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Tiny treasures
of the Mineral World

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Introduction

A collection does not start as a collection. It starts with one specimen that refuses to let you go. For me, that first specimen was small, unassuming, and utterly captivating once I saw it under magnification. From that single point, some 40 years ago, the collection grew organically, the way a snowball grows as it rolls downhill. One specimen led to another, then to ten, then to a hundred, and before I fully understood what was happening, I was organizing drawers, cataloging localities, and corresponding with collectors on the other side of the world.

Today, my collection numbers over 23,000 micromounts. That figure still surprises me when I say it aloud, because I never set out with a goal in mind, never thought I need to reach a certain number or acquire a certain rarity. The collection grew not because of an economic incentive but because my curiosity demands it. Each new specimen poses a question: what is this, exactly? What does its crystal form look like under high magnification? How does it compare to others from the same locality? How can I best photograph it ? Answering those questions required acquiring more specimens, which raised more questions, which required more specimens. It is a wonderful, endless loop.

Of those 23,000 specimens, I have photographed and published 5,600 on my personal website, tomeikminerals.com. Each photograph represents thorough preparation: cleaning the specimen, positioning it under the lens, adjusting lighting, capturing multiple focus-stacked images, and then postprocessing the result until it faithfully represents what I see through the eyepiece.

What drives this work is not some abstract sense of duty. It is the simple, unguarded delight of sharing something beautiful with someone who has never seen it before. I love sharing my passion, knowledge and 40 years of experience with others, with people who share the passion, but even so with people who have no clue that things like these even exist, let alone ever have seen any of them. Creating the wow-factor almost always works. When a newcomer leans into the microscope and gasps, when a friend asks where on earth such a thing can be found, when a stranger writes to say that a photograph on my website made them see rocks differently, I feel the full value of those 23,000 specimens measured not in rarity or monetary worth, but in moments of genuine human excitement.

What I want most is for you to have that same experience, even if only for a moment. This book is an attempt to hand you the microscope, to say: here, look at this. Look at what has been waiting for you all along. You do not need to be a geologist. You do not need any prior knowledge. You only need curiosity and a willingness to be astonished. The tiny treasures in the mineral world do the rest.

The reaction that I encounter most I call the wow-factor, and it is the engine behind everything I do. Not only for myself, but also for anyone curious. Not only the collecting itself, but also the sharing. My website, Facebook posts, presentations, magazine articles, exchange events: all of those play their part in creating wow-moments for as many people as possible. I have given talks to rooms full of experts and to rooms full of people who could not tell quartz from feldspar, but the wow-factor happens in both settings with equal intensity. Knowledge is not a prerequisite for wonder. Wonder is a prerequisite for knowledge.

This book exists because of the people who follow my work. For years, I not only have maintained and extended the website, but also have been posting photographs of micromounts to various Facebook groups, each image accompanied by a caption that tells a story about the specimen: where it came from, how it was found, what its crystal form reveals, why it matters to me. The response has been overwhelming. Many of the posts receive hundreds of likes and dozens of comments, with reactions ranging from simple appreciation to detailed technical questions. Over 5,000 followers now follow my posts regularly, and many have written to say that these photographs give them a lot of pleasure in getting to know the micromineral world.

From those hundreds of posted images, I have selected 100 highly appreciated specimens of indeed 100 different species for inclusion in this book, divided in 10 thematic chapters. The selection criterion was not rarity or monetary value, though some of the specimens are unquestionably rare. What guided me was the response they received from the community, which photographs sparked the most wonder, which stories resonated most, which crystal matches drew the most enthusiastic replies.

This book is a gift from me to you. The 100 specimens in these pages have given me countless hours of fascination, frustration, revelation, and joy. They have traveled with me, surprised me, and connected me to people I would otherwise never have met. Now I offer them to you in the same spirit in which I share everything: not for profit, not for recognition, but only for the passion that has carried me through four decades of looking closer. I hope you find here even a fraction of the wonder that these tiny treasures have given to me.

1. The colors that never change

Macro mineral specimens show color at a scale the eye can interpret against context. A big azurite nodule is blue, yes, but it is a blue you can hold. A micromount azurite is a blue that seems to have been concentrated by some impossible distillation, as if the entire sky were squeezed into a space the size of a pinhead. The intensity changes everything about the experience.

