

Northwest
Micro Mineral
Study Group



MICRO PROBE

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VOLUME VI Number 6

GISMONDINE from the OAK GROVE FORK of the CLACKAMAS RIVER, OREGON

by Rudy W. Tschernich

Donald Howard

Gismondine is found in a light colored vesicular volcanic rock along the road near Lake Harriet, on the Oak Grove Fork of the Clackamas River, northeast of Ripplebrook Ranger Station, Clackamas County.

Although the rock is in place in the cliff along the road, most of the collecting is concentrated in the road fill across from the cliff. Continued rock falls during the winter will produce new rock for collecting. Vesicles are usually only 2 to 4 cm in diameter with a few up to 13 cm.

The location and the gismondine were first found by Beulah and Phil Murphy, and only because of their persistence was the mineral recognized. This is the only gismondine location in the Pacific Northwest and is the only producing location in the Western Hemisphere. Although gismondine is found at many locations in Europe, it is quite a rare zeolite elsewhere. In North America gismondine rarely occurs at Mont Saint-Hilaire and in the state of Hawaii on Oahu and Kauai. Unconfirmed reports claim gismondine was found in Zacatecas, Mexico; Fritz Island, Reading, Pennsylvania; and Salome, Arizona; although none of these locations are now producing specimens of gismondine.

Only the four zeolites, chabazite, gismondine, thomsonite, and levyne (listed in decreasing order of abundance) plus clay and calcite have been found at the Oak Grove fork location, with chabazite being overwhelmingly the commonest species. The rock itself is unusual and needs further study. It is a light gray color, very rich in light colored minerals probably feldspar or feldspathoids with very few dark minerals sprinkled throughout. It is not a basalt or andesite and depending on its mineral composition may be one of the leucite or nepheline bearing volcanics similar to those found near Rome, Italy or in Hawaii where gismondine is also present. No alteration rim has been found around the cavities. Some cavities have discernable crystals of the primary rock-forming minerals, pyroxene and feldspar with sharp crystal faces, extending into the vesicles.

A typical pocket consists either of colorless drusy chabazite lining covered by a scattering of larger gismondine aggregates or has a thick flat platform composed of zeolites dividing the cavity into two portions; one side half empty with barren walls or only traces of orange clay while the other half is richly lined with zeolites. During crystallization, the platform was horizontal even though they are now tipped by folding or faulting of the volcanic flows.

Observation of each of the secondary cavity lining minerals follows in the order which they crystallized in the cavities.

MONTMORILLONITE-CLAY: A cream to orange colored clay was the first mineral to crystallize in some of the volcanic cavities settling to the base of the vesicle to form a layer filling a portion of the cavity from 0 to 30% with a few of the cavities being completely filled. Many of the cavities contain no clay at all. Tiny thomsonite spheres are found suspended in the upper half of the clay filling with the amount of clay decreasing until the thomsonite spheres form a solid layer at the top of some of the clay fillings.

In many of the vesicles the clay was either dissolved, or falls out when the pocket is exposed to leave an empty area devoid of zeolites. Because clay is not present in the upper part of the cavities, the colorless transparent zeolites appear black or white due to seeing the color of the rock forming feldspars and pyroxenes through the clear zeolite.

THOMSONITE: Occurs as tiny smooth spheres under 0.5mm in diameter, first forming sparsely amber colored spheres suspended in creamish-orange clay and becoming the dominate mineral just below the chabazite-gismondine plate. Tiny gray hemispheres of thomsonite are also rarely found between the rhombohedrons of chabazite and on one specimen shows a stacking of chabazite-thomsonite-chabazite.

CALCITE: Forms 3 to 5 mm long amber colored hexagonal scalenohedrons which crystallized on the top of the clay-thomsonite layer and usually is covered by drusy chabazite, thomsonite, and gismondine. Calcite is rarely still present in the cavities having been naturally dissolved away leaving only hollow hexagonal zeolite-covered shells.

LEVYNE: Occurs rarely as very small 1 to 2 mm water-clear colorless hexagonal plates. These are often the only mineral present in the pocket. If transparent chabazite rhombohedra grow over the top, the clear levyne is difficult to distinguish.

