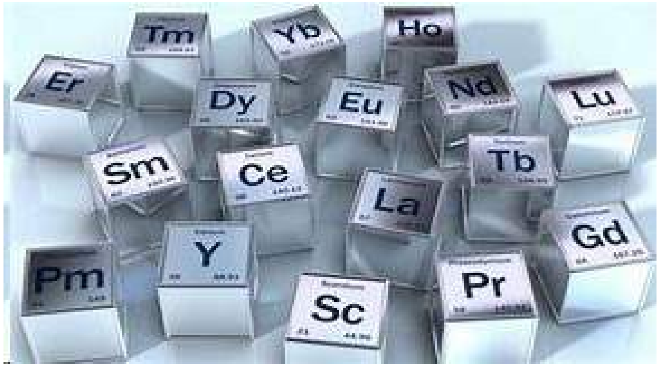
🟩 CREOs
HREOs
▨ LREOs

U.S. to Ensure Rare-Earth Supply Amid Trade War With China

By Andrew Mayeda

The U.S. will take steps to ensure it doesn't get cut off from the supply of rare earths used in everything from the production of computer screens to missile systems and mobile phones, Commerce Secretary Wilbur Ross said.

The Commerce Department on Tuesday released a report requested by President Donald Trump in December 2017, when he asked officials to look into U.S. access to so-called rare earths, a group of 17 elements including lanthanum and terbium.



"These critical minerals are often overlooked but modern life without them would be impossible," Ross said in a statement. "Through the recommendations detailed in this report, the federal government will take unprecedented action to ensure that the United States will not be cut off from these vital materials."

Beijing has readied a plan to restrict exports of rare earths to the U.S. if the trade war between the two nations deepens, people familiar with the matter told Bloomberg News last month.

Supply Shocks

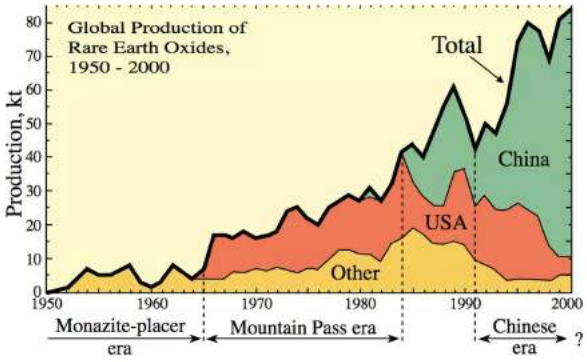
The report acknowledged the potential danger to the U.S. of being shut out of foreign supplies of rare earths. "The United States is heavily dependent on critical mineral imports," according to the report. "If China or Russia were to stop exports to the United States and its allies for a prolonged period – similar to China's rare earths embargo in 2010 – an extended supply disruption could cause significant shocks throughout U.S. and foreign critical mineral supply chains."

China accounts for more than 70% of global output of rare earths. The U.S. was the leading global producer of rare earths from the 1960s to the 80s, when production began shifting off shore.

The Commerce report recommends a number of steps, including improving the government's understanding of domestic sources of rare earths and expediting approvals of mining permits.

The U.S. has 1.4 million metric tons in rare earth mine reserves, 93 times the nation's output last year, according to data from the U.S. Geological Service website. The country's only producer, MP Materials, has been shipping all its output from the Mountain Pass mine in California to China because there is currently no refining capacity available to handle its output anywhere else in the world, its biggest shareholder said.

"As with our energy security, the Trump administration is dedicated to ensuring that we are never held hostage to foreign powers for the natural resources critical to our national security and economic growth," Interior Secretary David Bernhardt said in a separate statement. “The department will work expeditiously to implement the president’s strategy from streamlining the permitting process to locating domestic supplies of minerals.”



Source: Bloomberg.com from June 4, 2019

The Crazy Way Our Planet Slurps Down its Seafloor and Spits out Diamonds in Exchange

By Madison Dapcevich

Diamonds are as mysterious as they are beautiful, but a new study hopes to clear up any lingering mysteries about how these precious gems are formed deep within our planet. Publishing their work in *Science Advances*, researchers believe that diamonds may be the product of complex processes occurring 200 kilometers (124 miles) below the seafloor and have mimicked these processes in their lab to prove it.

