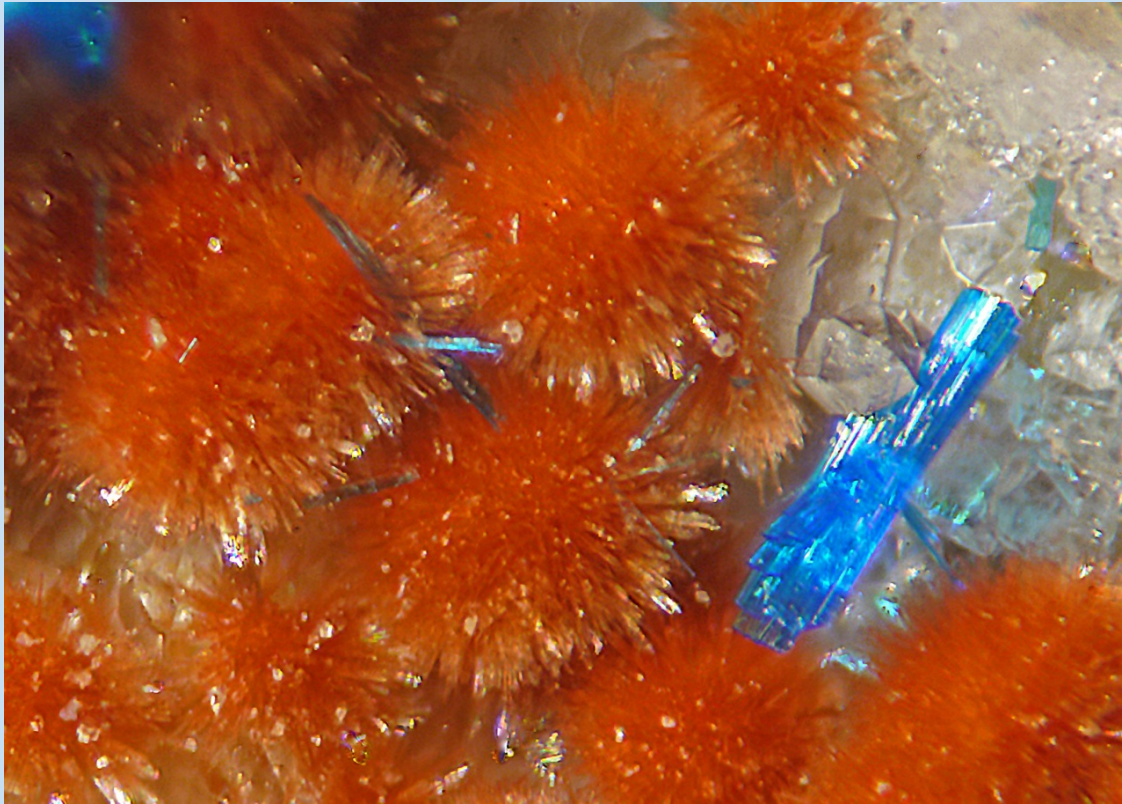


Copper Silicates of Arizona



Michael J Pabst

SVGMS

September 12, 2016

Copper Silicates

- World-wide, there are 39 approved copper silicates listed on Mindat.
- 18 copper silicates can be found in Arizona.
- 14 of these Arizona copper silicates can be found in just 3 mines.
 - Christmas Mine: 7
 - Mammoth-St. Anthony Mine: 7
 - New Cornelia Mine: 4

Localities for Copper Silicates in Arizona

- **Christmas Mine, Banner District, Gila County, AZ**
 - Apachite, Chrysocolla, Diopase, Gilalite, Kinoite, Stringhamite, Whelanite (and Ruizite - Mn)
- **New Cornelia Mine, Ajo, Pima County, AZ**
 - Ajoite, Chrysocolla, Papagoite, Shattuckite (but no Diopase!)
- **Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ**
 - Creaseyite, Bobmeyerite (Cu?), Diopase, Iranite, Macquartite, Plancheite, Wherryite
- **Rowley Mine, Theba, Painted Rock, Maricopa County, AZ**
 - Ashburtonite
- **Shattuck Mine, Bisbee, Warren District, Cochise County, AZ**
 - Shattuckite
- **Rawhide Mine, Artillery Mountains, Mojave County, AZ**
 - Luddenite
- **Copper Creek, Bunker Hill District, Pinal County, AZ**
 - Ajoite (compact)
- **Rat Tail Claim, Wickenburg, Maricopa County, AZ**
 - Hemihedrite-Iranite

Copper Silicates from Arizona

Mineral	Locality	Formula	System
Ajoite	New Cornelia Mine, Ajo, Pima County, AZ	$(K,Na)Cu_7AlSi_9O_{24}(OH)_6 \cdot 3H_2O$	triclinic
Apachite	Christmas Mine, Banner District, Gila County, AZ	$Cu_9Si_{10}O_{29} \cdot 11H_2O$	monoclinic
Ashburtonite	Rowley Mine, Theba, Painted Rock, Maricopa County, AZ	$Pb_4Cu_4(Si_4O_{12})(HCO_3)_4(OH)_3Cl \cdot H_2O$	tetragonal
Chrysocolla	New Cornelia Mine, Ajo, Pima County, AZ	$(Cu,Al)_2(H_2Si_2O_5)(OH)_4 \cdot nH_2O$	orthorhombic
Creaseyite	Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ	$Pb_2Cu_2Fe^{3+}_2(Si,Al)_5O_{15}(OH)_3 \cdot H_2O$	orthorhombic
Diopase	Christmas Mine, Banner District, Gila County, AZ	$CuSiO_3 \cdot H_2O$	trigonal
Gilalite	Christmas Mine, Banner District, Gila County, AZ	$Cu_5Si_6O_{17} \cdot 7H_2O$	monoclinic
Iranite - Hemihedrite	Rat Tail Claim, Wickenburg, Maricopa Co., AZ	$Pb_{10}Cu(CrO_4)(SiO_4)(OH)_2$	triclinic
Kinoite	Christmas Mine, Banner District, Gila County, AZ	$Ca_2Cu_2(H_2O)_2[Si_3O_{10}]$	monoclinic
Luddenite	Rawhide mine, Artillery Mts, Mohave County, AZ	$Cu_2Pb_2Si_5O_{14} \cdot 4H_2O$	monoclinic
Macquartite	Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ	$Cu_2Pb_7(CrO_4)_4(SiO_4)_2(OH)_2$	monoclinic
Papagoite	New Cornelia Mine, Ajo, Pima County, AZ	$CaCu[H_3AlSi_2O_9]$	monoclinic
Plancheite	Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ	$Cu_8(Si_8O_{22})(OH)_4 \cdot H_2O$	orthorhombic
Shattuckite	Shattuck Mine, Bisbee, Warren District, Cochise County, AZ	$Cu_5(Si_2O_6)_2(OH)_2$	monoclinic
Stringhamite	Christmas Mine, Banner District, Gila County, AZ	$CaCu(SiO_4) \cdot H_2O$	monoclinic
Whelanite	Christmas Mine, Banner District, Gila County, AZ	$Ca_5Cu^{2+}_2(OH)_2CO_3[Si_6O_{17}] \cdot 4H_2O$	orthorhombic
Wherryite	Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ	$Pb_7Cu_2(SO_4)(SiO_4)_2(OH)_2$	monoclinic

Ajoite (green-blue)
Calcite (colorless)

Photo by Michael Pabst
FOV 7 mm



Ajoite

New Cornelia Mine, Ajo, Pima County, AZ

$(\text{K}, \text{Na})\text{Cu}_2\text{AlSi}_6\text{O}_{14}(\text{OH})_2 \cdot 3\text{H}_2\text{O}$

Ajoite

Photo by Michael Pabst
FOV 10 mm



Ajoite

Copper Creek, Bunker Hill District, Pinal County, AZ

$(\text{K}, \text{Na})\text{Cu}_7\text{AlSi}_6\text{O}_{24}(\text{OH})_6 \cdot 3\text{H}_2\text{O}$

Apachite (blue) and
Gilalite (green)

Photo by Michael Pabst
FOV 11 mm



Apachite

Christmas Mine, Banner District, Gila County, AZ

$\text{Cu}_0\text{Si}_{10}\text{O}_{20}\cdot 11\text{H}_2\text{O}$

Apachite (blue)
Gilalite (green)
Apophyllite (colorless)