CHABAZITE: Occurs very commonly as a drusy lining of colorless transparent simple rhombohedrons not over 2 mm wide, lining the vesicle walls and covering the clay-thomsonite layer to form a thin shell-like plate. Chabazite is clearly seen covering levyne, calcite needles, and when present is itself covered by thomsonite and gismondine.

GISMONDINE: Forms complex clear colorless, milky-white and highly altered white aggregates ranging from 1 to 10 mm in diameter usually on colorless rhombohedrons of chabazite or forming a thick platform covering the clay-thomsonite filling. Rarely, it is found with chabazite and thomsonite covering calcite needles. Gismondine is the last mineral to crystallize in the cavities.

The crystal form of the gismondine is a pseudo-tetragonal dipyrmaid but is complicated by extensive twinning and offset growths to form aggregates with multiple edges. Small angle rotation of neighboring crystals cause fan-like aggregates which appear to have curved edges. Rarely, sharp single crystals, are present. Weathering of some of the rock after zeolite crystallization has altered some of the gismondine into rough white masses or hollow shells.

Sequence of crystallization observed: clay-thomsonite > thomsonite > calcite > levyne > chabazite-thomsonite > gismondine > followed by removal of the clay and weathering of the calcite and gismondine.

SPRING FIELD TRIP

DATE: May 28, 29, 30 We plan to meet between 10 and noon on the 28 th at the collecting site.

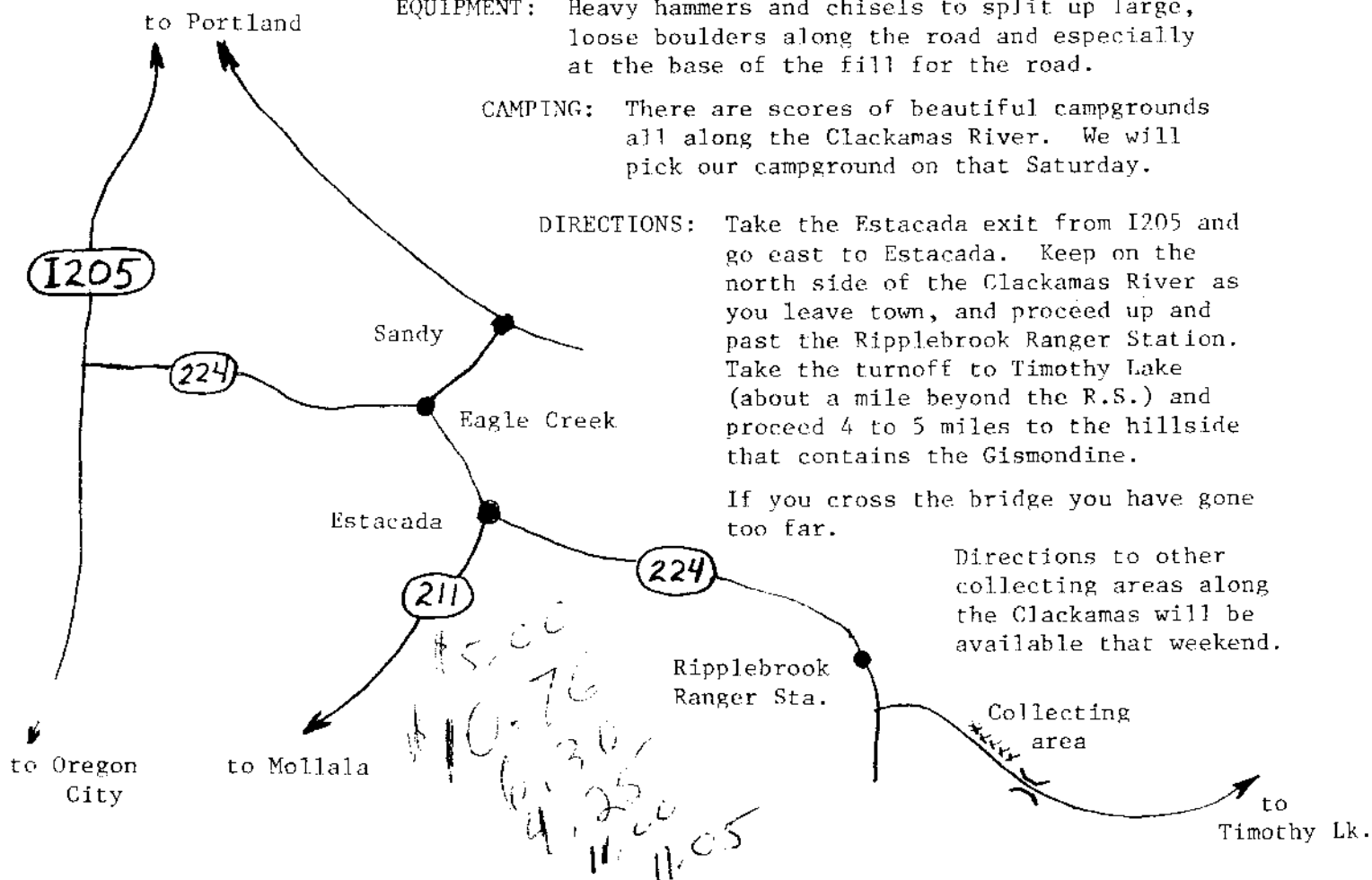
EQUIPMENT: Heavy hammers and chisels to split up large, loose boulders along the road and especially at the base of the fill for the road.