In a large specimen, light scatters through cracks, inclusions, and surface imperfections. The color gets diluted, absorbed, bounced around, and eventually flattened into something the eye can comfortably ignore. But in a micromount, the crystal is often nearly perfect, with clean faces and internal clarity that a larger specimen can only dream of. The light enters cleanly, reflects cleanly, and arrives at your eye with all its energy intact.

There is also a psychological element. When color comes from a tiny source, it feels like a discovery rather than a display. The concentrated red of a vanadinite crystal at 40x magnification does not just look red; it looks like the idea of red, refined down to its purest expression. It is not surrounded by context that dulls it. It exists alone, demanding attention, refusing to share the stage.

I have watched people look away from micromounts for five seconds and then look back, as if checking whether the color was real. It is always real. The specimens do not change. But the eye seems to need a moment to accept what it is seeing, because the brain has never encountered that particular saturation at that particular scale.

Color at the micro level is not an embellishment. It is a physical property that manifests most purely when the crystal is small enough to be structurally perfect. The same mineral that looks muddy and unremarkable in a fist-sized chunk can be a jewel under the lens. It is not a trick of the photography, though good photography certainly helps. It is a truth about how crystals grow and how light works.

Color alone often is not enough to determine the identity of a crystal. A whole lot of species can take different colors under different conditions. But there is also a category of minerals that are always of the same color. Azurite is always blue, malachite is always green, erythrite always pink. This first chapter shows some of these color solid minerals.

01. Azurite

Namibia, Tsumeb

Azurite is probably the most famous blue mineral in the world. Every collector knows it. Every child who has ever picked up a rock has probably seen azurite in a museum or a classroom display, because its deep blue color is impossible to misrepresent in a photograph. But azurite at the micromount scale is a different creature.

The big azurite specimens are blue, yes, and often beautiful. But the color has a heaviness to it, a density that comes from the sheer size of the material. When you shrink azurite down to a tiny crystal cluster, the blue becomes brighter, more intense, more electric. It is the same blue, and yet it is not the same blue at all. The light interacts differently with the small crystalline faces, and the result is a color that seems to vibrate.

Tsumeb used to be one of the top mineral areas in the world, that has produced over 400 different species. This azurite comes from there, and it surely is a high quality micro-specimen. Picture width 6 mm.

02. Brochantite

Australia, South Australia, North Flinders Ranges, Pinnacles Mine

And the sun is green… Quite a common mineral, but this individual specimen is far from common.
Brochantite is a secondary copper sulfate mineral known for its striking intense emerald-green to dark-green color. Chemically, it is hydrated basic copper sulfate, that forms in the oxidation zones of copper deposit weatherings, particularly in arid and semi-arid environments. Crystals are typically prismatic, acicular (needle-like) or fibrous.
It often occurs alongside other secondary copper minerals like malachite, azurite, and chrysocolla. Beyond its geological role as an indicator of copper ore deposits, it is highly valued by collectors for its vibrant green hue.

Brochantite was named in 1824 in honor of the French geologist and mineralogist André-Jean-François-Marie Brochant de Villiers. Picture width 2 mm.

03. Cacoxenite

Portugal, Guarda, Folgosinho, Sítio do Castelo Mine

For mineral collectors, cacoxenite’s appeal lies in its captivating visual aesthetics, rare growth forms, and unique geological display. Its main attraction is its distinct yellow color and delicate needle-like habit. The mineral forms radiant, fan-shaped tufts, broom-like sprays, and golden-yellow to sometimes deep amber-orange stars that stand out sharply against surrounding matrix rocks.
Additionally, cacoxenite carries an intriguing historical story: once despised by miners as a "bad guest" that ruined iron quality during smelting, it has been reinvented as a prized treasure for mineral enthusiasts. The blend of visual brilliance, delicate artistry, and historical irony makes cacoxenite a standout addition to any mineral collection.

This one I discovered recently in older material from the (abandoned) locality: a group of fabulous cacoxenites in their typical habit and color - Folgosinho is without any doubt one of the best places worldwide for cacoxenite. Picture width 4 mm.

