Photographing Minerals

Lighting and Focus Stacking

Bruce Kelley
bruce.kelley@gmail.com

Why take photos of rocks?

Share the wonderful world of small crystals!

Aesthetic enjoyment and art

Aid study of the nearly invisible

Silver
Batopilas, Andres del Rio District, Mun. de Batopilas, Chihuahua, Mexico
2.3 x 1.5 x 1.3 cm

Techniques depend on specimen

Factors

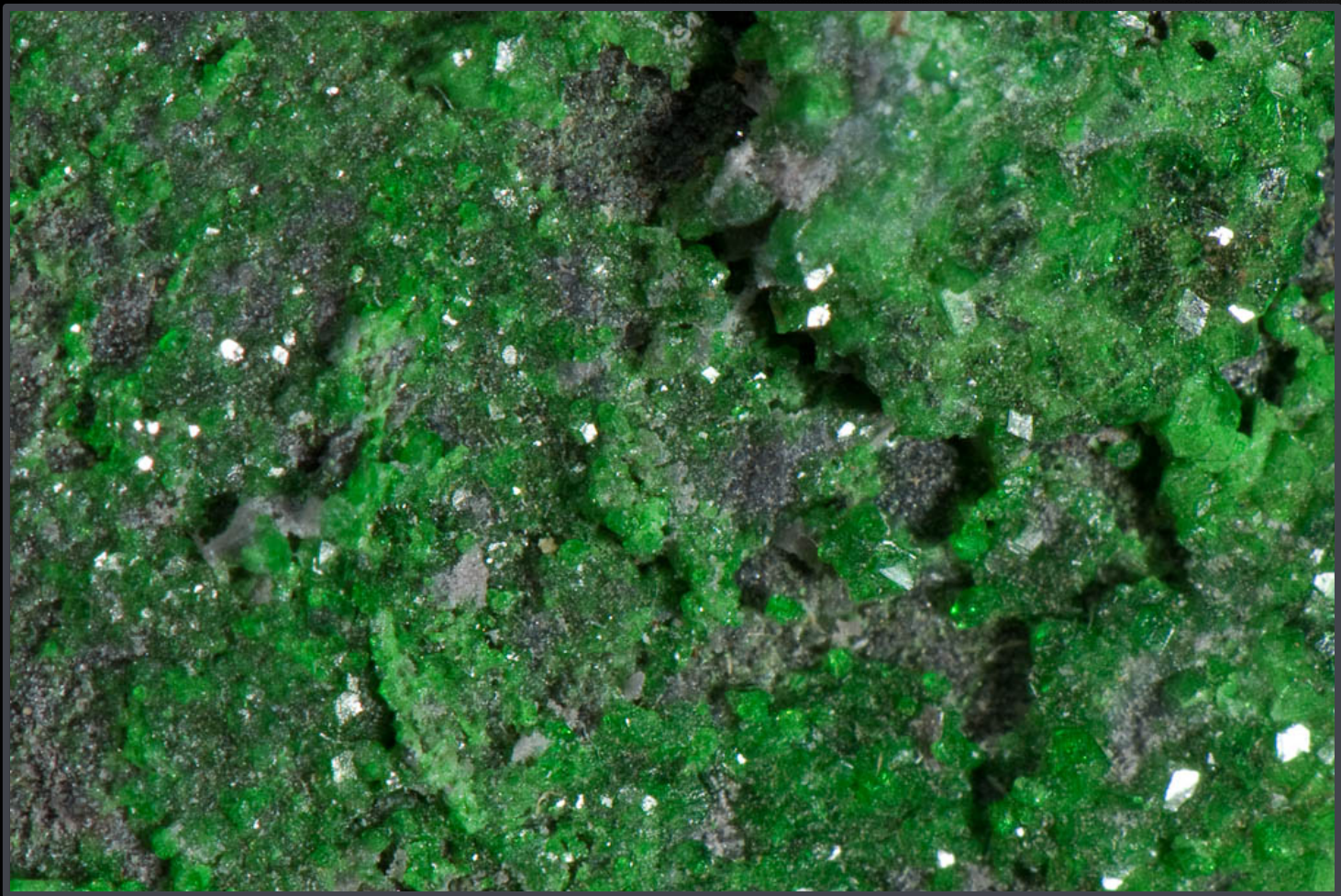
- Size of specimen
- Available light sources
- Available equipment – tripods, cameras, computers, etc.
- Luster and Transparency of crystals

Different subjects require different techniques

Sometimes, you just have to leave it where you find it and rely on the sun!

Lighting

Photography is ALL about the light!



"Taking a photo of a lustrous, multi-faced crystal, can be compared to taking a picture of a pile of broken mirrors."
Joel Arem

Uvarovite
Saranovskiy Mine, Mt. Rudniy, Ural Mts, Kazakhstan

Lighting – Sunlight

Chalcedony
var. Carnelian
Kalama area,
Cowlitz Co., WA
4.8 x 4.6 x 3.1 cm

Lighting – Incandescent

Plusses

- Lots of light
- Easy to see the resulting reflections while setting up the shot.
- Well known white balance
- Generally low cost

Minuses

- Hot! Can damage delicate specimens if too close.
- Uses more electricity than other light sources
- Can be fragile
- May need to diffuse light to reduce specular reflections
- Difficult to get light into vugs

Lighting – Electronic Flash

Plusses

- Lots of light
- Not much heat
- Well controlled white balance

Minuses

- Difficult to get light into vugs
- No "modeling light" – can't see the resulting reflections while setting up the shot.
- May need expensive multiple-flash setups
- Top of camera is not the ideal location for a macro light (need reflectors or remote control)
- May need to diffuse light to reduce specular reflections