CAMPING: There are scores of beautiful campgrounds all along the Clackamas River. We will pick our campground on that Saturday.

DIRECTIONS: Take the Estacada exit from I205 and go east to Estacada. Keep on the north side of the Clackamas River as you leave town, and proceed up and past the Ripplebrook Ranger Station. Take the turnoff to Timothy Lake (about a mile beyond the R.S.) and proceed 4 to 5 miles to the hillside that contains the Gismondine.

If you cross the bridge you have gone too far.

Directions to other collecting areas along the Clackamas will be available that weekend.



WHY IS THERE SO MUCH CONFUSION
IN IDENTIFYING CERTAIN ZEOLITES ?

Many of you may feel rather frustrated when you come to a meeting or read a new issue of the Microprobe and discover that you need to change the label on some of your specimens because "the experts" have changed their minds and called a mineral something else. This is a plea for patience, and an effort to explain why identification in some cases can be so difficult.

The three basic ways minerals are identified are:

Chemically ---- by differences in their compositions

Structurally -- by differences in their x-ray patterns

Optically ----- by differences in their refractive indices

To illustrate the problems that arise, let me deal with two "families" of zeolites.

Natrolite - Mesolite - Scolecite

As a glance at the chemical formulae in the table will show, these three minerals differ in composition by having calcium replace sodium, with an associated increase in the water content.

Structurally, the symmetry decreases as the calcium increases, distorting the original "simple" lattice of Natrolite. But the distortions are small, only a fraction of a degree in angle, causing only a very tiny shift in the x-ray reflections which can only be detected by precision equipment. The result is that the x-ray patterns of all three are virtually identical.

Optically, the distortion is more important. In Natrolite, the optic axis coincides with the c-axis. As calcium content increases, the distortion causes the optic axis to move a few degrees away from the c-axis. There are also changes in the refractive indices. Thus, the three minerals are best distinguished by careful study under the polarizing microscope.

Erionite - Offretite

These two minerals are closely related in structure to Levyne. Erionite has almost exactly twice as large a unit cell as Offretite. This leads to the possibility of more lines in its x-ray pattern. But the major lines for the two minerals are just the same.

The case is complicated in that they intergrow freely. If the intergrowths are rather thick, they can be distinguished in the polarizing microscope. But intergrowths of just a few molecular layers will be too fine a structure to see, so the optical properties will become those of the dominant species. This intergrowth further complicates the x-ray picture, which can "see" down to a few molecular layers thickness and therefore reports the presence of both minerals.

