

GOLDRUSH LEDGER



CHARLOTTE GEM & MINERAL CLUB

JANUARY 2013

Prez Sez ...

Well here we are in 2013. Linda and I spent Christmas with our grandkids in Wisconsin (couldn't figure out what that white powdery stuff sitting on the ground was for). If you ever have occasion to visit the cheese state there are a few side trips you should try to make.

One is Simon's Cheese Shop (no relation) somewhere near the middle of the state. The variety of great cheeses is amazing but be sure to sample the fresh cheese curds. A good beer, some cheese curds and a football game on TV – now that's an afternoon well spent. And with a name like "Simon" you know it's got to be good!

Next is the Racine Art Museum an hour north of Milwaukee. The RAM is the largest craft museum in the United States. At the time we were there they were featuring an exhibit of

fused glass jewelry. Many of the pieces on display were quite striking and unusual. Even though we are not into fused glass, Linda and I got some good ideas for color combinations, shapes and innovative settings. Unfortunately we missed an incredible polymer clay exhibit that had closed a few months ago after a very successful three-month run. Based on the pieces we saw for sale in the gift shop, it was apparent that the artists represented in that exhibit were at the top of their craft.

A final destination, especially for those who are interested in gems and minerals, has to be The Gem Shop in Cedarburg (an hour north of Milwaukee). You walk into a store that, on first glance, impresses you as a nice craft and gift shop. After a good bit of time spent looking at the many glass cases and shelves full of rock-related jewelry and display

pieces, I finally noticed the open archway at the back of the shop. Stepping through that opening was like going into another world. Before me was a big backyard full of large, open barrels filled to the brim with lapidary rough from all over the world. I found material I had never seen before and in quantities that made me wish I had packed a fork-

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lift truck. I spent over an hour going through barrels, getting as dirty as on a dig, and making the post office a more profitable business. On my way back into the store with an armful of rocks, I noticed someone coming up through what looked like a hole in the floor. This turned out to be the dirt cellar where all the older materials are to be found.

Open-faced boxes piled from floor to ceiling (about 5+ feet high) lined all the walls leaving narrow aisles to walk (???) around (like the Hunchback of Notre Dame). Many of those boxes contained hidden treasures sold by the pound. Another hour plus found me crawling back out of the hole with even more poundage to somehow get home to Charlotte. For some reason Linda chose not to go

back with me to root around some more in barrels and basement. The next time you're in Milwaukee don't miss The Gem Shop.

It is with deep regret that I announce the resignation of Neil Hohmann as vice president of CG&MC due to personal matters. Neil has been a strong and steady worker for the club and has certainly made my role as president a lot easier. Fortunately he is not leaving us and will continue to work in whatever capacity he can for the good and well being of the club. Many thanks for all you've done Neil. The vice president's position will be taken over by long time member Lindsey Werden .

Murray Simon, *President Charlotte Rock and Gem Club, Vice president Charlotte Rock'n Gym Club, 1st Officer Rocking Chair Club, and Top Custodian for the Vitimen and Mineral Club.*

Dues be do-be Due, do-be do-be ...

Up to date members of the club can buy raffle tickets starting in January, for the April drawing of the 15 ct citrine / sterling silver necklace custom faceted by Jimmy Strickland.

See Vivian at the January meeting, pay your dues and get some tickets ...



Charlotte Gem & Mineral Club Monthly Meeting

January 17, 2013 Thursday -- 7:00 pm --

Location: Tyvola Senior Center
2225 Tyvola Rd.
Charlotte, NC 28210
(704) 522-6222

Mineral trip to Morocco by Danny Jones

I have been asked to do the program this month on my Mineral Trip to Morocco and to bring specimens for sale. I will have seven flats for Morocco minerals for sale (net) as well I will be bring a whole lot of flats that I am moving out of the Firebird Minerals at half off.

Actually it is 50% off by the piece, 60% by the flat (Yes you can make up your own flat but it must be full) and if you want to take all the sale flats it is 75% off (does not include Morocco minerals).

The presentation will begin a little after 7:00 pm, but I will be set up by about 6 or 6:30 so come and look. I will be taking cash, check or credit card.



top of Prudent Man Plume Agate



Charlotte Jr. Rockhounds

**Saturday Jan 26, 2012
10-11:00 a.m.**

**Topic: Fossils and the Timeline of the Earth
by Lindsey Werden**

Location

**Matthews Community Center
100 McDowell St. East
Matthews, NC 28105
704-321-7275**

**Contact Mary Fisher
for further information
at: mefisher@att.net**

Charlotte Club Christmas Party - Awards

More than 40 people came out and enjoyed our annual Christmas/Holiday Party in December. There was ample food and beverage to go around.

