

Northwest
Micro Mineral
Study Group



MICRO PROBE

FALL, 1989

VOLUME VI Number 9

FALL MEETING ----- VANCOUVER, WASHINGTON

November 11, 1989 10 am to 10 pm

Clark County P. U. D. Building

1200 Ft. Vancouver Way

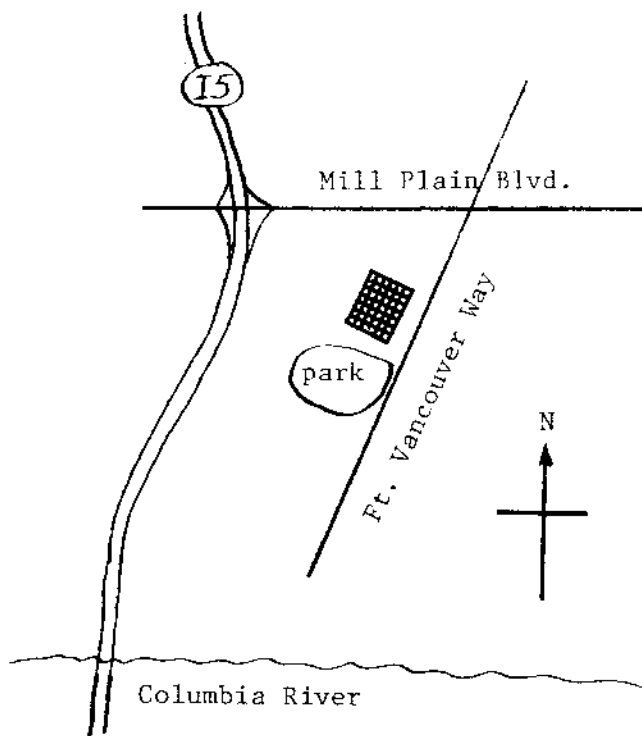
Bring your microscopes and bragging pieces for 1989 -- there will be lots of informal time to trade specimens, stories, and locations. Bring especially those things that you collected on the field trips for comparison and identification. Pieces from Hansen Creek, Sunday Creek, and the Van Silver Claim will be available for inspection.

Short business meeting at 2 pm: main order of business is to exchange information about the status of collecting spots in the Northwest, and to plan our future field trips. For those who are able to stay over for Sunday, we will plan (weather permitting) a collecting trip.

Pot Luck Dinner around 6 pm. Bring a salad, hot dish, or dessert plus plate, cup, and tableware.

Bring slides to show in the evening.

Easy to reach -- approximately 2 miles north of the Interstate Bridge on I5. Take the Mill Plain Blvd. exit and go east to the first intersection. Turn right onto Ft. Vancouver Way. The PUD building is on your right. Ample parking is available at the south end of the building.



CLEANING ZEOLITES BY THE NUMBERS

Rudy W. Tschernich
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Most mineralogy texts and books on cleaning minerals claim that zeolites can only be cleaned with soap and water since zeolites are easily dissolved or gelatinized in acids. I intend to show that zeolites can be cleaned with some acids, depending on the type of acid, length of time in the acid, and the silicon content of the specie.

The four most common materials that often need to be removed from zeolites are 1) soil, 2) iron oxide coatings, 3) manganese oxide coatings, and 4) calcite.

The only chemicals needed to clean zeolites are the following (listed in the order of increasing strength).

- 1) Biz bleach "laundry presoak"
- 2) Vitamin C (ascorbic acid)
- 3) Oxalic acid
- 4) Acetic acid
- 5) Hydrochloric acid (HCl) = Muriatic acid (28% HCl)

Always use the weakest chemical that will do the job. Strong and dangerous acids such as nitric, sulfuric, hydrofluoric, and aqua regia as well as strong bases such as sodium hydroxide are never required to clean zeolites. Small crystals which have more surface area than large blocky ones react more quickly. Some zeolites which are partly altered when collected (soft, pitted, hollow, or dull milky-white in color) react more quickly in acids than fresh samples. Brown and red colored zeolites show the effects of slight frosting more than do white crystals.