Thus there is no consistency in the literature for this system. The overgrowth on Levyne is called Offretite in the Northwest and Erionite in Europe. It has been postulated that the two minerals always occur intergrown to some extent. The x-ray patterns for the material from different locations differ somewhat in how sharp the lines appear, but on the whole they look pretty much the same. Experts interpret one mineral from the other based on small differences.

Some Properties of Selected Zeolite Minerals

Name	Chemical Formula	System	Cell Dimensions	Angle
Natrolite	$\text{Na}_6\text{Al}_6\text{Si}_9\text{O}_{30}\cdot 6\text{H}_2\text{O}$	Orthorhombic	18.284, 18.620, 6.592	$90^\circ 0'$
Mesolite	$\text{Na}_2\text{Ca}_2\text{Al}_6\text{Si}_9\text{O}_{30}\cdot 8\text{H}_2\text{O}$	Monoclinic	56.8, 18.82, 6.53	$90^\circ 43'$
Scolecite	$\text{Ca}_2\text{Al}_6\text{Si}_9\text{O}_{30}\cdot 9\text{H}_2\text{O}$	Monoclinic	18.52, 18.99, 6.55	$90^\circ 39'$
Offretite	$\text{KCaMgAl}_5\text{Si}_{13}\text{O}_{36}\cdot 14\text{H}_2\text{O}$	Hexagonal	13.291, 7.582	
Erionite	$\text{KNaCaAl}_4\text{Si}_{14}\text{O}_{36}\cdot 14\text{H}_2\text{O}$	Hexagonal	13.214, 15.041	

Optically, there is an important difference that makes these two minerals look either bluish or yellowish under crossed polaroids using a special filter. Unfortunately, as explained above, separating them optically does not agree with separating them structurally using x-rays at the current time. The literature is filled with contradictory analyses and conclusions.

In the pictures presented with this issue of the Microprobe, we have adopted names for the material shown based on optical analysis. Bear in mind, therefore, that even that designation may have to be changed at a later time if someone comes up with a more definitive test to distinguish between these two minerals.

NOTES ON MINERAL IDENTIFICATIONS

Yellow Lake, B.C.

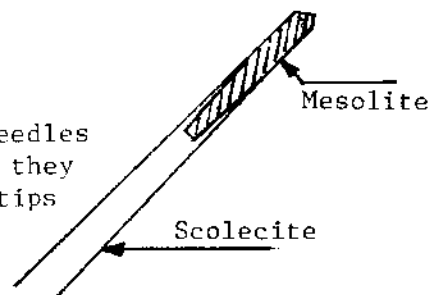
Microprobe analyses on the Wakefieldite samples show that the interior is rich in lanthanum. Rare earth analysis (in atomic %):

	La	Ce	Nd
bulk	48%	43%	9%
surface	29%	57%	14%

The specimens should therefore be labelled
Wakefieldite - La (D.G.Howard)

Yacolt, Wash.

Optical studies on the long, acicular needles found on top of the heulandite indicate that they are primarily Scolecite, with only the very tips being mesolite. (R.Tschernich)

Goble, Ore.

The small white spheres, reported last issue as Wairakite (photo #30, Fall, 1987 Microprobe) have proved NOT to have an appreciable calcium content in their interiors. They are therefore just another form of Analcime. (D.G.Howard)

PHOTOGRAPHS

All the photos reproduced in this issue are micrographs taken on an S.E.M. (Scanning Electron Microscope). First of all, a few words on how the images are formed:

A very tiny, parallel beam of electrons is allowed to hit the surface of the sample after they have been accelerated to a high velocity (typically a few thousand electron volts of energy). In colliding with the atoms in the sample, x-rays are produced, which are then detected, and an electrical signal proportional to the x-ray intensity is produced.

To make a picture, the narrow beam is caused to sweep across a small portion of the sample, then is displaced slightly sideways, and sweeps across again, forming traces in parallel lines -- much like the lines of a television picture. In fact, the electrical signal derived from the x-rays detected controls the intensity of light on a video monitor, so the picture is viewed on a screen just like a television picture. The magnification is determined by the size of the region scanned by the electron beam compared to the size of the TV screen.