Photo by Michael Pabst
FOV 1.5 mm



Apachite

Christmas Mine, Banner District, Gila County, AZ

$\text{Cu}_0\text{Si}_{10}\text{O}_{20}\cdot 11\text{H}_2\text{O}$

Ashburtonite

Photo by Pierre Clolus
FOV 0.6 mm



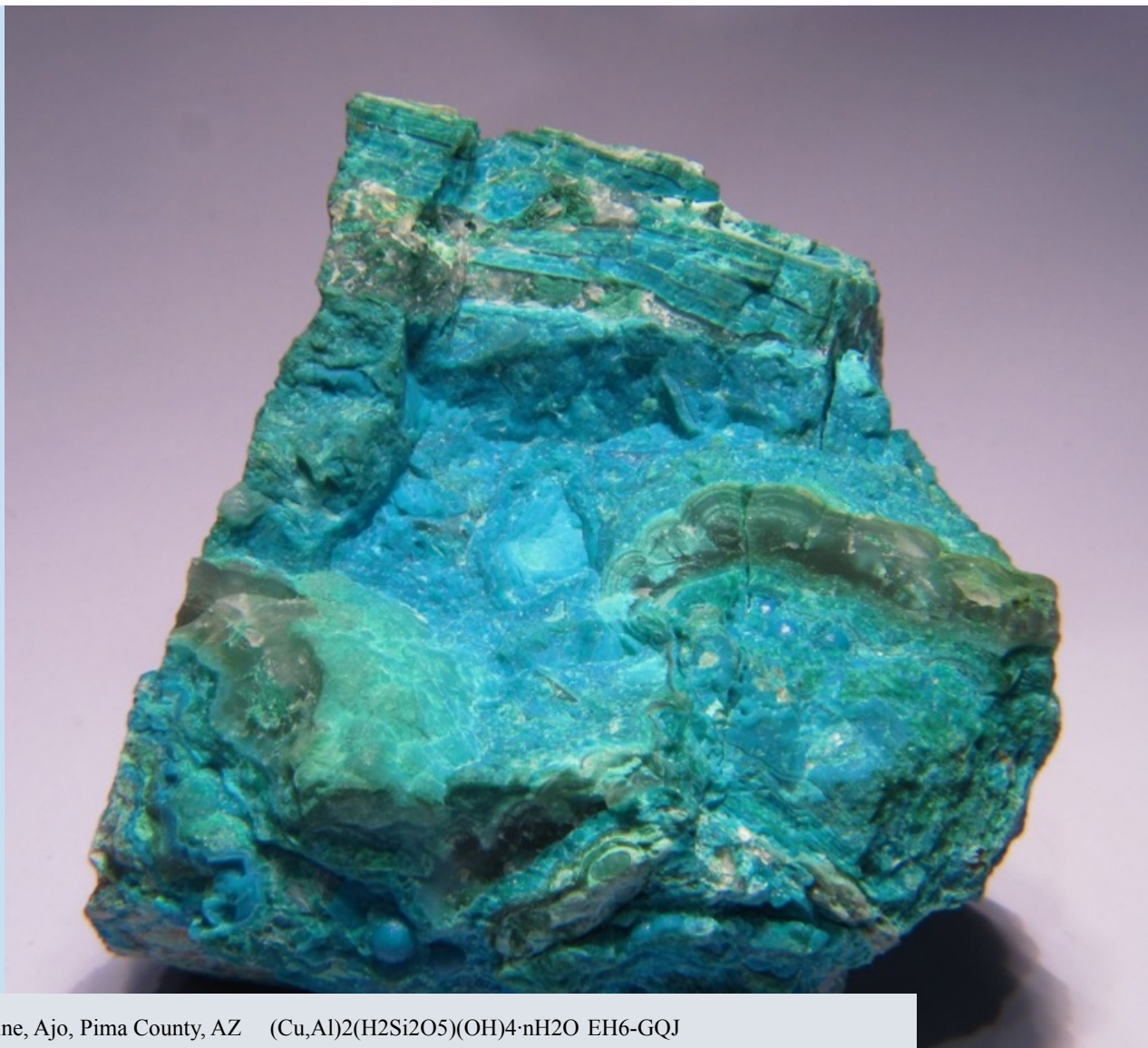
Ashburtonite

Rowley Mine, Theba, Painted Rock, Maricopa County, AZ

$\text{Pb}_2\text{Cu}_4(\text{Si}_4\text{O}_{13})(\text{HCO}_3)_4(\text{OH})_2\text{Cl}\cdot\text{H}_2\text{O}$

Chrysocolla

Photo by Mindat
FOV 50 mm



Chrysocolla, New Cornelia Mine, Ajo, Pima County, AZ $(\text{Cu,Al})_2(\text{H}_2\text{Si}_2\text{O}_5)(\text{OH})_4 \cdot n\text{H}_2\text{O}$ EH6-GQJ

orthorhombic

Creaseyite with Mimetite

Photo by Linda Smith
FOV 2.7 mm



Creaseyite

Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ

$\text{Pb}_2\text{Cu}_2\text{Fe}^{3+}_3(\text{Si}_2\text{O}_7)_2(\text{OH})_2 \cdot \text{H}_2\text{O}$

Dioptase (green) and
Cerussite (colorless)

Photo by Michael Pabst
FOV 6 mm



Dioptase

Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ

$\text{CuSiO}_3 \cdot \text{H}_2\text{O}$

Dioptase (green) and
Cerussite (colorless)

Photo by Michael Pabst
FOV 8 mm



Dioptase

Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ

$\text{CuSiO}_3 \cdot \text{H}_2\text{O}$

Dioptase (green)
Fluorite (colorless)
Wulfenite (orange)

Photo by Michael Pabst
FOV 4 mm



Diopside (blue-green)
Malachite (green)

Photo by Michael Pabst
FOV 3 mm



Diopside

Christmas Mine, Banner District, Gila County, AZ

$\text{CuSiO}_3 \cdot \text{H}_2\text{O}$

Dioptase (green)
on
Kinoite (blue)
Apophyllite (colorless)

Photo by Michael Pabst
FOV 3 mm



Dioptase

Christmas Mine, Banner District, Gila County, AZ

$\text{CuSiO}_3 \cdot \text{H}_2\text{O}$

Diopside (green)

Unknown (light green)

Chrysocolla?

Gilalite?

Pseudomorph after ??

Photo by Michael Pabst

FOV 24 mm



Diopside + Unknown??

Christmas Mine, Gila County, AZ

$\text{CuSiO}_3 \cdot \text{H}_2\text{O}$

Dioptase (green)
Apophyllite (colorless)

Photo by Michael Pabst
FOV 6 mm



Dioptase

Christmas Mine, Banner District, Gila County, AZ

$\text{CuSiO}_3 \cdot \text{H}_2\text{O}$

Gilalite (green caterpillar)
Cuprite (red eyes)

Photo by Michael Pabst
FOV 3 mm



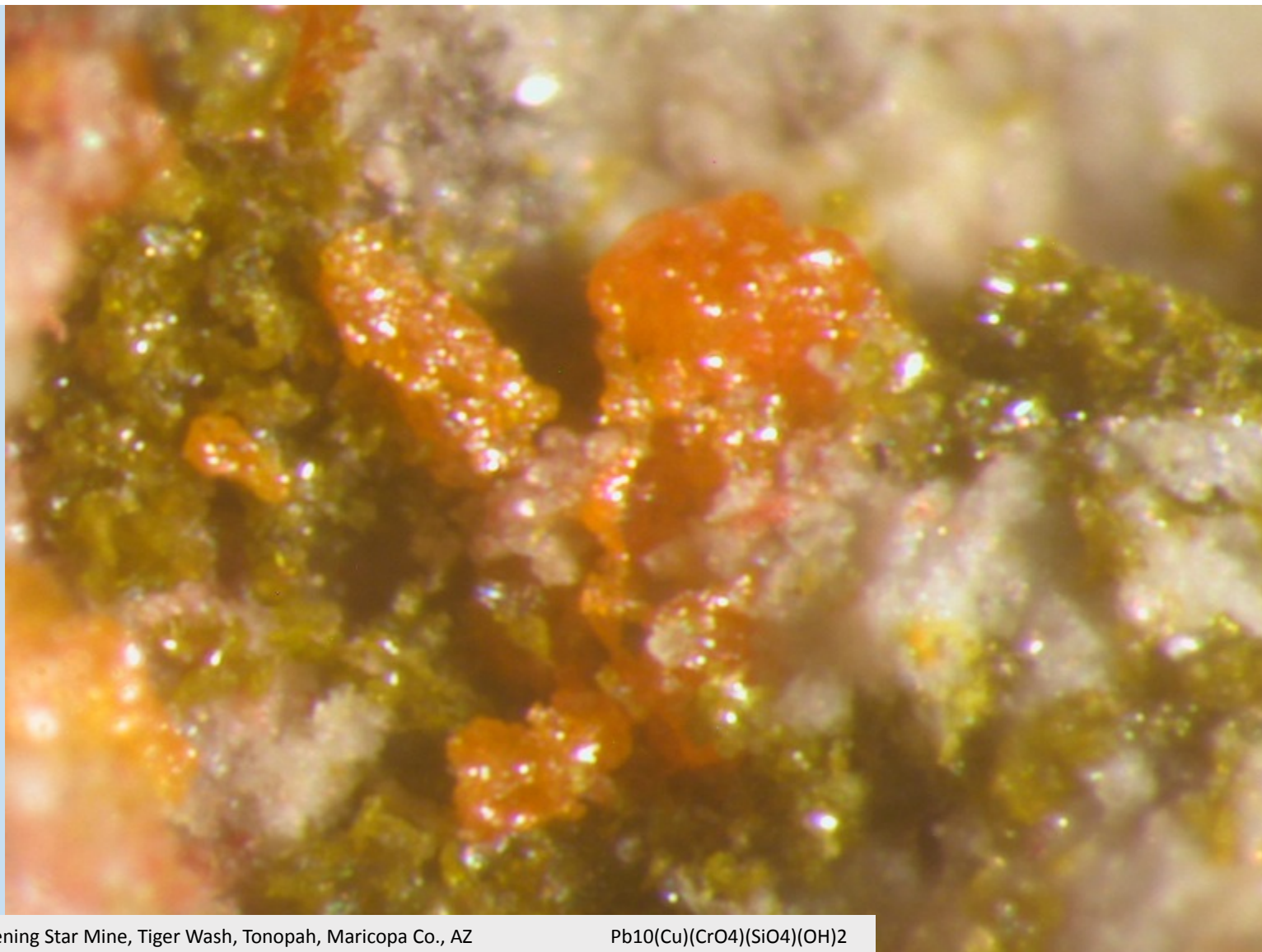
Gilalite

Christmas Mine, Banner District, Gila County, AZ

$\text{Cu}_5\text{Si}_4\text{O}_{17} \cdot 7\text{H}_2\text{O}$

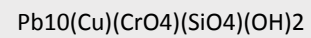
Iranite (orange)
Fornacite (yellow)
Wickenburgite (colorless)