Lighting – Electronic Flash

Elbaite
Cruzeiro Mine, São José da Safira, Minas Gerais, Brazil
FOV: 2.0 x 1.8 cm

Lighting – Ring Light

Plusses

- Lots of light
- Low temperature (usually)
- Well known white balance
- Diffuse light reduces specular reflections
- Gets light into vugs

Minuses

- Expensive
- Can give ring-shaped reflections on large crystal faces
- If mounted on lens, the light source sometimes moves with focus

Photo by: Darron Birgenheier

Lighting – Fiber Optic

Microscope Light with Fiber Optics

Plusses

- Well-controlled spot lights
- No heat near specimen
- Relatively easy to direct light into vugs

Minuses

- Expensive
- Can be awkward to work around
- Modest light output – good for microscope, not so much for macro
- Narrow field of illumination

Lighting – Studio

Professional soft-box with studio strobe lights

Use reflectors or white cards for fine control

Lighting – Studio

Plusses

- Well-controlled bright lights with tons of configuration options
- Use reflectors to guide light into tight spaces
- Most have "model light" for setting up shots
- This is what the pros use for cabinet and miniature specimens. For example, Jeff Scovil of Mineralogical Record.

Minuses

- Awkward to work around
- Steep learning curve
- Take up a lot of space
- Requires extra equipment and reflectors
- Very expensive

Lighting – Studio Strobes

Rhodochrosite
Bulgaria
8 mm crystal

Lighting – LED

Custom made LED Microscope Lights

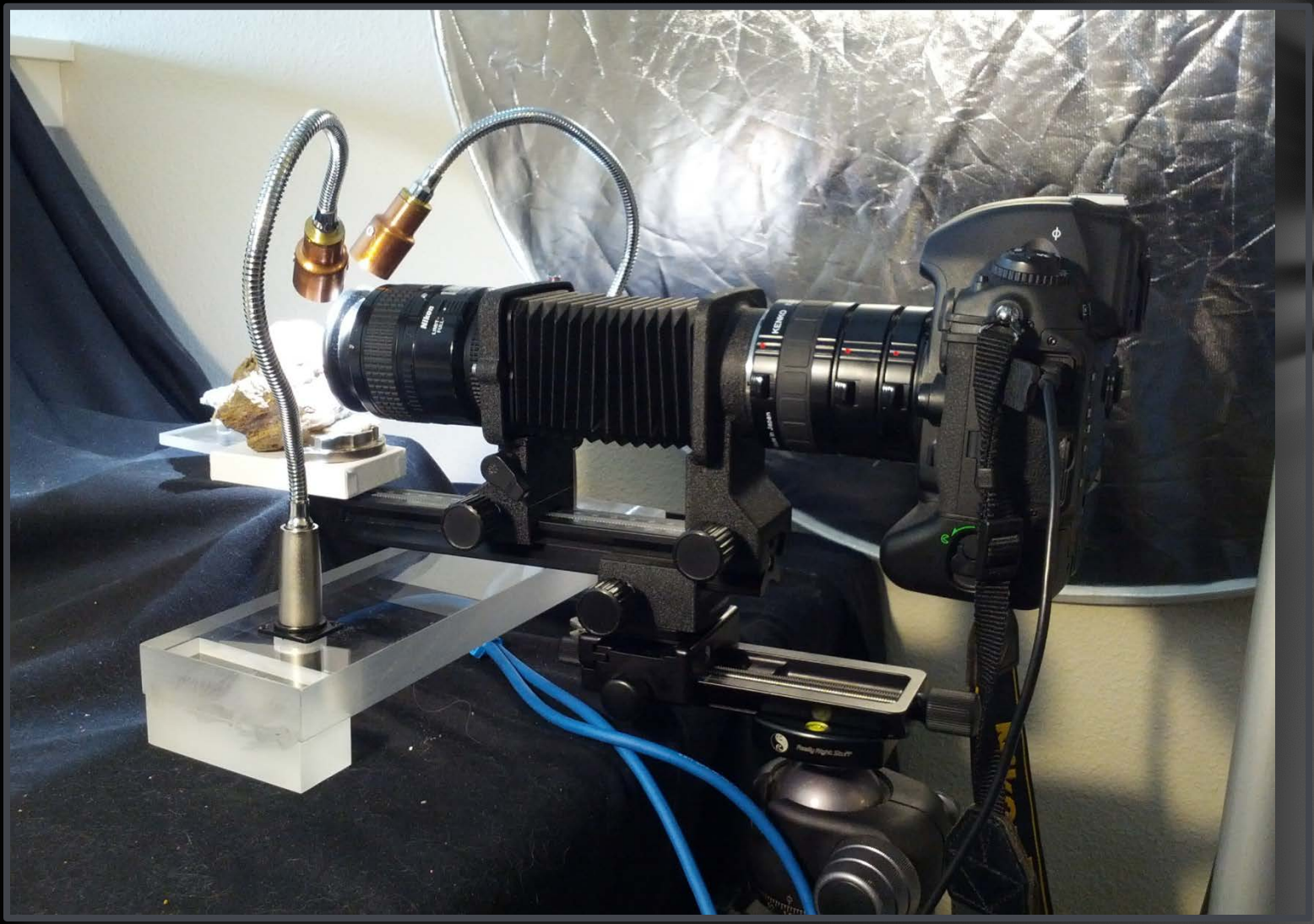
Plusses

- Well-controlled bright lights
- Relatively easy to direct light into vugs
- Modest cost if you build it yourself
- Constant light is easy to "model" for setting up shots
- Reuse for microscope lighting