The operator watches the screen as he moves the sample about under the electron beam. When he sees something worth recording, he transfers the image onto Polaroid film, producing both a positive (for direct viewing) and a negative (for later print-making).

In addition to an image, a chemical analysis can also be made. Each element produces x-rays of a different energy. By sorting the different x-rays by energy and storing the number detected versus energy in a computer, a graph of the elements present in the scan region can be produced. This can be evaluated quantitatively if it is compared to a similar graph made from a standard sample of known concentrations of the same elements.

Since a beam of electrons is used to excite the x-rays, electrical continuity must be provided. Therefore, unless the specimen is a natural conductor (and most minerals do not conduct electricity), a thin metal film must be evaporated onto the surface of each sample to be studied. Thus the sample must in general be sacrificed in order to get the highly detailed pictures.

The process is not inexpensive. A typical SEM unit would probably cost about \$ 50,000 . The film used costs about \$ 2 per picture. Typically, sample preparation and time on the microscope take an hour or two of operator time.

On the micrographs, a number (lower right) is assigned to each exposure.

#215 Thomsonite on Heulandite

(x400)

Goble, Columbia Co., Oregon

Recent specimens taken from the rock adjacent to the Tschernichite area occasionally show a cavity in which the thomsonite forms preferentially on the side faces of the heulandite as tiny bladed tufts.

#216 Erionite - Offretite (x520)
 Twig Creek (near Monte Lake), British Columbia
 Smooth first-order prisms of erionite usually have ends of offretite. The ends show numerous tiny pores, and exhibit small faces corresponding to the first-order pyramid.

#235 Erionite (x500)
 Dollar Lake, Wallowa Co., Oregon
 Crystals, crudely hexagonal in outline, are composed of parallel bundles of fibers. Differing lengths of fibers give a tapered appearance. (Compare to the optical photograph of the same mineral, photo #6 in the Fall, 1985 Microprobe)

#146 Offretite (x149)
 Kane's Quarry, Glengormley, Belfast, Co. Antrim, Northern Ireland
 Here the first-order pyramid is completely developed. The side faces, roughly hexagonal in outline, display the fibrous overgrowth. This is the first known occurrence of Offretite-erionite with a termination other than a simple basal plane.

ZEOLITES at ELK MOUNTAIN, COWLITZ COUNTY, WASHINGTON

by Rudy W. Tschernich

Collecting in this area was pioneered in the late 1960's by John Cowles, after Weyerhaeuser extended logging roads into the area. Zeolites occur sporadically throughout the maze of logging roads in Lewis River and Toutle River area. Zeolites are particularly abundant along Weyhauser logging road 1440 and several roads and quarries near the summit of Elk Mt. Pockets range from small scolecite-filled white amygdales to larger 6 to 10 inch open pockets. Rarely 2 foot pockets lined with scolecite, stilbite, apophyllite, or laumontite are found. Fresh rock produces the best specimens but is exceptionally tough due to large interlocking feldspar crystals in the dense black basalt, making the rock difficult to break even with a 8 lb. hammer. Altered rocks in the area are easier to dig in but the zeolites tend to fall apart, making it difficult to obtain large specimens. Weyerhaeuser logging roads are closed to the public during most of the year with the exception of deer hunting season from October to November when most gates are open for weekend hunting. This is the only time mineral collecting in this area is possible and great care must be taken to avoid looking like a deer. Elevation where most of the minerals are found ranges from 3000 to 4000 feet; therefore cold nights and snow is possible this time of year.

Scolecite, stilbite, laumontite, and apophyllite are the major minerals present but also present are levyne, quartz, calcite, and gyrolite.

Scolecite is the most widespread and abundant mineral present. It forms 1/2 to 3/4 inch snow-white linings terminated by small crystals which have the appearance of the white lining of a coconut. Single crystals examined under polarizing light show that zones of mesolite are present in the crystals with scolecite accounting for 95% of each needle. Calcite is the only mineral forming before the scolecite while stilbite, apophyllite and laumontite are on top of the white scolecite lining.

