Clackamas River Drainage, Clackamas and Marion Counties, Oregon:

A Micro-Mineral and Geological Research Project

By Beth Heesacker

It all started out with my love affair with Big Cliff siderite. All the colors and the beautiful shapes, hemispheres and rhombs really caught my attention. I wondered why they were so abundant at Big Cliff, so I had to investigate the geology. That meant looking at maps, not only of the geology but also the extent of the Clackamas River drainage.

A page from one of my large Benchmark roadmap books was the starting point, and with a colored marker, I traced the river, its tributaries and streams noted on the map. This gave me an idea of the extent of the drainage. I also marked some of the areas I had read about or had in my collection. Not all sites have been positively located using gps.

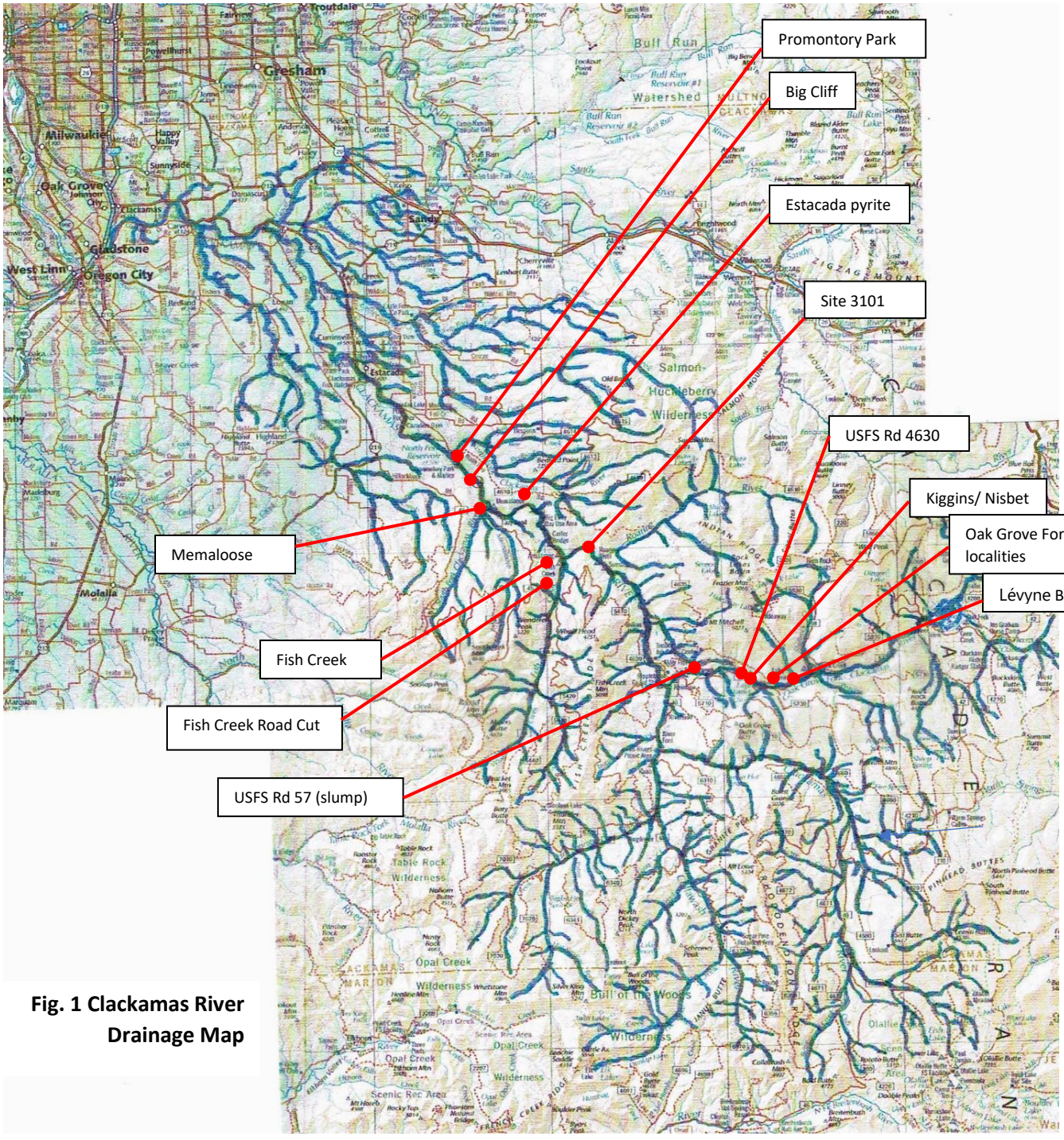


Fig. 1 Clackamas River Drainage Map

The Clackamas River begins on the slopes of Olallie Butte, a High Cascade volcano. The watershed includes 16 sub watersheds and flows 82.7 miles from an elevation of 6,000 feet to an elevation of 12 feet when it flows into the Willamette River near Oregon City.

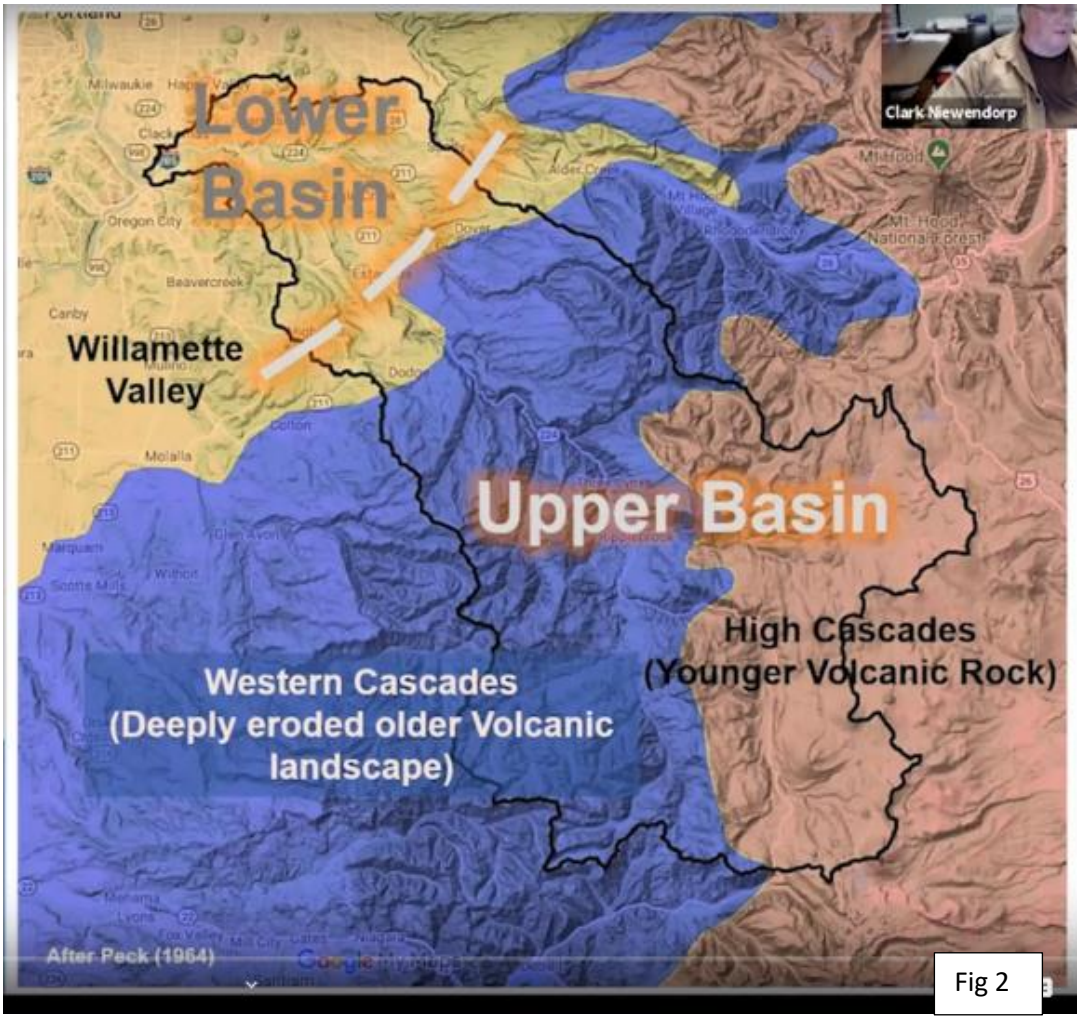


Fig 2

A YouTube presentation by Clark Newendorp, President of the Geological Society of the Oregon Country (GSOC), about the Clackamas River Basin in which he talked about the geology of the area was a very big help in identifying the geology of the collecting areas. Some of his slides are included in this paper with his permission.

According to Newendorp, there are three main areas of the Clackamas River Basin: The Lower Basin (closest to the Willamette Valley), the Upper Basin including the Western Cascades (eroded older volcanics) and the High Cascades (younger volcanics including glacial deposits).

From what I have gathered so far most of the micro mineral collecting has been done in the Western and High Cascades.

Two volcanic flows dominate the area, the Boring Lavas (purple in the lower and upper basin, Fig 3) and the Columbia River Basalt Group (CRBG) (red and blue in the upper basin Fig 4). All the collecting areas, where the exact location is known, are in CRBG.

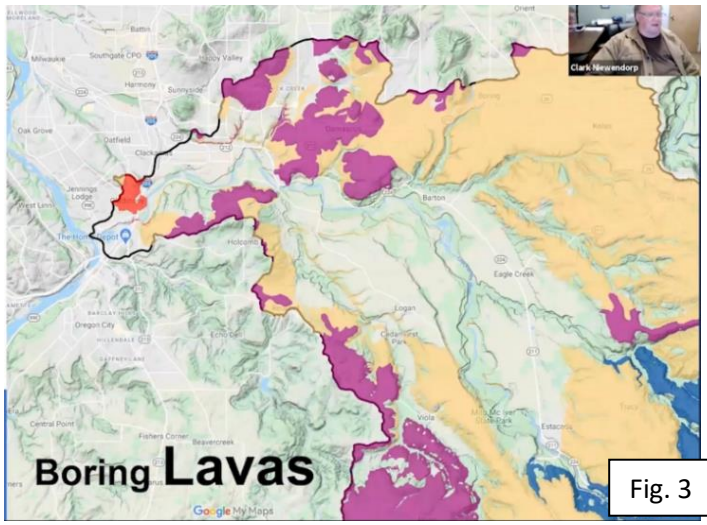


Fig. 3

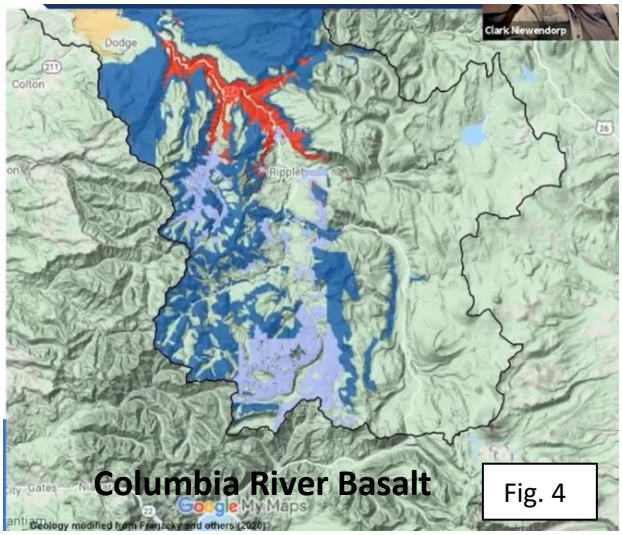


Fig. 4

There are also three river terraces (greens, Fig. 5) along the main river flow area in the Lower Basin which also include Missoula Flood deposits. Along the main river and its tributaries and streams there are landslides and debris flows (pinks and yellows, Fig. 6).

