Northwest
Micro Mineral
Study Group

MICRO PROBE

FALL, 2011 VOLUME XI, Number 4

FALL MEETING . . . . .VANCOUVER, WASHINGTON

November 5, 2011 9:00 am to 5:00 pm

Clark County P. U. D. Building
1200 Fort Vancouver Way
Vancouver, Washington

Schedule for the day;

9:00 am Doors open at the PUD building for table set up. Helpers needed.

9:30 am Meeting starts: (trading, selling, free tables, viewing specimens, and visiting). Since our emphasis this time will be on the minerals from Washington Pass, bring a selection of what you have collected from that area so we can compare with each other.

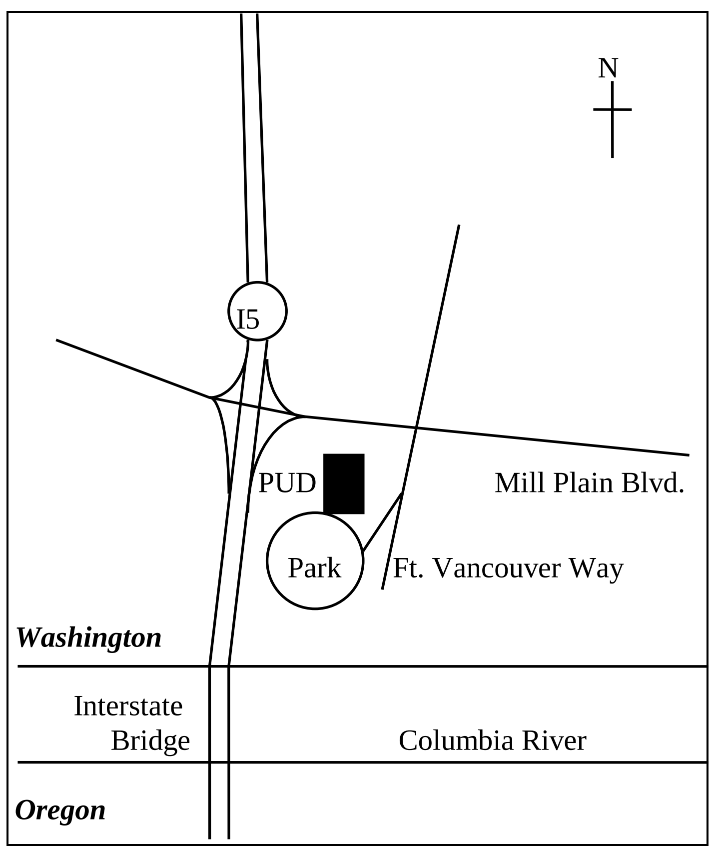
10:30 am Business meeting, including field trip reports and mineral news.

12:00 noon Lunch potluck: Club provides sandwich makings (bread, meat, lettuce, cheese, dressings, and coffee, tea, cocoa). Please bring salads, chips, pop, nuts, chili, cookies, pie, or cake to add to the lunch.

1:30 pm General round-table discussion of minerals from the Golden Horn. We need to know what minerals are present and what important information should be recorded to sort things out.

4:00 pm End of meeting and clean up. Please stay to put away tables and help clean up.

5:00 pm Dinner will be at the Hometown Buffet in Vancouver. Please join us if you can.



President's Page

I have made the move to the Moxee/Yakima area and have settled in. Randy Beck has moved into his new house in Yakima and is still unpacking. We will be studying his Washington Pass material, photographing his specimens and writing papers on many things from the Golden Horn Batholith.

At the Fall, 2011 meeting, **we will be concentrating on Minerals of the Golden Horn Batholith**. Please bring some of your specimens from Washington Pass, particularly those whose identification you may not be too sure of. By looking at each other's pieces, we will have a better understanding of what is there and what needs further work to properly identify and categorize.

9:00 Doors of the PUD building will open
Please help setup tables and chairs
Put out free minerals, trading minerals, set up your microscope, and talk to friends
10:30 We will start the meeting.
Noon Potluck lunch
The club provides, sandwich meat, cheese, bread, and coffee. I always bring potato and macaroni salads. Please bring something to add to the lunch. We need cold drinks, deserts, hot beans, and finger food.
1:00 Start Programs
- Digital Photography improvements, including StackShot rail and machine lens.
- Photos of Minerals from Washington Pass. Please bring a flash drive with pictures for viewing and discussion.

3:00 Digital photos of other minerals and trips.
4:30 Clean up room. We need everyone to help clean the kitchen, vacuum the floor, and put away the chairs.
5:00 Go to dinner.

We will talk about the need to carefully record where specimens are collected at Washington Pass and the need to indicate the rock type from which the specimens were extracted. When collecting boulders in road cuts, not only is the milepost number needed but the rock type is needed. Two rock types are present, one containing arfvedsonite needles and the other a greenish mica. These correspond to the arfvedsonite granite and the other the one feldspar "biotite" granite. There are different mineral assemblages in each type.

STACKSHOT

By
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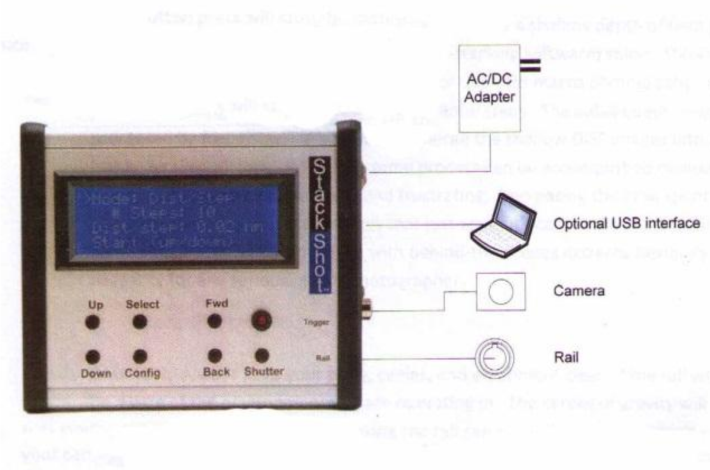
In the last issue of the Micro Probe, Bob Meyer explained the types of mineral photography and the advantage of using an Optem machine lens in conjunction with one of the image stacking programs such as Zerene Stacker, Combine ZP, or Helicon Soft to produce superb micro mineral photographs. In order to produce images with a great range of sharpness, a stack of 10 to 100 images needs to be taken and combined with the stacking program. The stack is a very tedious and time consuming process of moving the focus a tiny amount, pressing the shutter of the camera, refocusing the camera and pressing the shutter 10 to 100 times to produce one stack.