Some zeolites co-crystallize with calcite. When the calcite is removed from such specimens, malformed crystals result from the intergrowth. Some specimens were altered or dull on the surface before being coated with iron or manganese oxides.

Always run a test sample of poor specimen quality in acid before committing a good specimen. Dry the specimen (with a hair dryer if you are in a hurry) to be sure that it is not frosted or etched. Mechanically remove as much calcite and matrix from the specimen as possible before cleaning. If dolomite is present rather than calcite the reaction rate in acid is much slower.

1) Biz bleach is excellent for loosening soil from crystals. It can be purchased at most grocery stores. Mix a little powdered Biz in hot water the same way you do with laundry soap. Soak the dirty crystals from a few minutes to hours or days. Scrub with a toothbrush if the crystals are sturdy or use the solution in an ultrasonic cleaner. Biz will not harm any mineral. It does not remove the soil. It only loosens it. After soaking, use high pressured water or an ultrasonic cleaner to remove the soil. Crystallized clay can not be removed chemically.

2) Vitamin C is excellent for removing black manganese oxides from zeolites. It can be purchased in powder form at any drug store. Mix some powdered Vitamin C (about a tablespoon of crystals per cup of water) in warm water. If the black coating is a manganese oxide it will be removed in less than one minute. If iron oxide stains are present they might be removed with more time. Mix only enough Vitamin C to the job because the solution is good for only 12 hours. This weak acid is not harmful to people or minerals. It works great on black coatings on natrolite from Springfield, Oregon and epistilbite from Hawaii.

3) Oxalic acid is good in removing iron oxides. This chemical must be purchased from a chemical supply company. It comes in powder form and is mixed with hot water at the ratio of about one tablespoon per cup of water. Do not put your hand in the solution for the acid will penetrate your skin. Use rubber gloves. Mix only the amount that is needed to do the job. Always test a poor sample to be sure it does not frost the surface. Monitor the progress of the cleaning every 15 minutes, scrubbing the crystals, or placing the specimen in an ultrasonic cleaner, and replacing the specimen into the acid for another 15 minutes. Do not leave the specimen in the acid solution any longer than is required to remove the iron stain. If the solution becomes yellow, replace it with fresh acid. Try not to clean zeolites associated with calcite in oxalic acid for a yellow calcium oxalate can precipitate on the crystals which is very difficult to remove. After removing the specimen from solution, always flush with running water for at least 15 to 30 minutes.

4) Acetic acid is very good in removing calcite from all zeolites, even those with low silica content. Vinegar is only 5% acetic acid and is too weak to be useful. Concentrated acetic acid (100%) is called glacial acetic acid. It can be purchased from chemical supply companies. At room temperature the reaction rate is far too slow to be practical therefore heating is required. Glacial acetic acid has a very strong vinegar smell and can cause serious burns and irritation. Dilute the concentrate with about 50% water. Dilution does not generate heat therefore the water and acid can be mixed either way. Because of the strong odor, use this acid outside in a safe place where animals and children can not get into it. A fuming hood in a lab is excellent if you are lucky enough to have access to one. Place the specimen in a plastic container, such as the lower half of a clean gallon bleach or acid bottle. Place the specimens in the container and pour the warm diluted acetic acid solution over them. Hang a 250 watt heat lamp 12 to 16 inches above the top of the container to heat the solution. Active bubbling should be seen as CO_2 is released during removal of the calcite. If the calcite is just a coating it will be removed in about 30 minutes. If you are etching a solid calcite vein it may take up to 6 hours. After a few hours the acid may become depleted and release of CO_2 stops with some calcite still remaining. In this case pour off the depleted acid and replace it with new. If the solution becomes yellow, also pour off the acid and replace it with new for the yellow stain will penetrate the rock matrix and discolor the final sample. Always use rubber gloves when handling specimens in hot acetic acid. After the calcite is removed flush the specimen with warm running water for over an hour to remove any yellow coloration in the matrix and get rid of the odor. Graduate

the temperature change to room temperature over a period of time to avoid thermal shock and cracking.