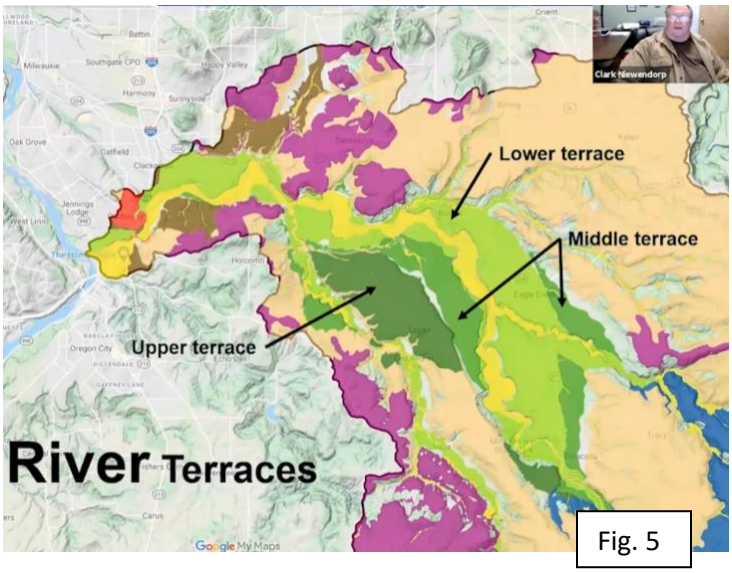


Fig. 5

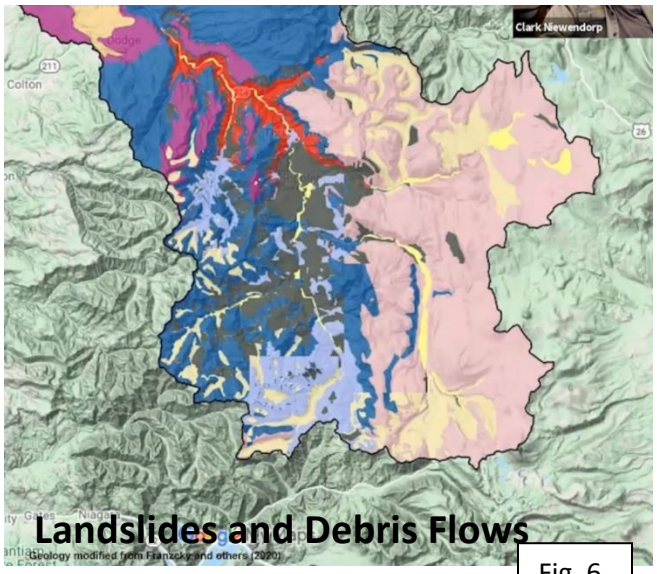


Fig. 6

Many fault systems cut through the Clackamas River Basin which possibly could lead to some of the many mineral deposits to form due to hydrothermal mineralization. Alteration of the deposits have been caused by intrusions, faulting, glaciation, and landslides.

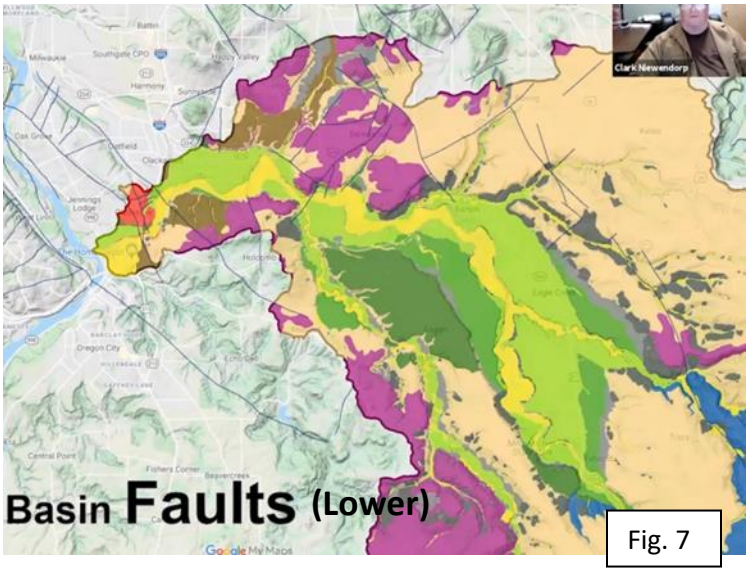


Fig. 7

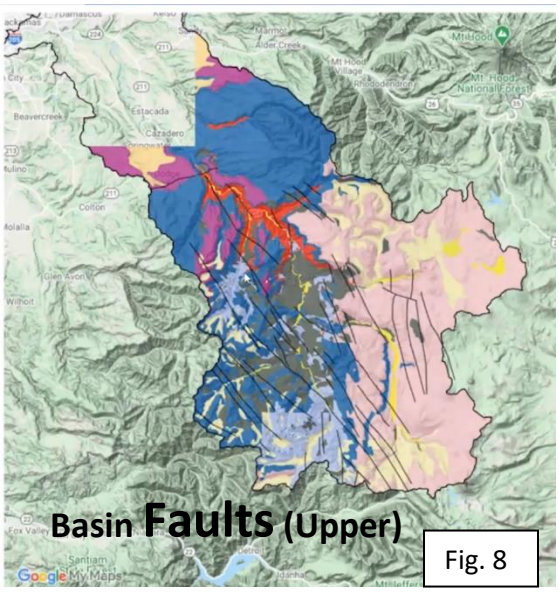


Fig. 8

Geology of the Collection Sites*:

Promontory Park – Promontory fault, Grande Ronde Basalt flow (Columbia River Basalt Group, CRBG)
Big Cliff – Grande Ronde Basalt flow overlying the Prineville flow (both CRBG flows)
Memaloose - Sedimentary layer on top of Grande Ronde Basalt flow
Fish Creek – Grande Ronde Basalt (CRBG) in contact with Wanapum Basalt (both CRBG flows)
Fish Creek Roadcut – Grande Ronde Basalt (CRBG) in contact with Wanapum Basalt (both CRBG flows)

Site 3101 – Lockaby Fault, Prineville and Grande Ronde Basalt (both CRBG flows)
USFS Rd 4630 – Lake Harriet Fault, Grande Ronde Basalt (CRBG) in contact with Wanapum Basalt (both CRBG flows)
USFS Rd 57 (slump) - Lake Harriet Fault, Grande Ronde Basalt in contact with Wanapum Basalt (both CRBG flows)
Kiggins - Lake Harriet Fault, Grande Ronde Basalt in contact with Wanapum Basalt (both CRBG flows)
Oak Grove Fork - Lake Harriet Fault, Grande Ronde Basalt in contact with Wanapum Basalt (both CRBG flows)
Lévyne Boulder – Unknown source location.

* The sites that have relatively known locations

Specimens:

The specimens were selected from collections originally owned by Jon Gladwell, Mickey Marks and Tony Sobelik. I do not have specimens from all the Clackamas area locations and sometimes specimen locations are not fully specified with gps coordinates or even mile post designations on the specimens.

Since these specimens are from three different collections, different site names may apply to the same area. Also, in some instances I cannot find the exact label locations on the map. I hope that some of you who have collected in the area will help bring all these locations together by identifying the exact places. I welcome your input.

Mindat resource:

Mindat has a very lengthy list of locations, many are for rock for road building and do not mention any minerals and many do not give exact locations or Google maps. That of course does not mean that they do not have minerals. Unless found and checked out physically, we will not know.

Mindat lists the following elements and minerals for the Clackamas River Localities:

Elements: Hydrogen, Carbon, Oxygen, Sodium, Magnesium, Aluminum, Silicon, Sulfur, Potassium, Calcium, Iron and Barium.

Minerals:

Group 2 - Sulphides and Sulfosalts

Pyrite	FeS_2

Group 4 - Oxides and Hydroxides

Opal	$SiO_2 \cdot nH_2O$
Quartz	SiO_2
var. Chalcedony	SiO_2

Group 5 - Nitrates and Carbonates

Calcite	$CaCO_3$
Siderite	$FeCO_3$
var. Sphärosiderite	$FeCO_3$

Group 7 - Sulphates, Chromates, Molybdates and Tungstates

Baryte	$BaSO_4$
Gypsum	$CaSO_4 \cdot 2H_2O$
var. Selenite	$CaSO_4 \cdot 2H_2O$

Group 9 - Silicates

Celadonite	$K(MgFe^{3+}\square)(Si_4O_{10})(OH)_2$
Harmotome	$Ba_2(Si_{12}Al_4)O_{32} \cdot 12H_2O$
Heulandite-Ca	$(Ca,Na)_5(Si_{27}Al_9)O_{72} \cdot 26H_2O$
Heulandite-K	$(K,Ca,Na)_5(Si_{27}Al_9)O_{72} \cdot 26H_2O$
Montmorillonite	$(Na,Ca)_{0.33}(Al,Mg)_2(Si_4O_{10})(OH)_2 \cdot nH_2O$

Phillipsite-K (K,Na,Ca0.5,Ba0.5)4-7[Al4-7Si12-9O32] . 12H2O
Thomsonite-Ca NaCa2[Al5Si5O20] · 6H2O

Unclassified Minerals, Rocks, etc.

'Chabazite' -
'Gismondine Subgroup' -

My Original Question:

Why is there so much siderite at the Big Cliff area, and though also found at other sites in the Clackamas River drainage, it is not found in the quantity and many colors found at Big Cliff?

1) The main commonality of the area is the Grande Ronde Basalt. The siderite is found in vesicles in this iron rich basalt in the Clackamas River Drainage.
2) Siderite is an iron carbonate (FeCO3), and a member of the Calcite Group. The range of colors, colorless to black, depends on the amount of ferric iron in the crystal. The darker the crystal, the more iron present.
3) According to Clark Niewendorp the Big Cliff site has a fault (right-lateral strike-slip) just north, or left, of the collecting area and looks hydrothermally altered.

Putting this information all together, the iron-rich basalt, the chemistry of siderite and the hydrothermal alteration along faults in the area, seem to answer some of my original question. But a key part of the question still remains: what is the source of the substantially higher amount of iron in this one locality that produces such a substantially larger amount of siderite. The presence of many other faults in the area also makes me wonder if more sites like this might be found but that is a challenge for others to undertake.