Photo by Brent Thorne
FOV 1 mm



Iranite

Evening Star Mine, Tiger Wash, Tonopah, Maricopa Co., AZ



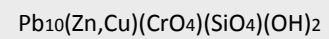
Hemihedrite – Iranite series
Zn²⁺ -- Cu²⁺

Photo by Michael Pabst
FOV 1.5 mm



Hemihedrite-Iranite

Rat Tail Claim, Wickenburg, Maricopa Co., AZ



Gilalite (green balls)
Junitoite (lilac and colorless)
Kinoite (blue)

Photo by Michael Pabst
FOV 4 mm

Halogen Light



Gilalite

Christmas Mine, Banner District, Gila County, AZ

$\text{Cu}_5\text{Si}_4\text{O}_{17} \cdot 7\text{H}_2\text{O}$

Gilalite (green balls)
Junitoite (lilac and colorless)
Kinoite (blue)

Photo by Michael Pabst
FOV 5 mm

LED Light



Kinoite (blue)
Apophyllite (colorless)

Photo by Michael Pabst
FOV 2 mm



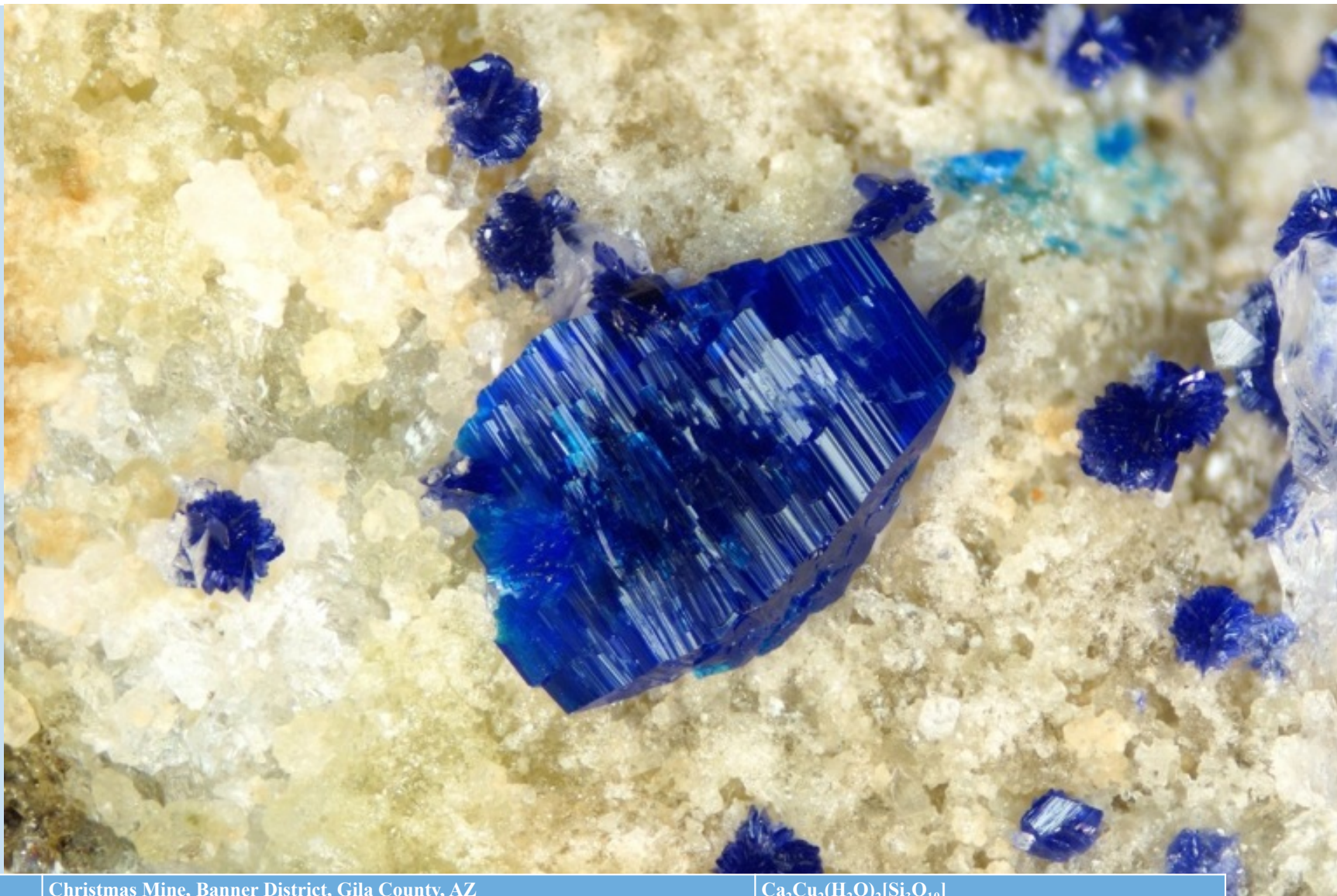
Kinoite

Christmas Mine, Banner District, Gila County, AZ

$\text{Ca,Cu}_2(\text{H}_2\text{O})_2[\text{Si}_2\text{O}_6]$

Kinoite

Photo by
Stephen Wolfsried
FOV 3 mm



Kinoite

Christmas Mine, Banner District, Gila County, AZ

$\text{Ca}_2\text{Cu}_2(\text{H}_2\text{O})_2[\text{Si}_2\text{O}_6]$

Kinoite (blue)
Ruizite (orange)
(Manganese Silicate)
Apophyllite (colorless)

Photo by Michael Pabst
FOV 18 mm



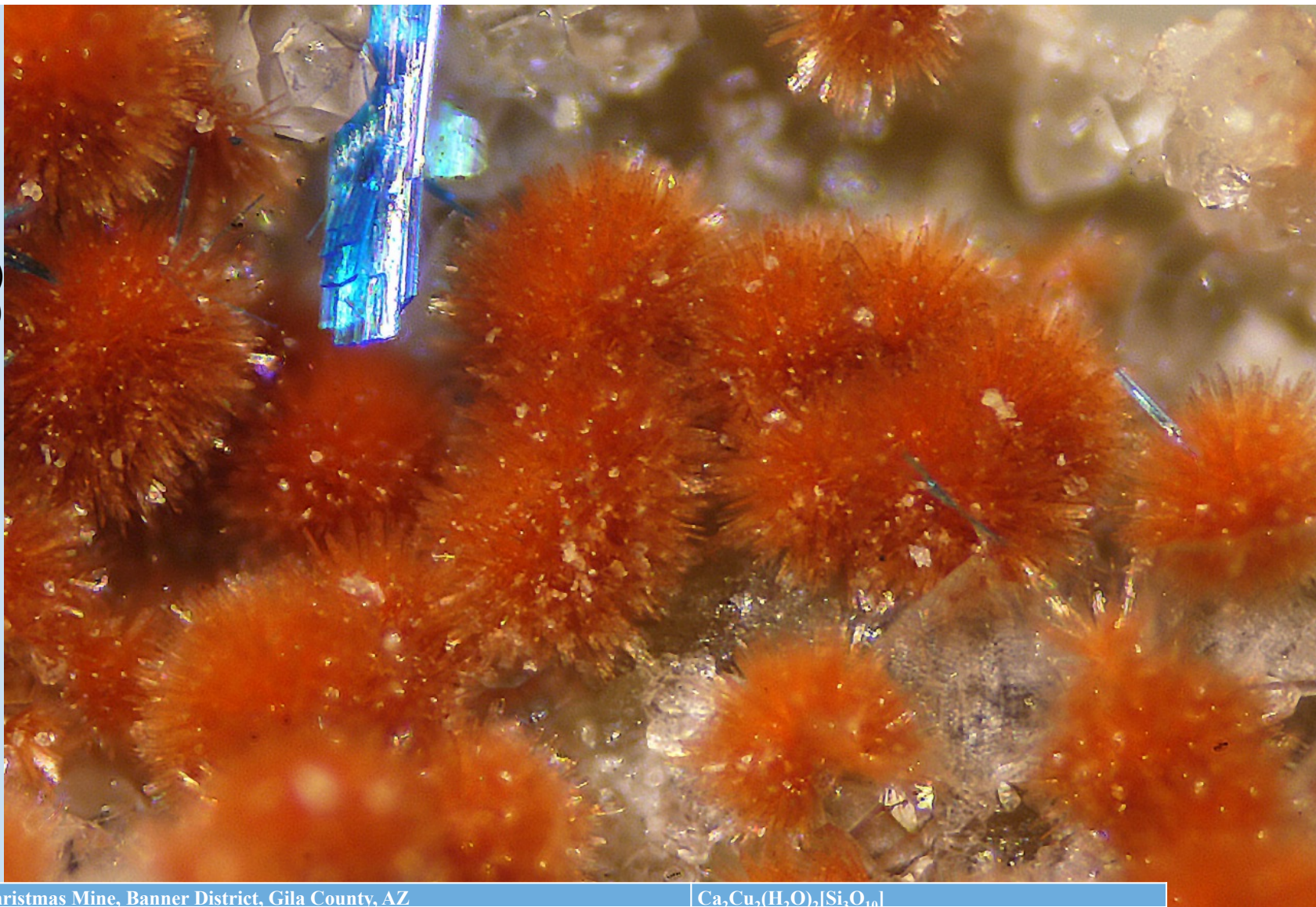
Kinoite

Christmas Mine, Banner District, Gila County, AZ

$\text{Ca,Cu}_2(\text{H}_2\text{O})_2[\text{Si}_2\text{O}_6]$

Kinoite (blue)
Ruizite (orange)
(Manganese Silicate)
Apophyllite (colorless)

