

Northwest
Micro Study Mineral Group



MICRO PROBE

FALL, 2000

VOLUME IX, Number 2

FALL MEETING VANCOUVER, WASHINGTON

November 11, 2000

9:30 am to 6:30 pm

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

Once again we have a day to talk rocks and share collecting stories. Microscopes are a must as usual, and don't forget to bring your extra material from this summer's collecting for the give-away table so that others will have treasures to look over and take home.

Morning program:

10:30 Lanny Ream will talk and show slides of recent collecting sites in Idaho.

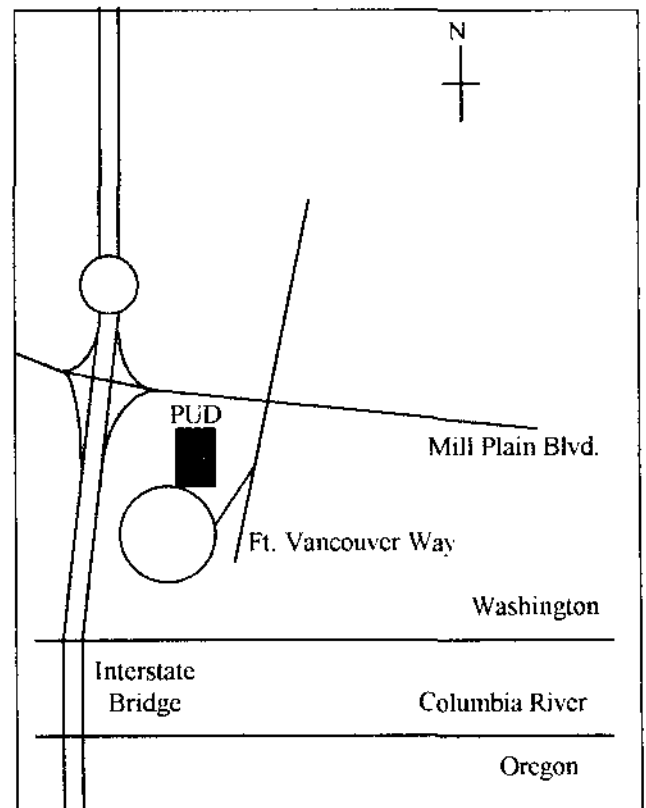
Afternoon program:

2:00 Our usual business meeting. We need to discuss the format of our meetings, provide some new ideas, and make some changes in leadership.

Following that, we will have the usual survey discussion of the status of collecting sites in the Northwest.

3:00 Rudy Tschernich will be showing slides of past NWMMSG field trips.

The kitchen area is available as usual and we will provide lemonade, coffee, hot water, etc. There will be a snack table, so bring snacks to share with others for lunch and during the day. Restaurants are available in the local area. Some of us will plan to eat dinner together, so please plan to join us.



DATOLITE FROM THE HALF ROUND ROADCUT, PE ELL, LEWIS COUNTY, WASHINGTON

by

Rudy W. Tschernich
526 Avenue A
Snohomish, Washington 98290

Datolite is a rather rare borosilicate mineral described with zeolites only in a few sites in the Pacific Northwest (Tschernich 1998a, 1998b). A new locality for datolite was found in 1998 by Warren Sorenson, Pe Ell area engineer for Weyerhaeuser, in veins cutting a massive diabase sill along Weyerhaeuser logging road 3000, in an isolated area one mile north of Elochoman Pass, east of the Chehalis River, south of Pe Ell, and northwest of Ryderwood, in Lewis County (N46° 24' 44.1" W123° 16' 45.4 or NE1/4NE1/4 Sec. 27, T11N R5W). To reach the site from Pe Ell, turn south from Highway 6 on to 3rd Street and proceed 1.7 miles to the Weyerhaeuser gate. If the gate is open, proceed south on the main Weyerhaeuser 1000 road along the Chehalis River and turn left on to the 3000 road. Continue along the 3000 road passing a quarry at 3.1 miles and reaching the datolite site 4.8 miles from the junction where the 3000 road branched from the 1000 road. A very large 12-foot diameter corrugated steel culvert with a rock bottom was placed under the road in 1998 to accommodate floodwater from the stream; hence the name of the site. Rock blasted from the roadcut just south of the creek to cover the pipe and make a parking area



Figure 1: Metal half round culvert with rock base for which the locality is named with basaltic sill exposed in the road cut to the south.

across from the roadcut exposed a few vertical white veins containing zeolites, datolite, and calcite cutting a massive diabase sill.