The process has now been automated with an ingenious programmable stacking rail called StackShot. The StackShot rail can be mounted on a camera tripod, vertically on a copy stand or vertical bar, or horizontally on a rail. The camera and lens system is mounted on the StackShot rail shown on the left.



Cables connect the motor on the StackShot rail to the controller (see below). Other cables connect the camera to a computer for live viewing and more controls. A cable can be used for shutter release or IR shutter control. Naturally, other cables are needed to power the camera and the controller. The top and bottom of the stack is entered into the controller, along with the number of photos required. Time off can be set between shots to allow time for the unit to settle between pictures to remove vibration.

The photos taken can be stored on a flash card in the camera, or sent directly to Helicon Soft or other program on a computer.

Complete information, video, and prices about the StackShot can be found at Cognisys-Inc.com. The Owner's Manual can be down loaded and reviewed for free. This system will be on display at the Fall 2011 meeting.

Twisted Crystals and Catalyzed Growth

By Don Howard

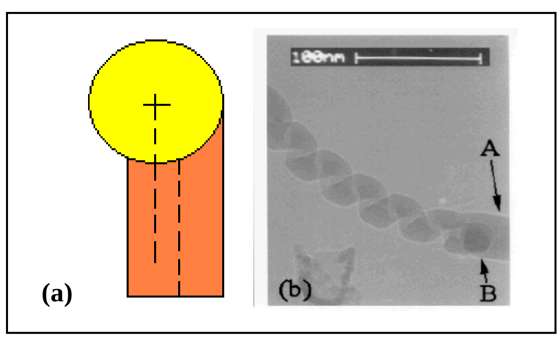
In a previous issue (XI-3-2), we introduced the concept of catalyzed growth of crystals and used it to describe how the sharp bends in filiform crystals could be explained. It turns out that the implications of the material science research are even more far-reaching. The purpose of this article is to explain how some very odd forms of crystal growth could be the result of something like catalyzed growth.

To begin with, let us review what is meant by catalyzed growth. The laboratory procedure starts with a very clean surface, onto which is evaporated just enough of a material to make very tiny particles. A vapor near the condensation point is introduced, which is believed to go into solution in the particles. It then crystallizes out preferentially at the point where the particle contacts the surface. The precipitated material lifts the particle as the process continues, thus forming a thin column between the particle and the substrate. As in the previous article, if the vapor contained the proper constituent to form crystals of ilmenite, the result would be a filiform crystal elongated along one of the ***a*** axes.

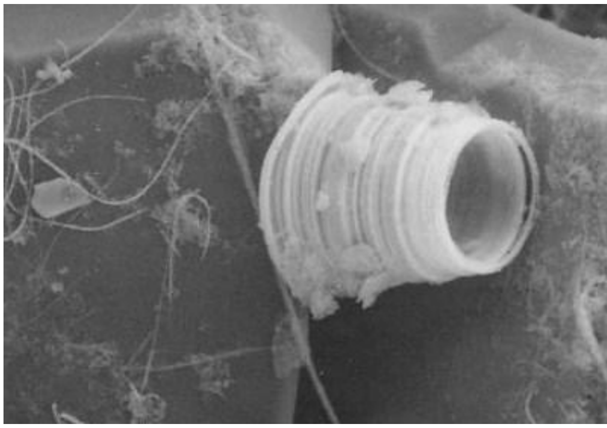
The above description assumed deposition from the vapor at an elevated temperature where the catalytic particle would act as a fluid into which the vapor phase material would dissolve. The whole process should also work at lower temperatures in a fluid medium, such as water, though it may well operate at a much slower rate. The particle would presumably be a solid under these conditions, so a different mechanism than solution would have to be operating. One possible mechanism could be surface adsorption. But another, much more likely, one could be internal concentration in a very porous material, such as a zeolite.

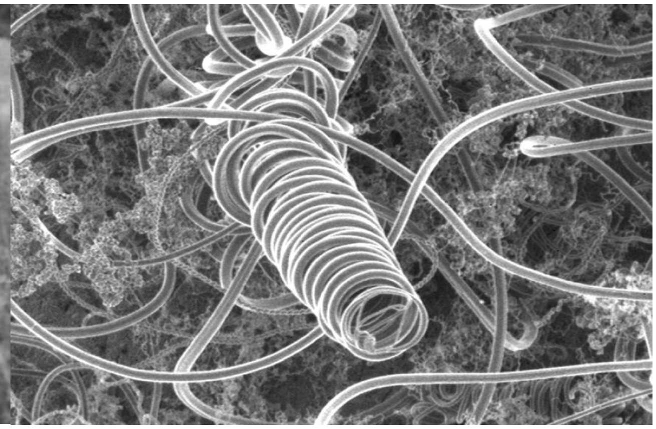
Imagine a tiny particle of a zeolite concentrating iron sulfide from solution and causing it to crystallize at a point of contact to form a filiform crystal of pyrite. The growth would be long and thin, in spite of the fact that pyrite is a cubic mineral. And if, because of a physical jarring (earthquake?) or change in the flow pattern of the fluid within the cavity, the particle was shifted off the end of the filiform, it could start growing in one of the equivalent directions. The result in pyrite would be a right-angle bend. Thus this process gives a natural explanation to an observed phenomenon that has been difficult to explain by other processes.

But the material science experiments give some other very surprising results. In those experiments, the catalyst particles are found to be spherical. If they sit symmetrically on top of the growing rod under them, the filament grows nicely straight and true. If, however, they are displaced to the side, a curving shape is produced. In the case where the side of the sphere just matches the side of the rod, a perfect helix is formed. Such helical filaments are found to grow even faster than the "normal" straight counterparts. So-called "nano-springs" of this type have been formed from a number of materials, including CdS, Si, NiSi, Si_3N_4, B_4C, BN , SiC , and C (nanotubes). The materials used for the small catalytic particles are usually metals, such as gold, nickel, or iron.