The Localities from Which I Have Specimens (Listed in order approximately going upriver):

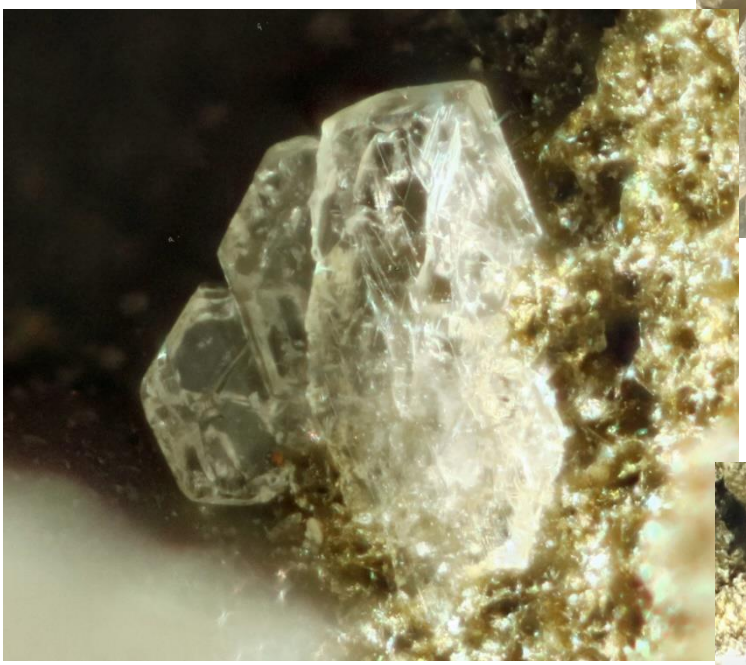
Locality (according to source's label and GPS, if known)		in Mindat	Location known	Source
Promontory Park	(45.216571, -122.236014)		X	Jon Gladwell
Big Cliff (MP 32)	(45.20040, -122.22183)	X	X	Jon Gladwell
Memaloose	(45.19199, -122.21146)	X	X	Mickey Marks
Fish Creek	(45.161219, -122.150655) (incorrect gps in Mindat)	X	X	Jon Gladwell
Fish Creek Roadcut	(45.14585, -122.15353)		X	Jon Gladwell
Site 3101	(45.13391, -122.07856)		X	Jon Gladwell
USFS Rd 4630	(45.081910, -121.980920) (incorrect gps in Mindat)	X	X	Jon Gladwell
USFS Rd 57 (slump)	(45.079814, -121.982598)		X	Jon Gladwell
Kiggins	(45.07722, -121.97306)	X	X	Jon Gladwell
Oak Grove Fork	(45.08307, -121.99102) (various localities)	X	X	Jon Gladwell
Lévyne Boulder	(45.070470, -121.951530) (or 45.079464, -121.982033)		X	Jon Gladwell
Route 224 Pyrite	(probably Mindat location Estacada pyrite)			Mickey Marks
Route 224 Selenite	(probably Big Cliff)			Mickey Marks
Route 224 (MP 32) Selenite	(probably Big Cliff)			Mickey Marks
Route 224 (MP 40.8)				Mickey Marks
Clackamas River Roadcut				Jon Gladwell
Clackamas River				Tony Sobelik
Estacada				Tony Sobelik
USFS Rd 57 (near rockslide)				Jon Gladwell

Specimen Photos (**All photos copyrighted by Beth Heesacker**):