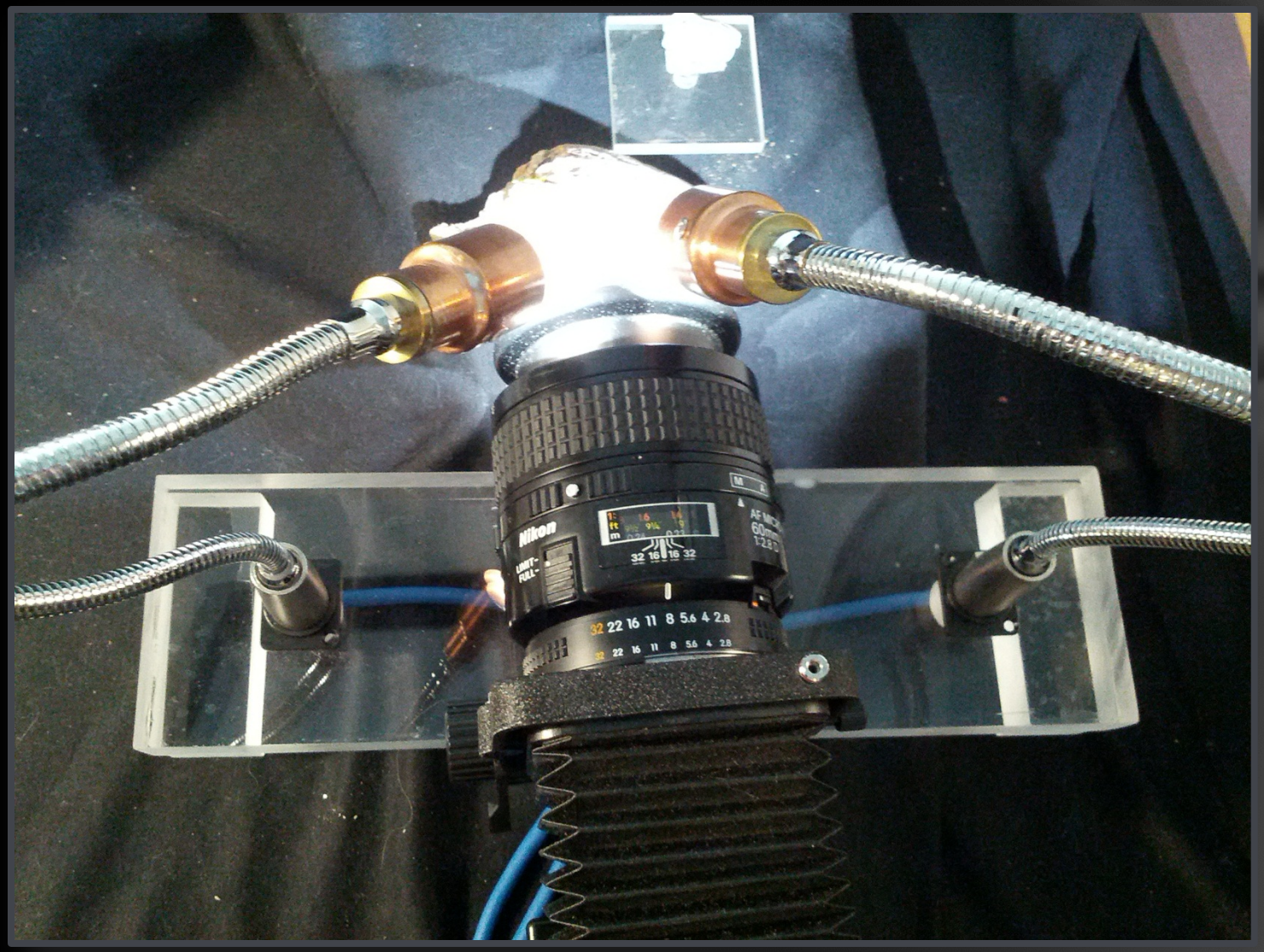
Minuses

- Color temperature is odd and changes with brightness.
- Bright LED's with a good color spectrum are expensive.
- Heat can be an issue, but not as bad as incandescent
- I don't know of any good commercially available setups.

Lighting – LED



Lighting – LED



Lighting – LED

Gypsum and Brochantite
Silver Coin Mine, Iron Point District, Humboldt Co., NV
FOV: 5.0 x 5.9 mm

White Balance

To compensate for the color peculiarities of a light source, shoot a gray target and generate a while balance setting.
Image edit software like Photoshop or Lightroom will use this to correct the color of the images so that it looks right.

Depth of Field

Physics is a pain sometimes!