Laboratory-grown filamentary materials
(a) showing the relationship of the catalytic sphere to the growing rod
(b) the resulting B_4C "nanospring". Notice that part of the Fe catalyst is seen embedded . (Marked B)

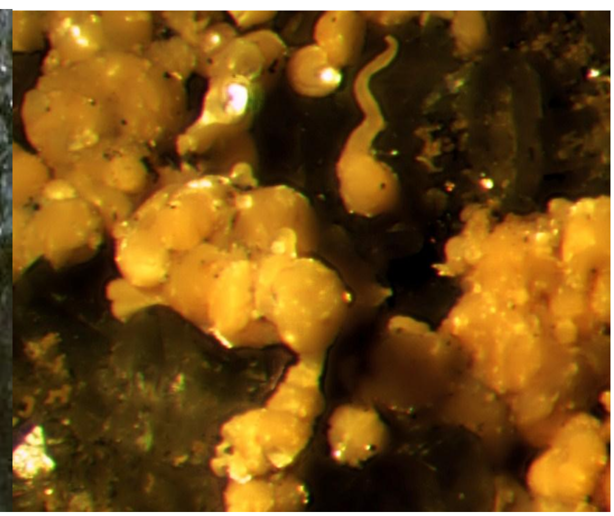




So, having described the nature of the experiments in Material Science, are there natural analogs to the types of helical materials produced? Consider the above two micrographs. The one on the right is a coil of carbon nanotube produced by Jun Jiao *et. al*. in the way just described. The one on the left is a coil of boulangerite found growing on quartz at the Van Silver Claim, near Whistler, British Columbia, Canada. The similarity is startling. The major difference is that the boulangerite coil is about 0.5 millimeters in diameter while the carbon tube has a diameter of only about 5 micrometers.

Other minerals have also been found to grow in helical form, though often not so tightly curled. Consider the two below. The fluorite is in a rather tight spiral. The rhodochrosite has both a very open spiral showing near the top of the photo, and a much tighter one in the lower center that somewhat resembles a seasnail's shell.

Fluorite on Phillipsite. About 7mm
Schellkopf, Eifel, Germany

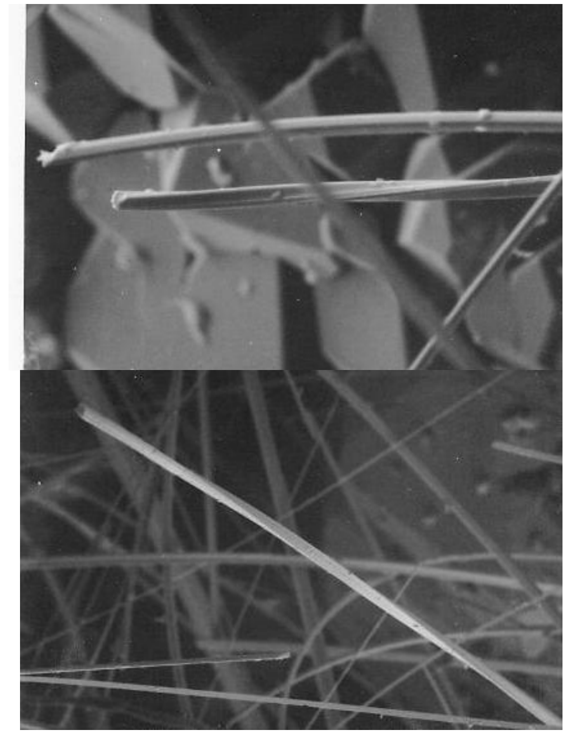


Rhodochrosite on Heulandite. About 0.5mm
Saddleback Basalt, Boron, Kern Co., Calif.

Minerals such as boulangerite point out something else we must consider. Since boulangerite is monoclinic, it is not a likely candidate to be considered filiform. Remember, we have defined a filiform mineral to be one that is elongated along a non-unique direction, such as cube axis in isometric or an ***a***-axis in tetragonal, trigonal, or hexagonal. The conclusion we draw is that catalyzed growth may be a factor in acicular minerals also, where the growth is along a unique direction. If this is the case, growth utilizing a catalyst could be an important mechanism for a number of hair-like minerals. Acanthite comes to mind, often growing rapidly on cabinet specimens of native silver.

Other possibilities include some of the zeolites, such as erionite, mordenite, natrolite, mesolite, and scolecite. Without some tell-tale indication, it is hard to distinguish if the form is due to the structure itself or due to a catalytic particle.

So we look for such a sign. Consider the mineral millerite, NiS, which is almost always found in slender, three-sided needles. Millerite is trigonal, with the elongation along the ***c***-axis, and thus does not qualify as a filiform. One of the classic collecting locations for millerite is Hall's Gap, Kentucky, where it forms long wire-like crystals on quartz. Careful examination under the microscope reveals that a small percentage of the crystals are twisted. Some have a right-handed twist and some have a left-handed twist. It is known that a screw dislocation running along the axis of a wire will cause it to twist, and there are both left- and right-handed screw dislocations. But the pitch of the twist is so short that it would require many thousand such dislocations in the center of the needle, and that would leave a hole (like the center of a pipe) that should be easy to see in a Scanning Electron Microscope. But examination fails to reveal such a hole. Can we find an alternate explanation?



Two Micrographs of Millerite
Hall's Gap, Kentucky
Upper, with a left-hand twist
Lower with a right-hand twist
Each is about 1mm long.

Notice first that all the Material Science preparations involve deposition at elevated temperature from a vapor. The only minerals that probably fit that description is the filiform ilmenite from Lemolo Lake, Oregon, and perhaps the fluorite from Eifel, Germany. All the other minerals under consideration – pyrite, copper, cuprite, boulangerite, rhodochrosite, and probably millerite – are secondary minerals that form at lower temperatures, normally in the presence of ground water. The explanation of the process given above assumed the catalytic particle was fluid and took a spherical shape.

Now we have no real knowledge of what the catalytic particles might be that help to form natural minerals. But at lower temperatures, they are probably solid and therefore may very well not be spherical. They probably are grains of other minerals that take on a crystal shape. Suppose that a few of them are irregular. That irregularity could easily give a handedness to the mineral forming beneath them. The pitch of the resulting twist would also be dependent on the degree of irregularity – and indeed the measured pitch (the distance for a complete turn compared to the diameter, usually of the order of 100:1) varies widely from crystal to crystal. My feeling is that the twisted millerites are strong candidates for evidence that minerals other than filiforms have forms that depend on the phenomenon of catalyzed growth.

Picture Credits:

B_4C:	Dr. David McIlroy and students, University of Idaho.
Carbon:	Dr. Jun Jiao and students, Portland State University.
Fluorite:	Eddy Van Der Meersche, *Le Cahier des Micromonteurs*, #100 (2-2008).
	All other photos are by the author from specimens in his collction.