We had some nice entertainment from Nathan Godin on the piano and eventually got around to giving

out the evenings awards. Michael Mohr and Suzanne Ching were both present to pick up their scholarship checks awarded to UNC students this year. *(photos below thanks to Pat Walker)*

Two lucky club members also won fully paid weeks at William Holland or Wild

Acres. Everyone who turned in point sheets was eligible. The winners this year were Vivian Philson and Chuck Borawa. We also drew alternates just in case the first place winners cannot attend, they were Linda (*wire n' clay*) Simon, and Gale Blevens.



The World of Minerals: Mineral Evolution

by Dr. Vivien Gornitz, New York Mineralogical Club

From: Bulletin of the New York Mineralogical Club, 6/2010

(3rd Place – 2011 AFMS Original Adult Articles Advanced)

Minerals evolve! Drawing parallels between the mineral kingdom and living organisms. Robert Hazen and his colleagues came to this startling conclusion to explain the wide variety of minerals on Earth.

Although the evolution of minerals and biology involves totally different principles, both share a number of fundamental characteristics in common with other complex systems. These include basic selection rules, increasing complexity over time, and extinction. Unlike biological systems, however, minerals cannot mutate nor can they pass information on to succeeding generations through a genetic-type code.

Furthermore, minerals have hardly ever gone extinct on Earth. (Diamond may be a rare exception. Diamonds crystallized billions of years ago in the Earth's upper mantle and came to the surface much later in violent volcanic eruptions). Mineral extinction has occurred elsewhere in space, e.g., the Moon and Mars. On the Moon, volcanism ceased several billion years ago. On Mars, deposition of clay and sulfate minerals stopped after the Red Planet grew drier

and colder. These examples illustrate the close connections between mineral evolution and the geological (and biological) evolution of their home planets or moons.

At its most basic level, evolution is simply "change over time," and in this sense, mineral evolution has undoubtedly occurred. Furthermore, mineral assemblages on Earth have grown more diverse and complex over time, going from the handful of minerals pre-dating the origin of the Solar System to over 4,400 species known today. Thus, mineral evolution represents another example of the growth of complexity in the universe. Other examples include cosmic evolution from the Big Bang to the creation of chemical elements (other than H and He) in stars, the formation of galaxies, the Solar System, the differentiation of the Earth into core, mantle, crust, the history of life, the development of languages, and lately, the growth of technology.

Hazen and his colleagues propose three major eras, sub-divided into ten stages of mineral evolution, that are closely linked to major

biological and geochemical transformations (summarized in Table 1). Prior to the formation of the Solar System, over 4.6 billion years ago, a mere dozen minerals had been created in the clouds of dust and gas swirling around stars. Tiny nano-grains of diamond, graphite, moissanite, spinel and other rare "ur-mineral" Stardust survive embedded in chondritic meteorites.

Meteorites provide our only window into the first era of mineral evolution, over 4.56 to 4.55 billion years ago, during the formation of the Solar System and planetary accretion. At that time, the first iron-nickel, sulfides (e.g., troilite), phosphides (e.g., schreibersite), and high-melting silicates (e.g., anorthite, forsterite) appeared, bringing the total to 60. Toward the end of the first era, additional heating, re-melting, and alteration by water expanded the list to 250 (Table 1 on next page).

The second era (4.55-2.5 billion years -- that of Earth's differentiation into core, mantle, crust -- generated a cumulative total of 1,500 minerals. New minerals formed as a result of igneous and volcanic processes, metamorphism, and fluids chemically interacting with rocks. Plate tectonics began in this era. Starting

with basalt, partial melting and crystallization led to formation of granitic rocks and pegmatites, along with their characteristic minerals quartz, microcline, muscovite, albite, tourmaline, beryl, topaz, and uranium, thorium, and rare earth minerals. Hydrothermal ore deposits also accumulated in veins, producing many sulfides, sulfarsenides, and sulfantimonides. Life originated toward the end of this era, ultimately transforming the planet profoundly.

The third era (>2.5 billion years to the present)-- that of biologically-influenced mineralogy -- produced over half of the known minerals. Although the earliest life forms had already appeared toward the end of the second era, their influence on geology remained scant until around 2.5 billion years ago. The Great Oxidation Event,

around 2.5 to 2.4 billion years ago, marks a major bio-geochemical milestone, when atmospheric oxygen levels reached over 1 percent of modern values, irreversibly transforming the Earth's surface mineralogy. The oxygen we breathe was initially produced by photosynthesizing cyanobacteria and later by plants that converted the Sun's energy, water, and carbon dioxide into carbohydrates and other organic molecules. Before 2.5 billion years ago, when atmospheric oxygen levels were still quite low, detrital pyrite and uraninite grains were able to concentrate into the 2.9-2.7 billion year old gold and uranium placer deposits of the Witwatersrand, South Africa. Today, because these minerals would rapidly oxidize at the Earth's surface, they never occur as detrital grains. The abundance of banded iron formations

(BIFs) culminated during the Great Oxidation Event. These deposits, our main source of iron, consist of layers of red jasper, hematite, magnetite, with lesser iron sulfides, carbonates, and other minerals.