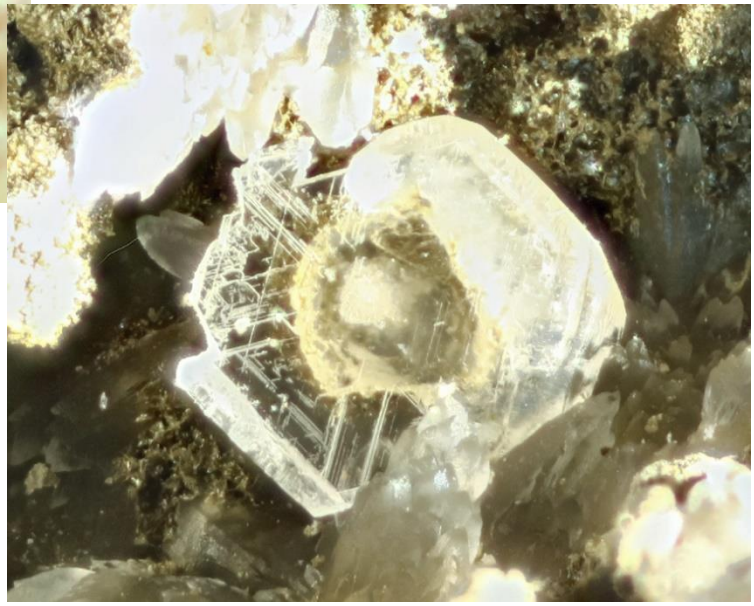
Promontory Park

Quartz and Pyrite blade, fov 3 mm

Quartz, fov 4 mm



Calcite?, fov 1 mm



Calcite? and unknown, fov 1 mm

Big Cliff


Siderite, fov 12 mm


Siderite, fov 3 mm


Siderite, fov 2 mm

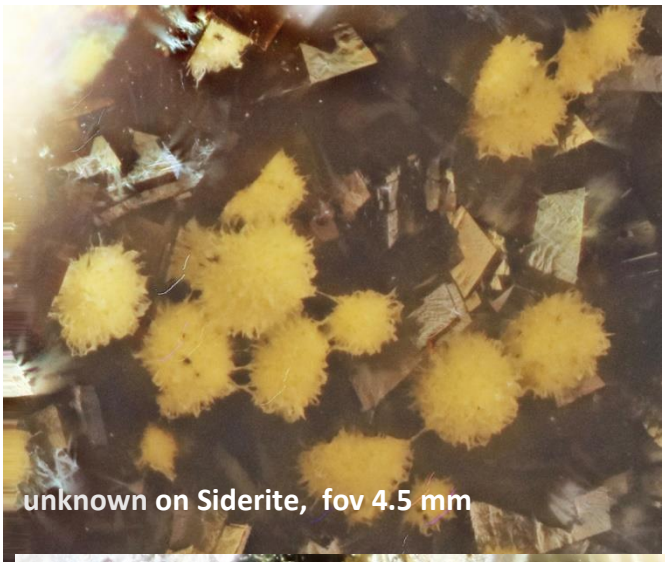

Siderite, fov 4 mm


Siderite, fov 6 mm

Memaloose

unknown, fov 4.5

unknown on Opal, fov 3.5 mm



unknown on Siderite, fov 4.5 mm

unknown on Siderite, fov 1.5 mm

Siderite, fov 3.5 mm

Fish Creek

Selenite ,
fov 6 mm

Selenite, fov 3.5 mm

Selenite and unknown, fov 5.5 mm

Selenite, fov 2 mm

Selenite, fov 3 mm

Fish Creek Roadcut

unknown, fov 1.25 mm

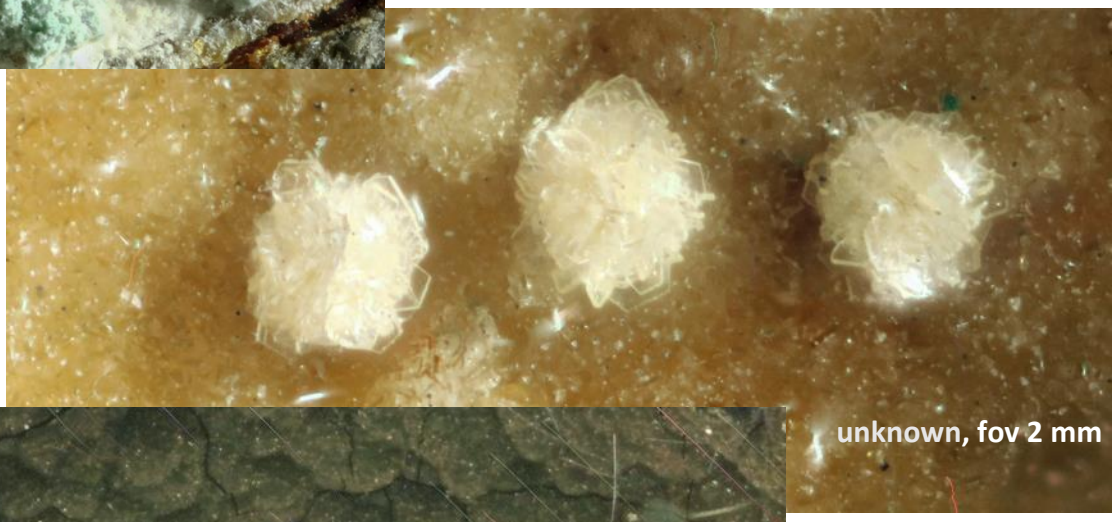
Celadonite, fov 2 mm

Clay, fov 3 mm

Clay, fov 4 mm

Site 3101

Celadonite, fov 4.5 mm



unknown, fov 2 mm

unknown, fov 4.5 mm

Mesolite?, fov 4 mm

Site 3101 continued

Celadonite (green) and iron stained unknown, fov 1.5 mm

unknown on unknown with Celadonite, fov 3 mm

USFS Rd 4630

unknown plate, fov 8 mm

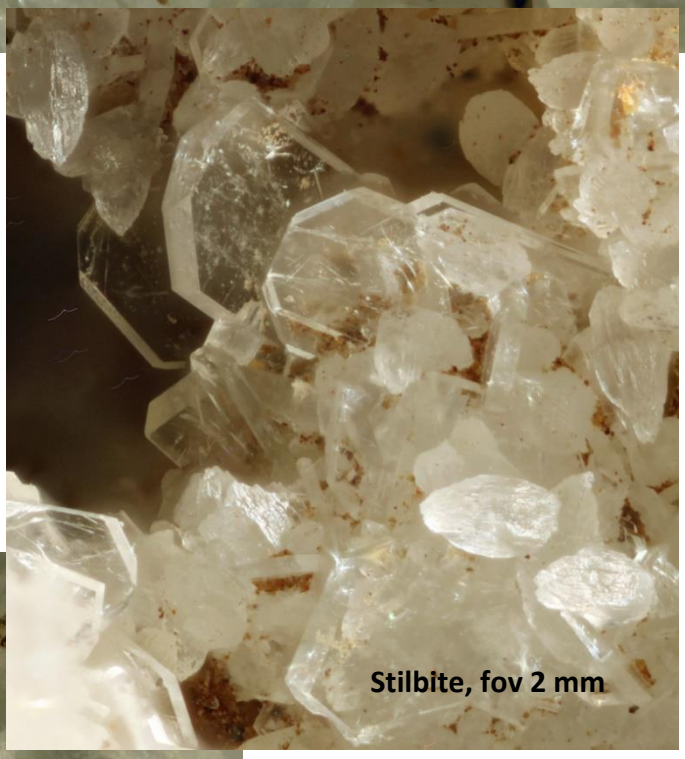
Gismondine, fov 4 mm

unknown, fov 4 mm

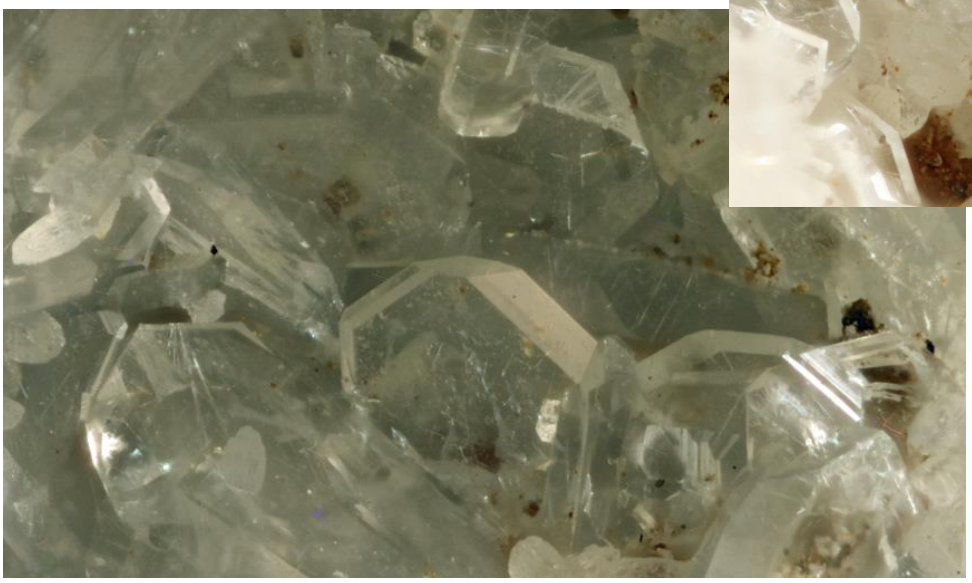
USFS Rd 57 (slump)

Calcite, fov 2 mm

Quartz, fov 2 mm

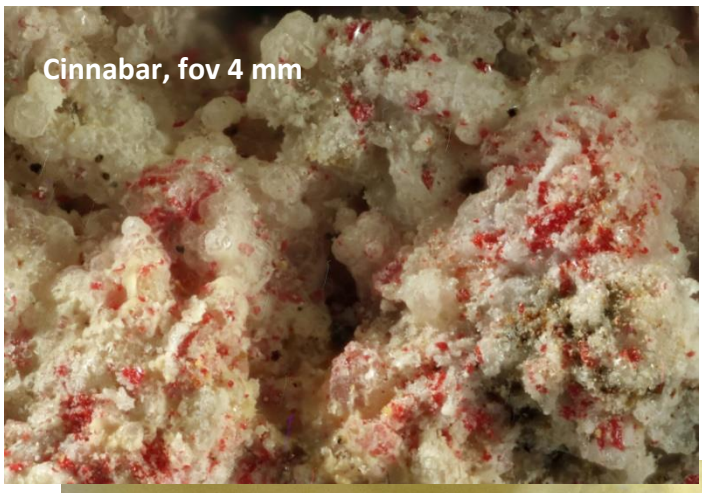


Stilbite, fov 2 mm

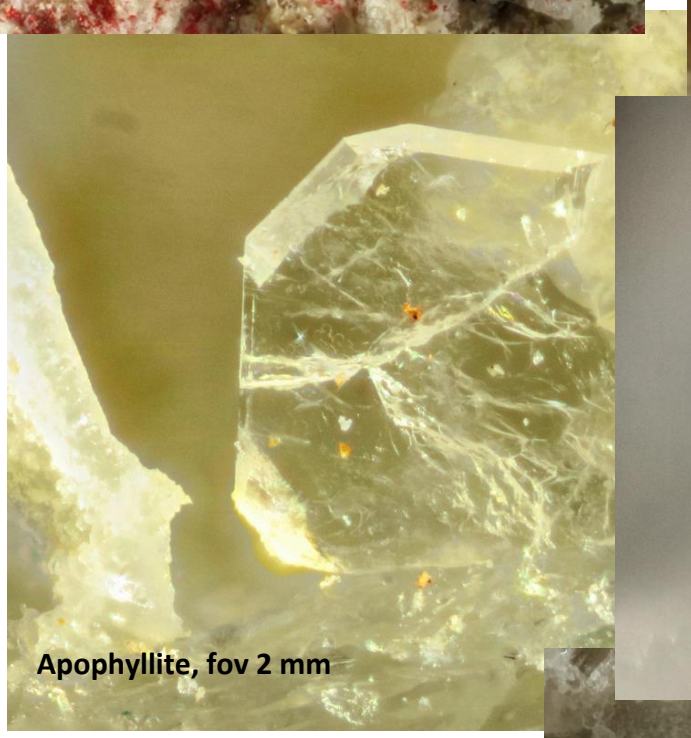


Stilbite, fov 4 mm

Kiggins (Nisbet)