Minerals of Washington Pass

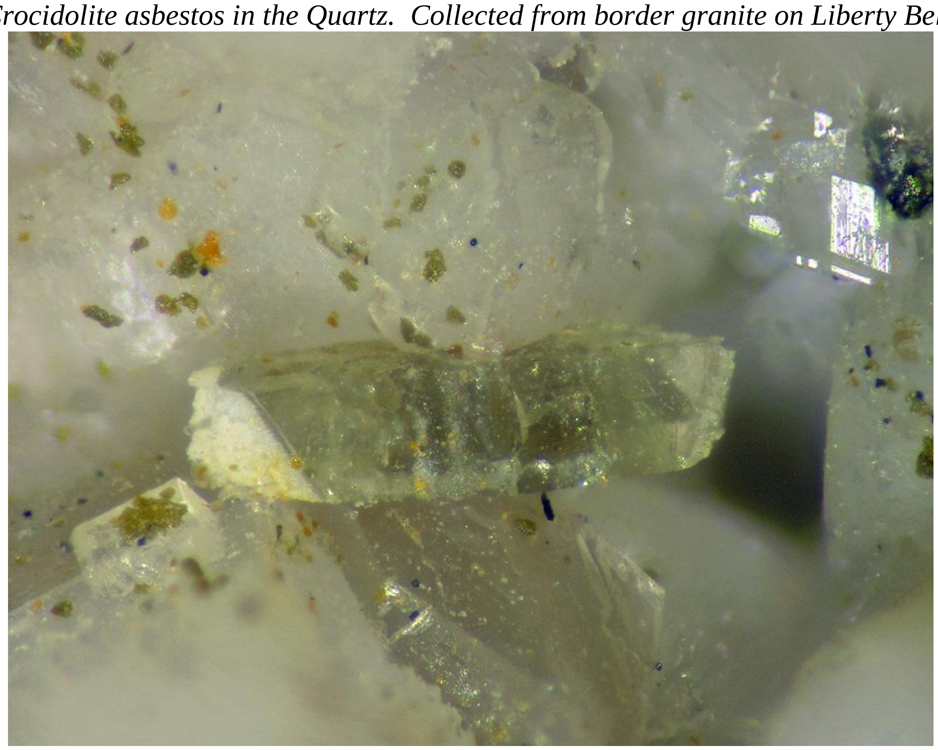
Bob Myers

For a micro mineral collector in the Pacific Northwest, very few localities can compare with the Washington Pass area, or more specifically, the suites of rare minerals that occur within miarolitic cavities and pegmatites in the alkaline granitoids of the Golden Horn batholith. The area has produced three new mineral species, Zektzerite, Calciohilairite, and Okanoganite-(Y), and there are further opportunities for observant micro mineral collectors to add to that list. The area has great potential in the area of new discoveries and additions to the understanding of the mineralogy there, but frankly, there has been a dearth for many years of any real scientific work on the minerals of Washington Pass. This report will explore some of the minerals that can be found there, serving as a sort of photographic tour. It is hoped that these reports can help to renew interest in the mineralogy of the Golden Horn batholith.

Parisite-(Ce). *A sharp orange-brown hexagonal prism measuring 0.4mm in length, with blades of hematite on pale pink highly altered granite.*

Gagarinite-(Y). *Remnants of pale pink crystals from "the roadcut," collected in 2008. Gagarinite is typically found as altered crystals such as these within pegmatites and miarolitic cavities in the Arfvedsonite granite at Washington Pass. In this case, either the interiors of the crystals have been etched away, or the entire crystals are missing, with these relict caps of what is possibly another mineral still in evidence as casts after the Gagarinite. In any case, the pink material visible in the bottom of the photograph shows that at least some Gagarinite is still present. The group is 3.5 mm long.*

Kainosite-(Y). *A 1.2 mm long pale-yellow doubly-terminated crystal of Kainosite-(Y) perched on the end of a Quartz crystal with rosettes of golden-brown Chamosite. Note the inclusions of Riebeckite variety Crocidolite asbestos in the Quartz. Collected from border granite on Liberty Bell.*



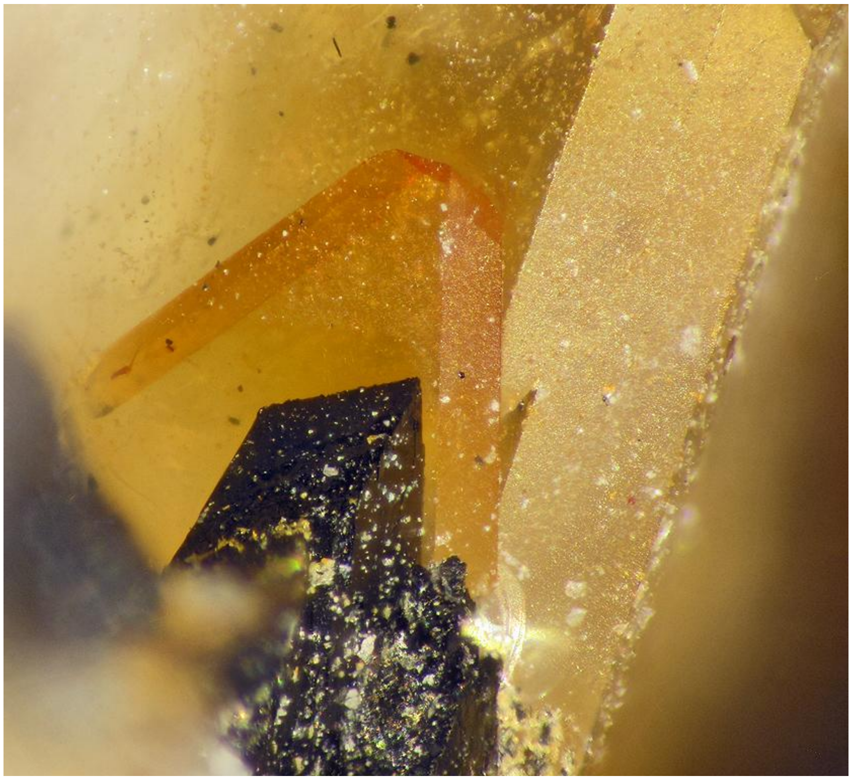
Kainosite-(Y). *A 1.0 mm long pale-yellow doubly-terminated crystal of Kainosite-(Y) from an unusual granite phase near milepost 164. The granite at this locality exhibits traits of both the Arfvedsonite granite and the border granite, but seems to have its own unique mineralogy. Crystals of Kainosite-(Y) are very rare from this granite phase, with only a few specimens known.*

Allanite-(Ce). *A combination specimen from the border granite on Liberty Bell. A black Allanite-(Ce) crystal on colorless Kainosite-(Y), associated with two purple Fluorite crystals, orange brown Chamosite, and a pale yellow Zircon on the right. The field of view is 3.2 mm.*