The theory holds that when parts of the slabs of seafloor (or oceanic plates) rapidly glide under the continental plate – a process called subduction – sediment on the seafloor drops hundreds of kilometers into the Earth’s crust, where high temperatures and intense pressure at 40,000 times that of atmospheric pressure ultimately compound the minerals into small crystals. These then melt in the ancient mantle at temperatures of more than 800°C (1,500°F).

These small carbon-fixed stones mix with a volcanic magma called kimberlite and spout back onto the Earth’s surface as diamonds. Fluids trapped inside of diamonds have high concentrations of saline thought to come from deep subduction zones, which suggests that this process may very well have been occurring for billions of years.

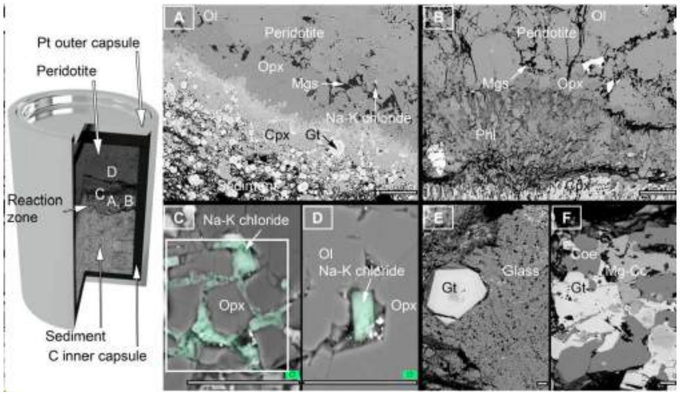
“There was a theory that the salts trapped inside diamonds came from marine seawater, but couldn’t be tested,” said lead author Michael Forster in a statement. “Our research showed that they came from marine sediment.”

Sounds pretty magical, doesn’t it?

To put their theory to the test, the scientists recreated these extreme conditions in the lab where they plopped marine sediment in a vessel with a common rock called peridotite. Here, they simulated the reaction between the two by cranking up the pressure and heat and giving them time to react with one another.

“We demonstrated that the processes that lead to diamond growth are driven by the recycling of oceanic sediments in subduction zones,” said Forster. “The products of our experiments also resulted in the formation of minerals that are necessary ingredients for the formation of kimberlite magmas, which transport diamonds to the Earth's surface.”

But these aren’t the shiny diamonds found on your grandmother’s engagement ring. Diamonds formed through this process are likely those known as cloudy, less desirable fibrous diamonds which have applications in technology and engineering.



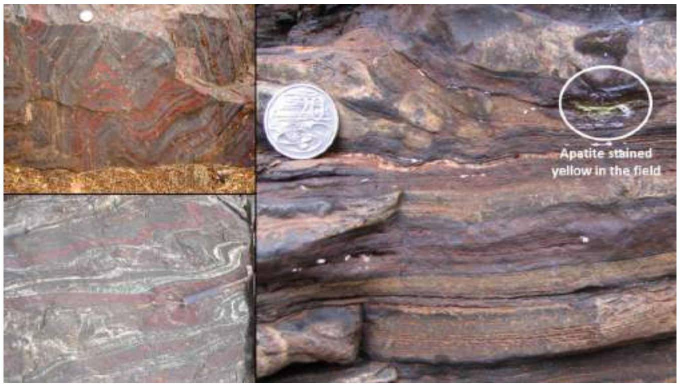
Backscattered electron images of experimental charges showing different stages in the experimental process. Science Advances

Source: IFLScience.com from May 30, 2019

3.8-Billion-Year-Old Rocks Reveal the Story of Life’s Origins

By Stephen Luntz

We have good reason to believe life first appeared on Earth soon after the planet cooled enough to support it. However, whether we can find traces of these early organisms has been highly controversial. Two papers from one team of scientists support the theory that bands of graphite in ancient rocks come from some of the earliest life forms. The work may expand our capacity to find life on other planets.