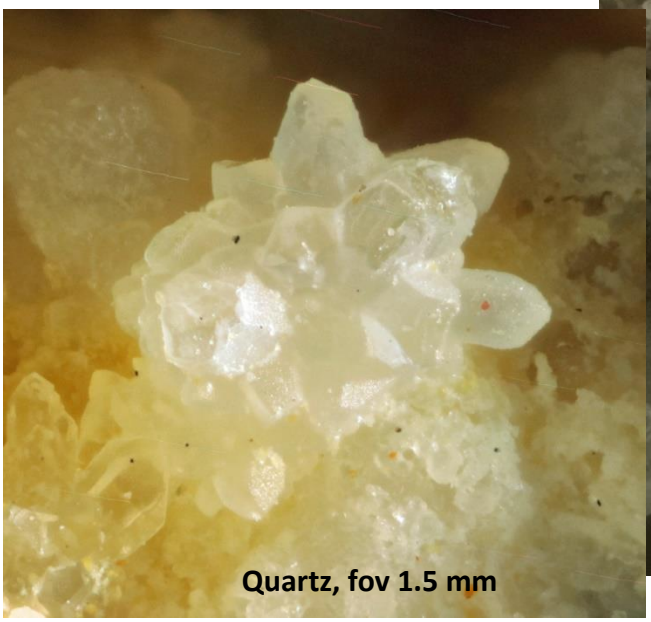

Cinnabar, fov 4 mm


Cinnabar on unknown (note the pink color) , fov 1.5 mm


Apophyllite, fov 2 mm

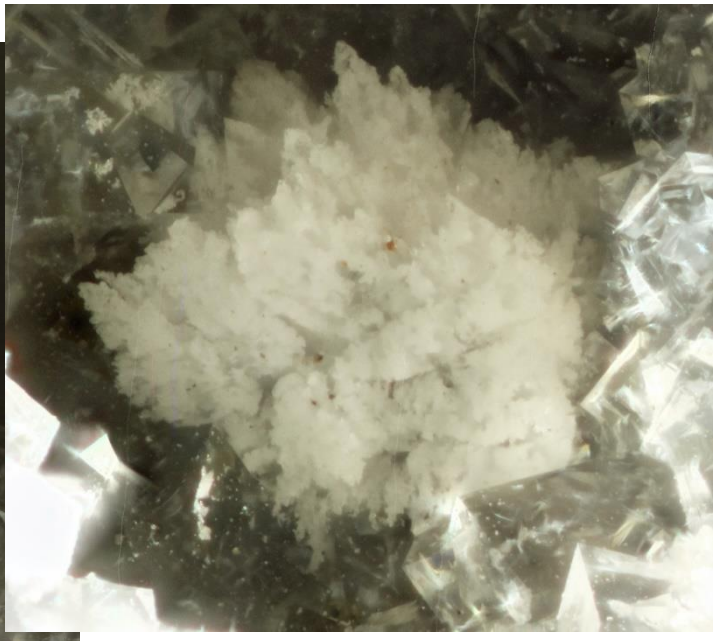

Cinnabar on unknown, fov 1 mm


unknown and Opal, fov 2 mm

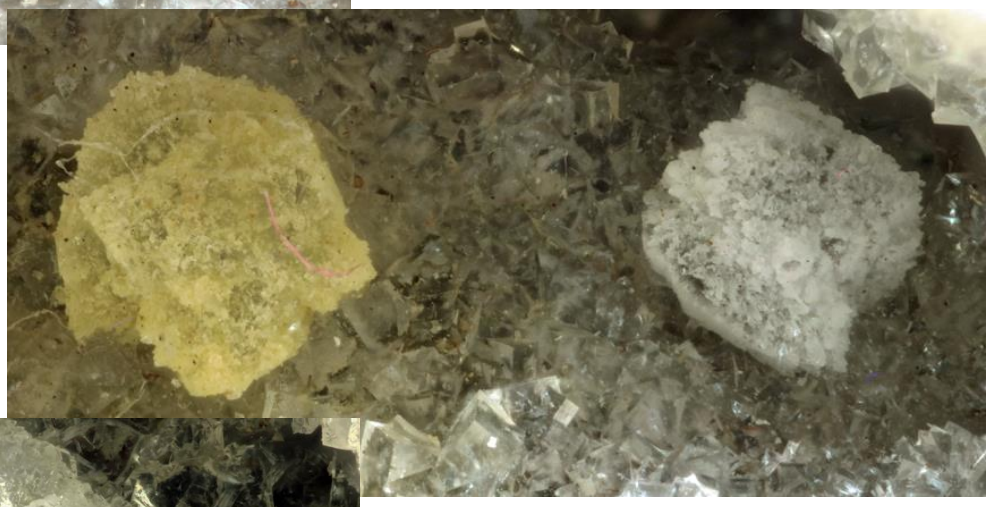

Quartz, fov 1.5 mm

Oak Grove Fork

Gismondine, fov 3 mm



unknown, fov 1.5 mm



Gismondine, fov 4.5 mm

Gismondine, fov 4 mm

Lévyne Boulder

Chabazite and unknown, fov 3 mm

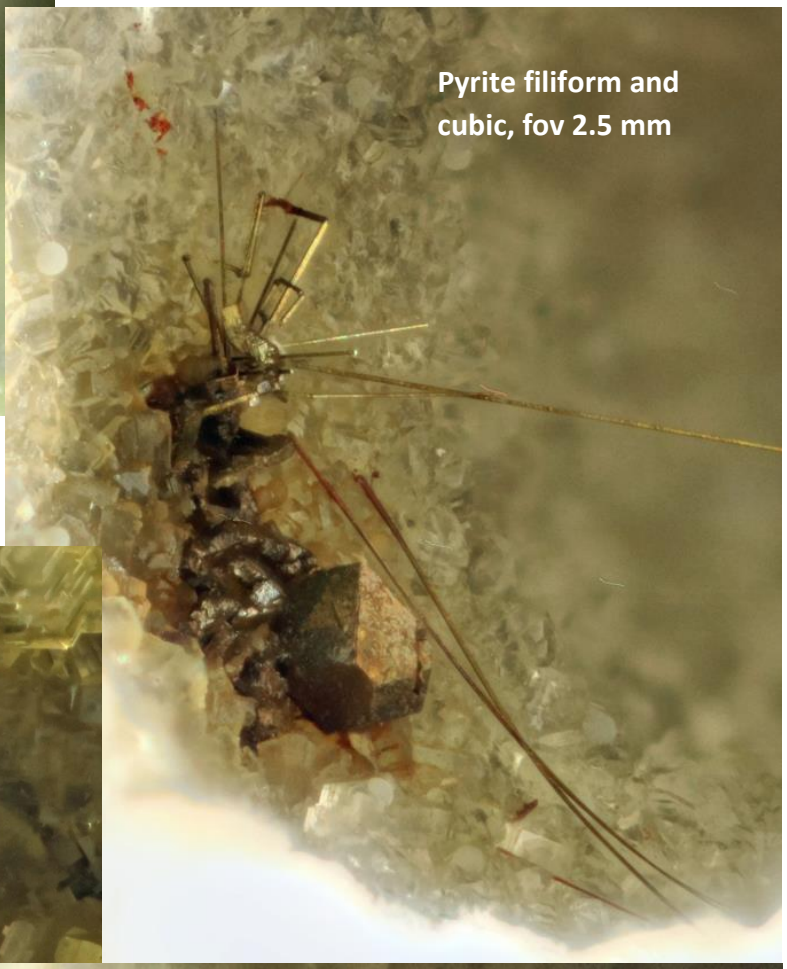
Lévyne and unknown, fov 2 mm

Lévyne, fov 3 mm

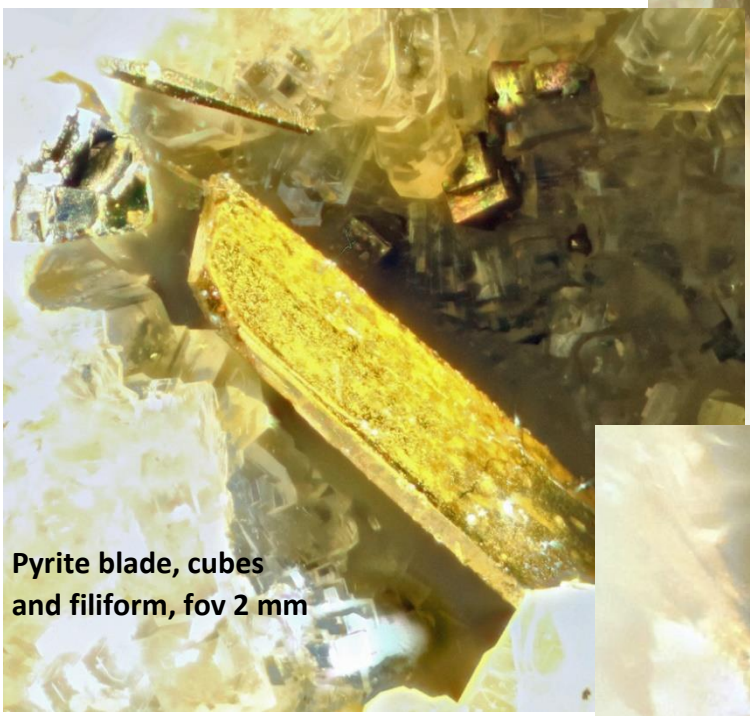
Lévyne, fov 2.25 mm

Route 224 Pyrite (probably Mindat location Estacada Pyrite)

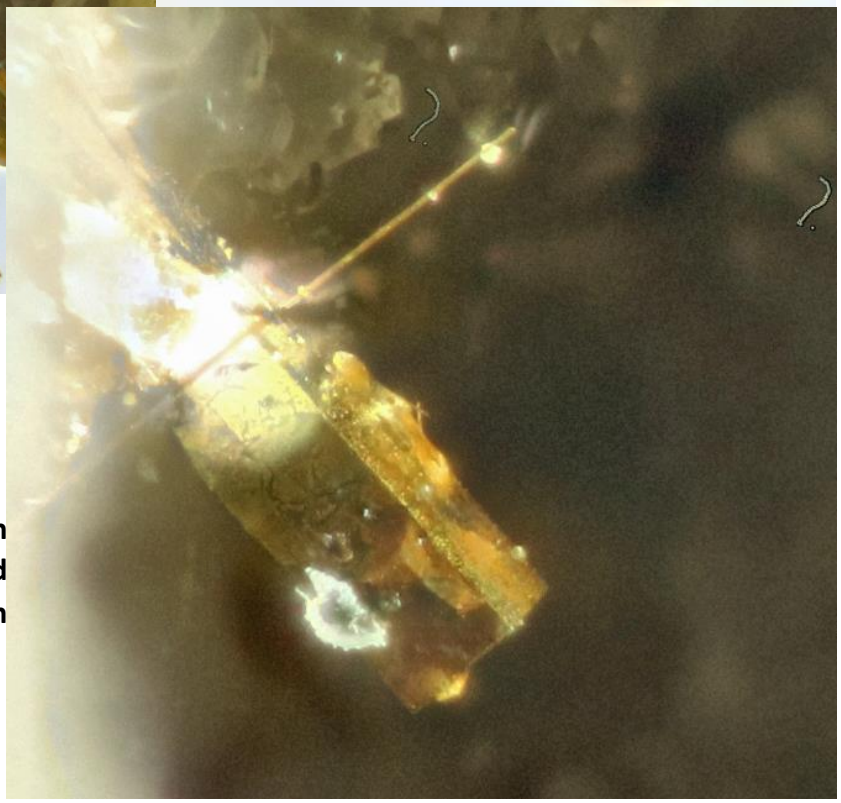
Pyrite filiform, fov 2.5 mm



Pyrite filiform and cubic, fov 2.5 mm

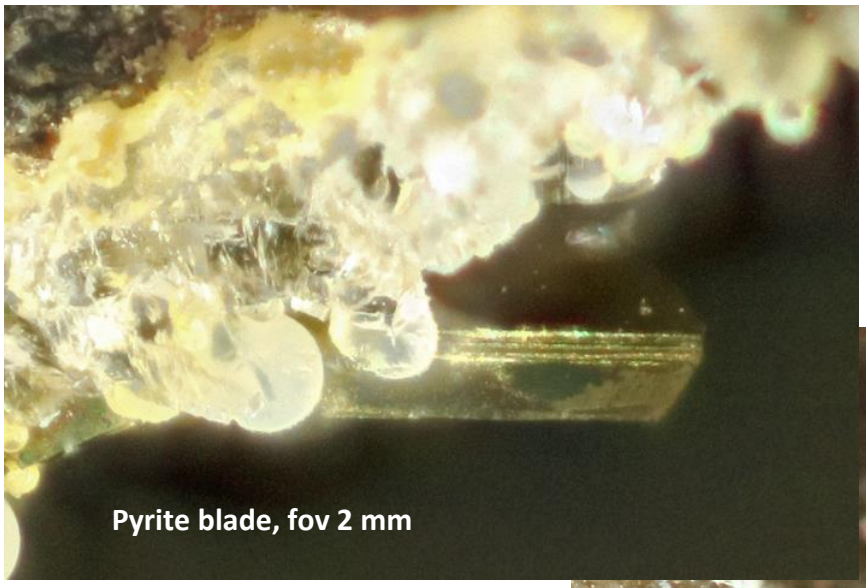


Pyrite blade, cubes and filiform, fov 2 mm

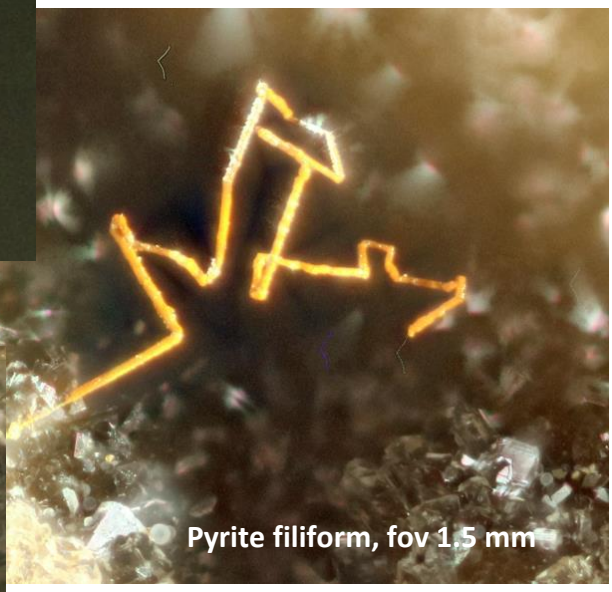


Pyrite blade and needle with Opal or Thomsonite ball and unknown, fov 1.5 mm

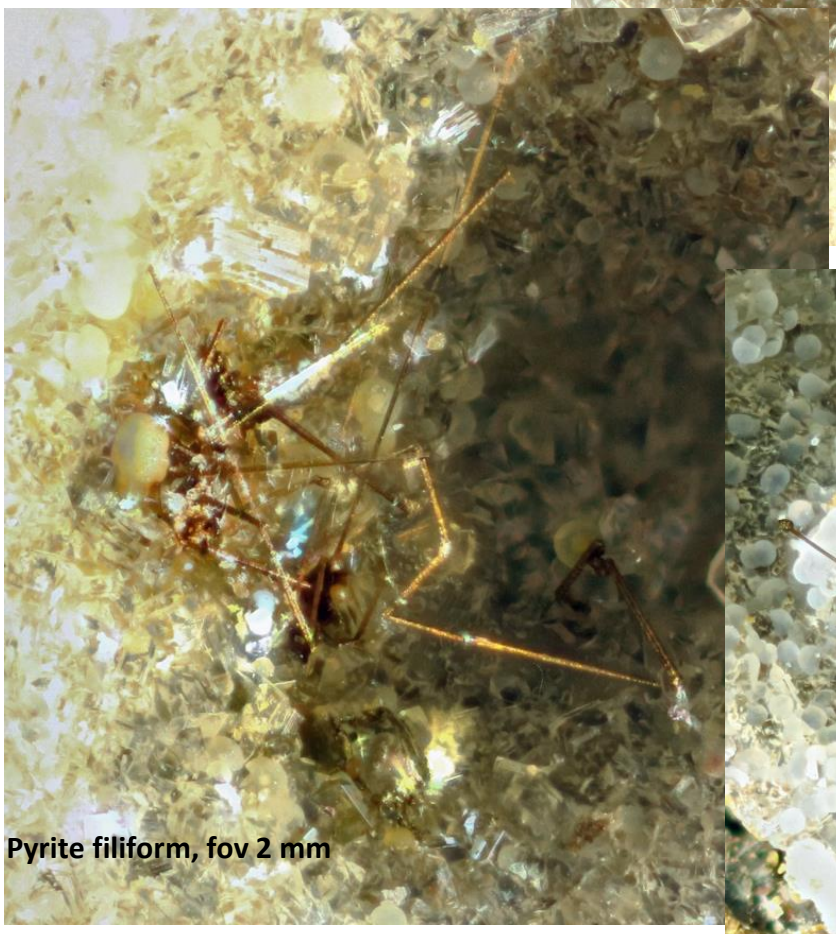
Route 224 Pyrite (probably Mindat location Estacada Pyrite) continued