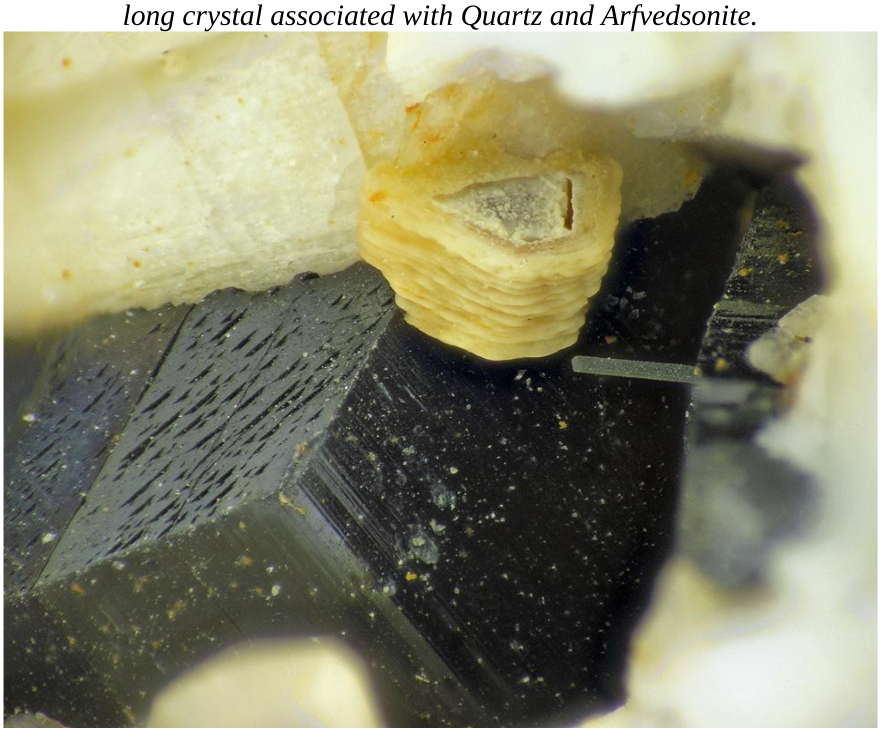
Allanite-(Ce). *A 1.8 mm crystal from Liberty Bell. Allanite is a member of the Epidote group. Imagine an Epidote where some cerium substitutes for the calcium and you have it.*

Okanoganite-(Y). *Exquisite sharp orange twinned crystals of Okanoganite-(Y) associated with purple Fluorite from the Arfvedsonite granite. The field of view is 1.5 mm. One of the three species for which Washington Pass is the type locale.*

Hundholmenite-(Y). *Orange-brown crystals in yttrian Fluorite from Hundholmen, Tysfjord, Norway. This relatively new mineral species is isostructural with Okanoganite-(Y), and is shown here to illustrate that relationship and point out the potential for new discoveries in the Golden Horn. Collected by Stein Rørvik in 1990.*



Euxenite-(Y). *One of the more uncommon species seen in the Arfvedsonite granite. An orange 1.7 mm long crystal associated with Quartz and Arfvedsonite.*



Bastnäsite-(Ce) & Synchysite-(Ce). *Some of the rare earth carbonates in the Golden Horn batholith are zoned like this, and collectors refer to them as Bastnäsite/Synchysite polycrystals in reference to a supposed intergrowth of these two species. A yellowish Bastnäsite/Synchysite polycrystal on black Arfvedsonite that displays unusual terminal pit features, with a single dark green Aegirine crystal jutting into the pocket. The field of view is 4.0 mm.*

Calciohilairite. *A 2.0 mm group of white to cream-colored crystals with brown Chamosite from the border granite on Liberty Bell. One of the three species for which Washington Pass is the type locale.*

Zektzerite. *A group of crystals, 9.0 mm across, with abundant inclusions of fibrous Astrophyllite. The consistency of the re-entrant angles suggests that these are twinned crystals. Zektzerite was the first of the minerals to be first described from the Golden Horn. It remains quite rare worldwide, with only three localities known. This specimen was collected by Kristin Lindell in 2009.*

History of Geology and Mineralogy in the Golden Horn Batholith, Okanogan Country, Washington

by
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The first reconnaissance geology of Washington Territory was conducted by Gibbs (1855) and later in the northern Cascades by Russell (1900). The first detailed work was by Barksdale (1947, 1956, 1958, 1960, 1975) and Misch (1952, 1966a, 1966b). In the 1950's Peter Misch, a professor of geology at the University of Washington, made the first real geologic map of the North Cascades. During reconnaissance mapping of the area, Misch (1952) named the "Golden Horn granodiorite" after the golden color of the rock on Golden Horn Peak (elevation 8366 feet or 2550 meters), located north of Washington Pass (Boggs, 1984). The work of Misch and his many students established a framework upon which all later studies have been built. He was first to determine that the Golden Horn batholith was a unique type of intrusion in the Cascades and changed the name to Golden Horn granite (Misch (1966b). Misch encouraged Robert Stull, one of his students, to conduct his PhD thesis on the Golden Horn (Bart Cannon, pers. comm. 2011).

Smoky quartz has been collected from the Early Winters Creek banks since the 1940's (Cannon, pers. comm. 2011). The crystals were collected by horseback expeditions and sold at Don Bobo's Rock Shop at NE 82nd and Roosevelt Avenue NE, Seattle. Don had large bins of water-worn, partly smoky quartz crystals, up to 10 inches long (Lew Landers, pers. comm. 2011, Cannon, pers. comm. 2011). He went out of business in the early 1970's.

Washington State Route 20 (North Cascades Highway, North-Cross Highway or simply SR20 extends from Port Townsend, Washington to the Newport near the Idaho state line. This route was one of those used by local Native American tribes as a trading route from the Pacific Coast to the Eastern Plateau for more than 8,000 years. Several routes were considered and in 1958 the State of Washington appropriated funds to build the highway from Seattle City Light company town of Diablo to Thunder Arm, on the southern arm of Diablo Lake, and to improve access roads on both sides of the North Cascades.