5) Hydrochloric acid (HCl) can be used to remove iron stains and calcite. I prefer to use oxalic acid to remove iron oxide because it is the weaker of the two acids and less harmful to the minerals. HCl rapidly removes calcite even at room temperature, is inexpensive, and is easy to purchase. Muriatic acid (28% HCl) can be purchased at most hardware or building supply stores since it is used to clean bricks and cement. I usually mix equal amounts muriatic acid and water. No heat is released in the mixing therefore HCl and water can be mixed in either direction. Always use rubber gloves, avoid the fumes, and flush with running water if any acid gets on your skin or clothes. Some zeolites can be cleaned or calcite removed with HCl without any harm, some can withstand a few minutes in the acid, and others are immediately frosted or turned to gelatin. It is very important to know how each zeolite specie reacts in HCl. The reaction in HCl can be predicted by the silicon content in the framework of the exact zeolite specie being cleaned. A graph and range of silicon contents for all the zeolites is given in Table 1. The higher the silicon content the less reactive the zeolite is in HCl. On this scale 100% would equal quartz which is not effected at all by HCl. The high silica zeolites (silicon content over 70%) are generally uneffected by HCl and can be etched directly from calcite with concentrated HCl without any harm, even over long periods of time. As the silicon content decrease below 70% the zeolites become slightly effected by diluted HCl and can be immersed for only 1 to 3 minutes. The lower the silicon content the more reactive the zeolite becomes. Thomsonite, with the lowest silicon content, is frosted immediately while the zeolites in the 50% to 60% range should never be put in HCl. Some zeolites have a wide range of silicon content therefore it is wise to always test a poor sample in the acid before placing a prized specimen in HCl. Never leave a zeolite in the acid any longer than you have to. Always flush the specimen with running water. Remember that most specimens consist of more than one mineral. The reactivity of the least silicon-rich specie must be considered. Furthermore, most minerals commonly associated with zeolites such as apophyllite, gyrolite, okenite, tacharanite, and most important all clay linings are highly altered with HCl and must be considered before placing a specimen in HCl.

When using glacial acetic acid, oxalic acid, or HCl always use rubber gloves, work outside, keep animals and children way, and be careful. Store acids where children can not get them.

Table 1. Silica Content of Zeolites. See page 7.

LYTTELTON QUARRY, SOUTH ISLAND, NEW ZEALAND

D. G. Howard and Jocelyn Thornton

It was my pleasure, during an extended visit to New Zealand in 1982, to spend a day collecting zeolites in a quarry only a few miles from the heart of Christchurch. Recently, additional specimens sent from New Zealand have rounded out the minerals identified from this quarry. Since this is a basalt quarry containing several zeolites, we thought it might be interesting to our readers to describe a little of the geology of the area, and the mineralization of the basalt.

GEOLOGY

The South Island of New Zealand is rather elongated, running somewhat east of south from the upper island. A mountainous backbone, the Southern Alps, runs the length of the island along its western side. The eastern side is occupied by the Canterbury Plains, sloping gently from the mountains about 100 kilometers to beaches on the South Pacific Ocean. The city of Christchurch is located about one third of the way down the eastern coast of the South Island.

Starting about 12 million years ago, a major outflow of basalt just off the coastline began to build Banks Peninsula to the west of the current site of Christchurch. The first cone to form was the Lyttelton volcano. In time the eruption moved southeast and formed a second cone, the Akaroa volcano. Both cauldrea eventually collapsed to below sea level and were infiltrated by the Pacific Ocean, forming two natural harbors.

In several places the vesicular basalts of the Banks Peninsula have been mineralized. One of the best collecting areas is an active quarry worked into the western rim of the Lyttelton cauldrea just above the town of Lyttelton. The top of this rim reaches perhaps 300 meters elevation, serving to separate Lyttelton Harbor from the city of Christchurch, whose residential areas spread up the western slopes. The quarry itself extends down the eastern slope for a considerable distance, and has been worked at a number of levels.