Photo by
Michael Pabst
FOV 2 mm
Luminar



Kinoite

Christmas Mine, Banner District, Gila County, AZ

$\text{Ca,Cu}_2(\text{H}_2\text{O})_2[\text{Si}_2\text{O}_6]$

Kinoite (blue)
Ruizite (orange)
(Manganese Silicate)
Apophyllite (colorless)

Photo by Michael Pabst
FOV 1.5 mm
Scope



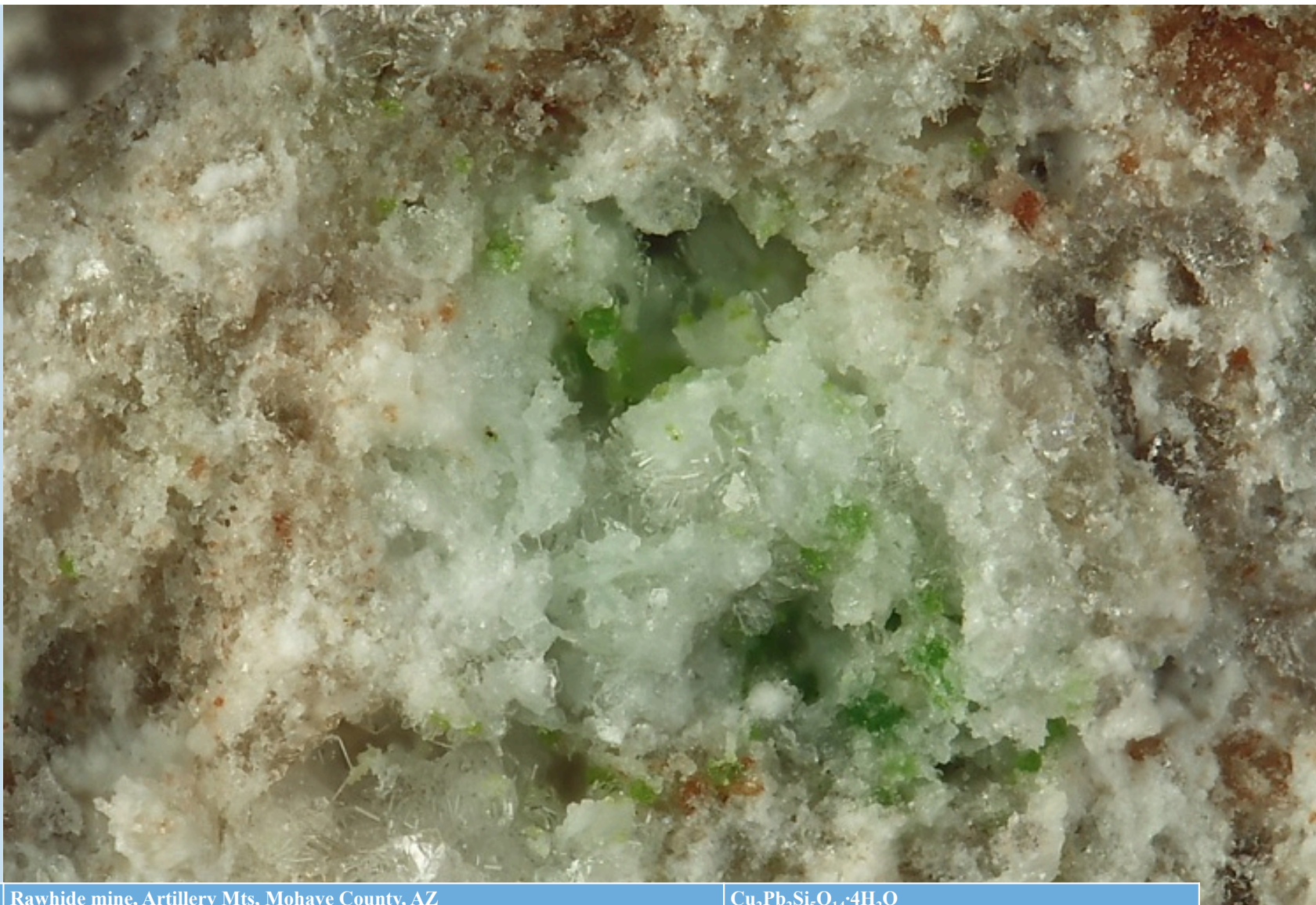
Kinoite

Christmas Mine, Banner District, Gila County, AZ

$\text{Ca,Cu}_2(\text{H}_2\text{O})_2[\text{Si}_2\text{O}_6]$

Luddenite (green)
Wickenburgite
(colorless)

Photo by
Elmar Lackner
FOV 1.8 mm



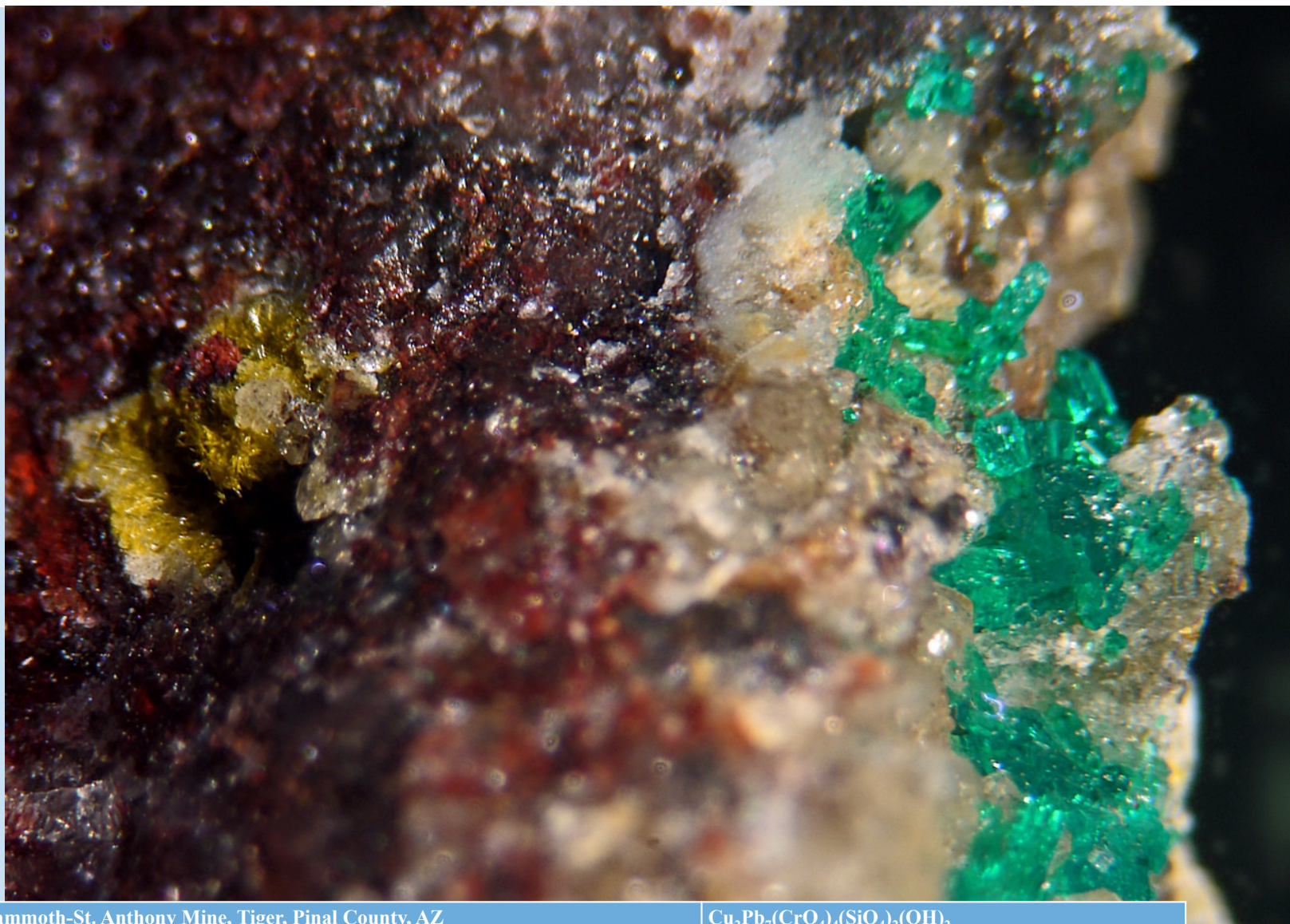
Luddenite

Rawhide mine, Artillery Mts, Mohave County, AZ

$\text{Cu}_2\text{Pb}_2\text{Si}_2\text{O}_{14} \cdot 4\text{H}_2\text{O}$

Macquartite (yellow)
Diopside (green)