During the years of construction, the short stretch of highway that wound up Early Winters Creek just west of Winthrop came to an abrupt end where a barrier across the road was placed with the sign, "Road closed to unauthorized traffic" (North Cascades Highway Dedication Issue). On the west side another gate blocked the road at Thunder Arm of Diablo Lake. In 1962, some of the construction workers brought their families to live in the woods in tents at what is currently called Lone Fir Campground, under the shadow of Silver Star Mountain (Roe, 1980). One of these women, Ella Hoefs, a rock hound, spent her spare time with a pick, and once found a rare "tourmaline" (Roe, 1980). This crystal was really arfvedsonite. In 1965, when the highway construction crew reached the current location of the Silver Star Overlook (MP166), CAT operators exposed loose boulders with pockets lined with large smoky quartz crystals with arfvedsonite inclusions (Bart Cannon, pers. comm. 2011). In the late 1960's an article appeared in the Times that "obsidian crystals" had been found during the highway construction by one of highway engineers, Red Hill (Lew Landers, pers. comm. 2011). Lew visited Red Hill and found that the "obsidian crystals" were smoky quartz crystals, some up to 3 inches long, that came from a cavity in the hard rock along the road just before the curve. Lew Landers visited the area on a club field trip in 1966 (Lew Landers, pers. comm. 2011) but did not find much in the road cuts. During this time reports of smoky quartz with black tourmaline inclusions (= arfvedsonite) were circulating around the collecting community, but access up the unfinished highway was still restricted. Gary Maykut reported he saw one of finest smoky quartz specimens that he had ever seen being displayed at a Mt. Vernon show and that it was from Washington Pass (Lew Landers, pers. comm. 2011). It consisted of very shiny, glass clear, smoky quartz crystals with very visible pencil-sized, black crystals (arfvedsonite) protruding through them. Gary suspected that it came from the highway construction itself.

On September 28, 1968 a rough pioneer road was completed, and on the 29th hundreds of four-wheel drive vehicles formed a caravan to make the first crossing (WSDOT North Cascades Highway-Birth of a Highway). At that time the west side was still a crude narrow pioneer road that clung to the mountainside, with some small streams still unbridged, but the east side was finished most of the way (Roe, 1980). When the road was not being worked on, gates on both sides kept people from traveling on the road. Bart had keys to both gates. In 1973, before the road opened, Bart often had the only car on the silky new highway. The gates were officially opened September 2, 1972 and Highway 20 was officially connected from western to eastern Washington via Washington Pass (WSDOT North Cascades Highway-Birth of a Highway).

It was Peter Misch's description of the miarolitic cavities that got Bart excited about being Robert Stull's field assistant (Bart Cannon, pers. comm. 2011). Bart posted an announcement on the U of W geology Department bulletin board that he was interested in being some student's field assistant during the field season in the North Cascades. Robert Stull was the first to call. He gave Bart a sales pitch on the smoky quartz and riebeckite (as they were known in those days since they crushed blue – a field test for sodic amphiboles). During the summers of 1967 and 1968, Bart Cannon was field assistant to Robert J. Stull who was working on his PhD thesis on the geology and mineralogy of the Golden Horn Batholith (cannonmicroprobe.com) (Stull, 1969). The first strange looking beryl (= zektzerite) was collected by Bart Cannon after dinner in July 1968 (incorrect date "1966" given by Gait, 1991) in a talus field in lower Willow Creek (Bart Cannon, pers. comm. 2011). The crystals were distinctly pink and showed tabular hexagonal habit. Bart showed it to Lew Landers and they concluded it was the pink variety of beryl, morganite (Lew Landers, pers. comm. 2011). Bart nearly published an image of it as beryl in the 1975 "Minerals of Washington".

After Bart's work with Stull, he made one visit per year until 1973, when he conducted field work on his post graduate thesis on the geological controls of vegetation distribution at the University of Washington (Cannon, 1973). He found that one can cross the contact between the Black Peak Granodiorite and the Golden Horn Granite and step from one vegetation association to another. The Black Peak Granite hosted lush herb meadow while the Golden Horn Granite hosted scrubby heath meadow (Bart Cannon, pers. comm. 2011).

Cannon (1975) "Minerals of Washington" listed the following minerals in the Golden Horn Batholith: aegirine, aenigmatite, albite, arfvedsonite, astrophyllite, fluorite, hastingsite, hornblende, ilmenite, microcline, quartz, riebeckite, rutile and zircon but did not list beryl as one of the species.

In the summer of 1975, Jack Zektzer found a pocket on Kangaroo Ridge containing more of this strange looking "beryl" and showed it to Bart Cannon. The crystals seemed similar Bart's "beryl". Bart did XRD on both specimens at the Soil Genesis lab in the Hugo Wenkenwerder Forest Science Laboratory at the University of Washington and found them to be the same. Bart and Jack both had copies of Roberts, Rapp, and Weber's Encyclopedia of Minerals and together searched the three most prominent peaks for all the minerals listed. They determined their mineral was not in there. Jack said, "I'll send it back to the Smithsonian." The next week Jack called Bart and said, "Pete Dunn has decided to name it after Yours Truly." Jack said he suggested "Pigletite" (after his cat) as an alternative, but added that Bart could submit some names. Bart suggested okanoganite, but Pete Dunn stood fast and named it zektzerite (Dunn et al, 1977).

In the fall of 1975, Bart started a campaign of prospecting in the southeast Golden Horn Batholith and found numerous zektzerite specimens in the debris of the Silver Star road cut (Bart Cannon, pers. comm. 2011). Bart continued prospecting in 1976, expanding the search into outlying areas. He hiked more than 100 miles of backcountry to determine which areas had potential and which didn't. Some areas with seemingly good potential were ruined by late stage hydrothermal or simple ground water that dissolved the interesting minerals and left behind quartz, feldspar, and siderite. Bart collected minerals of all sizes from tiny cavities up to a giant miarolitic cavity, 40 feet long, which he named the "Wookie Tub". Bart and his brother spent five days using a wire rope and pulley trying to excavate the cavity.