One major vein, which varies from 1 to 5 inches thick, and several veins under 0.5 inches were present. The veins consisted of colorless to amber-colored calcite crystals, that when there are open spaces, are covered by colorless pointed blades of stilbite, tiny colorless wedge-shaped datolite crystals, and white laumontite. Several large boxes of loose vein material were collected from the blast in 1998 and brought to the

author for identification. The datolite is very crumbly, peels off the calcite, and is damaged very easily; therefore, good specimens are not abundant. A trip by the author in 2000 produced more vein material that when carefully broken with a trimmer produced excellent specimens of

datolite and associated minerals. Although the extent of the vein is limited, it continues into the roadcut.

The veins are lined with amber-colored calcite crystals, up to one inch across, followed by colorless rhombohedra of calcite towards the center. Both generations of calcite fluoresce a cream color with long wave ultraviolet light. Any remaining openings between the calcite crystals are covered with widely scattered, colorless, pointed stilbite blades, up to 10 mm long, along with a druse of 3-mm colorless, highly lustrous, transparent datolite crystals and 4-mm



Figure 2: Randy Tschernich removing rock from beneath the white datolite/calcite vein in the Spring of 2000.

long white prisms of laumontite. The datolite crystals are flattened dipyrramids or wedge shaped similar to gismondine or calcite but have slightly curved faces. Although datolite crystals resemble several other minerals, it does not effervesce in hydrochloric acid like calcite and has a much higher refractive index than zeolites. Drusy datolite crystals completely cover some rhombohedral calcite to form incrustation pseudomorphs. Datolite crystals are clearly seen on the stilbite blades and commonly are covered by colorless to white prisms of laumontite with a single sloping termination. The

laumontite rapidly dehydrates, turns chalky white and falls apart. Small, pointed, light-yellow calcite crystals and larger colorless calcite crystals are found on some of the datolite. Bright cubes of pyrite, up to 3 mm across, are found along the edge of the veins predating crystallization of the calcite. Etching the calcite away with hydrochloric acid exposed the larger bright pyrite cubes directly on the diabase-wall of the veins. Tiny, colorless, drusy heulandite crystals, under 1-mm long, partly cover the larger pyrite crystals and are covered by a scattering of minute cubes of pyrite. The heulandite is only obvious when the calcite is etched away. The minerals appear to have crystallized in the order: pyrite > heulandite > amber calcite > clear calcite > stilbite > datolite > laumontite > light yellow to colorless calcite.

References:

- Tschernich, R.W. (1998a) Zeolites and associated minerals from Lacamas Creek, Orchards, Clark County, Washington. *Micro Probe*, V 8, No. 8, pp 10-12.
 Tschernich, R.W. (1998b) Zeolites and associated minerals from the Beaver Falls Quarry, Sappho, Clallam County, Washington. *Micro Probe*, V 8, No. 8, pp 13-16.

Zeolites and Associated Minerals from Juniper Canyon, Wheeler County, Oregon

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Zeolites and associated minerals are present at many locations near the John Day River and its tributaries in Grant and Wheeler Counties. These minerals occur in some of the lower vesicular flows of the Miocene Columbia River basalt. Several well-known locations have produced fine specimens of many different zeolite species as well as calcite, apophyllite, gyrolite, and a few others. In addition to these major zeolite sites, there are several smaller locations that offer a wide range of mineral species.

The Juniper Canyon site is a large road cut along Highway 19-207, located 4.8 km (3 miles) east of Service Creek and 14.6 km (9.1 miles) west of Spray. The site was discovered by Rudy W. Tschernich in 1994 and was named, by him, for a near-by canyon. The cut consists of an upper portion, several 10's of meters high, composed of dense, dark platy basalt. A lower, highly vesicular flow is exposed at the western end of the road cut. The exposure is approximately 100 meters long and exposed to a height of 1.5 meters above the highway. The vesicular rock weathers gray-brown and contains cavities from a few millimeters to several centimeters in diameter. Cavities from this lower rock contain micro crystals of mesolite, chabazite, thomsonite, analcime, and calcite. When the site was visited in 1998, the highway department had recently cleared the ditches of fallen rock, but a few boulders of a dark, less vesicular basalt were present in the ditch. These rocks, presumably had fallen from a higher flow and contain a different assemblage of minerals. Boulders from the "upper" level contain micro crystals of chabazite, levyne, offretite/erionite, analcime, apophyllite, gyrolite, phillipsite, thomsonite, and tacharonite/torbermorite.

Minerals of the lower gray-brown highly vesicular flow

It is difficult to determine which mineral is most abundant in the lower flow. Nearly all the larger cavities (greater than 1 cm in diameter) contain mesolite, thomsonite, and chabazite. In a few of the cavities, only mesolite and thomsonite are present.