Pyrite blade, fov 2 mm



Pyrite filiform, fov 1.5 mm



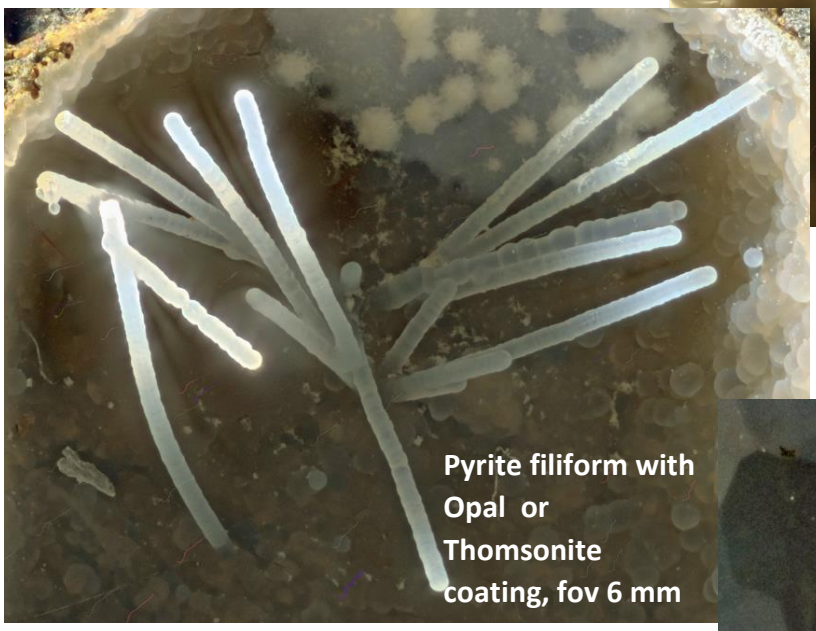
Pyrite filiform, fov 2 mm

Pyrite filiform (note the end of the long needle), fov 2.5 mm

Route 224 Pyrite (probably Mindat location Estacada Pyrite) continued

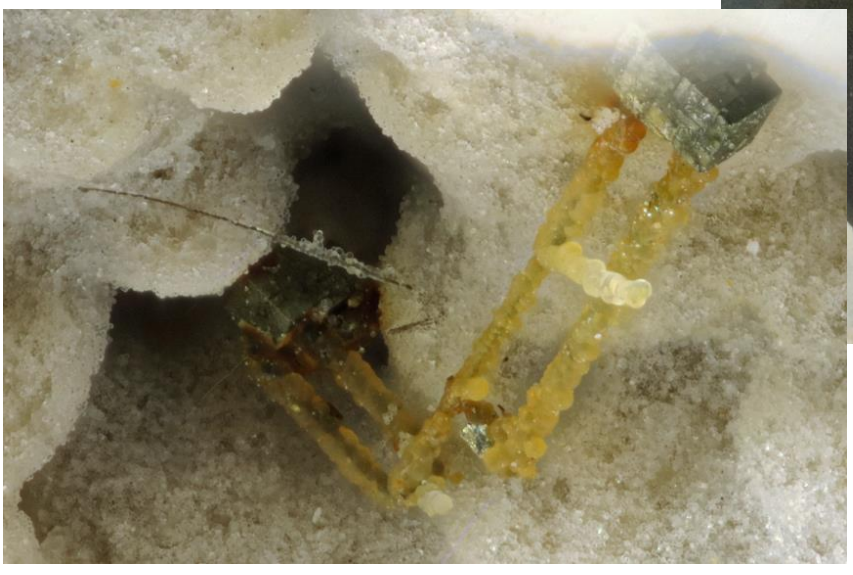
Pyrite filiform with Opal or Thomsonite coating, fov 2 mm

Stilbite?, fov 2 mm



Pyrite filiform with Opal or Thomsonite coating, fov 6 mm

unknown, fov 1.5 mm



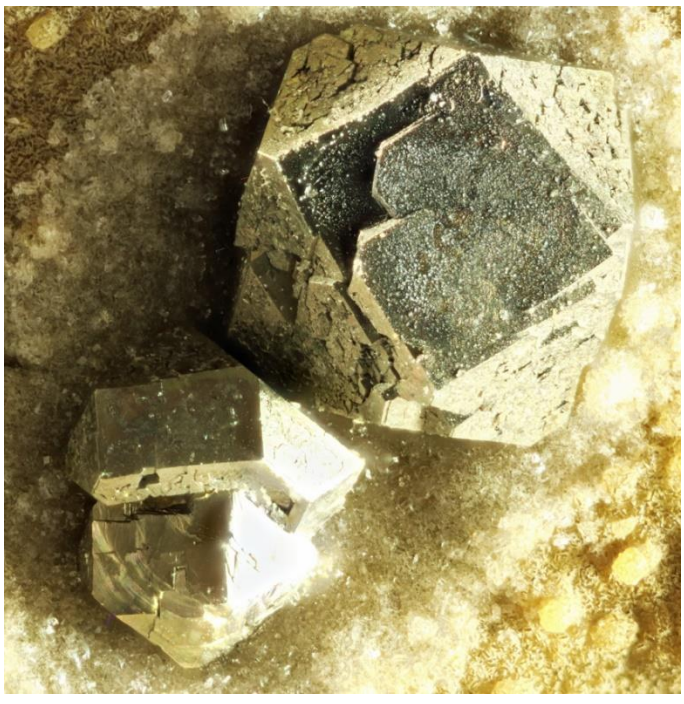
Pyrite filiform with Opal or Thomsonite coating and iron staining, fov 4 mm

Route 224 Pyrite (probably Mindat location Estacada Pyrite) continued

Philipsite?, fov 3.5 mm

Pyrite, fov 7 mm

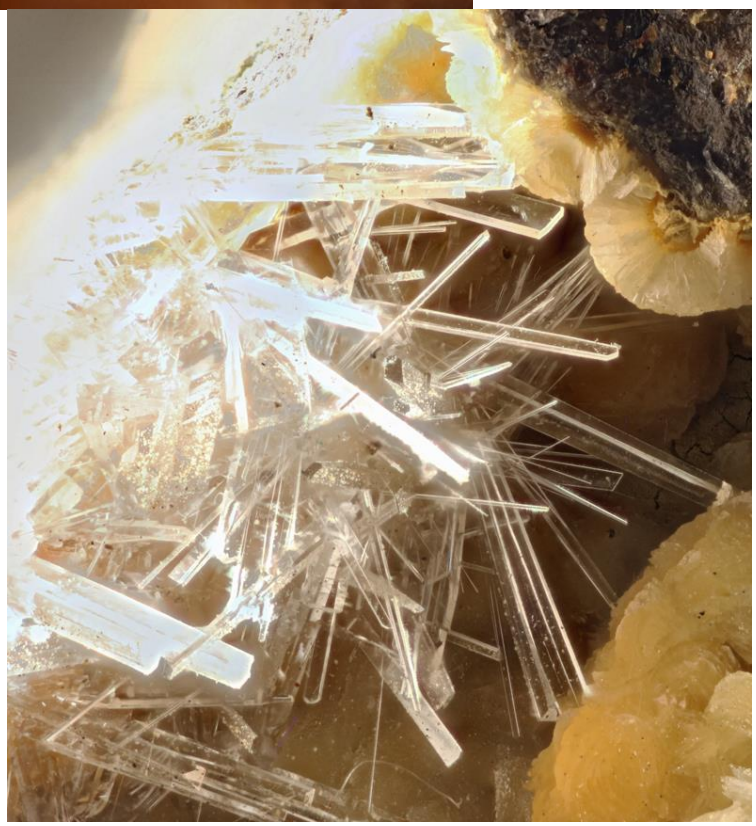
Pyrite, fov 4 mm



Pyrite, fov 5 mm

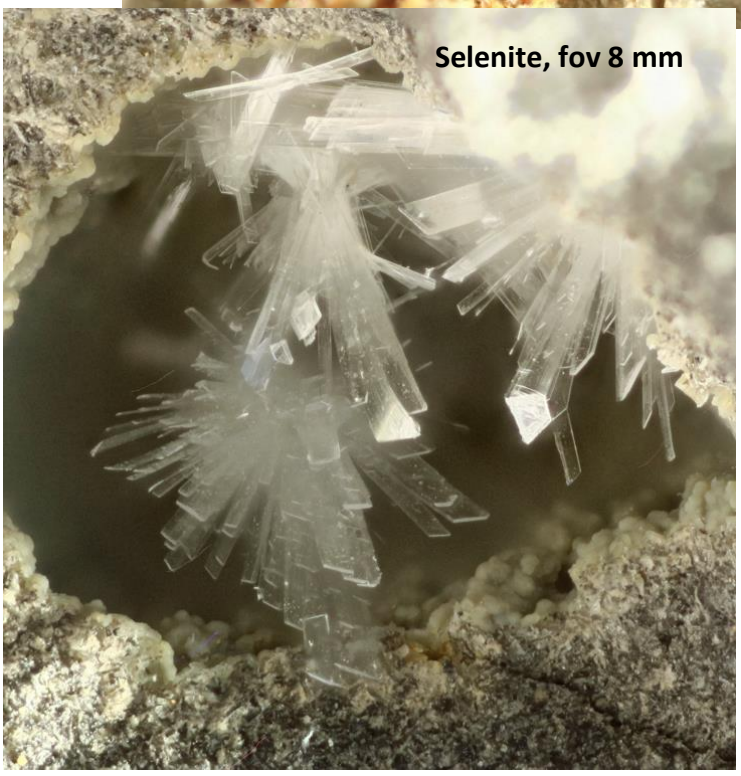
Route 224 Selenite (probably Big Cliff)

Selenite, fov 10 mm



Selenite, fov 8 mm

Route 224 (MP 32) Selenite (probably Big Cliff)