Zektzerite crystals (7mm FOV)

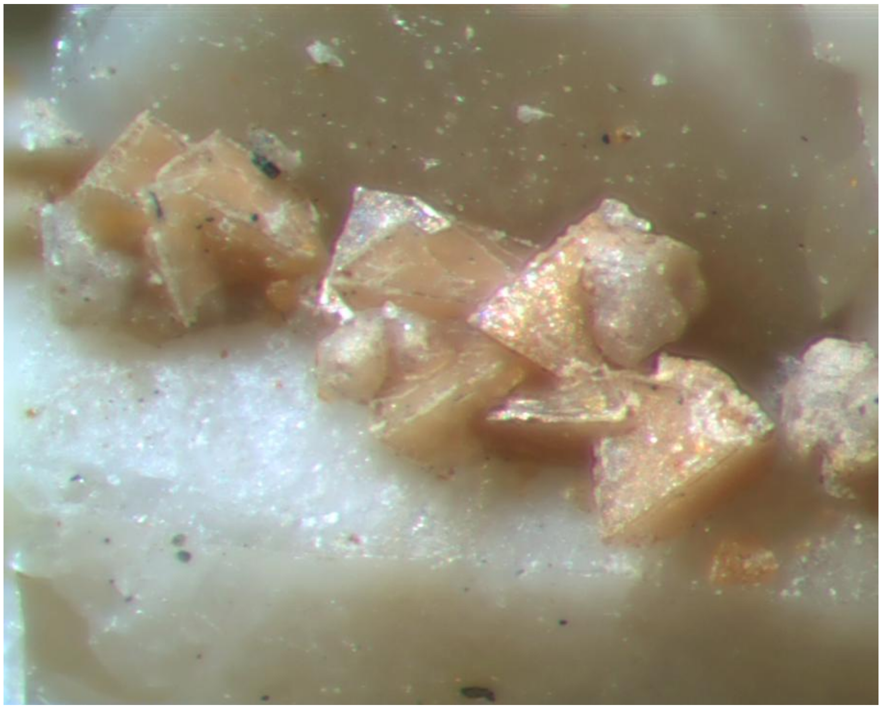
They camped in the vug until they learned that after a rain the roof dripped heavily. The cavity dipped into the mountain and kept filling in with water. They did not recover a single specimen. Bart did find other large pockets with large smoky quartz and odd, very large arfvedsonite crystals. While working with Stull in 1966-1967, Bart had passed right over the boulder in which Jack Zektzer, in 1975, found his famous pocket. Bart was the first to find kainosite, astrophyllite, acmite, bastnaesite, elpidite, allanite, gadolinite, prehnite, and others (Bart Cannon, pers. comm. 2011). Pete Dunn, at the Smithsonian, identified them, later complaining that Bart was exploiting him since Franklin minerals were his passion (Bart Cannon, pers. comm. 2011). Bart's collecting slowed in 1978 to making an annual trip, mostly to the road cuts.

Russell Boggs first visited Washington Pass on a geologic field trip (four Greyhound buses) from the Geology Department at the University of Washington in 1975. Russ returned with his father Robert (Bob) to first collect in the road cut in 1975 (Bob Boggs, pers. comm. 2011). Russ graduated from University of Washington in 1976 with a major in geology (Gait, 1991).

In 1976 both Russell Boggs and Bart placed ads in the Mineralogical Record advertising the new mineral zektzerite. Bart did well enough to purchase his house with money from zektzerite sales (Bart Cannon, pers. comm. 2011).

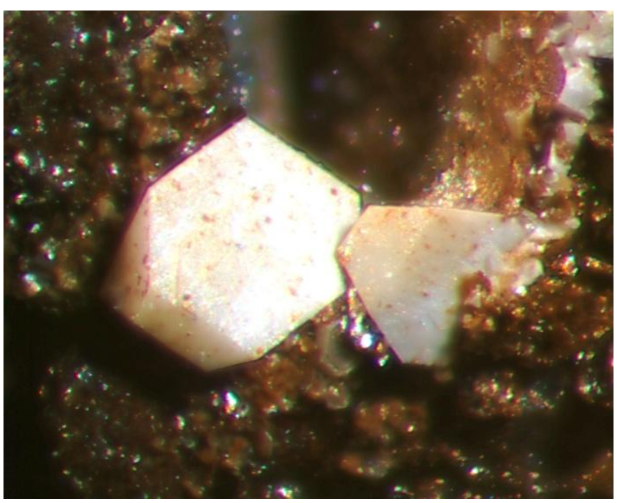
Russell Boggs first recognized an unknown new mineral on September 19, 1976 in the arfvedsonite granite (Boggs, 1980) and with better specimens found by Bob Boggs (Boggs, 1980, Bob Boggs, pers. comm. 2011) described it as okanoganite as part of Russ's M. S. degree (1980) at the University of California, Santa Barbara (Gaits, 1991). Although okanoganite has not been found at any other locality and there is no evidence of other dominant ions, it has been arbitrarily designated by Mindat and The Glossary of Mineral Species as Okanoganite-(Y).

Russell Boggs, aided by field assistants Jack Zektzer and Bob Boggs, collected and studied the minerals in the miarolitic cavities to complete his PhD thesis, "Mineralogy and Geochemistry of the Golden Horn Batholith, Northern Cascades, Washington" from the University of California at Santa Barbara in 1984.

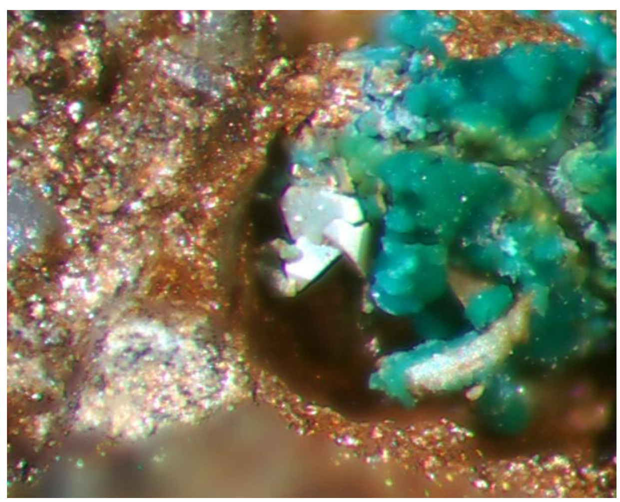


A string of crystals of Okanoganite-(Y). The mineral is actually hexagonal so that each 'tetrahedron' is a twinned group of four. (2mm FOV)

Robert Boggs first found another unknown mineral in the border granite on the north side of Liberty Bell Mountain in September 1982, and better material in October 1984 (Boggs, 1988). This material was named calciohilairite (Boggs, 1988).



Calciohilairite from the boulder that also contained Kainosite-(Ce) in the skree slope beneath Liberty Bell. (2mm FOV)



Calciohilairite and Malachite from the other source boulder in the skree slope beneath Liberty Bell. This material has enough copper replacing calcium to have a pale blue color. (2mm FOV)

Collecting by Randy Becker started in September 1977 with many trips in 1978. Randy found the Okanoganite Boulder Sept 4, 1978. This boulder has a zone of abundant small miarolite cavites. These cavities contained an unique abundance of zektzerite, okanoganite, bastnaesite-synchysite poly crystals, euxenite, chevkinite, plus others.