Biosignatures in banded iron formations from around the world - 1.9 billion years old, Michigan (top left), 2.7 billion years old, Ontario, (bottom left) and 2.5 billion years old, Karijini National Park, Western Australia (right). Dr Dominic Papineau, UCL

Greenland hosts some of the world’s oldest surviving rocks. Among these, particles of graphitic carbon can be found, not dissimilar to the contents of a pencil (google it, kids). The discovery of this carbon created plenty of enthusiasm, as it might be life’s earliest remains. However, two other, much less exciting, theories have also been proposed – either the carbon had a non-biological source, or it was from more recent living things that worked their way into the rocks long after they formed.

In Earth and Planetary Science Letters, a team including University College London’s Dr Dominic Papineau make the case that the hoped-for explanation is right. “We now have multiple strands of evidence that these mineral associations are biological in banded iron formations,” Papineau said in a statement.

The graphite is trapped in banded iron rocks, some of which are more than 3.8 billion years old. In 10 cases it has been found associating with apatite, a component of teeth and bones that can also have non-biological origins. They’ve been transformed under heat and pressure many geologists expected would destroy any distinctively biological chemicals trapped within them.

However, the paper reports the graphite is depleted in carbon-13 isotopes, like material laid down by more recent life forms. The distribution through the rocks is also consistent with the remains of organisms being deposited by hot fluids, such as from volcanically heated water.

In a second paper, published in the Journal of the Geological Society, Papineau demonstrates life’s traces can survive similar metamorphosis. He used banded iron formations from Michigan, less than half the age of their Greenland counterparts.

The shapes of animals within the Michigan rocks reveal they once held life, but they have experienced temperatures of at least 550ºC (1,022ºF). Yet graphitic carbon in these rocks has formed expanded lattices containing chemical and isotopic signatures of life. If these could survive such temperatures and pressures, there is no reason to think they wouldn’t make it through another 2 billion years.

If Mars once hosted life, the traces it left behind would probably resemble these, leading Papineau to claim: “This has huge implications for how we determine the origin of carbon in samples of extra-terrestrial rocks returned from elsewhere in the Solar System.”

Source: IFLScience.com from April 15, 2019

Large Quantities of Nuclear Fallout Are Stored in Melting Glaciers

By Rosie McCall

The Earth’s glaciers are shrinking – and fast. Indeed, recent research suggests the rate of glacial melt is 18 percent higher than previously thought and five times the speed it was in the 1960s.

It is a bulldozer to polar bear real estate. It is also causing sea levels to rise, extreme weather to become more extreme, and ancient diseases to re-emerge. In short, it is not good.

Now, it appears there is another thing we should worry about – the nuclear fallout buried in all that snow and ice. Radioactive icebergs sound like a dodgy plot device in a fanciful disaster flick along the lines of Geostorm. And yet, emerging research presented at this year’s General Assembly of the European Geosciences Union (EGU) suggests that radioactive debris stored in glaciers really could be a ticking time bomb.

“Research into the impact of nuclear accidents has previously focussed on their effects on human and ecosystem health in non-glaciated areas,” lead researcher Caroline Clason, from the University of Plymouth, said in a statement.

“But evidence is mounting that cryoconite on glaciers can efficiently accumulate radionuclides to potentially hazardous levels.”

This is the first time an international team of researchers has set about analyzing the nuclear contents of glaciers in the Arctic, the Antarctic, the Alps and Caucasus Mountains, British Columbia, and Iceland. Their findings reveal levels of human-made radioactive material in each of the 17 sites surveyed. Frequently, these were at concentrations 10 times higher (or more) than those at non-glacial sites.

The explanation for this especially high concentration comes down to the dispersal of radioactive particles after a nuclear disaster event like Chernobyl or Fukushima. These particles are light and can travel far.

Normally, they return to the ground as acid rain, where they may be absorbed into the soil or consumed by plants. Hence, the higher concentrations of radioactivity in places like Chernobyl and Fukushima – and, subsequently, higher cancer rates, higher infertility rates, and the existence of radioactive boar. However, some of these particles will travel to icier climes where they fall to Earth as snow, land on the ice, set in weightier sediment, and accumulate in denser concentrations.

The team analyzed the material and not only did they find nuclear fallout from Chernobyl and Fukushima, both nuclear accidents, but they also found material from decades of nuclear weapons testing.

“We’re talking about weapons testing from the 1950s and 1960s onwards, going right back in the development of the bomb,” Clason told the Associated Press.