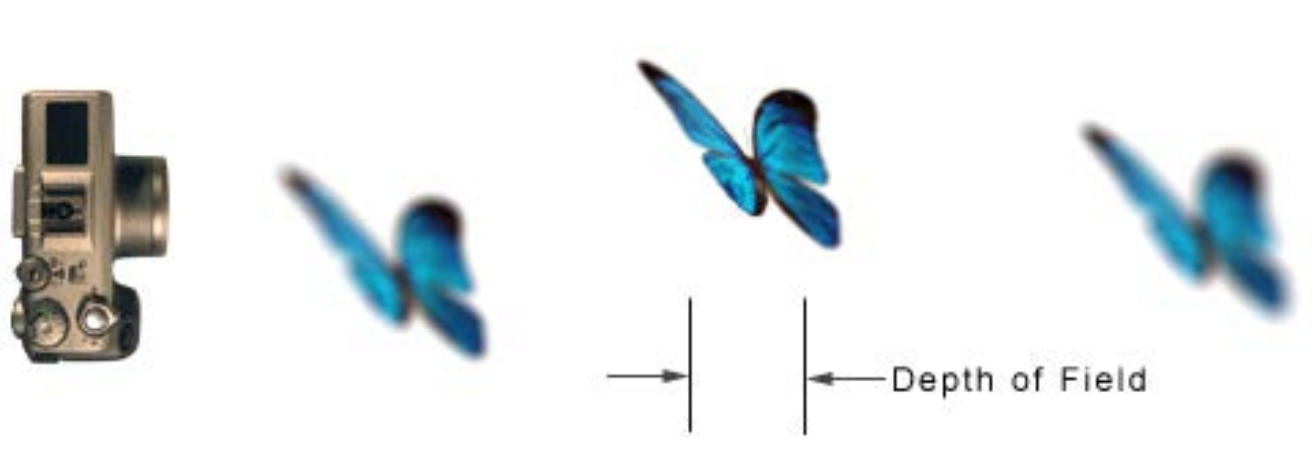
"zone of acceptable sharpness"

The higher the magnification, the shallower the depth of field.

The smaller the aperture, the larger the depth of field.

Gotchas for smaller aperture:

- Less light gets into camera
- Diffraction becomes a problem as aperture gets very small.

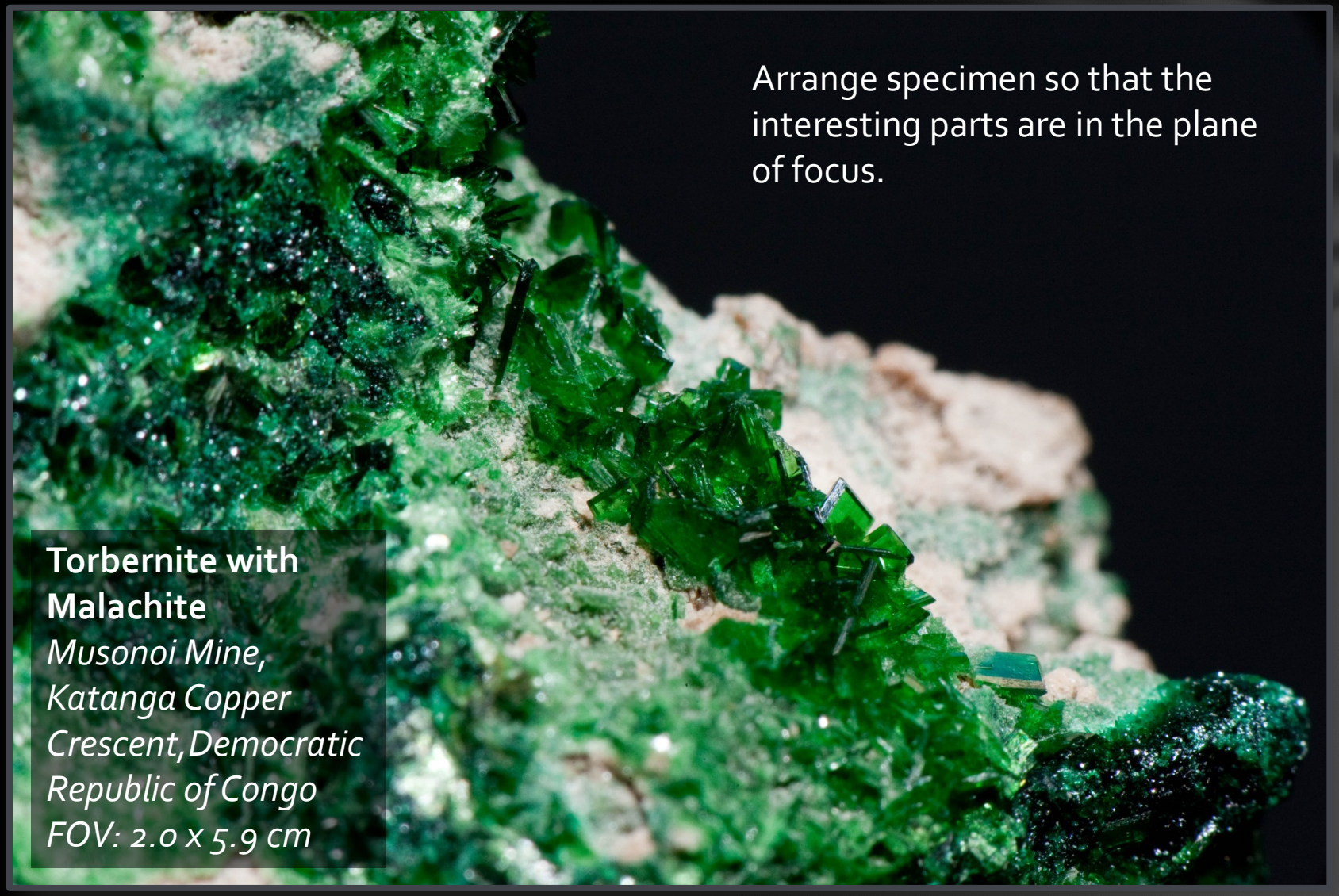


Depth of Field

We would like to be able to see all of the subject crystals in focus in the same image, but optical physics puts up a roadblock.