04. Chalcotrichite

USA, Arizona, Pima Co., New Cornelia Mine

Chalcotrichite is the hairy variety of cuprite, copper oxide. Cuprite itself forms red cubes, with sharp faces and a luster that draws the eye like a magnet. I have specimens like that, and they are magnificent. But this chalcotrichite has rejected the cube entirely. Instead, it has grown as a mat of fine, hair-like crystals, so thin and so red that under the microscope they look like strands of fiber optic cable. The copper atoms are the same. The mineral is still cuprite. But the shape belongs to a different world.

The name chalcotrichite comes from Greek words meaning copper hair, and the description is perfectly accurate. Under the lens, the crystals are bright red, fine, and tangled, growing in tufts that look like they could bend if you touched them. They do not bend, of course. They are brittle. But the visual impression of softness is almost impossible to shake.… Picture width 6 mm.

05. Crocoite

Australia, Tasmania, Zeehan District, Adelaide Mine

Some minerals are beautiful in a way that feels almost aggressive. Crocoite is one of them. The color is a red-orange so intense that the specimen seems to burn through the lens, as if the image itself might catch fire if you look too long. This is one of the most visually dramatic species in the entire micromount universe.

Crocoite is a lead chromate mineral, and its chemistry is the direct source of its color. The chromate ion absorbs and reflects light in a way that produces the blazing red that gave the mineral its name — from the same root that gives us the word "chromium." The crystals are monoclinic prisms, often elongated and slender, clustering together in sprays that look like a frozen explosion of fire. During my holiday in Australia and Tasmania in 2022 I had the opportunity to visit the mine, the worldwide best source for crocoite crystals. I didn’t even go into the mine, just roamed around the dumps for microcrystals: in about an hour and a half I collected some 50 specimens. Because of the sensitivity of the material you have to be very cautious and patient when formatting and cleaning the specimens, but then the reward is great, look at this one. Picture width 8 mm.

06. Cyanotrichite

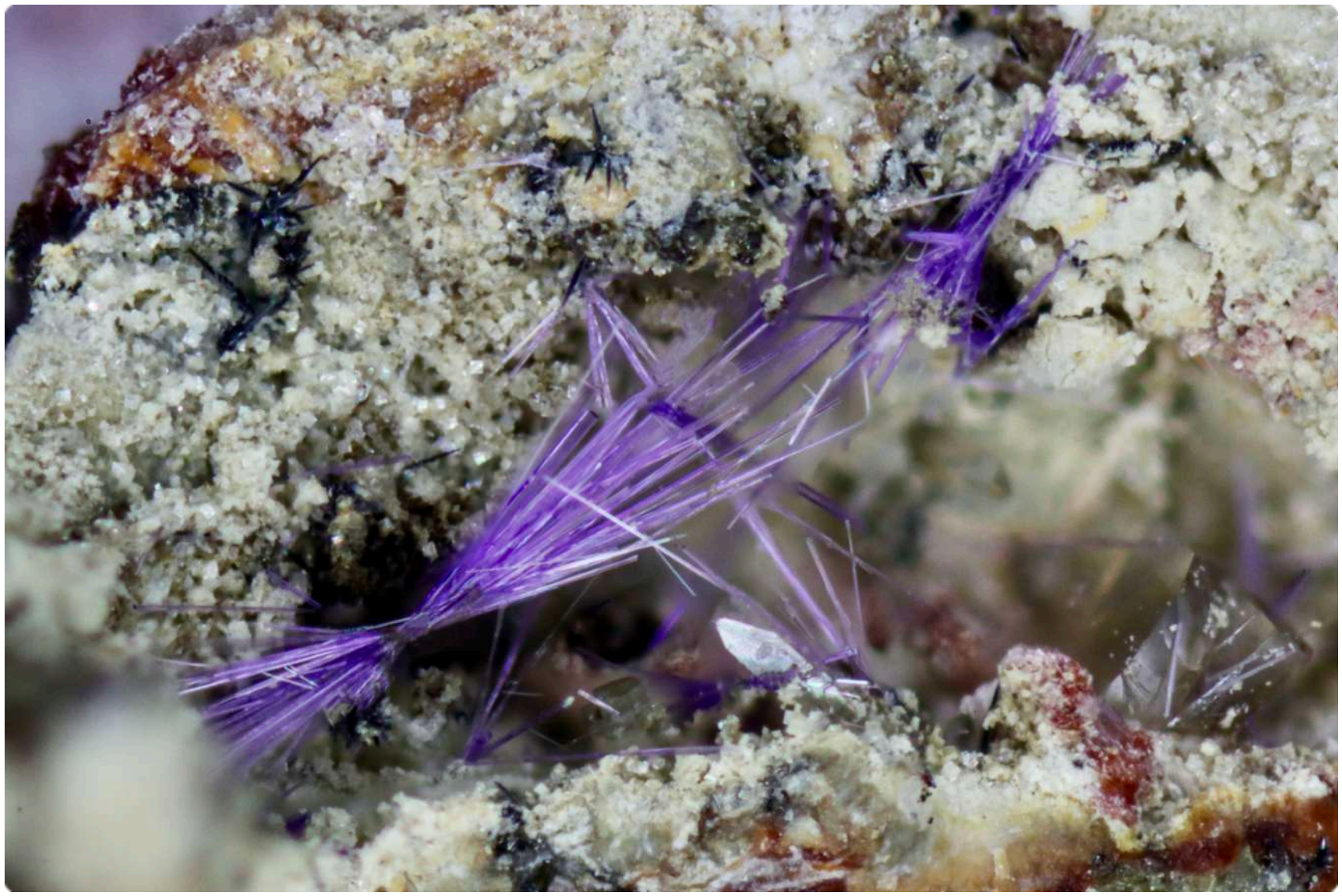
Greece, Attica, Kamariza, Jean Baptiste Mine