Mesolite is common in nearly all of the larger cavities, where it forms sprays of needles as much as 2 cm long. This mineral generally forms clusters of dense fibers that cover and hide most other minerals in the cavities. In some cavities, it is evident that these fibers originate from clusters of bladed thomsonite crystals. Washing the cavity with a stream of moderate pressure water removes most of the mesolite, but unfortunately generally damages the delicate thomsonite blades underneath.

Thomsonite completely lines many of the cavities and is overgrown by mesolite. The thomsonite forms clusters of rectangular bladed crystals about .5 mm long. The clusters are not compact; individual blades are very thin and separate. In cavities that also contain chabazite, the thomsonite appears to have grown between the chabazite crystals suggesting the chabazite

crystallized first.

Chabazite is common in many of the cavities. Chabazite var: Phacolite forms colorless complex crystals up to 2 mm in diameter (longest dimension). In most cavities, the chabazite is overgrown with mesolite. Rhombohedral chabazite is also present in this flow but is much less common than the phacolite variety. Penetration twins of chabazite up to 1.5 mm are present in a few cavities where it occurs with thomsonite and mesolite. Rhombohedral chabazite and the phacolite variety do not occur in the same cavities.

Analcime is found as small, colorless trapezohedra lining small cavities. Individual crystals are 1.5 to 2 mm in diameter. When analcime is present, no other zeolite are found in the cavity.

Calcite occurs as colorless to amber “dogtooth” crystals up to 3 mm long. In some cavities, amber calcite is completely enclosed in massive thomsonite, but in others, pale yellow to amber calcite crystals are overgrown by radiating clusters of thomsonite blades. Mesolite is also present in these cavities.

Clay is very rare in cavities in the lower flow. Most zeolite grow directly on the cavity wall.

Minerals of the “upper” dense dark rock

Cavities in the “upper” dense rock are much smaller (generally less than 1 cm) and fewer. Clay is found in nearly all cavities of the “upper” rock. The clay varies from nearly black to dark golden brown in color. Minerals generally occur in clay-lined cavities with one or two species present, making it difficult to determine order of crystallization of the various species.

Apophyllite occurs as colorless, transparent rectangular crystals up to 2 mm long in longest dimension. Most crystals have flat terminations with no development of the pyramid, but a few have small pyramid development. Two cavities were found with complex intergrowths of crystals. Apophyllite crystals are present in cavities with clay, gyrolite, and possible aragonite(?) or calcite(?).

Levyne is present in two types: thin hexagonal plates covered with an overgrowth of offenite/erionite and thicker transparent tablets. Thin plates of levyne occur directly on clay in some cavities; crystals up to 3 mm nearly fill some cavities. Thick transparent levyne crystals completely fill some cavities. Individual crystals are up to 2 mm wide and .3 mm thick. The crystals are highly fractured and do not make good specimens. Thick levyne was found in one cavity with analcime. The levyne occurs over the analcime. In another cavity, a cluster of thin “feathery” thomsonite crystals are found in association with thick levyne.

Offenite/erionite forms a white overgrowth on the surface of thin levyne crystals. Levyne crystals that nearly fill cavities have the thickest overgrowth, with individual offenite/erionite crystals reaching .7 mm in length.

Phillipsite is present in some of the larger cavities. The mineral forms colorless to white crystals up to several millimeters in length. Where present, phillipsite is the only mineral in the

6.

cavity and phillipsite crystals completely cover the cavity walls.

Gyrolite occurs as white hemispheres of balded crystals up to 1.5 mm across. The minerals generally occur in cavities lined with black clay. Gyrolite was found in cavities with apophyllite and thomsonite hemispheres described below.

Thomsonite is not common in the upper zone rock. Three distinct types of thomsonite crystallization were found. Light blue masses with radial structure are present in some cavities. Thomsonite of this habit completely fills cavities that are a few millimeters in diameter. Clusters of thin rectangular crystals are present in a single cavity with thick levyne. The last morphology occurs as hemispheres up to 3 mm covered by white to light blue thomsonite "roots." The "roots" are similar to material present at Beach Creek Quarry, but they are much thicker toward the base and resemble a thickened, twisted, deformed carrot. "Root-like" thomsonite was found in cavities lined with dark clay associated with gyrolite.

Analcime is rare in the "upper" dense rock. Only one cavity, lined with 1 mm trapezohedra, was found. The same cavity contained a single 1.5 mm crystal of thick levyne.

Tacharanite/tobermorite is present in some cavities, where it forms mats of white fibrous material that completely line the cavities.

Aragonite(?) or calcite(?) forms unusual hemispheres with a "spike-looking" outside appearance. These hemispheres are several millimeters in diameter. They are generally coated with a thick brown to black crust, making the crystal forms of the spikes difficult to see. They effervesce with hydrochloric acid. In broken cross sections, the crystals form a thin outer coat over a fine-grained carbonate core.