MINERALIZATION

The best zeolites are found in a basalt of a light gray color that is very highly vesicular. It tends to be rather heavily weathered. Dark clays are, in general, not present, while light gray clay present in some cavities without zeolites seems to be of late origin. Most of the zeolites are mounted more or less directly on the basalt, with little clay under them.

Chabazite, both in simple rhombohedrons and in more complex crystals, is by far the most common zeolite present in this quarry. Normally, the chabazite is clear and colorless, though some is yellow in color. Opaque coatings, white or yellow in color, often coat the chabazite. Chabazite is often the only zeolite present, though tiny yellow spheres of thomsonite may be scattered occassionally in with the chabazite.

In one small area a greater variety of zeolites occur. The basalt here is more brown in color, and the cavities often show crystals of the primary minerals: augite (as elongated prisms brown in color) and mica

(as thin books of hexagonal flakes). Larger cavities contain glassy phillipsite. Levyne is present as clear crystals thick enough to show discernable edge faces. Only some of the levyne crystals, especially those that are very thin, show a clouding on the surface of offretite overgrowth. Thomsonite occurs as groups of smooth, hard spheres completely lining cavities. Cowlesite also lines some of the cavities, white and bladed when fresh, but often stained yellow. Thus, New Zealand joins the long list of places in the world where cowlesite has been confirmed.

Late mineralization is very interesting at Lyttelton Quarry. Much of the stained material appears to be manganese oxide. When forming on chabazite, these stains often show a dendritic structure, though the deposit is thicker than the usual dendrite. In other cavities, on darkened clay linings or on yellowed cowlesite, the deposits form piles of dark material with a brassy, metallic glitter. X-ray shows this mineral to be todorokite, a hydrated oxide of manganese near $Mn_4O_7 \cdot H_2O$.

A photograph of a patch of todorokite on clear chabazite is included with the illustrations for this issue. The appearance of the specimen is very different from our Northwest material, where late dark mineralization on zeolites is usually in the form of parallel "books" of smectite or clinocllore.

Editor's Note:

We would like to officially welcome Jocelyn Thornton as our first overseas member and subscriber. The geologic description of the Banks Peninsula is taken from her book: "Field Guide to New Zealand Geology", (Heinemann Reed, Auckland, New Zealand, 1985). The specimen shown in the photograph was collected by the editor at Lyttelton in 1982. Jocelyn Thornton provided the specimens containing phillipsite, levyne, thomsonite and cowlesite.