Photo by Michael Pabst
FOV 8 mm



Macquartite

Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ

$\text{Cu}_2\text{Pb}_2(\text{CrO}_4)_4(\text{SiO}_4)_2(\text{OH})_2$

Macquartite (yellow)

Photo by Michael Pabst
FOV 2 mm



Macquartite

Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ

$\text{Cu}_2\text{Pb}_2(\text{CrO}_4)_4(\text{SiO}_4)_2(\text{OH})_2$

Macquartite in Quartz

Photo by Michael Cline
FOV 3.5 mm



Macquartite

Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ

$\text{Cu}_2\text{Pb}_7(\text{CrO}_4)_4(\text{SiO}_4)_2(\text{OH})_2$

Papagoite (blue) and
Ajoite (green)

Photo by Michael Pabst
FOV 3 mm



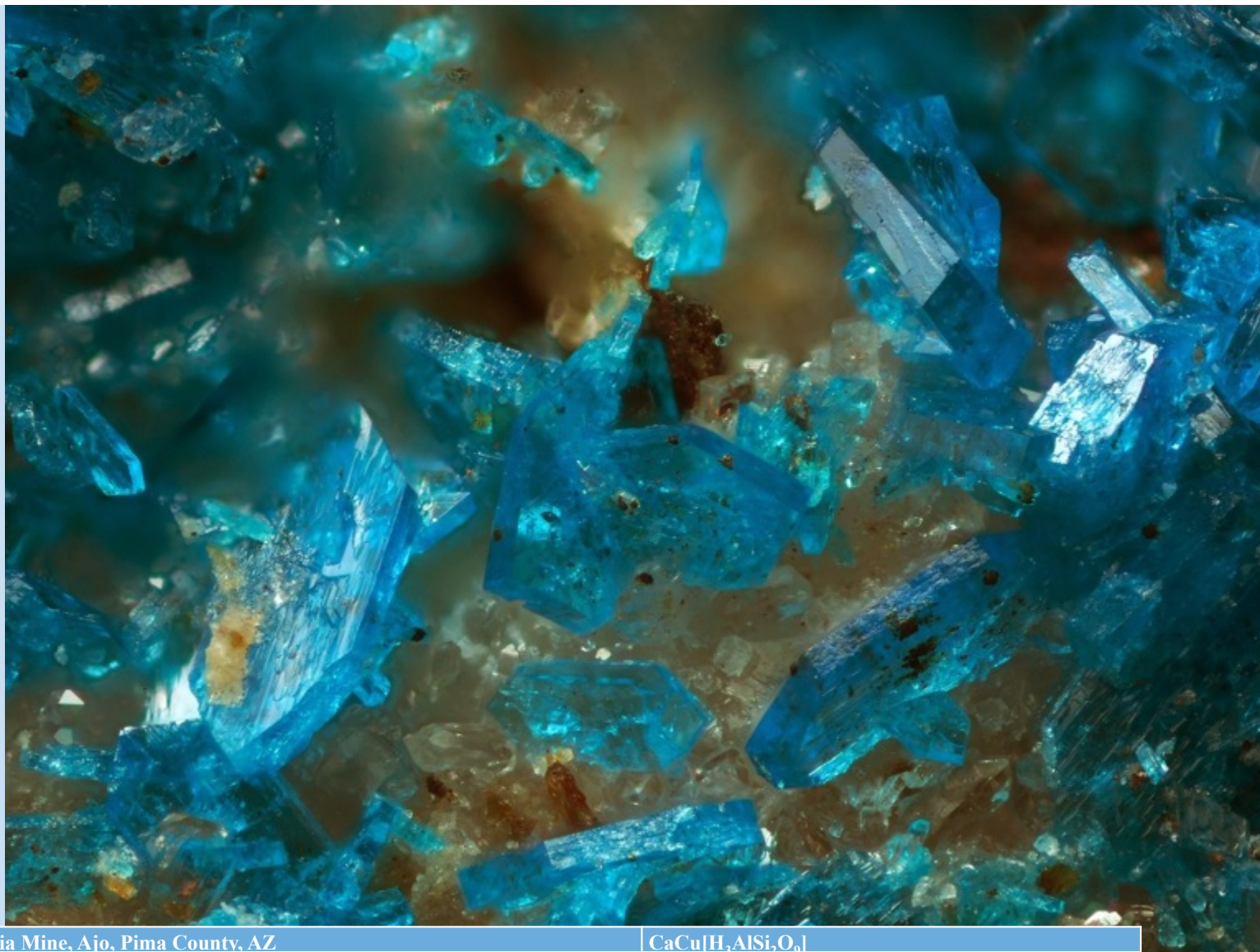
Papagoite

New Cornelia Mine, Ajo, Pima County, AZ

$\text{CaCu}[\text{H}_2\text{AlSi}_2\text{O}_6]$

Papagoite

Photo by Joy Desor
FOV 1.6 mm



Papagoite

New Cornelia Mine, Ajo, Pima County, AZ

$\text{CaCu}[\text{H}_2\text{AlSi}_2\text{O}_6]$

Plancheteite (blue)
Quartz
Willemite (colorless)
Mimetite (yellow)

Photo by
Robert O. Meyer
FOV 4 mm



Plancheite

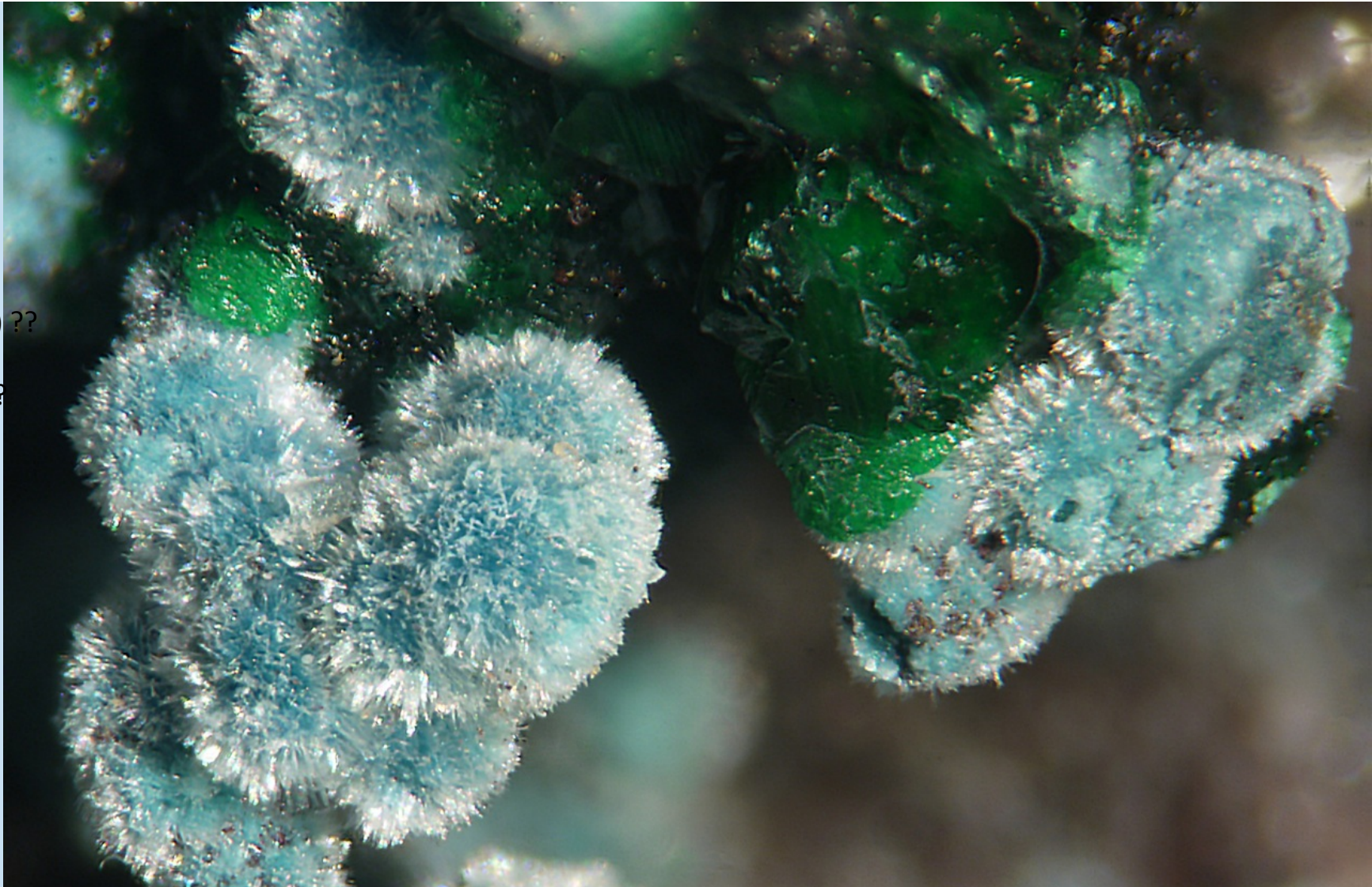
Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ

$\text{Cu}_6(\text{Si}_6\text{O}_{18})(\text{OH})_4 \cdot \text{H}_2\text{O}$

Shattuckite (blue)

Brochantite (green) ??
or
Namibite (green) ??