Juniper Canyon is a good collecting location for anyone interested in micro crystals. The site is well exposed and rock is relatively easy to remove. There is a large pull-out along the highway almost directly across from the zeolite-bearing flow.

I would like to extend a very special thanks to Rudy W. Tschernich for providing basic information concerning this location and many others. Thanks also, for identification of many mineral specimens I have collected from this and other locations. **Thank you Rudy !!!!**

Reference

Tschernich, R. W, **Zeolite of the World**, (Geoscience Press, Phoenix, AZ, 1992)

LEVYNE: HABIT AND OVERGROWTHS

Don Howard

Levyne, though certainly not the most abundant of the zeolites, is present to some degree in quite a number of our collecting localities. When we think of levyne, we generally think of reasonably thin hexagonal blades that may be glassy clear or may be covered by a milky overgrowth. As a matter of fact, we tend to collect the type with the overgrowth most often because it survives the rigors of a field trip better than the clear variety: the clear blades are much more likely to shatter when exposed to sunlight, and almost always develop internal cracking that ruins the clear look of the blades.

But in reality, levyne crystals belong to the trigonal (rhombohedral) system rather than the hexagonal system. The hexagonal cross-section is generated by a very well developed c-face coupled with considerable twinning. The real rhombohedral structure is only apparent in thicker crystals.

One of the places that thicker crystals occur is the Bear Valley Quarry near Port Ludlow, Jefferson Co., Washington. (See Micrograph #663.) The c-face is present, but the edges that alternately slope in opposite directions show the rhombohedral influence, as shown in fig. 1. The actual steps present on those faces in the micrograph of the real crystal indicate that some twinning is still present.

The rhombohedral nature is even more evident when the c-face is absent. Crystals of this type have been found along Road 1440, Elk Mountain, Cowlitz Co., Washington. (See Micrograph #702.) Here three faces of each rhombohedron are visible. The crystal is cyclically twinned as a sixling every 60° around what would be the c-axis in each crystal. Additional twinning by reflection in the c-plane creates what appears to be a twelveling – twelve regions related by symmetry in each individual, as shown in fig. 2.

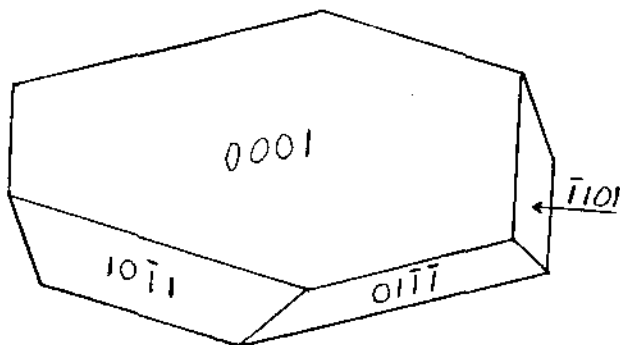


Fig. 1 rhombohedral ($10\bar{1}1$) faces cut by a large c-face (0001).
Bear Valley Q., Jefferson Co., WA.

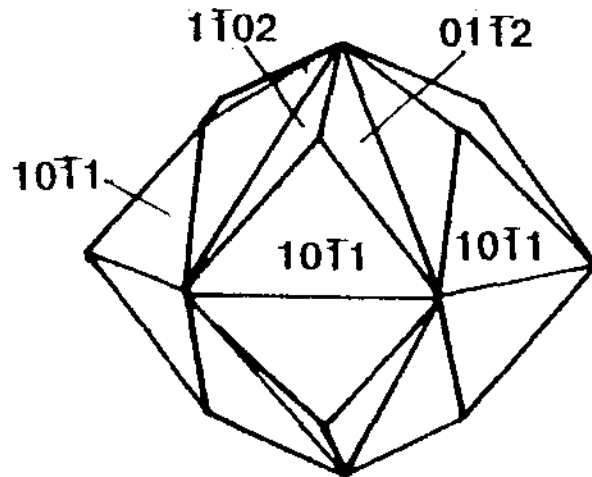


Fig. 2 "Twelveling" created from rhombohedra twinned cyclically around the c-axis and by reflection in the (0001) plane.
Elk Mountain, Cowlitz Co., WA.