Stilbite is abundant in some outcrops, forming colorless crystals 1/2 to 1 inch long. Pockets up to 12 inches across lined with 1/2 inch stilbite can be seen in some outcrops near the summit of the mountain.

Laumontite, the scourge of zeolite collecting, is abundant either lining pockets by itself or perched on scolecite linings. When freshly collected from damp pockets the crystals are colorless and hard. Those which have partly lost water and turned whitish-clear are difficult to save while those that have lost considerable water are chalky white and crumble upon touch. Only the colorless specimens should be collected for any that are already white will only crumble before you reach home. In order to save the laumontite, collect fresh laumontite, place it in the shade where the sun will not be upon it, wrap it with white paper towels, pour a little water over the paper towels so they will keep the laumontite moist until further treatment can be carried out at home.

Apophyllite forms colorless blocky crystals up to 1/2 across on scolecite and are terminated by a flat "c" face rather than a pyramid.

Milky white levyne crystals 2 to 5 mm in diameter with the color uniformly throughout the crystal are locally abundant in small pockets up to 1 inch in diameter. The crystal habit of these levyne is unusual in that the large "c" face common at many other locations is not predominate and often not present at all. Levyne crystals are composed of many twinned rhombodrons which resemble highly twinned chabazite variety phacolite. Offretite, which is usually found as an overgrowth of levyne, has been found on only one crystal.

Gyrolite has been seen filling some solid nodules but does not make impressive specimens.

Calcite is not abundant but forms either 1/2 inch elongated crystals which are covered by scolecite or is seen forming after the other zeolites.

Quartz is not abundant but has been seen as small crystals covering one specimen of scolecite.

NOTICE TO MEMBERS

At the fall meeting in Forest Grove, the membership voted unanimously to increase the annual dues to \$6.00 per mailing address. Dues for 1988 will be due and payable at the Spring meeting and will be considered overdue after the Fall meeting.

THE MICROPROBE

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NOTICE OF
 SPRING MEETING

Edith Heilman tells me that she is anxious to have the whole group gather once again in Raymond, Washington.

DATE: April 30, 1988
 TIME: 10 AM until late evening.

PROGRAM:

We have talked about Goble so much that we thought it would be refreshing to concentrate on some other areas.

* OAK GROVE FORK, CLACKAMAS RIVER
 We will be talking about our Spring Field Trip.

* YACOLT, WASHINGTON
 We need to compare notes and specimens with the intent of featuring a write-up of this area in the fall, 1988 Microprobe.

* RITTER, OREGON
 We also need to sort out and discuss what was collected on last year's field trip.

Bring your specimens from these areas so that we can have the widest possible survey of materials.