Cyanotrichite means “blue hair”. It is a secondary copper mineral, forming where copper deposits meet the surface and begin to weather. The chemistry is straightforward, but the visual result is not. The crystals are acicular — needle-like — and they cluster together in sprays that catch light from every angle. When one needle reflects a beam directly at the lens, the flash is startling. When a hundred needles catch the light simultaneously, the effect is overwhelming.

The blue of cyanotrichite belongs to a class of colors that macro collectors rarely see so vividly. You can hold a specimen of this mineral in your hand and see a faint bluish tint on a gray rock. But under magnification, the blue detaches itself from the rock and becomes its own entity. It is no longer a hint or a tint. It is the entire story. Picture width 6 mm.

07. Elyite

Germany, Sauerland, Neheim-Hüsten, “An der Seilbahn”



For micromount collectors, elyite represents an extraordinary prize due to its rarity, distinctive violet hue, and delicate crystallization. Unlike many common secondary copper or lead minerals that display shades of green or bright blue, elyite is revered for its unusual and striking violet-to-lavender-blue color. Chemically a hydrated lead-copper sulfate, it forms exquisite, microscopic, needle-like (acicular) crystals, often clustering in radial rosettes, spray-like fans, or delicate tufts nestled in host rock cavities.
Because elyite crystals are typically sub-millimeter in size, the mineral holds a special allure for micromount collectors who appreciate fine details under magnification. Its formation requirements make it scarce; it appears in highly specific oxidized lead-copper zone - frequently in alkaline environments or historic post-mining slag dumps - making authentic specimens rare occurrences in the mineral market.

The specific color of these rodlike crystals leaves no room for any confusion: they are elyite, mostly found in slags, just like these. Total length of the crystals 0,6 mm.

08. Erythrite

Spain, Andalusia, Granada, Molvizar, La Encontrada Mine

Some of the most beautiful colors in the mineral world exist because of poisons. Erythrite, a cobalt arsenate, is one of them. The arsenic in its chemistry is toxic; you would not want to handle this mineral carelessly or breathe its dust. But the crystal aggregates it forms — delicate, needle-fine, and a pink so vivid it seems almost artificial — look like tiny flowers that have decided to grow in a place where nothing should grow at all.

The name erythrite comes from the Greek word for red, and the color does lean toward red in some specimens. But in micromounts, the pink is often at its purest, a saturated rose color that appears far more intense than anything visible without magnification. The crystals are fine, radiating needles that form velvety coatings on matrix rock, and the overall effect is one of softness, even tenderness.

The green spheres scattered among the erythrites are conichalcite. Picture width 4 mm.

09. Malachite

Germany, Düsseldorf, Dornap, Schickenberg Quarry

Clear elongated malachite crystals, partly concealed by the calcite matrix..