From the perspective of mineral evolution, the rise of atmospheric oxygen probably represents the most important cause of mineral diversification. Of over 4,400 known mineral species, more than half are oxidized and hydrated minerals that are weathered or altered from others. Sedimentary phosphates and sulfates (e.g., gypsum, anhydrite) grew more abundant in shallow seas. Colorful secondary copper minerals such as turquoise, azurite, malachite, and brochantite could not have deposited until enough biologically-produced oxygen had accumulated in

Table 1. Mineral Evolution

Era	Age (billion years)	Total No. Species	Typical Minerals
Pre-solar minerals	>4.6	12	Nano-diamond, graphite, moissanite
I. Formation of Solar System	>4.55	250	Iron-nickel, troilite, olivine, pyroxene
II. Planetary differentiation and onset of plate tectonics	4.55-2.5	1,500	Quartz, orthoclase, mica, tourmaline, zircon, kyanite, pyrite
III. Biologically-influenced minerals	>2.5 to present	4,400+	Hematite, calcite, aragonite, hydroxyapatite, abundant clays

the atmosphere. The same holds true for many other elements (e.g., uranium, vanadium, arsenic, antimony, boron) as well. By the end of the Great Oxidation Event, over 4,000 mineral species had formed.

The last chapter of the third era (from 542 million years to the present) saw the great diversification of life from trilobite and ultimately to Homo sapiens. The proliferation of life resulted in extensive biomineralization. e.g., most limestones and phosphatic rocks deposited form the remains of marine organisms with calcite,

Further Reading:

Hazen. R. M.. 2010. Evolution of Minerals. Scientific American. March 2010, p. 58-65.

Hazen. R. M. and Ferry. J.M.. 2010. Mineral Evolution: Mineralogy in the Fourth Dimension. Elements, 61 (I). p. 9-12.

(The adventurous reader may want to explore the other articles in this special issue of Elements (Feb. 2010) devoted to the theme of mineral evolution).

Hazen, R. M., et al.. 2008. Mineral Evolution. American Mineralogist. 03. p. 1603-1720.

"Fire Ice" or Methane Clathrate (Hydrate)

by Zeb William Rike, III, Pine Country Gem & Mineral Society

From: The Pineywoods Rooter, 9/2010 (9th Place – AFMS Original Articles)

We have seen pictures on TV of the 'ice' crystals forming around the blown-out BP well in the Gulf. (1) We may have wondered why ice formed there when the water had not been freezing previously. Simply because it is not ice but 'fire ice', 'methane ice', or 'methane clathrate (hydrate)', a combination of water and methane (natural gas) which forms under certain conditions of pressure and temperature, with water molecules in a crystal lattice forming 'cages' which trap the methane. It is surprisingly common, being

aragonite, and of hydroxy apatite shells or skeletons. Microbial reduction of evaporitic gypsum produced the native sulfur deposits of the Gulf Coast. Other biominerals include whewellite and whitlockite.

Directly or indirectly, living organisms have contributed to the formation of more than 60 minerals, but the influence of life extends way beyond these. Soil microbial activity has hastened chemical weathering. Biology affects the geochemical cycling of many elements, such as carbon, nitrogen, sulfur, and phosphorous

a larger reservoir of natural gas than the more conventional gas deposits. (2)

PROPERTIES

Methane clathrate is an icy looking solid, about 0.9X the density of water, contains 1 mole of methane for 5.75 mole of water (13.4% methane by weight) and will melt to give off ice water and burn with a typical looking natural gas flame. One cubic foot of the solid contains enough methane to give 168 cubic feet of gas at standard temperature and pres-

sure through the atmosphere and in rocks. Altogether, through various geological and biological processes, the Earth now boasts a grand total of over 4,400 mineral species and new ones are still being discovered.

This novel perspective enables us to appreciate the co-evolution of minerals and life. Life did not just evolve passively, merely adapting to changing environmental conditions, but also participated actively in shaping the geology and climate of this planet.

sure. The gas can be liberated by reducing pressure and/or adding heat.