ZEOLITE CLASSIFICATION

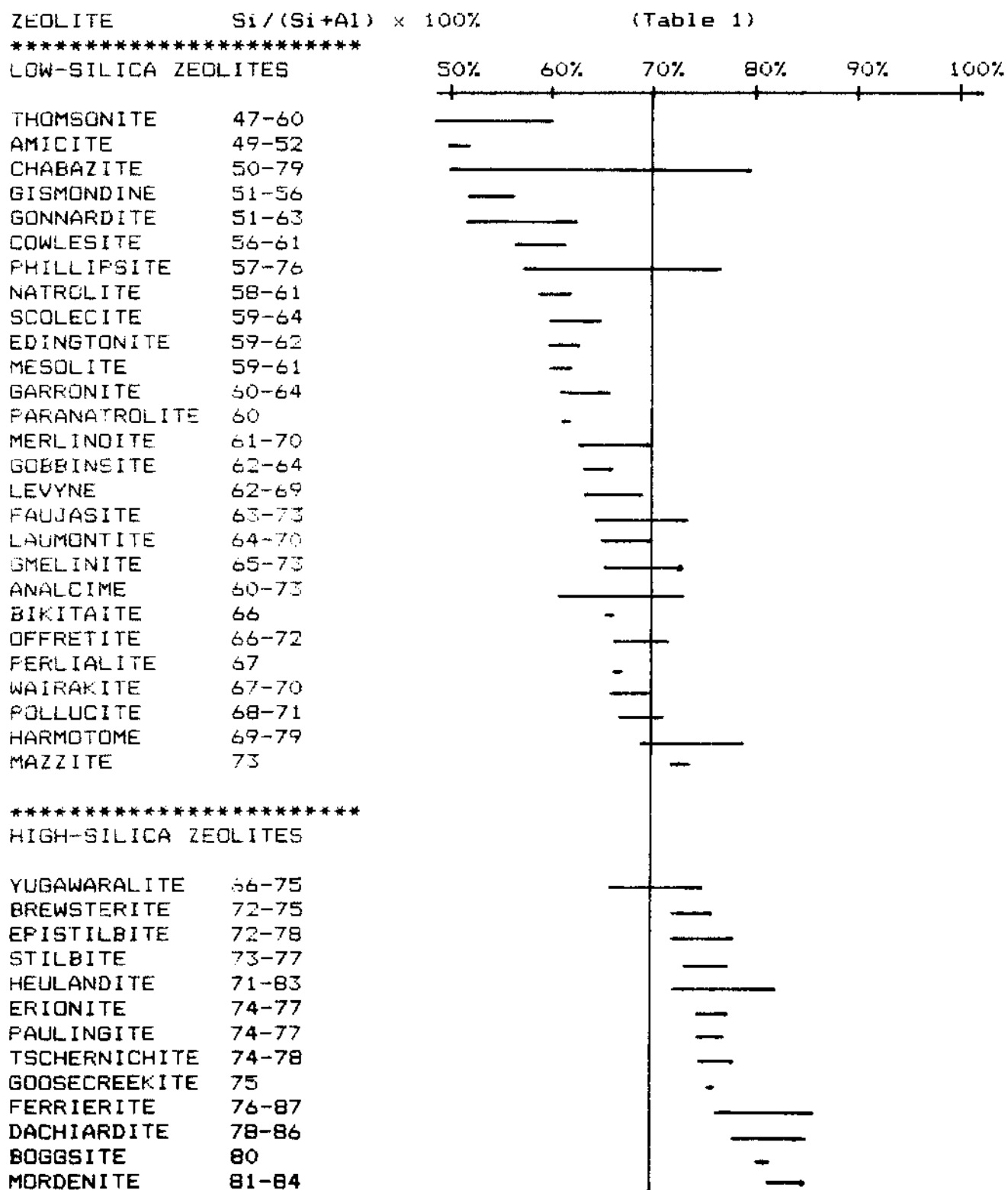
One often hears certain zeolites referred to as "high-silica" or "low-silica". This refers to the zeolite's chemistry: what percentage by weight is composed of SiO_2 . Why is such a thing interesting?

For one thing, the higher the silica content, the more resistant the mineral is to weathering and to acids used to clean specimens.

Much more important, zeolites forming together as associates in a basalt are forming from solutions with a certain silica content, and are at equilibrium with that solution. Zeolites of similar silica content therefore tend to form together. The presence of certain species may therefore suggest other, rarer, species to look out for. Of course, the solutions may change over time, so that a trend (usually toward lower silica content) may be observed in the development of zeolites at a location.