Malachite is a famous secondary copper carbonate mineral, celebrated for its vibrant bright-green color and distinctive light-and-dark banded patterns.
The mineral most commonly occurs in botryoidal (grape-like), fibrous, stalactitic, or massive rounded formations rather than individual distinct crystals.
Its name derives from the Greek word *malache* (mallow) in reference to its leaf-green color, or *malakos* (soft) referring to its low hardness.
It frequently forms intimate intergrowths with azurite, yielding the striking blue-and-green mineral combination known as azurite-malachite.
Historically, malachite was crushed and used as a major green paint pigment from antiquity through the Renaissance. Today it serves as a popular gemstone, an ornamental stone for decorative objects, and an essential indicator mineral for underlying copper deposits. Picture width 8 mm. Old find from sometime in the 1970s.

10. Uranophane

Germany, Black Forest, Wolfach, Clara Mine

For collectors uranophane holds a powerful allure driven by its intense visual presentation, distinctive crystal habits, and radioactive nature. Its most striking aesthetic feature is its vivid lemon-yellow to canary-yellow color. The mineral frequently forms delicate, needle-like (acicular) crystals arranged in radiating sprays, velvety tufts, or dense fan-like clusters that pop brilliantly against dark host rocks.
Beyond its physical beauty, uranophane occupies a unique niche as one of the most common and sought-after secondary uranium minerals. As a hydrated calcium uranyl silicate, its strong radioactivity adds a layer of novelty and scientific intrigue for advanced collectors who curate radioactive display suites. Under long-wave ultraviolet light, many specimens also exhibit a subtle greenish-yellow fluorescence, adding another layer of visual interest.

This spectacular uranophane is one of the pieces in an old collection, that my friend Felix Maassen obtained some time ago. Picture width 5 mm.

2. Looking through waterclear glass

In the vast spectrum of mineralogy, visual attraction is overwhelmingly dominated by color. The deep azure of azurite, the fiery scarlet of crocoite, and the intense emerald green of malachite capture immediate attention through chromatic intensity. Yet, within the natural world, there exists a quieter, more profound form of elegance: the beauty of colorless crystals. Devoid of transition metal impurities, radiation-induced color centers, or chromophoric chemical bonds, water-clear minerals present an aesthetic grounded entirely in purity, geometry, and light manipulation. Far from being simple voids of color, transparent crystals represent the ultimate expression of mineral perfection - a state where material structure interacts with light in its most unadulterated form.

To appreciate a colorless crystal is to understand that color in minerals is often the result of chemical imperfections. The deep purple of amethyst arises from trace iron substituting for silicon, coupled with natural gamma irradiation; the vibrant green of emerald stems from minor chromium or vanadium impurities within a basically colorless beryl matrix. When a mineral is completely colorless, it signifies an extraordinary level of chemical purity. The lattice consists solely of its essential constituent elements, arranged in flawless periodic symmetry without the lattice defects or foreign chromophores that absorb specific wavelengths of visible light.

This chemical perfection creates a distinct optical phenomenon: total transparency. When light enters a water-clear quartz crystal, a pristine fluorite cube, or a gem-quality diamond, the visible spectrum passes through without selective absorption. The mineral appears colorless not because it lacks identity, but because it permits the entirety of ambient light to traverse through it, fully undisturbed. What remains is pure structure - an unmasked architecture of geometric faces, sharp interfacial angles, and crisp terminations that define the mineral's symmetry group.

Furthermore, the absence of body color shifts the observer's focus from hue to form. In colored specimens, rich pigmentation can often obscure fine growth features, subtle striations, or twin boundaries. In a waterclear specimen, every internal feature is exposed with microscopic clarity. Growth veils, microscopic fluid inclusions, and phantom outlines become suspended in three-dimensional space, offering an unfiltered window into the geological conditions under which the crystal once grew.

Colorless crystals do not merely transmit light; they bend, split, and transform it. Because the substance itself lacks pigment, light becomes the primary medium through which the crystal manifests its visual presence. The interplay between a colorless crystal's refractive index and its crystalline facets governs its brilliance and optical luster.