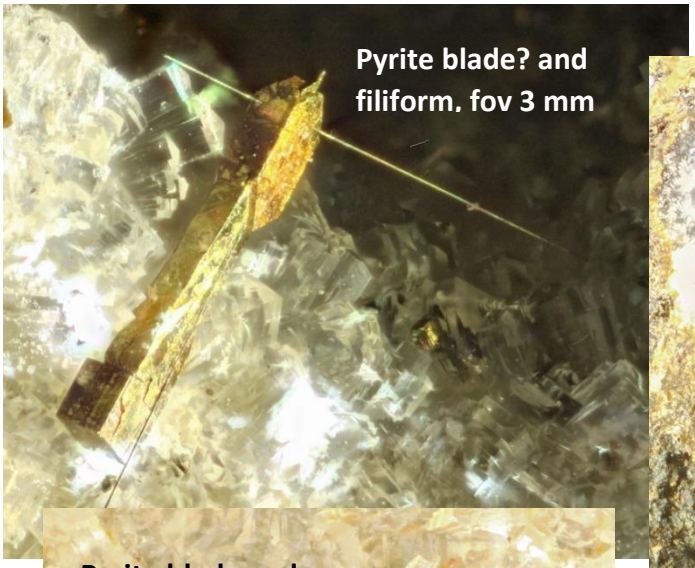
Route 224 MP 40.8

Chabazite, fov 3.5 mm

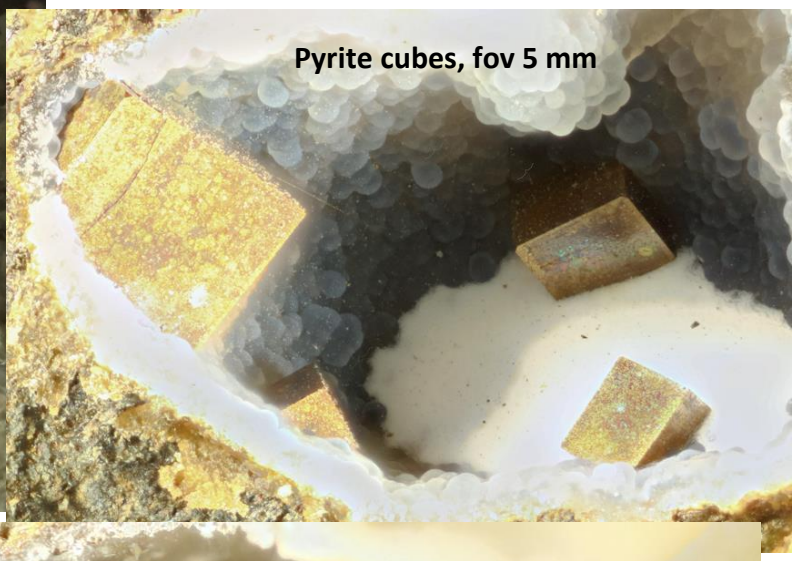
Quartz, fov 7 mm

Chabazite, fov 5 mm

Route 224 MP 40.8 continued

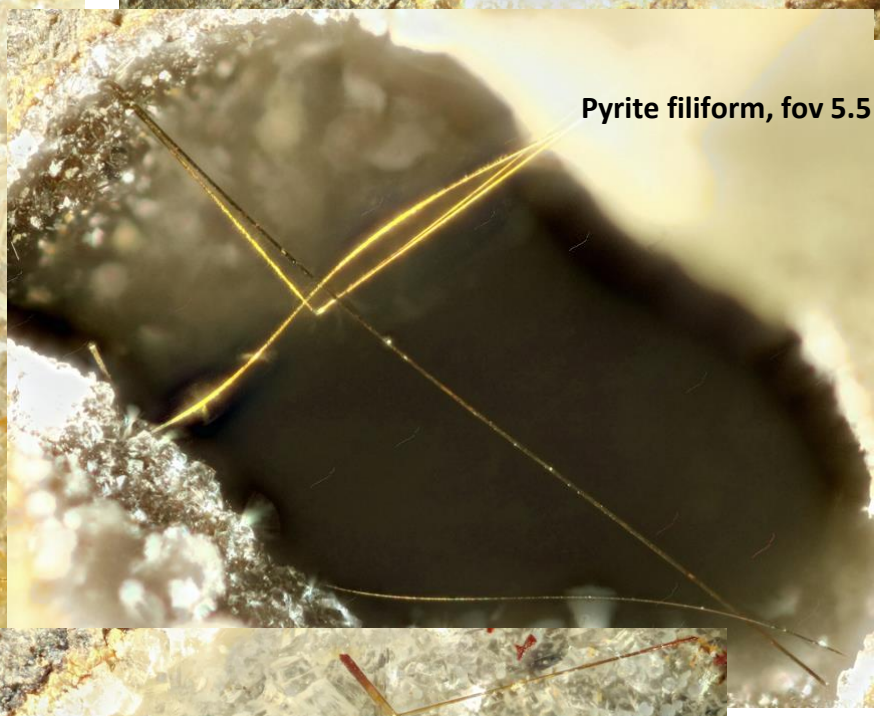


Pyrite blade? and filiform. fov 3 mm



Pyrite cubes, fov 5 mm

Pyrite blade and filiform. fov 1.5 mm



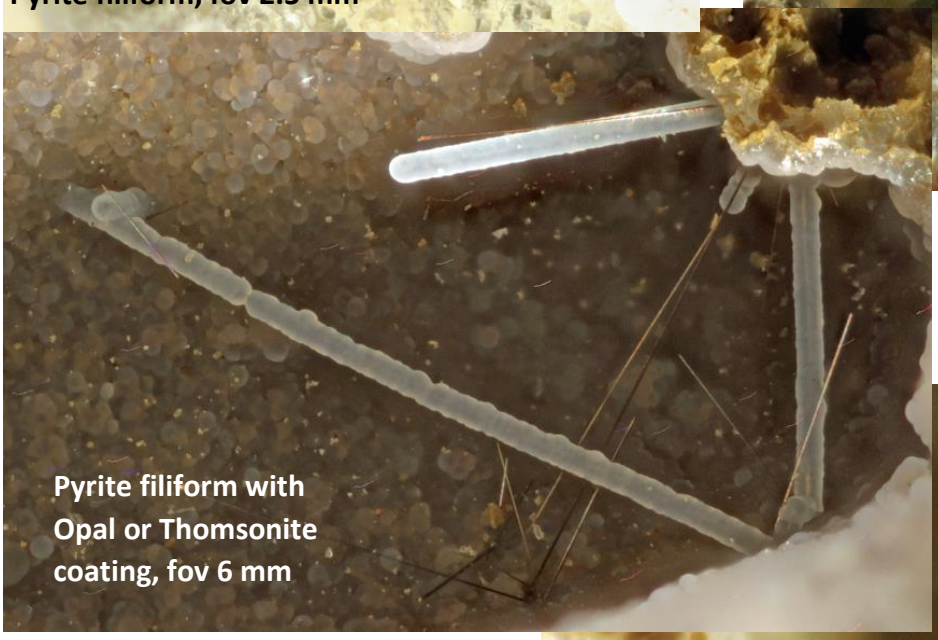
Pyrite filiform, fov 5.5 mm

Pyrite filiform, fov 4 mm

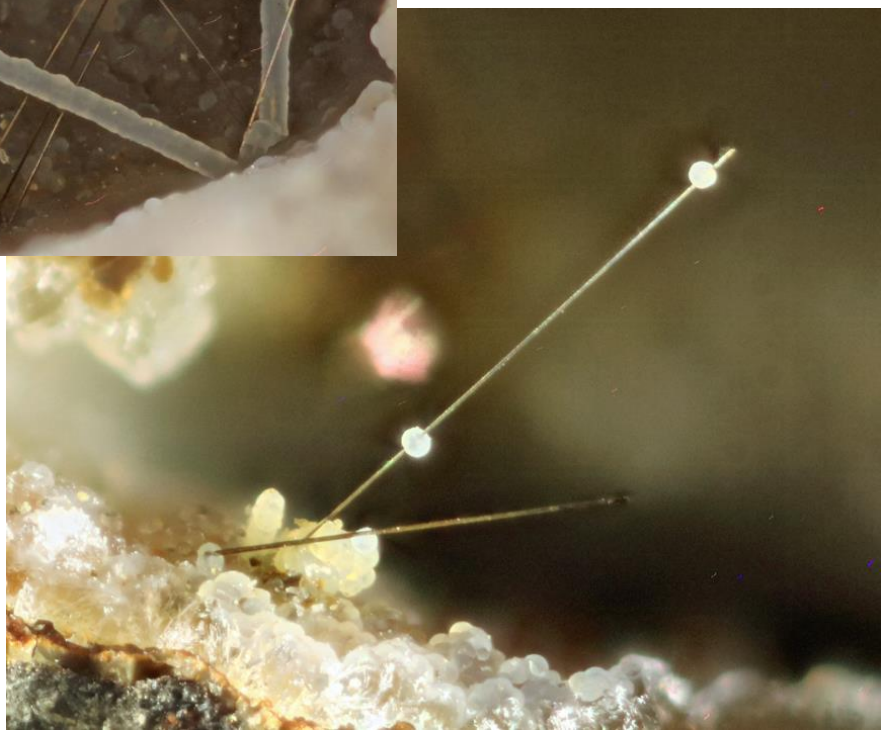
Route 224 MP 40.8 continued

Pyrite filiform, fov 2.5 mm

unknown, fov 1.5 mm

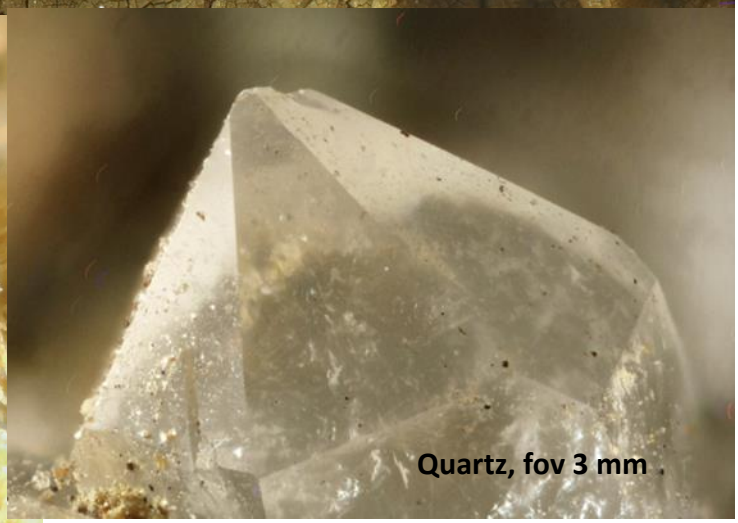


Pyrite filiform with Opal or Thomsonite coating, fov 6 mm

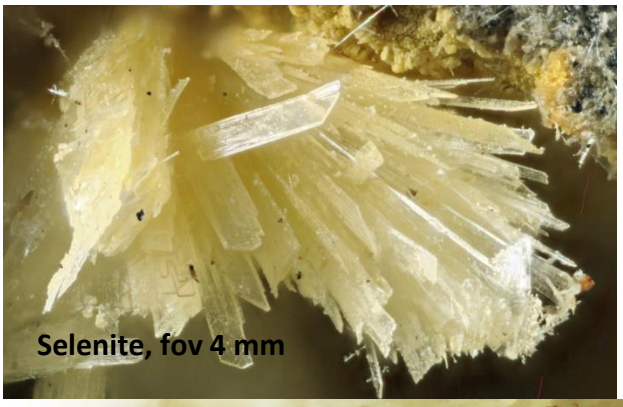


Pyrite filiform with Opal or Thomsonite balls, fov 2.5 mm

Clackamas River Roadcut (exact locations unknown)



Clackamas River (exact locations unknown)