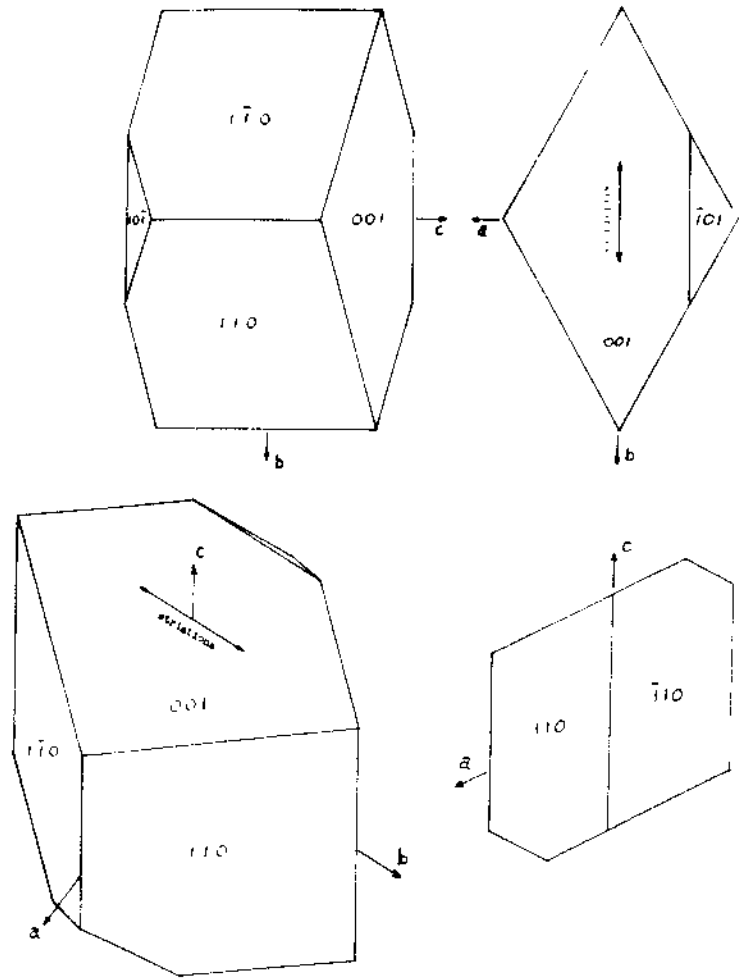
Rudy Tschernich has kindly prepared the following chart to indicate the silica content of many of the members of the zeolite family.

PERCENTAGE OF SILICON IN THE FRAMEWORK OF ZEOLITES



ADULARIA

Adularia is the low temperature form of orthoclase: $KAlSi_3O_8$. It is generally considered to crystallize rather rapidly. Crystals are monoclinic with an obtuse angle of about 116° . They are usually quite simple: prism faces (110) with a basal termination (001). The additional faces ($\bar{1}01$) are developed to a greater or lesser extent on different crystals. The crystal may in fact, alternate development of (001) and ($\bar{1}01$) to form somewhat curved surfaces. At any rate, this alternate development causes striations to appear parallel to the b-axis on the diamond-shaped end faces.



PICTURE CAPTIONS

- #36 Goethite pseudomorph after pyrite (x6)
The alteration preserves sharp faces, including the small (111) bevels of the original crystals, the glossy surfaces, and even the striation lines.
- #37 Arsenopyrite on clinocllore and quartz (x7)
Two crystals on a specimen that did not have a calcite filling. This is the first arsenopyrite found at this location.
- #38 Quartz (Japan-Jaw twin) (x6)
Though common at other sites in the immediate area, such twins are unusual in the rock of zone 3.
Hansen Creek, near Snoqualmie Pass, King Co., Wash.
- #39 Titanite with adularia on clinocllore (x8)
Sharp, unaltered crystals
- #40 Adularia and titanite on clinocllore (x4)
Classic shape. See diagram above.
Sunday Creek, No. Fk. Snoqualmie R., King Co., Wash.
- #41 Todorokite on chabazite (x8)
A rare associate of zeolites
Lyttelton Quarry, near Christchurch, New Zealand

Pictures and specimens, D. G. Howard.

SUNDAY CREEK, KING COUNTY, WASHINGTON

D. G. Howard

The previous issue of the Microprobe featured a detailed description of the minerals found at Hansen Creek. Sunday Creek, only a few miles away, has many of the same minerals present, though in different relative abundances and in a different sort of matrix material.