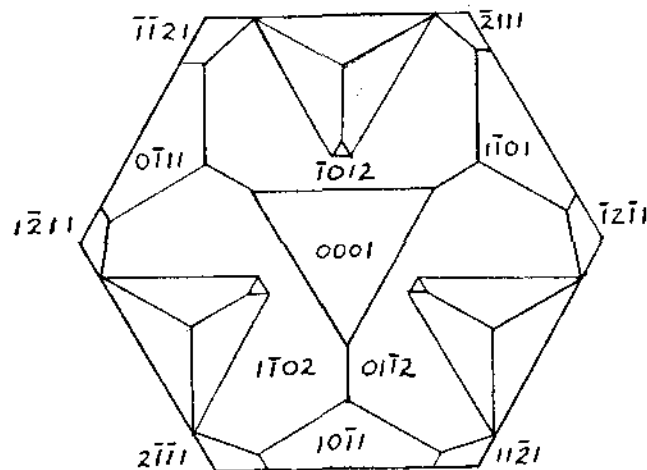
Even more interesting forms of levyne can be found at the Baird Creek Quarry, Cowlitz Co., Washington. Forms observed there range from flattened crystals with large milky c-faces and clear edges, to glassy clear crystals with no c-face at all. The latter type is most common, and rather confusing to identify. The shapes are often distorted by repeated twinning into strange forms. Generally, the best indicators are the striations, often running in different directions in neighboring areas of a face, and the presence of re-entrant angles in various regions. Frankly, they look more like chabazite, which while it also occurs in the quarry is quite rare.

One particularly interesting cavity from Baird Creek Quarry, illustrated in Photograph #1, deserves particular attention. The vug is about an inch in diameter and somewhat flattened; both halves have been retained. This cavity started out with a few early calcite crystals, opaque straw-colored needles growing out from the walls.

Next came crystallization of levyne to entirely line the wall of the pocket. These levyne do not show a c-face at all. They began as a milky white and became clearer as crystallization continued. They have a wide variety of shapes, from blocky to elongated and lance-shaped. There are many faces at odd angles, most showing striations in one direction or another.

Toward the end of this process, more nearly circular levyne crystals formed. These are quite clear, and are often stacked up. In particular, one of these kind grew on the tips of the still-exposed needles of calcite. These crystals show a c-face that is triangular, with the other three points of a star below the level of the triangle visible around it (see fig. 3). The sides of the triangle are intersections with $(1\bar{1}02)$ and $(01\bar{1}2)$ faces, and the tip points down along an edge to a $(10\bar{1}1)$ face, forming what looks like the three sides of the repeated "rhombohedral" that form the most prominent feature in micrograph #702 of the twinning of levyne from Elk Mountain diagrammed in fig. 2. The same pattern is present on the back side like a mirror image, except that the triangular face on that side is rotated 60° . That gives a clue to the form we are observing. This is a **penetration twin**; on one side the three less-developed "points" are the crystal that has penetrated from the back side, and are thus less developed. On the back side, it is the other three points, penetrated from the front, that are less developed. It is interesting to note that small faces of the class $\{1\bar{1}21\}$ are present in most of the corners.

Fig. 3 Penetration twin of levyne. The indexed faces belong to the front crystal, while the other faces are penetrating from behind.
Baird Creek Quarry,
Cowlitz Co., Washington.



The final thing that makes this cavity so unusual is that following the levyne, more calcite crystallized. This calcite is water-clear. Since some of the early calcite needles were still exposed, more was added to those crystals, forming rhombohedrons instead of acicular needles. The early opaque calcite needle is visible as a phantom running diagonally from one end of the rhombohedron to the other, clearly showing the relative orientation of the two forms.

In other cavities, the early calcite needles have been observed completely embedded in water-clear heulandite.

OVERGROWTHS

Some comments need to be made about the nature of the overgrowths on the surface of the levyne blades from a number of localities. This has been a controversial issue for a number of years, with most of the specimens from the Northwest locations being identified as offretite and those from European locations being identified as erionite.

First, some comments about the identification of erionite and offretite. The fundamental difference between these two minerals lies in slight differences between their structures. Basically, erionite has a unit cell that is double that of offretite along the c-axis. This means that there are many more x-ray diffraction peaks for erionite than there is for offretite. The complication comes from the fact that erionite has all the same diffraction peaks as offretite plus a lot more. This means that it is relatively easy to identify pure offretite by x-ray diffraction, but that any mixture of the two minerals give x-ray patterns that look qualitatively the same as pure erionite. Since in addition to this, the overgrowths will generally give patterns that contain peaks from levyne as well, the x-ray diffraction studies can be quite confusing. Moreover, x-ray diffraction studies are difficult for most people to perform, especially on thin coatings.

For that reason, other means were sought to differentiate the two. One of the proposed schemes involved the chemistry: a Si/Al ratio in the range 1.99 to 2.80 for offretite, 2.85 to 3.60 for erionite; $Ca+Mg > K+Na$ for offretite, $K+Na > Ca+Mg$ for erionite. But again, detailed quantitative chemical analysis is difficult and expensive, so as a simpler test that could be done much easier, optical properties were systematized: offretite uniaxially negative with a refractive index above 1.485, erionite uniaxially positive with a refractive index below 1.485. Many specimens were identified on this basis.