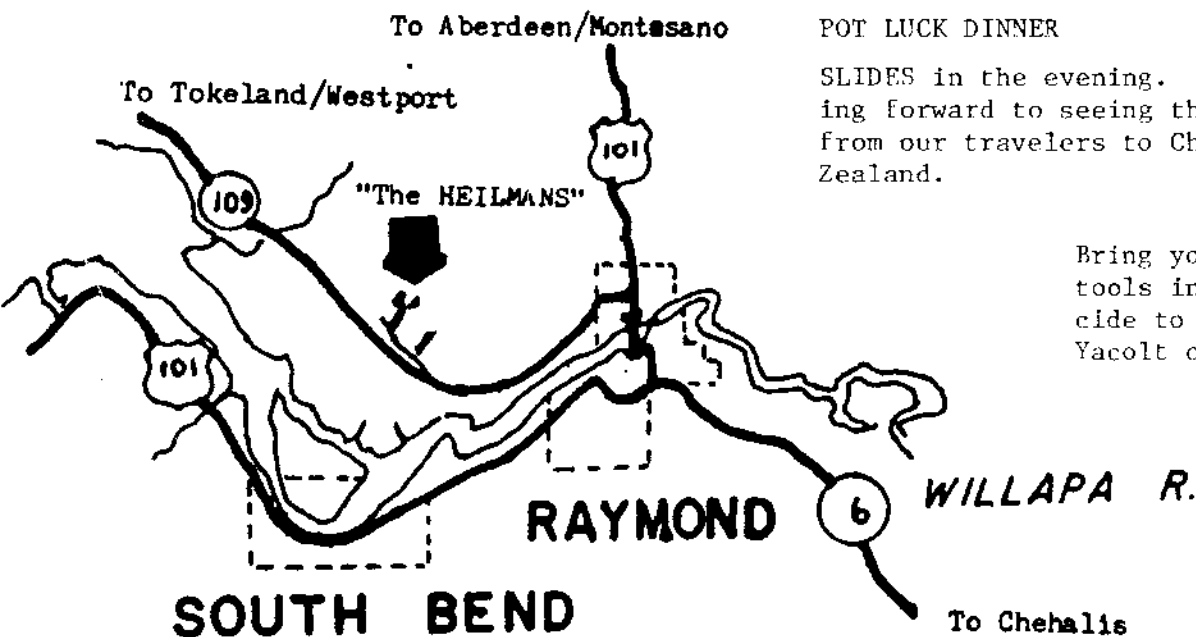
ANNUAL BUSINESS MEETING

POT LUCK DINNER

SLIDES in the evening. We are looking forward to seeing the pictures from our travelers to China and New Zealand.

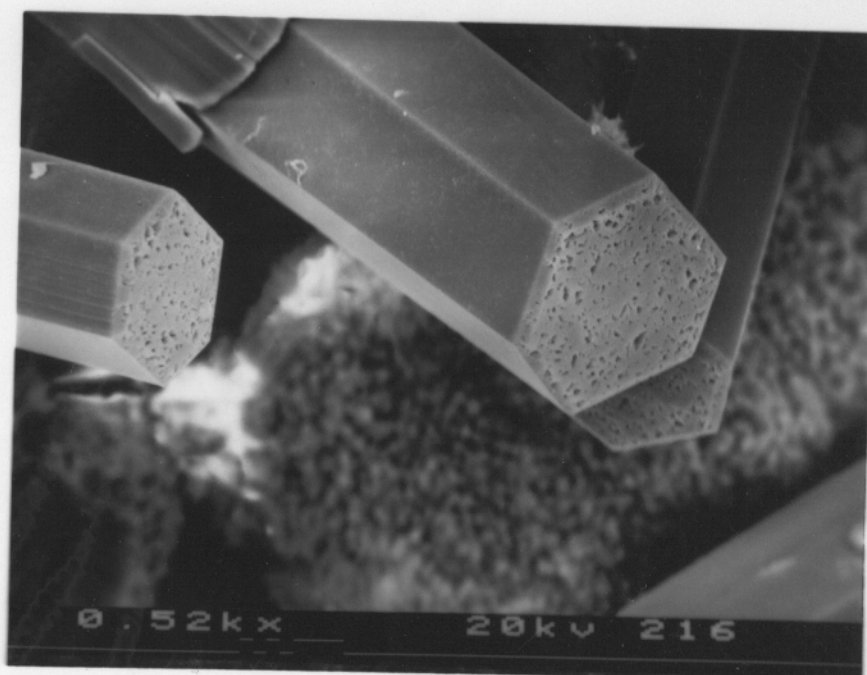
Bring your collecting tools in case we decide to collect at Yacolt on Sunday.

*To reach the HEILMANS (former Bayles Army Post), turn west off highway US 101 at the north end of the bridge in Raymond, Washington. Follow highway toward Tokeland/Westport about 2 miles. A side road angles off to the right. Follow this road until you see the buildings on your right (just before you come to a hill). Turn into the driveway
 Phone 942-5237*