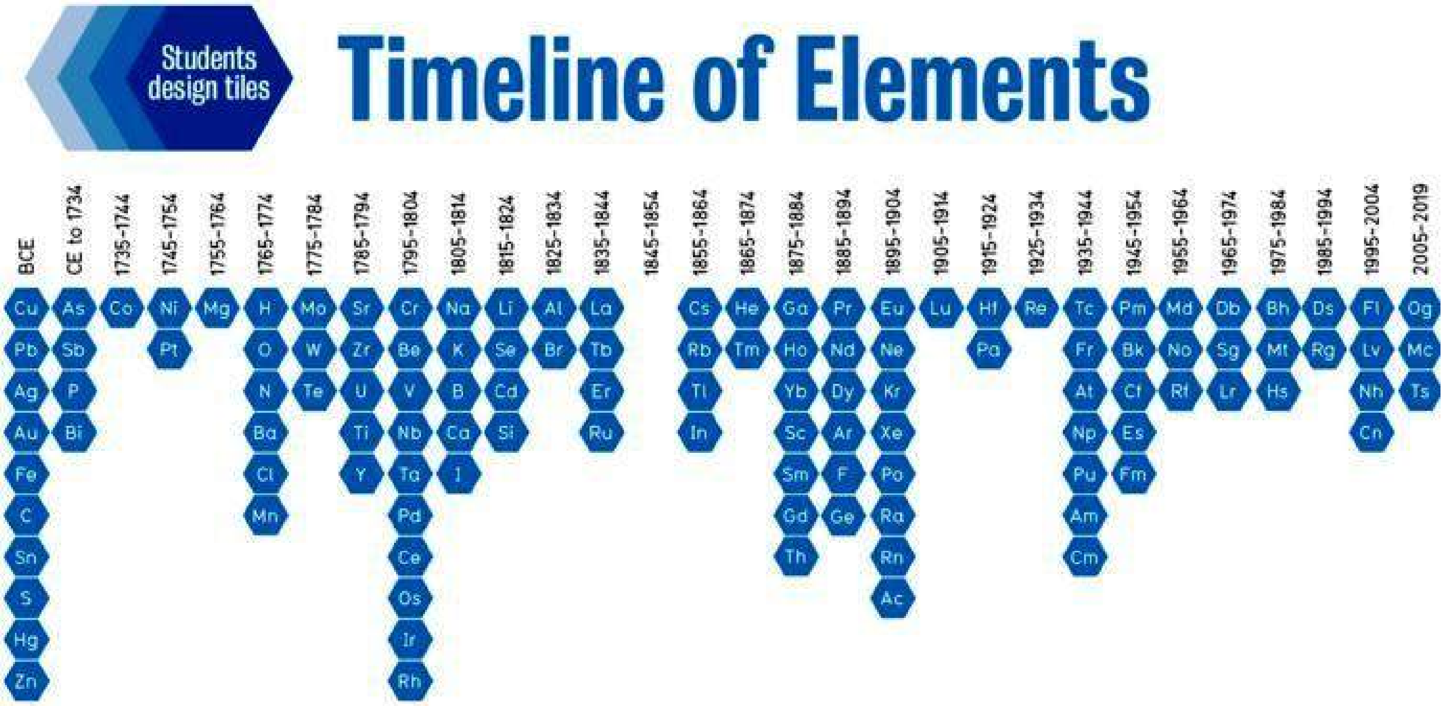
“If we take a sediment core you can see a clear spike where Chernobyl was, but you can also see quite a defined spike in around 1963 when there was a period of quite heavy weapons testing.”

While research shows that radioactive material in the food chain is definitely not good for you, it is unclear yet what the presence of this nuclear fallout means exactly. The team hopes to find out.

“Very high concentrations of radionuclides have been found in several recent field studies, but their precise impact is yet to be established,” Clason said.

“Our collaborative work is beginning to address this because it is clearly important for the pro-glacial environment and downstream communities to understand any unseen threats they might face in the future.”