Photo by
Michael Pabst
FOV 5 mm



Shattuckite

Shattuck Mine, Bisbee, Warren District, Cochise County, AZ

$\text{Cu}_2(\text{Si}_2\text{O}_6)_2(\text{OH})_2$

Shattuckite

Photo by
Luigi Chiappino
FOV 6.5 mm



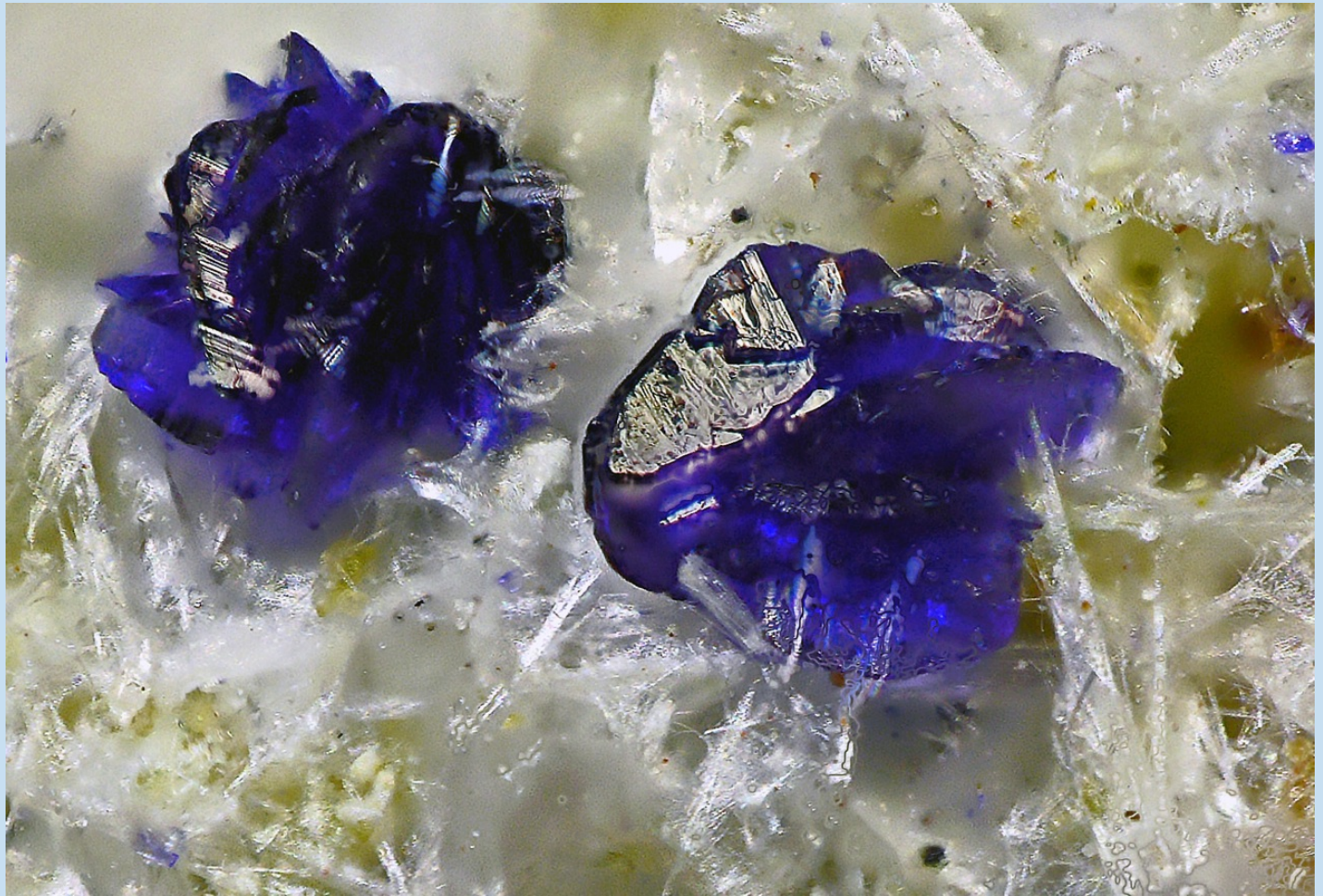
Shattuckite

Yavapai County, AZ

$\text{Cu}_2(\text{Si}_2\text{O}_6)(\text{OH})_2$

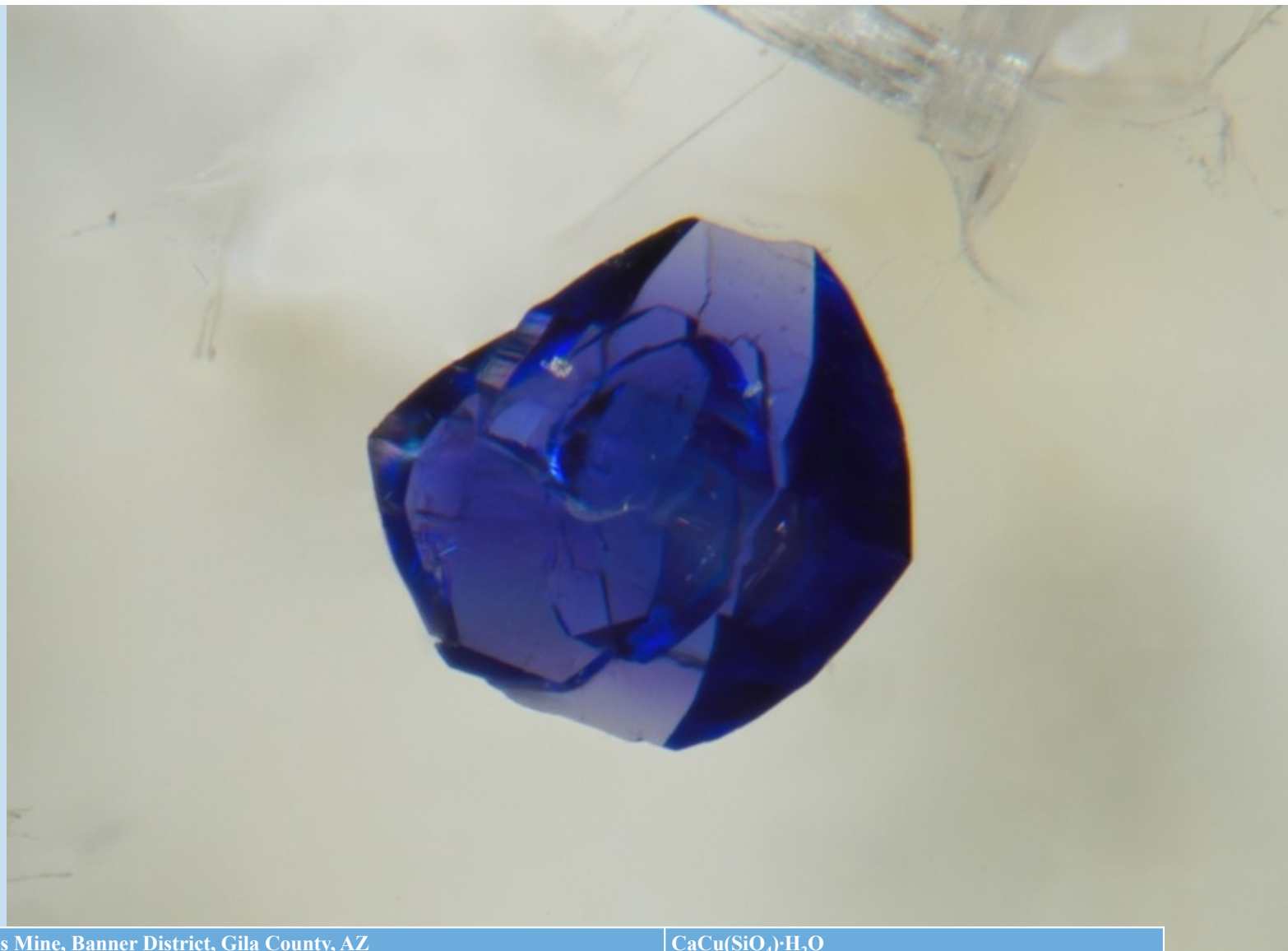
Stringhamite
(blue-violet)
on
Xonotlite (white)