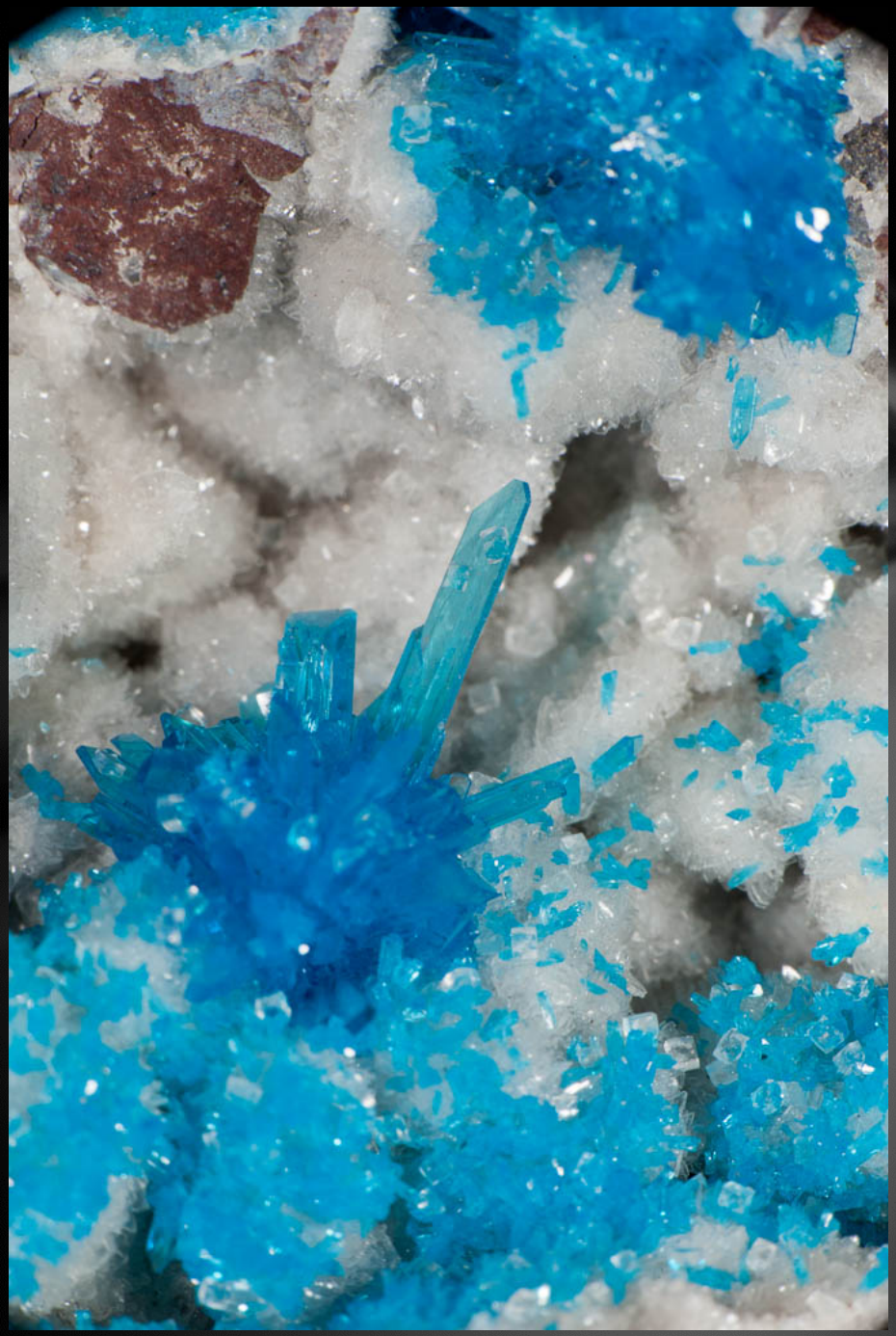
Hubeite & Inesite
Fengjiashan Mine, Daye Co., Hubei Province, China
FOV: 1.0 x 1.2 m

Depth of Field



Focus Stacking

The desired depth of field for this image is about 7 mm. But, at that magnification, we only get about 1 mm of sharp depth of field at the f/24 aperture.



Pentagonite & Stilbite
Wagholi Quarry, Pune District, Maharashtra, India
FOV: 1.8 x 2.3 cm

Focus Stacking: Details

This part is sharp.