Selenite, fov 4 mm

Augite?, fov 4 mm

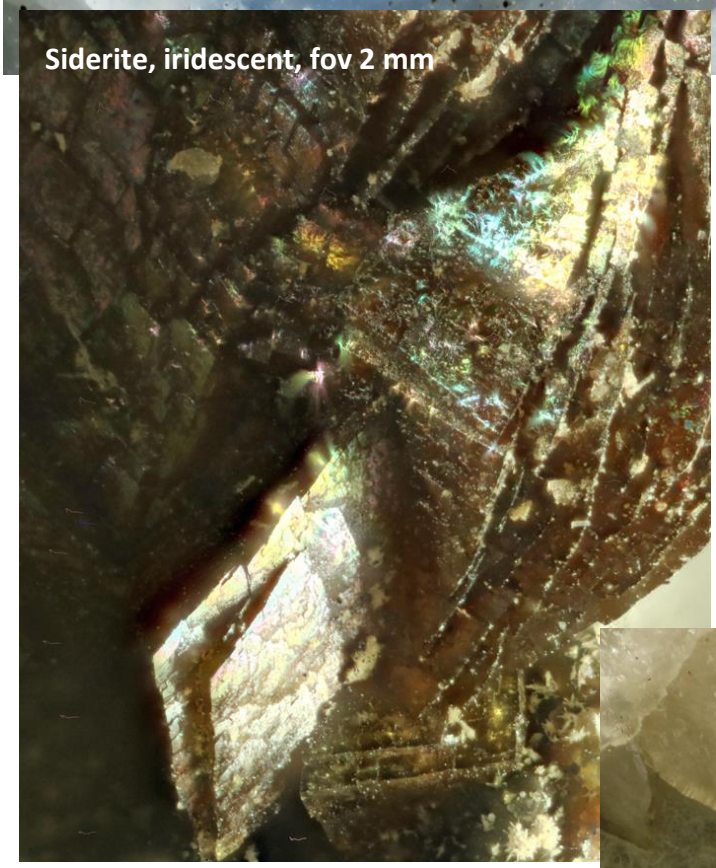
Calcite, fov 4 mm

unknown, fov 2.25 mm

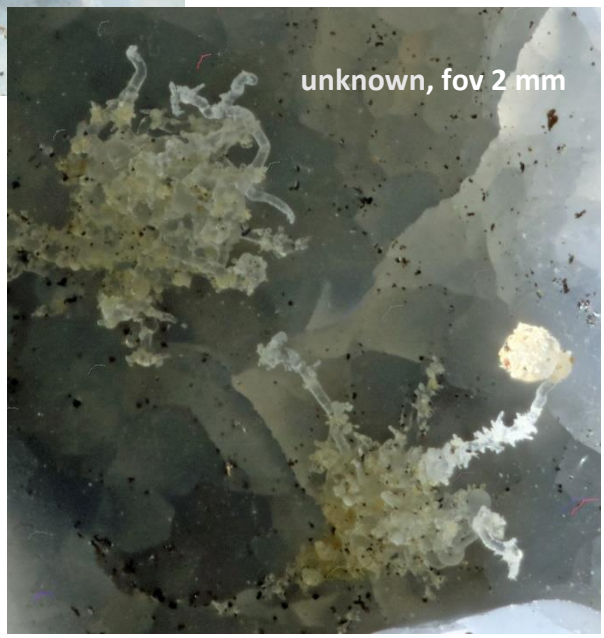
Opal on Siderite, fov 2.5 mm

Clackamas River (exact locations unknown) continued

unknown on Opal, fov 2 mm



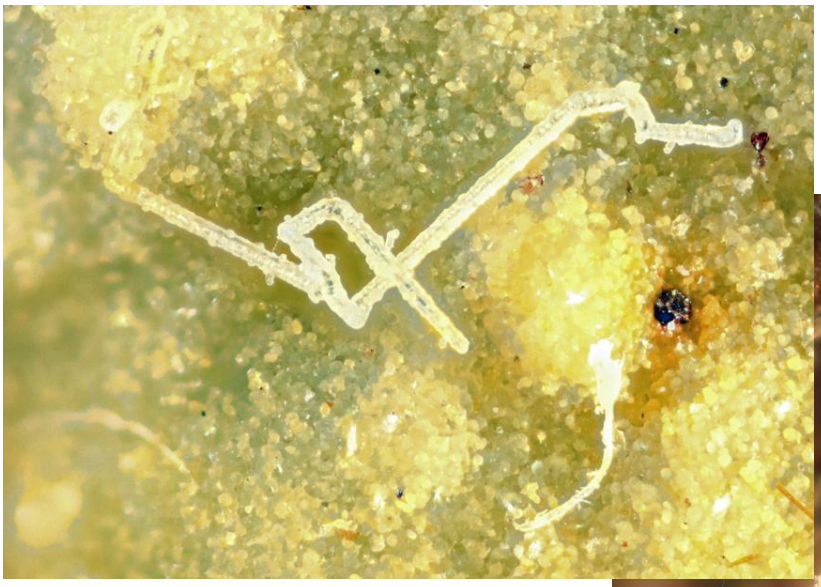
Siderite, iridescent, fov 2 mm



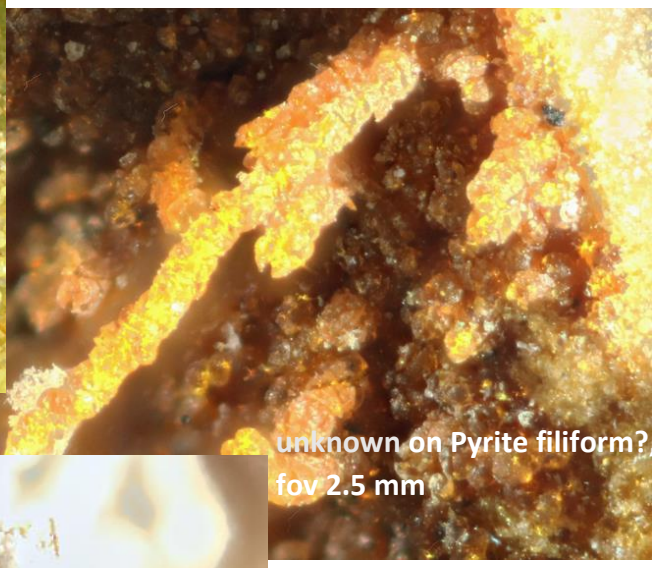
unknown, fov 2 mm

Siderite, fov 4 mm

Clackamas River (exact locations unknown) continued



Pyrite filiform with Opal or Thomsonite coating, fov 2.5 mm



unknown on Pyrite filiform? fov 2.5 mm

Opal on Pyrite filiform?, fov 13 mm

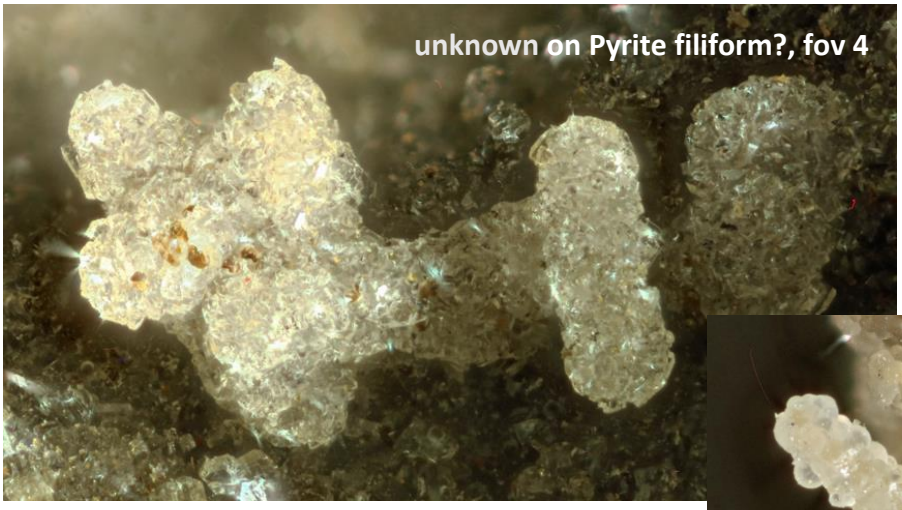
Clay “flowers”?, fov 3.5 mm

Estacada (exact locations unknown)

unknown and Pyrite filiform, fov 1.5 mm

unknown, fov 2.5 mm

Estacada (exact locations unknown) continued



unknown on Pyrite filiform?
and Pyrite filiform, fov 2.5 mm

unknown, fov 1.5 mm

unknown on Pyrite
filiform?, fov 4.5 mm

USFS Rd 57, near rockslide (exact location unknown)

Gismondine, fov 4 mm

Chabazite, fov 2 mm

Gismondine, fov 1.5 mm

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References

Benchmark Maps, Oregon, 2002, Second edition, pages 48-49

Google Maps. [Various gps coordinates in the Clackamas River drainage]. Retrieved September, 2023, from https://maps.google.com

Hammond, P.E., Anderson, J.L., and Manning, K.J., 1980, Guide to the geology of the upper Clackamas and North Santiam Rivers area, northern Oregon Cascade Range, *in* Oles, K.F., Johnson, J.G., Niem, A.R., and Niem, W.A., eds., Geologic field trips in western Oregon and southwestern Washington: Oregon Department of Geology and Mineral Industries Bulletin 101, p. 133-167.

Gladwell, Jon, Crystals & Minerals, Big Cliff, Vol 1: 32-33.
Gladwell, Jon, Crystals & Minerals, Lake Harriet, Vol 2: 12-13.
Gladwell, Jon, Crystals & Minerals, Fish Creek Cut, Vol 3: 24-25.
Gladwell, Jon, Crystals & Minerals, Memaloose, Vol 3: 32-33.
Gladwell, Jon, personal email correspondence

Howard, Don, personal email correspondence
Howard, Don, Carbonate Minerals, Micro Probe, Vol XIII, No. 6, Fall 2022:10-12

Mindat, https://www.mindat.org/loc-298837.html

Niewendorp, C. (2011, March 9). An introduction to the lower & upper Clackamas River Basin: Geology and earth resources [PowerPoint presentation]. Journey Down the Clackamas Conference. Clackamas River Basin Council, Gladstone, OR, United States. https://www.youtube.com/watch?v=W6r--Qpv304
Niewendorp, Clark, personal email correspondence

Reidel, Stephen P., Tolan, Terry L,. 2013,The Grande Ronde Basalt, Columbia River Basalt Group. The Geological Society of America, Special Paper 497,

Siderite Mineral Data, WebMineral.com. Retrieved 15 September 2023.

"Siderite". *Handbook of Mineralogy: Borates, Carbonates, Sulfates (PDF)*. Tucson, Arizona: Mineral Data Publishing. 2003. *ISBN 9780962209741*. Archived from *the original (PDF)* on 13 March 2022. Retrieved 15 September 2023

Siderite. 22 April 2023, at 22:29 (UTC). In Wikipedia: The Free Encyclopedia. Wikimedia Foundation Inc. Encyclopedia on-line. Available from https://en.wikipedia.org/wiki/Siderite. Internet. Retrieved 15 September 2023.

Tompkins, Bill (2001) MicroProbe: 9(9), Spring 2001: 6-13
Tompkins, Bill, Siderite along the Clackamas River, Oregon, 2010
https://www.mindat.org/article.php/920/Siderite+Along+the+Clackamas+River%2C+Oregon

Tschernich, Rudy W. (1992) *Zeolites of the World*. Geoscience Press, Inc., Phoenix, Arizona. 567pp.