SOURCE, FORMATION

The hydrate forms any time methane reaches water at sufficiently high pressure and low temperature and is a common constituent of marine sediment. It is typically found on the continental shelves in the depth range of 300-500 meters where the bottom water temperature is around 2°C. Some deposits are found in shallow sandstone layers (less than 1000 meters) on land in Alaska and Siberia where the surface temperature is around 0°C.

Marine deposits are formed by either of two processes (or a combination of the two) and are distinguishable by the $^{13}\text{C}/^{12}\text{C}$ isotopic ratio. Some are formed by microbial reduction of CO_2 (from carbonate rocks) and are isotopically light; the methane in these is formed in-situ as indicated by the isotope ratio being the same in the clathrate and in the dissolved methane. In other deposits, the carbon in the methane is isotopically heavy as a result of having been produced by geological heating of deeply buried petroleum (and other organic residues) with 'cracking*' of the higher hydro-carbons. The methane migrates upward through geological faults until it reaches conditions where the solid hydrate forms. In either case, the hydrate typically acts as a cap and traps gaseous methane below.

RESOURCES

Recent estimates are that the global oceanic inventory of methane clathrate corresponds to 500-3500 giga-tons (a giga-ton is one billion tons) of carbon, smaller than the estimated 5000 giga-tons of total other fossil fuels, but greatly larger than the estimated 230 giga-tons for other natural gas reserves. The permafrost reservoir in the Arctic has been estimated as 400 giga-tons. Some natural gas has been produced from methane hydrate deposits but in general, most are too scattered to make it feasible to recover the gas.

GREENHOUSE EFFECT (3-5)

The "greenhouse effect" is a well established fact; it has been known since early in the 20th century that that the surface of the earth is much warmer than it would be without water vapor, carbon dioxide (CO_2), methane, nitrous oxide and ozone in the atmosphere, with the estimate now being some 59°F . These gases absorb and trap some of the heat from the sun like glass in a greenhouse, making the earth

warmer. The planet Venus is almost a twin of the Earth except that it has an atmosphere containing over 96% carbon dioxide and an atmospheric pressure 90 times ours, and a surface temperature of 860°F because of a run-away greenhouse effect. (The Earth has this much CO_2 but it is tied up in limestone.)

There has been concern about the increasing concentration of carbon dioxide in the air as a result of the burning of fossil fuels. This increase seems to be correlated with global warming, which is reasonable. How much of the warming is caused by human activities is not known. The pre-industrial concentration of CO_2 was about 280ppm (ice core data shows it was 260-280 since the end of the last ice age about 10,000 years ago), while the current level is about 388. More alarming than this is the increase in concentration of methane from 700ppb to 1800ppb today, the highest in the past 400,000 years, particularly since methane is a MUCH MORE potent greenhouse gas than CO_2 .

Molecule per molecule, methane is about 80 times more potent a greenhouse gas than CO_2 but present in much lower concentrations. With global warming, methane emissions will likely increase from decomposition of the hydrate, increased bacterial generation from organic materials in swamps and bogs, and other sources.

THE "CLATHRATE GUN" (6)

When you pull the trigger on a gun and the firing pin strikes the primer, there is no way to stop the firing. Similarly there have been some doomsday predictions that at some critical point in global warming, the deposits of methane hydrate will begin to decompose, leading to more rapid temperature rise, more rapid decomposition of still more methane hydrate and a run-away heating. Indeed, methane hydrate in arctic

permafrost is now decomposing and releasing methane with measurably higher methane in the Arctic atmosphere than the global average. The worst-case predictions have postulated that a run-away global warming might happen within the span of a human lifetime. A more realistic time scale seems to be 1000-10,000 years, just a blink of the eye in geological time. And there is good indication that ocean warming or sea level lowering may have triggered a number of rapid methane clathrate decompositions, which resulted in heating of the oceans enough to cause mass extinctions, particularly the one at the end of the Permian when 96% of the marine species became extinct.

FOOTNOTES

1. The blow-out itself was a result of formation of methane clathrate in the well bore, which flowed upward with drilling mud until the pressure was lower and then it began to decompose to gas, which blew the mud out, resulting in a lower pressure and more rapid run-away decomposition. The failure of the first attempt to cap the well was also a result of formation of methane hydrate in the cap and its floating out of place.(1)

2. http://en.wikipedia.org/wiki/Methane_clathrate

3. http://en.wikipedia.org/wiki/Greenhouse_gas

4. <http://en.wikipedia.org/wiki/Methane>

5. <http://ircamera.as.arizona.edu/NatSci102/lectures/venus.htm>

6. http://en.wikipedia.org/wiki/Clathrate_gun_hypothesis