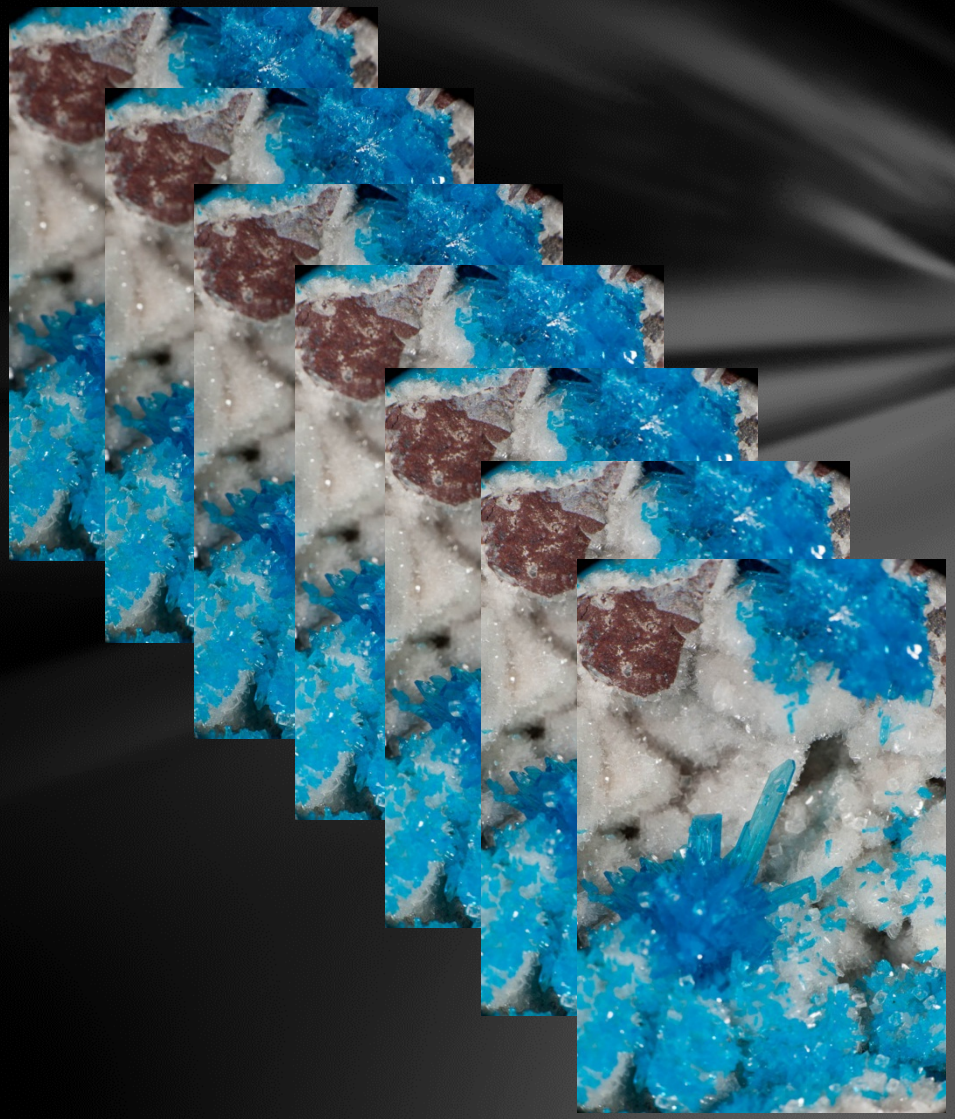
This part : not so much.

Focus Stacking

Computers to the rescue!

Take multiple photos, each at a different focus point. Use software to combine the sharpest parts of each into one final image.

These 7 shots, each at a different point of focus, cover the entire depth of field.



Focus Stacking

Software can analyze and combine the individual frames into a single sharp image.

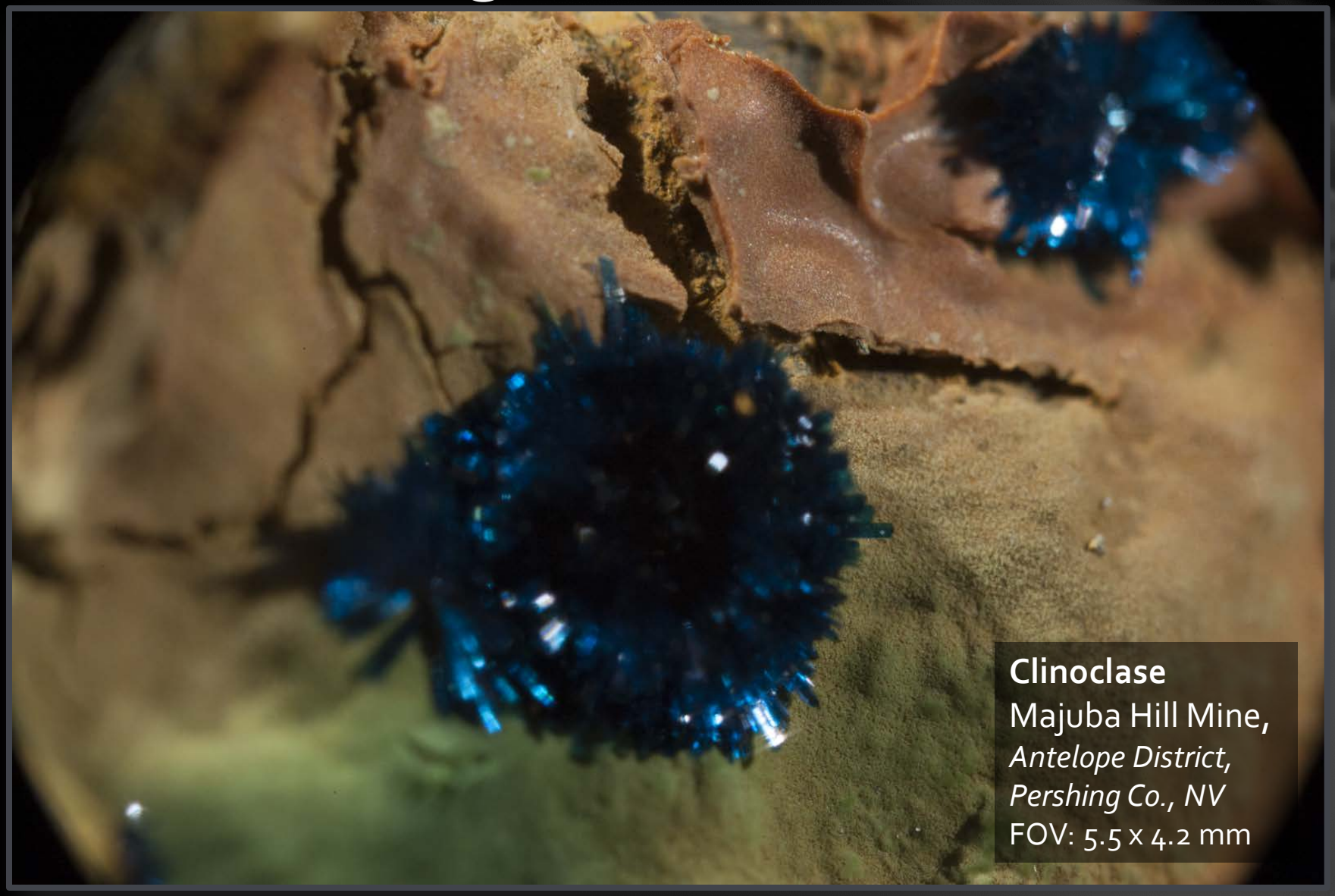
There are several programs available:

- CombineZP: free!
- Zerene Stacker: $85-289
- Helicon Focus: $115-250

I used Combine ZP until recently, but have migrated to Zerene Stacker.

Focus Stacking – Detail

Focus Stacking - Demonstration



Focus Stacking - Demonstration

Focus Stacking - Demonstration

Focus Stacking - Demonstration

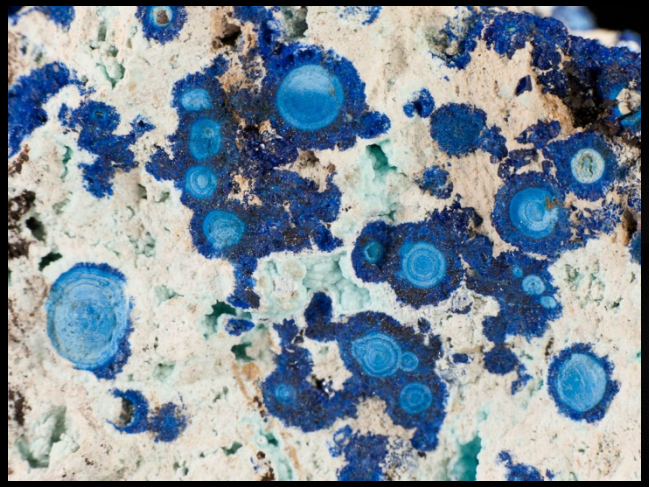
Higher magnification requires more frames to get approx. 3 mm of depth.

26 Full-size frames, 4256 x 2832 resolution (13.5 MB per frame)

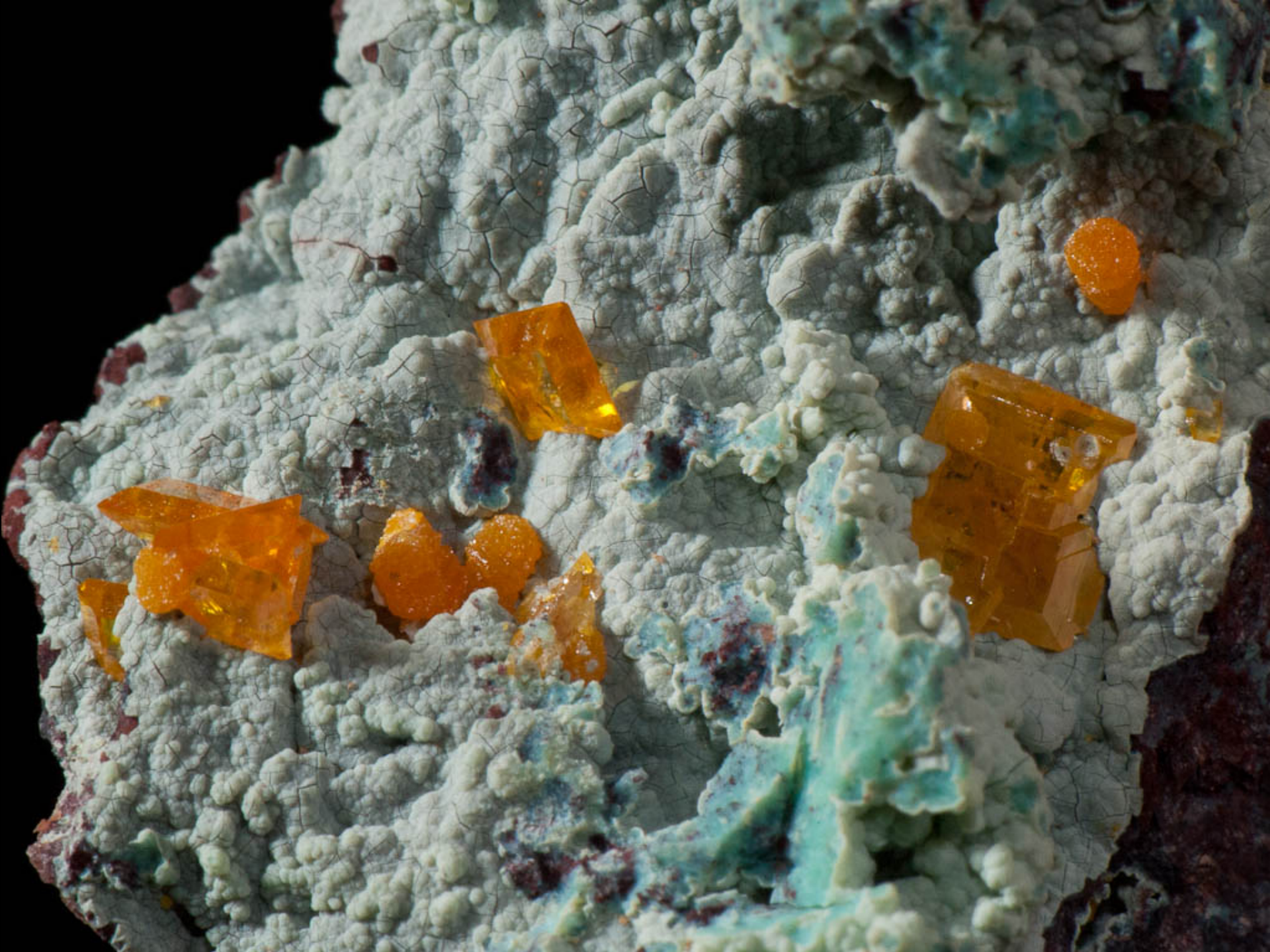
Zerene Stacker takes 4-1/2 minutes on a fast 4-core processor with 8 GB of RAM.