Photo by
Michael Pabst
FOV 1.5 mm



Stringhamite
suspended by Tobermorite

Photo by Vincent Bourgoin
FOV 0.5 mm



Stringhamite

Christmas Mine, Banner District, Gila County, AZ

$\text{CaCu}(\text{SiO}_4) \cdot \text{H}_2\text{O}$

Whelanite (light blue)
Andradite (yellow)

Photo by Michael Pabst
FOV 8 mm



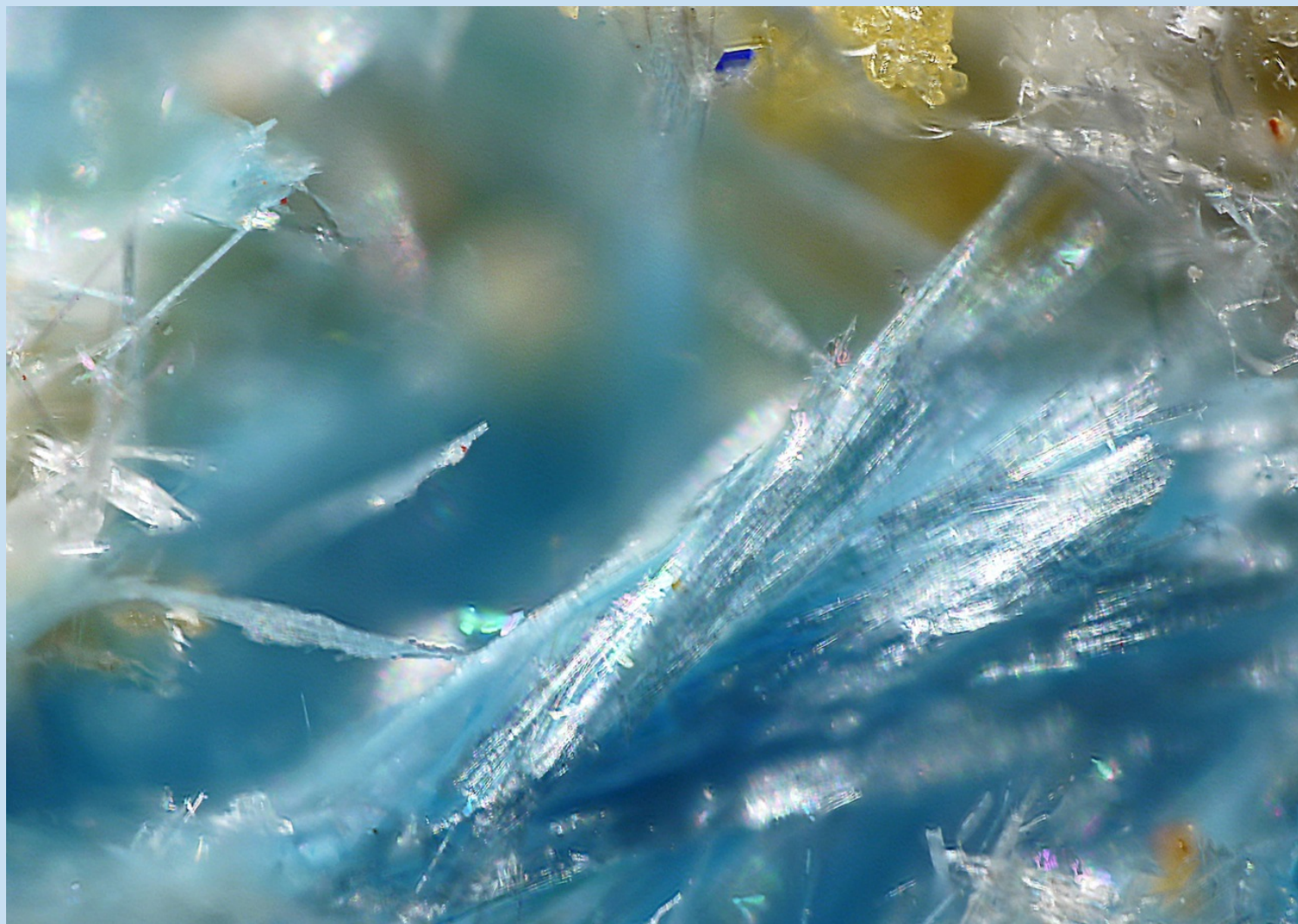
Whelanite

Christmas Mine, Banner District, Gila County, AZ

$\text{Ca}_2\text{Cu}^{2+}_3(\text{OH})_2\text{CO}_3[\text{Si}_2\text{O}_7]\cdot 4\text{H}_2\text{O}$

Whelanite (light blue)
Andradite (yellow)
Stringhamite (blue)

Photo by Michael Pabst
FOV 3 mm



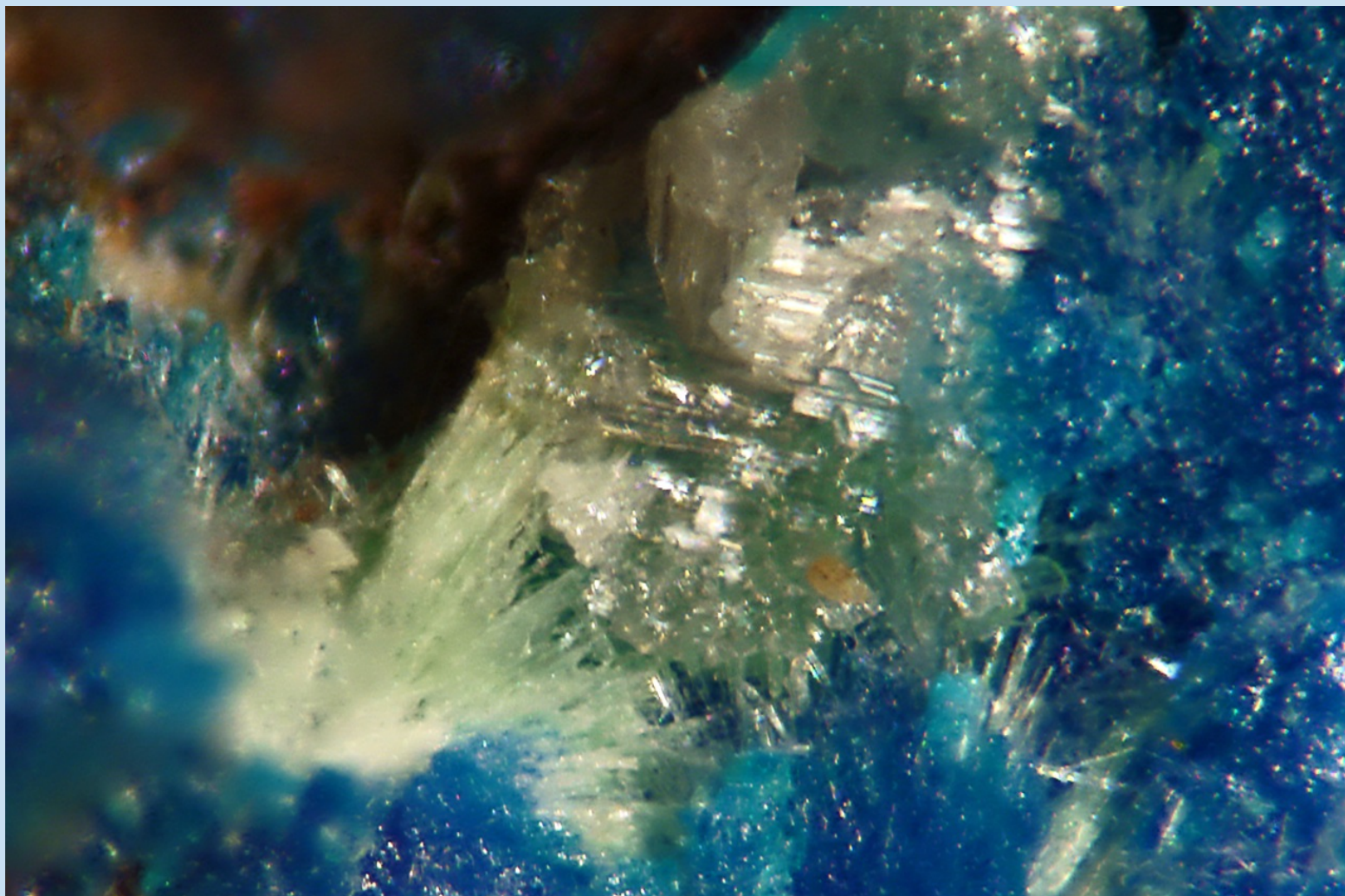
Whelanite

Christmas Mine, Banner District, Gila County, AZ

$\text{Ca}_5\text{Cu}^{2+}_2(\text{OH})_2\text{CO}_3[\text{Si}_6\text{O}_{17}]\cdot 4\text{H}_2\text{O}$

Wherryite (light green)
Diaboleite (blue)
Unknown (colorless)