But the real basis for the difference between the two minerals is the crystal structure. Passaglia et. al. Have recently published a detailed study made on samples from a variety of site including Australia, Canada, Oregon, Arizona, Georgia, Northern Ireland, Italy, Scotland, France, Germany, Russia, Spain, and Antarctica. This included samples of the minerals both as coatings on levyne and as crystals in their own right. The Italians looked very carefully at the intensity of certain x-ray lines unique to erionite as compared to other lines shared by both minerals. Their findings are as follows:

- Both minerals have been found with Na+K rich members and Ca+Mg rich members.
- While there is a trend in the Si/Al ratio, there is a region of overlap that makes this ratio an unreliable indicator.

Their conclusion is that chemistry is not a good way to differentiate the two minerals. They also look at the ratio $Mg/(Ca+Na)$ and suggest that, from their analyses, that

offretite has values near 1:1, while erionite has very low magnesium concentrations. They suggest that this may be the determining factor as to which mineral forms.

As to the sign of the optical index, they find no correlation between it and the identity of the mineral present. In fact, they find this sign is related to the Si/Al ratio. This removes the easy method of identifying between these two minerals.

The claim in the paper is that ALL of the overgrowth samples that they analyzed proved to be erionite. Part of the confusion has come from the fact that the erionite overgrown on levyne appears to have a lower Si/Al ratio than that formed by itself. They have found very few instances where erionite and offretite intergrow. The only offretite overgrowths that they detected were on chabazite, not levyne.

So the bottom line: we really need to stop labeling our specimens offretite on levyne and change that to erionite on levyne. Clearly the Beech Creek material should be so designated, since that was included in their set of analyses. I have therefore included a micrograph (#410) of the *erionite* on levyne from Adel to emphasize the point. (For a closer look at this material, see micrograph #412, Vol. VII, #9.) Several pictures from back issues should be corrected in light of this:

- #25 Erionite (on levyne) Upper Ritter Quarry, Grant Co., OR Vol. VI, #4
- #3 Levyne with Erionite Flowers Gulch Summit, Grant Co., OR Vol. VIII, #1

It is not at all clear how other specimens, such as the material from Kane's Quarry, Northern Ireland (Micrograph #146, Vol. VI, #6) should be labelled.

References:

1. E Passaglia, G Artioli & A. Gualtieri, *Crystal Chemistry of the Zeolites Erionite and Offretite*, American Mineralogist **83**, p. 577-589 (1998).

THE MICROPROBE

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JUANITAITE, A NEW MINERAL FROM GOLD HILL, UTAH

Beverly Moreau
Southern California Micro-Mineralogists

In a joint announcement made at the 35th Annual Pacific Micromount Conference in Redlands, California on January 29, 2000, Dr. William S. Wise of the Department of Geological Sciences, University of California at Santa Barbara and Dr. Anthony R. Kampf, Curator of Mineral Sciences Section, Los Angeles County Museum of Natural History, confirmed the approval by the IMA of a new mineral named "juanitaite" for Juanita Curtis.

Juanita served the California Federation of Mineralogical Societies as their first Executive Secretary from 1961 to 1989. She and her husband, Bob Curtis (now deceased), were avid collectors and micromounters. In 1969 Juanita was honored with the Federation's Golden Bear Award, and more recently was named as one of their Scholarship Honorees.

The following written statement regarding the discovery, description and naming of the mineral was issued jointly by Dr. Wise, Dr. Kampf, and Dr. George R. Rossman, Division of Geological and Planetary Sciences, California Institute of Technology:

In September of 1971, a group of four collectors, Juanita and husband (Charles (Bob) Curtis, Wayne Leicht and Fred Croad, visited the Gold Hill mine in Utah. On the dump immediately west of the 30-foot level adit (see Kokinos and Wise, 1993, Fig. 2), they noticed weathered fragments of limonitic gossan bearing a green mineral they took for malachite (but which was later determined to be mixite). Juanita noticed native gold in the matrix, which spurred Wayne and Bob to venture through a crawl hole into the shallow inclined adit. Here they found similar material in place in the walls. They collected approximately two flats of this material.

A couple of weeks later, while examining the material more closely, Juanita noticed dark spots appearing much like pepper scattered on many of the specimens. Under the microscope she observed these to be clusters of olive green plates and bronzy reflections. They didn't match anything she had seen from Gold Hill, so she sent them to Bill Wise for identification. Powder diffraction and chemical analysis indicated that the mineral was new, but it was not until recently that crystals of sufficient quality to complete the description were recognized in the original material.