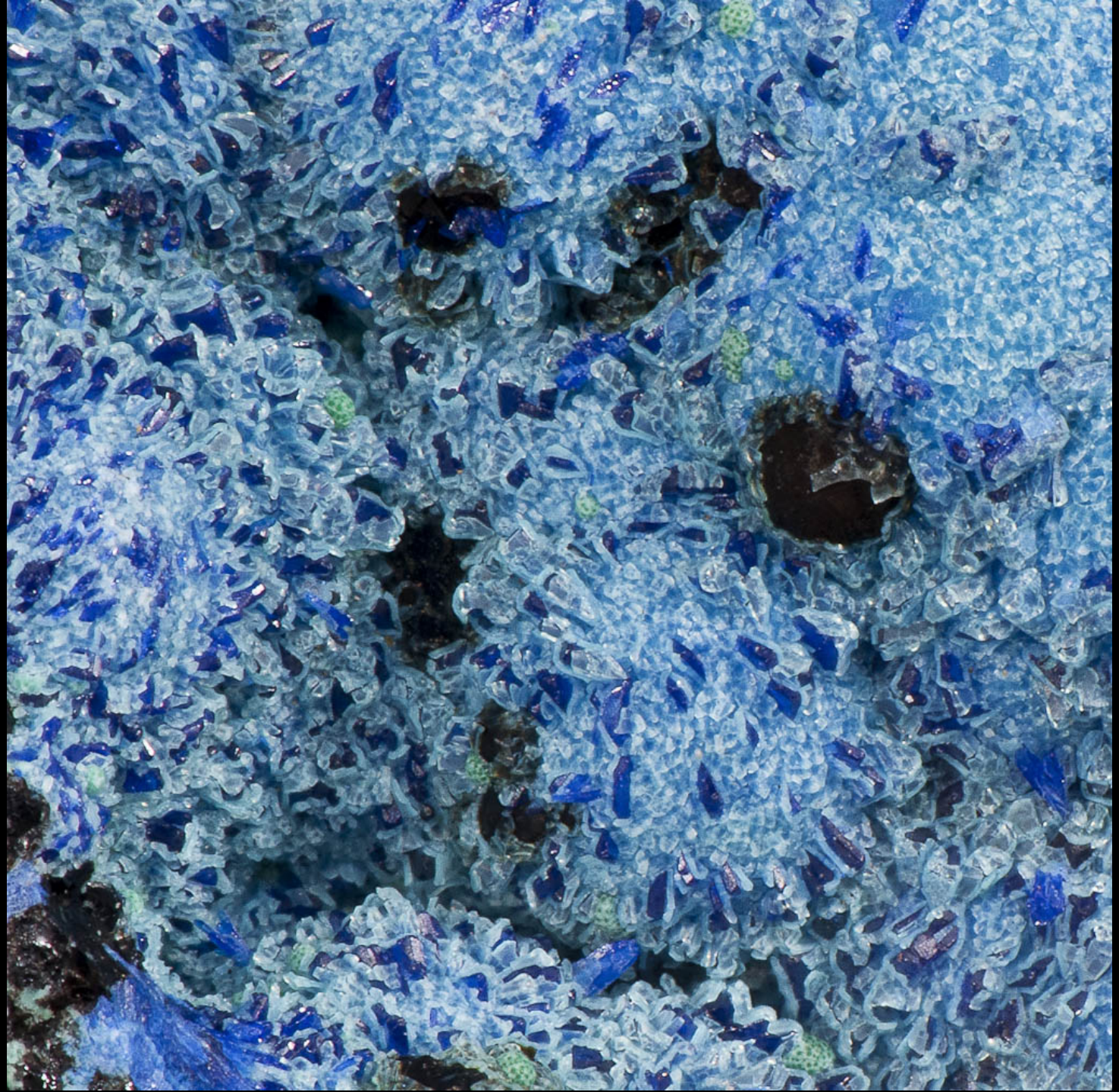
I'll demo with lower resolution on this laptop: 1600 x 1065 resolution.

Slideshow



Gold on Quartz
Pierina Gold-Silver Mine, Huaraz, Aija Province, Ancash Department, Peru
6 mm crystals





References & More Information

Advanced Lighting Techniques for Mineral photography, Wendell E. Wilson
Mineralogical Record Axis, Vol. 1, No.2 (2005)
http://www.minrec.org/pdfs/Advanced%20Lighting%20Techniques.pdf

Photomacrography.net
http://www.photomacrography.net

Zerene Stacker
http://zerenesystems.com

I will post these slides:
http://www.BruceKelley.com