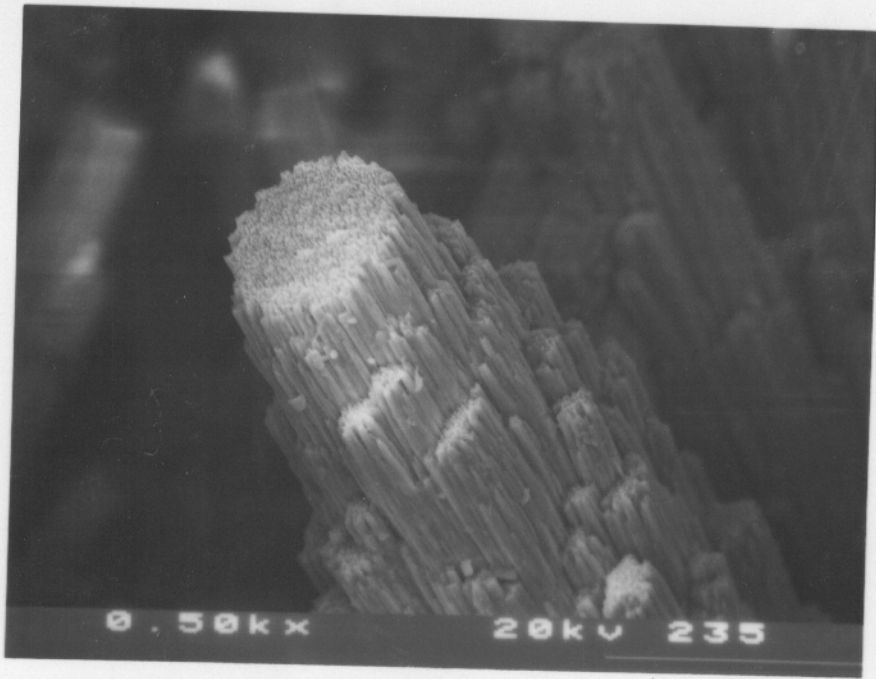




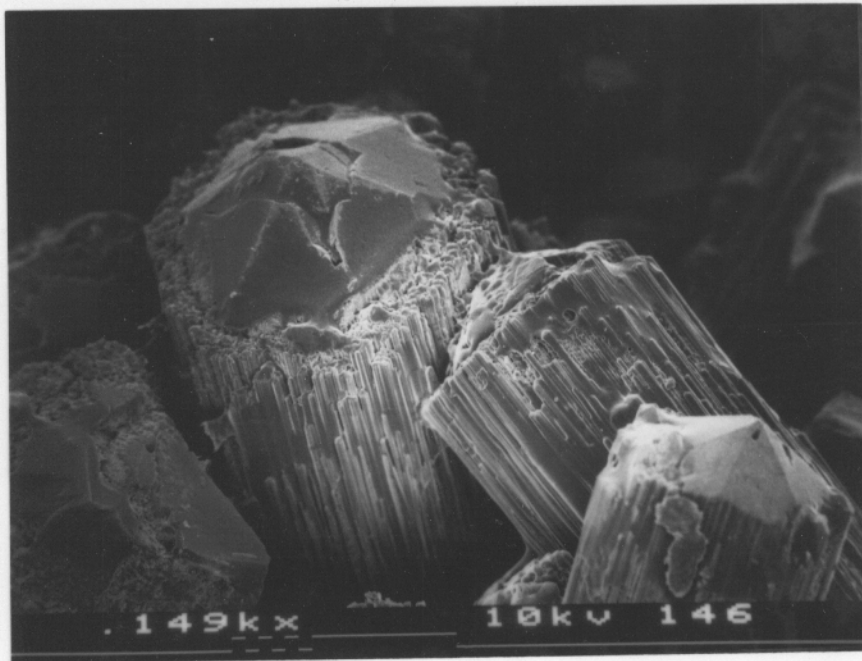
#215 - THOMSONITE, HEULANDITE - GOBLE, COLUMBIA COUNTY, OREGON - 400X



#216 - ERIONITE, OFFRETITE - TWIG CREEK, MONTE LAKE, BRITISH COLUMBIA, CANADA - 520X



#235 - ERIONITE - DOLLAR LAKE, WALLOWA COUNTY, OREGON - 500X



#146 - OFFRETITE - KANE'S QUARRY, GLENGORMLEY, BELFAST, COUNTY ANTRIM, NORTHERN IRELAND - 149X