Source: IFLScience.com from April 12, 2019



BCE	CE to 1734	1735–1744	1745–1754	1755–1764	1765–1774	1775–1784	1785–1794	1795–1804	1805–1814	1815–1824	1825–1834	1835–1844	1845–1854	1855–1864	1865–1874	1875–1884	1885–1894	1895–1904	1905–1914	1915–1924	1925–1934	1935–1944	1945–1954	1955–1964	1965–1974	1975–1984	1985–1994	1995–2004	2005–2019
Cu	As	Co	Ni	Mg	H	Mo	Sr	Cr	Na	Li	Al	La		Cs	He	Ga	Pr	Eu	Lu	Hf	Re	Tc	Pm	Md	Db	Bh	Ds	Fl	Og
Pb	Sb		Pt		O	W	Zr	Be	K	Se	Br	Tb		Rb	Tm	Ho	Nd	Ne		Pa		Fr	Bk	No	Sg	Mt	Rg	Lv	Mc
Ag	P				N	Te	U	V	B	Cd		Er		Tl		Yb	Dy	Kr				At	Cf	Rf	Lr	Hs		Nh	Ts
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Fe					Cl		Y	Ta	I							Sm	F	Po				Pu	Fm						
C					Mn			Pd								Gd	Ge	Ra				Am							
Sn								Ce								Th		Rn				Cm							
S								Os										Ac											
Hg								Ir																					
Zn								Rh																					

Bring an additional friend or loved one!

133nd Anniversary New York Mineralogical Club Banquet

Date: October 16, 2019 [Wednesday Evening]
Time: 6:00 p.m. - 11:00 p.m. [Social Hour & Silent Auction from 6 p.m. - 7 p.m.]
Place: Watson Hotel Manhattan, 57th Street Between Ninth & Tenth Avenues, NYC
Cost: $30 for Members/Guests (***Advance Payment***); $35 for Non-Members (or ***Payment at the Door***)

Gala Dinner Menu (tentative)

Appetizer
Salad
Choice of Entree:
chicken • salmon • beef • vegetarian • kosher
Potatoes & Seasonal Vegetables
Selection of Breads & Rolls
Red & White Wine
Soft Drink Assortment
"Labradorite" Dessert Selection
Coffee & Tea

Special Banquet Theme

"Dazzling Labradorite"

Amount	
	Please reserve _______ seat(s) for me at the banquet @ $30.00 per member (or $35.00 per non-member) each. I will ***probably*** be ordering ☐ **Salmon** ☐ **Chicken** ☐ **Beef** ☐ **Vegetarian** ☐ **Kosher** for my dinner entree(s).
	Special Food Instructions (if any):
	Special Seating Instructions (if any):
	Also included are my **2020 New York Mineralogical Club Membership Dues.** (☐ $25 Individual, ☐ $35 Family)
	I am adding a **Wine/Dessert Donation** to help make the banquet an affair to remember. (Each bottle costs about $25)
	I REALLY want _____ of the **NYMC T-Shirt(s)**! [$15.00 each - indicate size(s)] S M L XL XXL
	Please bring _____ copies of the **Club's Award-Winning Publication, "The 100"** for me. (Each book @ $10.00)
	I'd like to get _____ of the **Drawstring Backpack(s)** which features the Club. (Each backpack @ $5.00)
	Please reserve _____ set(s) of the **Boxed Labradorite Note Card Sets** for me. (Sets @ $5.00 each include envelopes)
	Please reserve **Labradorite Banquet Souvenir ______ CD-ROMS** and/or _____ **Flash Drives**. (Each item @ $5.00)
	I wish to make an **Additional Donation** as a sponsor to help support the Banquet and the NYMC.
	← Total Included Other Comments:

Name(s)
Street Address **Apt. No.**
City **State** **Zip**
Phone **Email**

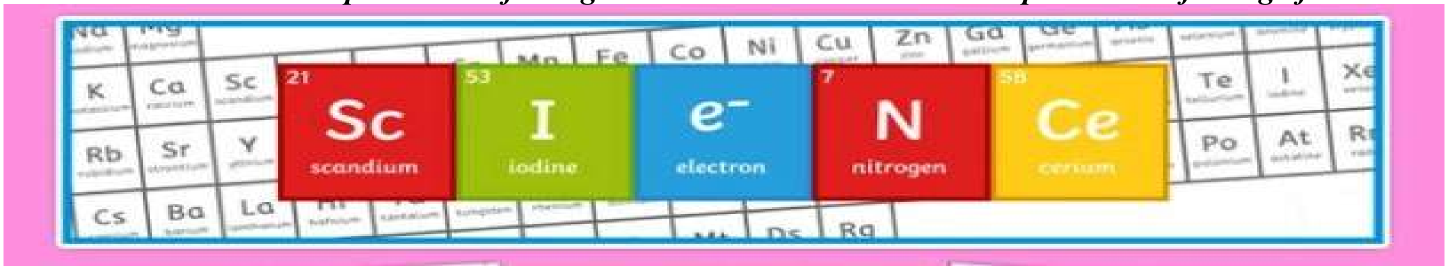
2019-2020 Club Calendar

Date	Event	Location	Remarks & Information
THIRD Wednesday! September 18	Meeting at 6:00 pm	Watson Hotel, Manhattan	Special Lecture: Christopher Kemper Ober – "The Periodic Table and the Language of Science"
Thursday October 3	Special Gallery Talk at 6:00 pm	Wilensky Mineral Gallery 173 Tenth Avenue (at 20th Street)	Emerald Exhibit Talk by Stuart Wilensky RSVP required! (Members & Friends ONLY!)
THIRD Wednesday! October 16	Annual Gala Banquet	Mezzanine B & C Watson Hotel, Manhattan	Theme: Labradorite; Silent Auction; Awards; Fun & Games; Gifts & MANY Surprises!
CHANGE! November 13	Meeting at 6:00 pm	Watson Hotel, Manhattan	Special Lecture: Mitch Portnoy– "The Building Stones of NYC Parks Monuments"
December 11	Meeting at 6:00 pm	Watson Hotel, Manhattan	Special Lecture: Vivien Gornitz– "Ice: The Mineral that Shapes the World"
January 8, 2020	3rd Annual Movie Night	Watson Hotel, Manhattan	"Treasures of the Earth: Gems" (Nova Series) Popcorn & Candy, Surprises Galore!

2019-20 Show & Event Calendar

Date	Event	Location	Remarks & Information
September 7 - 8	Jewelry, Gem & Mineral Show	New Milford High School New Milford, Connecticut	https://danburymineralogicalsociety.weebly.com/annual-club-show.html is the Website
September 21 - 22	Mid-Hudson Valley Gem and Mineral Show & Sale	Gold's Gym, Poughkeepsie, New York	50th Anniversary Show!; Theme: "Pyrite . . . Don't be Fooled"; Pyrite Exhibit by Vassar College
Thursday Evening September 26	Opening: "Magnificent Emerald's: Fura's Tears"	Wilensky Gallery, 173 10th Avenue, New York, NY (20th Street)	Time: 5-7 pm; Info: Wilenskyminerals.com
September 28 - 29	Franklin-Sterling Hill Gem & Mineral Show	Littell Community Center, Franklin, New Jersey	Website: www.franklinmineralmuseum.com
October 11 - 13	Paul Desautels Micromount Symposium	Friends School of Baltimore, Baltimore, Maryland	Mineral Talks, Silent & Voice Auctions, Trading & Giveaway Tables; info: mseeds@fandm.edu
October 12 - 13	South Jersey Gem, Jewelry, Mineral & Fossil Show	1721 Springdale Road Cherry Hill, New Jersey	Website: www.sjmineralshow.com
October 18 - 20	2019 Yale Mineral & Gem Symposium	David Friend Hall, Yale Peabody Museum, New Haven, Connecticut	Lectures, Mineral Galleries, Other Events; Info: peabody.yale.edu/events/peabody-mineral-symposium
November 2 - 3	Gem, Mineral, Jewelry & Fossil Show	Eastern Greenwich Civic Center, Old Greenwich, Connecticut	Sponsor: Stamford Mineralogical Society
November 9-10	**Fall NYC Gem, Mineral, Jewelry & Fossil Show**	**Grand Ballroom, Watson Hotel, New York City**	**25+ High Quality Dealers; NYMC Booth; Lecture on Both Days; Wholesale Section**
November 20	Naomi Sarna Solo Show	Wilensky Mineral Gallery 173 Tenth Avenue (at 20th Street)	Details TBD
November 30 - December 1	Rock and Mineral Weekend	Morris Museum , Morristown, New Jersey	Sponsor: Morris Museum Mineralogical Society
January 9, 2020	Magnificent Masterpieces Group Show Including N. Sarna, etc.	Wilensky Mineral Gallery 173 Tenth Avenue (at 20th Street)	Details TBD

For more extensive national and regional show information check online:
AFMS Website: http://www.amfed.org and/or the EFMLS Website: http://www.amfed.org/efmls



The New York Mineralogical Club, Inc.