The new mineral is named 'juanitaite' for Juanita Curtis. This name was chosen rather than "curtisite", because the latter was originally applied to a mineral described in 1926, which in 1975 was determined to be a mixture of hydrocarbons. The new mineral and name have been approved by the Commission on New Minerals and Mineral Names, IMA. Specimens LACMNH #45266 and #45267 are designated as co-types and are deposited in the collection of the Los Angeles County Museum of Natural History.

In their joint statement, Bill Wise and Tony Kampf related the process through which the mineral was finally approved. After the first application was submitted by Dr. Wise, the mineral was returned for further studies. At that time, he requested those studies to be made by Dr. Kampf at the L. A. County Museum, and upon completion of the studies, another application was submitted. Once again, the IMA requested studies of

a different nature, and these were placed in the capable hands of Dr. George Rossman. Upon completion of the further studies, a third application was submitted.

Word of the approval reached Dr. Wise late in 1999, and the official announcement is scheduled to appear in an imminent issue of the *Mineralogical Record*.

Timing of the announcement by Dr. Wise and Dr. Kampf could not have been more meaningful. The Pacific Micromount Conference, founded at the suggestion of Juanita Curtis in 1966, celebrated its 35th anniversary at their January meeting. In 1965, Juanita expressed to Dr. Fred Pough, then Curator of the Santa Barbara County Museum of Natural History, a wish that there could be a local micromount conference, such as was being held in the eastern part of the United States. Dr. Pough responded with an offer to host the conference at the Museum, and Juanita began sending out invitations for a conference in early 1966. Over 100 reservations resulted.

During the past 35 years, the conference has been hosted in various locations, including Santa Monica, Torance, Westwood, and Pasadena. For the past twelve years the location has been at the San Bernardino County Museum in Redlands. The conference, traditionally held the last weekend in January, is sponsored by the Southern California Micro-Minerologists, based in Long Beach, California, and draws participants from many states in the U. S., from Canada, Bolivia, and from New Zealand and Australia. Inquiries about future conferences may be addressed to Beverly Moreau, Registrar, at bcmoreau@4dnet.com.

* * * * *

Juanitaite $(\text{Cu, Ca, Fe})_{10} \text{Bi} (\text{AsO}_4)_4 (\text{OH}) \cdot 2 \text{H}_2\text{O}$

is a tetragonal mineral, olive green to greenish bronze in color, that occurs in drusies of tiny, glittering prismatic crystals in various places in the Gold Hill Mine, Tooele Co., Utah. (See photograph #2.) Associated minerals include tyrolite, connellite, mixite, conichalcite, azurite, crednerite and quartz.

References:

1. Michael Kokinos & William Wise, *The Gold Hill Mine, Tooele County, Utah*, *Min. Rec.* **24-1**, Pg 11, (1993).
2. Anthony Kampf, William Wise & George Rossman, *Juanitaite, A New Mineral from Gold Hill, Utah*, *Min. Rec.* **31-4**, pg 301, (2000).

ANOTHER NEW MINERAL FROM GOLD HILL, UTAH?

Don Howard

Gold Hill, Utah has been the source of many many fine specimens of colorful zinc, copper and lead minerals, particularly arsenates. One would think that all the possible copper arsenates had been identified. These include:

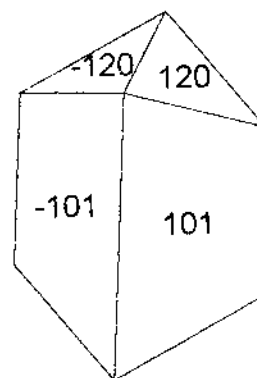
• Clinoclase	$\text{Cu}_3 (\text{As O}_4) (\text{OH})_3$
• Cornubite	$\text{Cu}_5 (\text{As O}_4)_2 (\text{OH})_4$
• Cornwallite	$\text{Cu}_5 (\text{As O}_4)_2 (\text{OH})_4 \cdot \text{H}_2\text{O}$
• Philipsburgite	$\text{Cu}_6 (\text{As O}_4)_2 (\text{OH})_6 \cdot \text{H}_2\text{O}$
• Strashimirite	$\text{Cu}_8 (\text{As O}_4)_4 (\text{OH})_4 \cdot 5 \text{H}_2\text{O}$
• Olivenite	$(\text{Cu,Zn})_2 (\text{As O}_4) (\text{OH})$
• Cuprian adamite	$(\text{Zn,Cu})_2 (\text{As O}_4) (\text{OH})$
• Conichalcite	$\text{Ca Cu}_2 (\text{As O}_4) (\text{OH})$
• Cuprian austinite	$\text{Ca}_2 (\text{Zn,Cu})_2 (\text{As O}_4) (\text{OH})$
• Metazucunerite	$\text{Cu} (\text{UO}_2)_2 (\text{As O}_4)_2 \cdot 8 \text{H}_2\text{O}$
• Mixite	$\text{Cu}_6 \text{Bi} (\text{As O}_4)_3 (\text{OH})_6 \cdot 3 \text{H}_2\text{O}$
• Juanitaite	$(\text{Cu,Ca,Fe})_{10} \text{Bi} (\text{As O}_4)_4 (\text{OH}) \cdot 2 \text{H}_2\text{O}$
• Thometzekite	$\text{Pb} (\text{Cu,Zn})_2 (\text{As O}_4)_2 \cdot 2 \text{H}_2\text{O}$
• Bayldonite	$\text{Pb Cu} (\text{As O}_4)_2 (\text{OH})_2 \cdot \text{H}_2\text{O}$
• Parnauite	$\text{Cu}_9 (\text{As O}_4)_2 (\text{SO}_4) (\text{OH})_{10} \cdot 7 \text{H}_2\text{O}$
• Tyrolite	$\text{Ca Cu}_5 (\text{As O}_4)_2 (\text{CO}_3) (\text{OH})_4 \cdot \text{H}_2\text{O}$
• Lavendulan	$\text{Na Ca Cu}_5 (\text{As O}_4)_4 \text{Cl} \cdot 5 \text{H}_2\text{O}$