Don Stalder collected in 1982-3 in a side shoot above MP166 road cut that contained several good pockets, up to 10 by 18 inches, that had been over looked. One contained several good large zektzerite crystals, large arfvedsonite crystals, and excellent groups of lustrous smoky quartz with arfvedsonite inclusions.

In August 1990 the Friends of Mineralogy held their first combined road cleanup and collecting field Trip at Washington Pass. Members spent Saturday cleaning up the road side and embankments of debris and litter for the Forest Service. They camped at Klipchuck Campground and on Sunday collected along the roadside. This relationship with the Forest Service has greatly improved minerals collector status at Washington Pass. The cleanup and collecting weekend has been continued for the past 21 years and continues to be the best time to collect in the area. The area where most of the collecting is done is controlled by the Forest Service. The DOT (Department of Transportation) will not give permission to collect along the road and the Highway Patrol will ask you to leave. Collecting on weekends is the best because both the Forest Service and DOT have those days off. Never make it obvious what you are doing. Do not assume you have the right to collect along any highway. We do not want the area closed to collecting.

Randy Becker (1991) wrote an excellent summary of the minerals found in the Golden Horn Batholith that is still the best single source of information on the area. In a series papers, Don Howard restudied the minerals from selected sites in the Golden Horn Batholith in the Micro Probe (1990-1992). Other papers have been published on occurrences in the Golden Horn Batholith (see references listed below) with the best detailed work being done by Saul Krotki (2009) on Gadolinite-(Ce).

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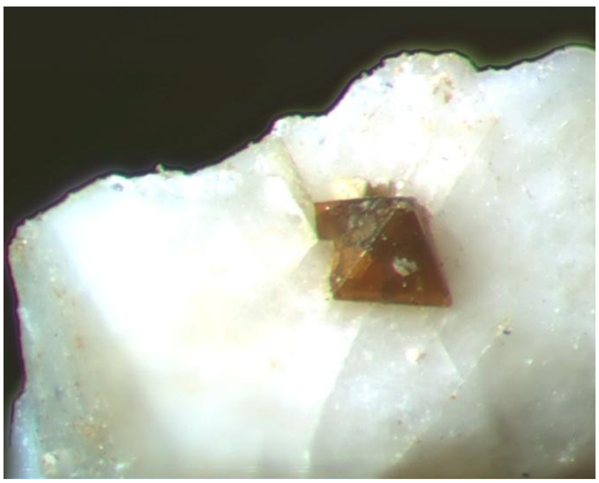
Future Minerals at Washington Pass

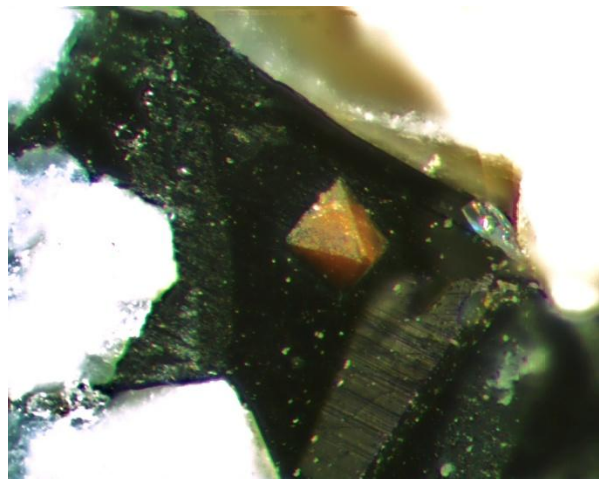
Donald Howard

Several potential new minerals from the Golden Horn batholith have been kicking around for several years. Among them are the two illustrated below:

“ceriobetafite” or perhaps “uranopyrochlore”

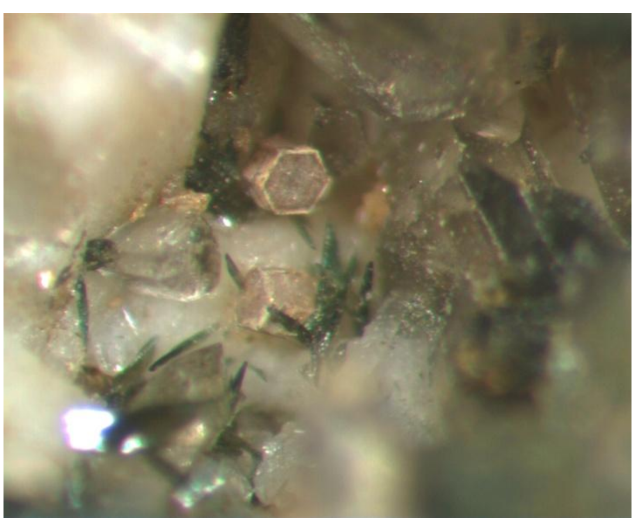
Both names have been suggested for these octahedral crystals that have been found in the ‘Okanoganite Boulder’. Mainly, the chemistry has to be nailed down. For the anion, it is betafite if titanium is most dominant, and pyrochlore if niobium predominates. There are a whole host of cations present, and by the current rules the most abundant one determines the correct mineral name.

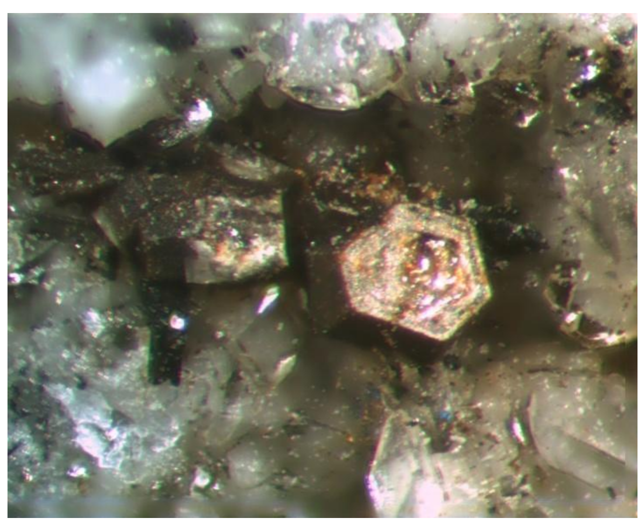




“ferrosynchysite”

These little six-sided prisms from the blue dike rock occasionally found among the strewn boulders at the base of Liberty Bell have all the physical properties of synchysite including a very similar x-ray powder pattern. But unlike any previously reported synchysite, they contain a considerable concentration of iron, presumably replacing some of the rare earths in the structure. If it could be shown that the iron resided primarily in one of the three cation sites, this would surely be a new mineral.





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