Founded in 1886 for the purpose of increasing interest in the science of mineralogy through the collecting, describing and displaying of minerals and associated gemstones.

Website: www.newyorkmineralogicalclub.org

P.O. Box 77, Planetarium Station, New York City, New York, 10024-0077

2019 Executive Committee

[redacted]

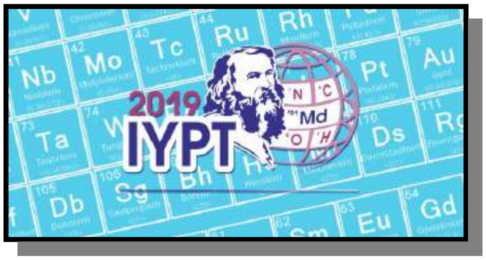
Dues: $25 Individual, $35 Family per calendar year. **Meetings**: 2nd Wednesday of every month (except August) at the Watson Hotel, 440 West 57th Street between Ninth and Tenth Avenues, New York City, New York. Meetings will generally be held in one of the conference rooms on the Mezzanine Level. The doors open at 5:30 P.M. and the meeting starts at 6:45 P.M. **(Please watch for any announced time / date changes.)** This bulletin is published monthly by the New York Mineralogical Club, Inc. The submission deadline for each month's bulletin is the 20th of the preceding month. You may reprint articles or quote from this bulletin for **non-profit usage only** provided credit is given to the New York Mineralogical Club ***and* permission** is obtained from the author and/or Editor. The Editor and the New York Mineralogical Club are not responsible for the accuracy or authenticity of information or information in articles accepted for publication, nor are the expressed opinions necessarily those of the officers of the New York Mineralogical Club, Inc.

Next Meeting: Wednesday Evening, September 18, 2019 from 6:00 p.m. to 9:00 p.m.

Mezzanine Level, Watson Hotel, 57th Street & Tenth Avenue, New York City

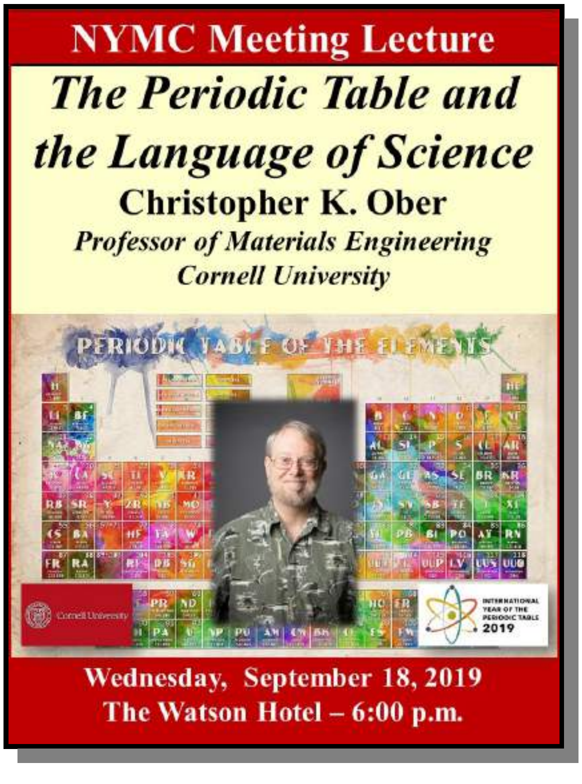
Special Lecture: Christopher K. Ober – *"The Periodic Table and the Language of Science"*

New York Mineralogical Club, Inc.
Mitchell Portnoy, Bulletin Editor
P.O. Box 77, Planetarium Station
New York City, New York 10024-0077



FIRST CLASS

George F. Kunz
Founder



NYMC Meeting Lecture

The Periodic Table and the Language of Science

Christopher K. Ober

Professor of Materials Engineering
Cornell University

Wednesday, September 18, 2019
The Watson Hotel – 6:00 p.m.