It seems there is at least one more. On a collecting trip to Gold Hill last summer, Doug Merson found several pieces of broken quartz matrix in one of the pits that he thought was different. He was right. The x-ray diffraction pattern taken from a small cluster of the material fails to match any of the above copper arsenates, or any other mineral, for that matter. The x-ray fluorescence indicates about a 3:1 ratio of copper to zinc.

How could a bright green mineral be missed all this time? The material is the same color and roughly the same (small) size of specimens of cuprian adamite. Most people have mistaken the two as being the same. Several people have suggested that there was another copper arsenate mineral, but the samples have always been so small and so scattered that there was too little to analyze. Doug's pieces are very rich.

The difference between the forms of the new mineral and cuprian adamite can be seen by comparing micrograph #668 with #779. Adamite shows wedge-shaped terminations to orthorhombic prisms. The new mineral forms curved, wedge-shaped crystals that feather out toward the ends, probably indicating considerable twinning. That may mean that characterizing the mineral, even the crystal system, may prove difficult.

Time will tell. We'll be working on it.



The crystal habit of adamite

FIGURE CAPTIONS

Micrograph Number is in the lower right corner of the front.

For color photographs, the number is in the upper left corner on the back.

- #663 Levyne (x25)**
Bear Valley Road Quarry, Port Ludlow, Washington
 Milky white crystals with shiny, uncoated faces. The alternating slope of the edge faces shows the rhombohedral nature of the mineral.
- #1 Calcite and Levyne (x15)**
Baird Creek Quarry, Cowlitz Co., Washington
 The clear rhombohedron of calcite has an opaque phantom diagonally through its center. The levyne is clear (hexagon, right center) to milky white and complexly twinned.
- #410 Erionite on Levyne (x20)**
Adel, Lake Co., Oregon
 A scattering of individuals. The levyne forms only the thinnest core. Erionite fibers growing perpendicular to the levyne c-face give the specimen a pearly appearance. The erionite growth is thickest along the edges where clay deposits have not interfered.
- #702 Levyne (x25)**
Elk Mountain, Washington
 Thick, twinned crystals of the "twelveling" type shown in the figure on pages 7 & 8. These crystals have greatly reduced c-faces with no overgrowth.
- #2 Juanitaite with Conichalcite and Mixite on Quartz (x10)**
Gold Hill Mine, Tooele Co., Utah
 Juanitaite is the brassy green, fine grained material along the right edge of the specimen. The shiny, dark green is conichalcite and the fibrous material is mixite.
- #668 Unknown Copper Arsenate mineral with Conichalcite (x150)**
Gold Hill Mine, Tooele Co., Utah
 The small spheres perched on top are conichalcite. Crystals of the unknown form curving ridges similar to gismondine. The feathering out at the ends of the ridges seems to indicate considerable twinning.
- #3 Unknown Copper Arsenate mineral with Chrysocolla (x7)**
Gold Hill Mine, Tooele Co., Utah
 The shiny, dark green clusters on a broken quartz matrix.
- #779 Cuprian Adamite (x150)**
Wandering Jew Mine, Tooele Co., Utah
 A typical cluster of the mineral the above has been mistaken for. Note the cluster is about the same size as the cluster in #668. Typical wedge-shaped terminations appear to be aligned with each other to some extent. Gold Hill material has a similar appearance.

Picture Credits:

Micrographs and photographs	Don Howard
Specimens: #1, 2, 410	Don Howard
#3, 663, 668	Doug Merson
#702	Rudy Tschernich
#779	Joe Marty