High-refractive-index minerals like diamond, cerussite or anglesite bend light sharply at their boundaries. When shaped by natural growth or skilled lapidary cutting, these minerals reflect incoming light internally, returning it to the viewer's eye as brilliant flashes of white light. Accompanying this refraction is chromatic dispersion - the separation of white light into its constituent spectral colors as it passes through the crystal. In minerals with high dispersion, such as titanite, zircon or diamond, a colorless matrix acts as a natural prism. The crystal itself remains transparent, yet it projects vivid, rainbow-like flashes of spectral color across its facets, creating a dynamic visual interplay known as "fire".

For collectors, particularly those examining minerals under magnification, colorless crystals offer an unparalleled study in structural geometry. When a specimen lacks vibrant coloration to command the eye, its value relies entirely on symmetry, luster and habit. A waterclear microcrystal of topaz, baryte or phenakite forces the viewer to examine the precision of its natural facets: the mirror-like smoothness of pinacoids, the razorsharp edges of dipyramids, or the complex striations along prism faces.
Colorless minerals also serve as the ultimate visual contrast when situated on a dark matrix. A cluster of waterclear cerussite twins resting on black goethite, or limpid fluorite cubes seated on dark galena, creates a striking monochromatic palette. The dark substrate acts as a shadow box, absorbing light and highlighting the transparent, reflective contours of the overlaying crystals. The contrast emphasizes form over color, transforming the mineral specimen into a high contrast architectural sculpture, carved by geological fluids.

Ultimately, the beauty of colorless crystals lies in their quiet complexity. They do not demand attention through vivid pigments, nor do they rely on chemical impurities for their allure. Instead, they celebrate the fundamental laws of solid-state physics and mineralogy: chemical purity, spatial symmetry, and the behavior of light. In a world rich with colorful distractions, transparent minerals remain timeless symbols of clarity, revealing that the purest form of natural beauty is often found in total transparency.