Sunday Creek is a short stream (perhaps 3 to 4 miles long) connecting Sunday Lake with the north fork of the Snoqualmie River. It is located about 20 miles from North Bend, Washington on the road that parallels the north fork of the Snoqualmie River. Most of this road goes through clear-cuts on the west side of the river; after the road crosses back to the east side of the river, Sunday Creek is the first major stream that is spanned by a bridge. About 1 mile above that bridge, a trail takes off for Sunday Lake.

Collecting is from boulders in the creek bed itself. To date, no one has found the area where they are originating. Like most of the rocks in the stream, they are a light cream color with a fine-grain texture, being composed of an intimate mixture of microcline and quartz. The best mineralized pieces appear to be a breccia, with angular fragments cemented mainly by greenish to olive brown chlorite. Further mineralization is primarily as small voids between the breccia fragments. Unlike Hansen Creek, there is very little calcite, so it is not necessary to etch the samples. Nor is there a heavy coating of iron oxide (though the specimens look much brighter is given a 5 minute dip in oxalic acid).

Minerals thus far found and identified (in approximately the order in which they have formed) are:

Tourmaline -- appears to be the first mineral formed, since it can be seen embedded in most of the other minerals. It forms long slender individual needles of a dark golden-brown color. Some needles appear to be fibrous on the end. Broken cross-sections are the characteristic triangle with curved faces. Some of the crystals appear to be terminated.

Apatite -- forms as opaque white groups of euhedral crystals showing primarily prism and basal faces. Dark needles of tourmaline can be seen within the white apatite.

Arsenopyrite -- forms in some of the seams as patches of silvery metallic mineral. Only occasionally are faces visible along the edges and on smaller crystals; most arsenopyrite is thoroughly embedded in the surrounding chlorite. Needles of tourmaline can be seen within the masses of arsenopyrite along fractures.

Quartz -- as tiny, clear crystals are not very abundant in the pockets. Larger crystals are simply not present.

Clinocllore -- is the primary cement between fragments of the breccia, and the major dark mineral. The clinocllore forms rounded packets of parallel growth "books", in appearance rather like the Hansen

Creek material. The color, however, is more of an olive green. The surface of the chlorite is often dull or dusty when freshly broken; a few minutes in oxalic acid restores it to a clear, glossy appearance.

Titanite -- occurs as sharp, brownish orange crystals scattered about the clinocllore in open pockets. The crystals are complex, showing many faces. There is no decomposition of any of the titanite into brookite, anatase, etc.

Adularia -- occurs as well-formed crystals of the classic shape, with the (001) faces prominently striated parallel to the b-axis (see crystal drawing). The crystals may be up to $\frac{1}{2}$ inch or more. The larger are white in color, but the smaller ones are very nearly water clear. Some are twinned. Mixtures of white adularia and golden titanite on dark clinocllore make most attractive specimens.

Pyrite -- seems to be a very late mineral at this location. It is not abundant. It shows shiny, pyritohedral faces.

Calcite -- is also not common at Sunday Creek. Small patches of calcite often have been seriously eroded to form rough, splintery surfaces.

As mentioned earlier, Sunday Creek shows a similarity to Hansen Creek, but also interesting differences. Adularia is much more common and well developed. Crystalline quartz is a very minor constituent. Tourmaline and arsenopyrite are much more abundant.

The fact that the titanite is unaltered is probably related to the fact that solutions rich in calcium carbonate did not permeate the deposit. Alteration of titanite to brookite, anatase, and rutile is probably accomplished by the carbonate solutions. The alteration of pyrite into goethite at Hansen Creek is probably also the work of these solutions.

Collecting so far has been restricted to stream boulders, so the size of fresh voids is practically limited to an inch or two. It would be worth while to attempt to locate the breccia in place; presumably if larger voids are present, they would be the places where pieces would split off, and stream action would ruin their surfaces quickly. Location of the primary source of this material might mean larger cavities with bigger crystals.

N O T I C E

Dues are \$6.00 per calendar Year.

Please keep your dues up to date.