Photo by
Michael Pabst
FOV 2 mm



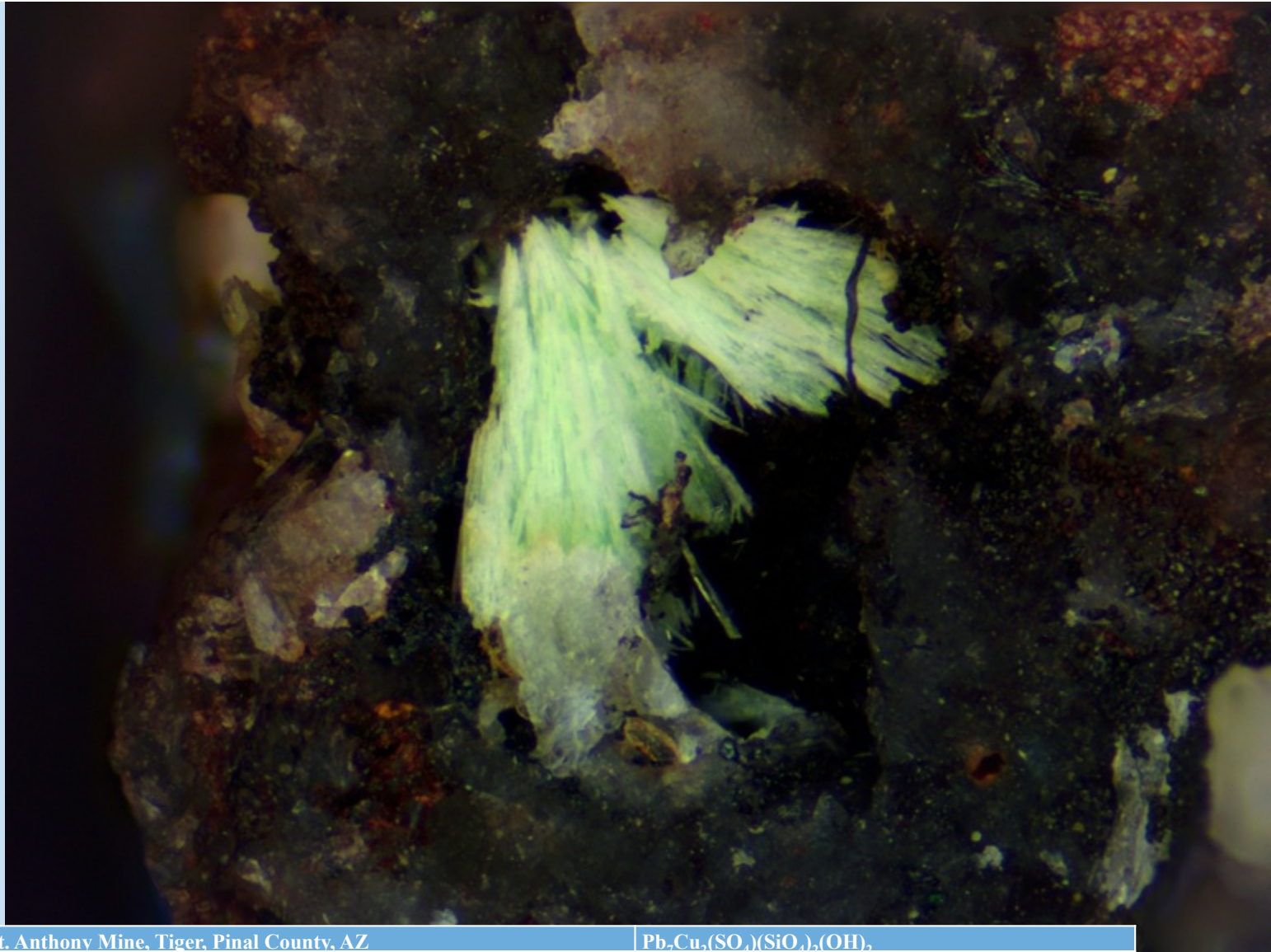
Wherryite

Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ

$\text{Pb}_2\text{Cu}_3(\text{SO}_4)(\text{SiO}_3)_2(\text{OH})_2$

Wherryite

Photo by Ben Kirchner
FOV 2 mm



Wherryite

Mammoth-St. Anthony Mine, Tiger, Pinal County, AZ

$\text{Pb}_2\text{Cu}_3(\text{SO}_4)(\text{SiO}_3)_2(\text{OH})_2$

That concludes Part One of my Presentation: Copper Silicates of Arizona

I hope you enjoyed these colorful and rare copper minerals.

Next, Part Two of my Presentation: Silver Silicates of Arizona

And then, after that, Part Three of my Presentation: Gold Silicates of Arizona

Does anyone need to be awakened for Part Two and Part Three?? Did I hear groaning in the audience?

Let's proceed!

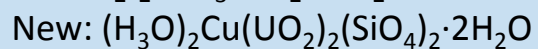
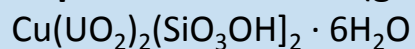


There are NO Silver Silicate or Gold Silicate Minerals.

Not in Arizona or anywhere else on Earth!

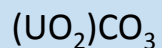
If we can't have Silver or Gold, then
here is one last copper silicate,
although not from Arizona.

Cuprosklodowskite (green)

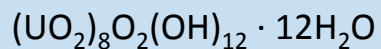


With three other uranium minerals:

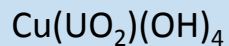
Rutherfordine (tan)



Schoepite (yellow)



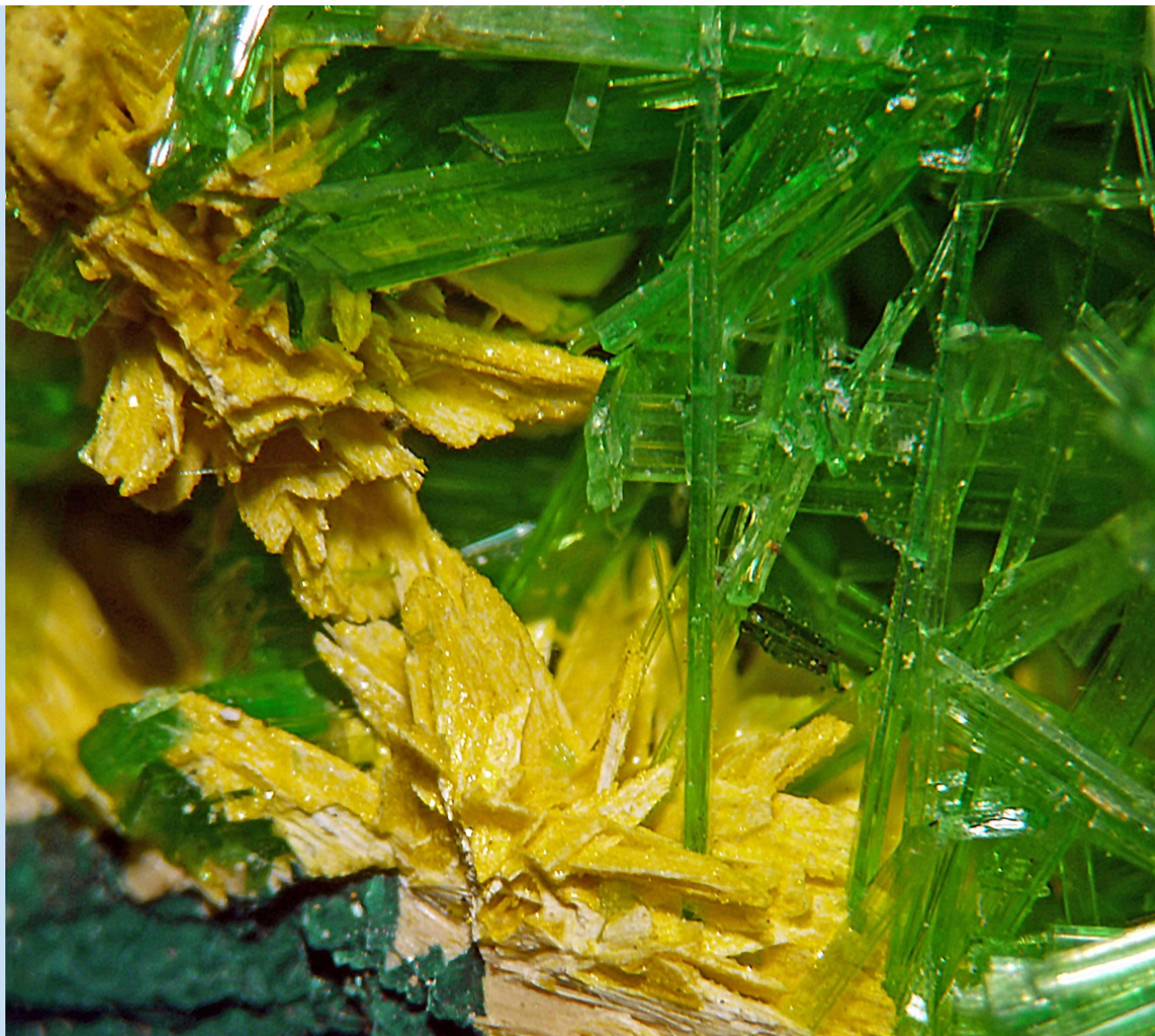
Vandenbrandeite (dark green)



Musonoi, Katanga, Zaire

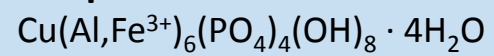
FOV 4 mm

Photo by Michael Pabst



A Copper Aluminum Phosphate
From Virginia

Turquoise



From Lynch Station, Virginia

Photo by Michael Pabst
FOV 2 mm