11. Adamite

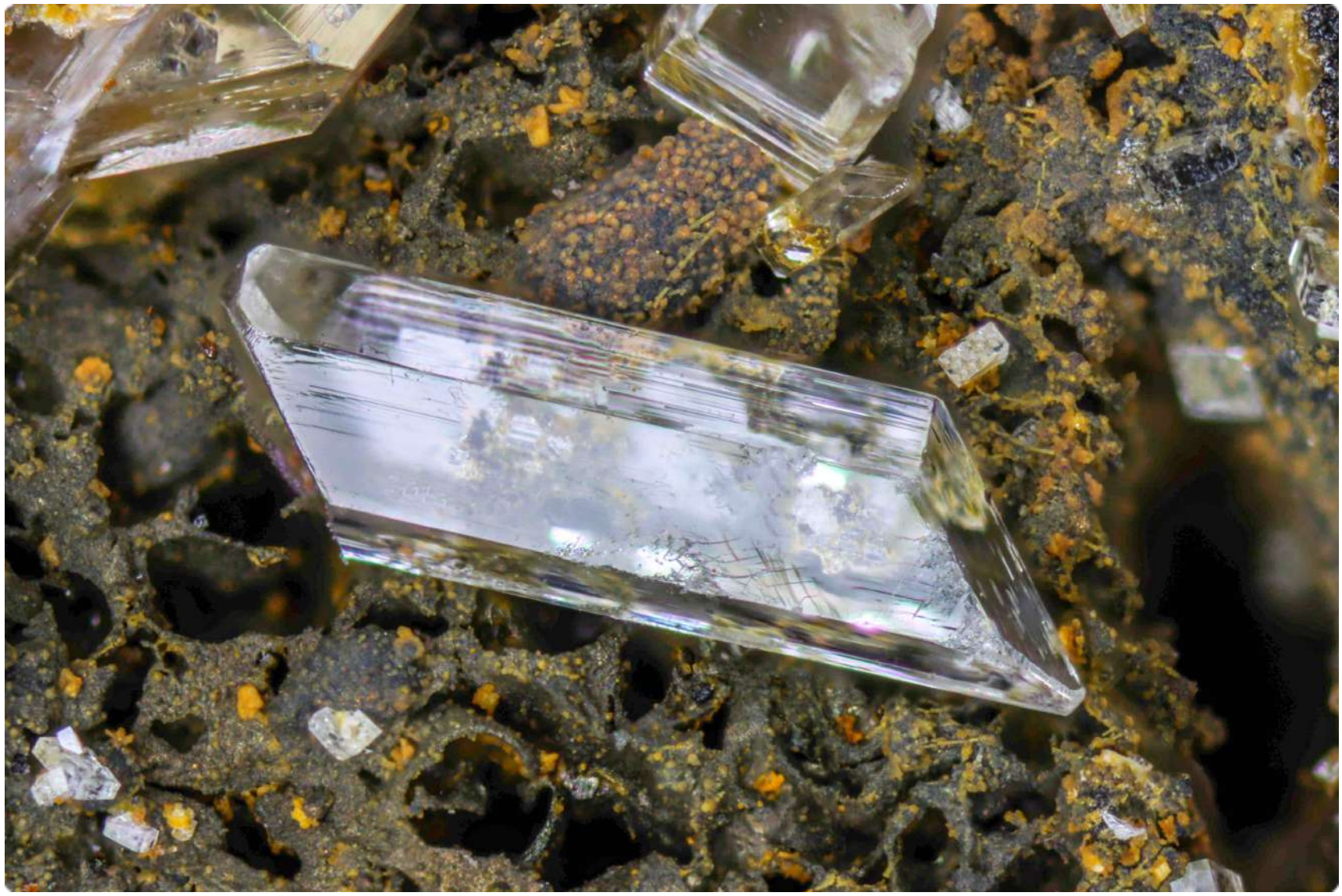
Greece, Attica, Kamariza, Hilarion Mine

While adamite is globally famous for its vivid neon-green or warm yellow hues, completely colorless adamite represents the pure endmember of zinc arsenate, entirely free from transition metal impurities like copper or iron.
Aesthetically, colorless adamite manifests as razor-sharp, blocky, orthorhombic dipyramids, wedge-like prisms, and delicate fan-shaped rosettes. These waterclear crystals possess a brilliant vitreous to sub-adamantine luster that sparkles intensely under direct illumination. Under short-wave and long-wave ultraviolet light, specimens frequently exhibit a spectacular, intense lime-green fluorescence.
Visual contrast plays a major role in its appeal. Colorless adamite typically crystallizes in the gossanous oxidation zones of zinc deposits, perched directly atop dark, cavernous, brick-red to dark-brown limonite or goethite matrix, providing a striking monochromatic balance between glassy, limpid crystals and rugged, rusty host rock.

A classic you might say: highly lustrous top quality adamite crystals that are of 1,2 mm total width.

12. Gypsum

Belgium, Namur Province, Sclaigneaux



Colorless gypsum - often referred to as selenite in its transparent, well-crystallized form - holds a timeless fascination for mineral collectors due to its extraordinary optical purity, silky luster, and distinct crystallographic traits.
Aesthetically, colorless gypsum displays a diverse array of crystal habits. Collectors highly prize its classic contact twin, most notably the famous "swallowtail" and "fishtail" twins, as well as long, razor-sharp acicular needles and thin, flexible tabular sheets. Under magnification, micromount specimens reveal pristine terminations and internal reflections that resemble sculpted ice.
Furthermore, its low Mohs hardness (2) gives colorless gypsum a delicate, pearly-to-vitreous feel that distinguishes it from harder, glassier minerals like quartz or topaz. Situated on dark limestone, limonite, or clay matrices, waterclear gypsum crystals provide a stark monochromatic contrast, making them an enduring favorite for both aesthetic display cases and detailed micromineralogy studies.

This double terminated textbook crystal is 4 mm long. Personal find from around 1993.

13. Hemimorphite

Greece, Attica, Agrileza, Mine No. 6 (“Exi”)

Hemimorphite occupies a legendary status among mineral collectors, revered for its remarkable structural diversity, classic historical heritage, and aesthetic perfection under magnification.
The primary attraction of hemimorphite lies in the crisp, water-clear quality of its crystals and its exquisite array of growth habits. In oxidized lead-zinc zones hemimorphite forms highly aesthetic, razor-sharp tabular crystals, cockscomb aggregates, radiating fans, and delicate sheaf-like sprays. Often completely colorless or exhibiting soft ice-blue to pale turquoise hues due to trace copper inclusions, these crystals possess a brilliant vitreous-to-pearly luster that catches light vividly across its c-axis terminations.
Crystallographically, hemimorphite is a polar zinc silicate that lacks a center of symmetry, meaning its two crystal ends terminate differently - a phenomenon micro-collectors can clearly observe under high magnification on pristine specimens.