If you are not able to attend the fall meeting and have not paid dues for the year 1989, please send \$6.00 to:

Donald G. Howard
356 S. E. 44th Ave.
Portland, OR 97215

Members who fall more than one year in arrears will be in danger of missing the twice-yearly mailings of the Microprobe.



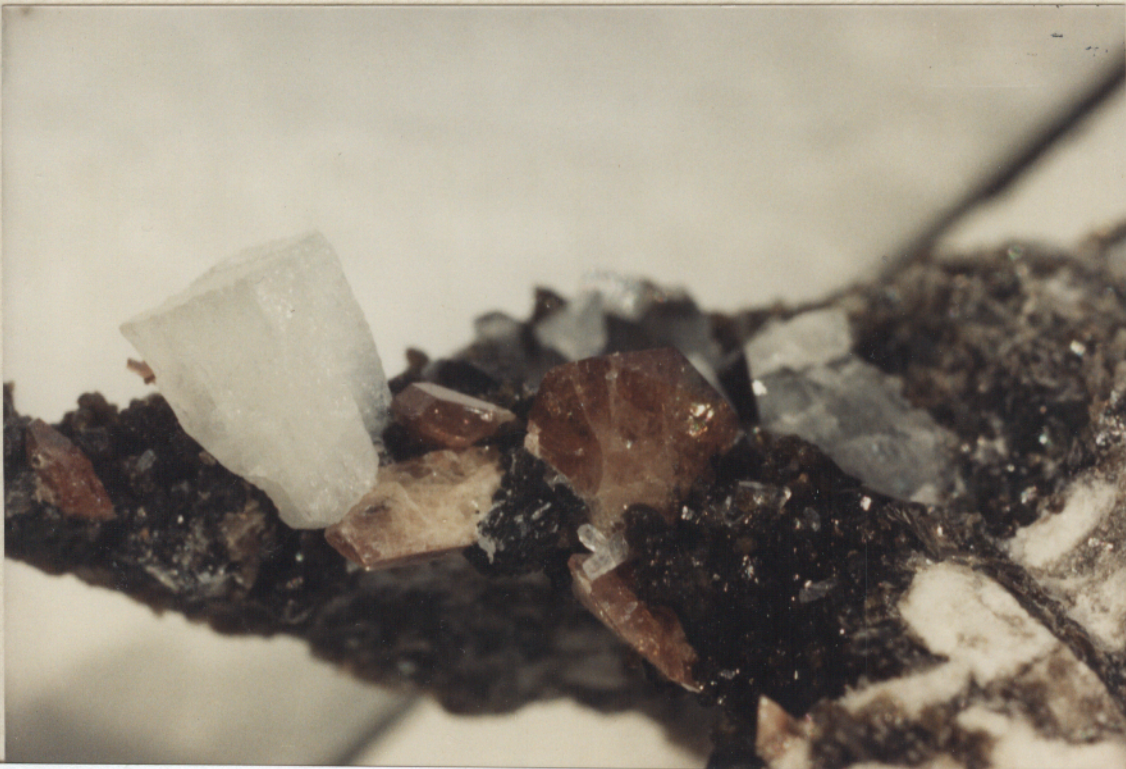
#36 - GOETHITE - HANSEN CREEK, SNOQUALMIE PASS, KING COUNTY, WASHINGTON - 6X



#37 - ARSENOPYRITE - HANSEN CREEK, SNOQUALMIE PASS, KING COUNTY, WASHINGTON - 7X



#38 - QUARTZ - HANSEN CREEK, SNOQUALMIE PASS, KING COUNTY, WASHINGTON - 6X



#39 - TITANITE - SUNDAY CREEK, NORTH FORK SNOQUALMIE RIVER, KING COUNTY, WASHINGTON - 8X



#40 - ADULARIA, TITANITE - SUNDAY CREEK, NORTH FORK SNOQUALMIE, KING COUNTY, WASHINGTON - 4X



#41 - TODOROKITE, CHABAZITE - LYTTTELTON QUARRY, CHRISTCHURCH, NEW ZEALAND