This is a 3 mm section of a 3 cm specimen that is completely covered with flowery sprays of hemimorphite crystals in their typical pointy flat habit as it occurs often at this location.

14. Mimetite

Greece, Attica, Kamariza, Christiana Mine

While mimetite is typically celebrated for its intense canary-yellow, orange-yellow, or bright yellow barrel-shaped crystals, completely colorless mimetite represents the pure, unadulterated lead arsenate end-member. It forms when no trace chromophores or chemical substitutions (such as minor vanadium or phosphate) are present during crystallization.
Aesthetically, colorless mimetite manifests as razor-sharp hexagonal prisms, delicate acicular needles, or blocky, water-clear barrels terminating in flat basal pinacoids or pyramidal faces. Because of mimetite's exceptionally high refractive index these colorless crystals possess an intense, diamond-like (adamantine) to resinous luster. Under magnification, the glasslike clarity combined with sharp hexagonal geometry creates brilliant internal light reflections.

This small cluster of hexagonal mimetite crystals is just 0,5 mm high, and is a detail from a specimen of some 6 cm, that carries literally dozens of crystals like these.

15. Minyulite

Australia, South Australia, Koonunga, Tom’s Quarry

Minyulite is closely related to the wavellite later in this chapter. Chemically a hydrated potassium aluminium phosphate, minyulite typically crystallizes in the orthorhombic system. It forms pristine, waterclear to pearly white or pale greenish needles, delicate acicular sprays, radiating fibrous rosettes, and sheaflike crystal clusters nestled inside vugs of ironstone or chert. Visually minyulite and wavellite are not easy to tell apart, but for observant eyes there is clear distinctions in the top endfaces. While both form orthorombic rods, the top faces of wavellite usually are more pointy or rooflike, where minyulite shows flat top faces, as can be clearly seen in the photo.
What you see is a 1 mm fraction of a very rich specimen of some 15 mm.

16. Opal

France, Occitanie, Hérault, Béziers, Caux

Colorless opal - traditionally known as hyalite (Opal-AN) - occupies a distinct and highly prized niche among mineral collectors. Unlike precious opals celebrated for iridescence, hyalite captivates through glassy purity, organic forms, and remarkable optical phenomena.
Lacking an ordered internal silica-sphere lattice, hyalite exhibits no diffraction-based play-of-color. Instead, its charm lies in liquid-like transparency and smooth, rounded growth habits. It forms glassy botryoidal crusts, bubble-like hemispheres, grape-like clusters, and stalactitic drippings that look like frozen water over host rock.
The crowning glory for many collectors is its dramatic fluorescence. Trace uranyl ions incorporated during fumarolic or hydrothermal formation cause many hyalites to glow an intense, neon electric-green under short-wave and long-wave ultraviolet light.

For some reason the waterclear opal at this location tends to grow in coronalike circular arrays, that give it a special appearance. Picture width 3 mm.

17. Phosgenite

Greece, Attica, Lavrion, Vrissaki Point

Phosgenite holds a legendary status among mineral collectors due to its exceptional adamantine luster, high density, unusual chemical composition, and remarkable crystallographic sharpness.
The primary attraction of phosgenite lies in its striking optical brilliance. As a lead chlorocarbonate, it possesses an extraordinarily high refractive index, which gives transparent to translucent specimens a diamond-like, greasy-to-adamantine sheen. Colors range from colorless and waterclear to rich honey yellow, amber brown, pale green, and smoke gray, and exhibiting distinct bright yellow fluorescence under long-wave ultraviolet light.
Aesthetically, phosgenite forms blocky, tabular, or stout prismatic crystals belonging to the tetragonal crystal system. Collectors prize its well-defined crystal faces, sharp terminations, and distinct basal cleavage. Under magnification or in cabinet display, pristine phosgenite crystals often exhibit smooth, glassy surfaces that reflect light with intense brilliance. Height of the crystals is 0,8 mm.

18. Topaz

Germany, Eifel, Ochtendung, Wannenköpfe Quarry

Colorless topaz from the volcanic Eifel region in Germany holds a special place in the mineralogical community. Unlike classic gem-quality topaz that forms in granitic pegmatites or greisens as large crystals, Eifel topaz is a pneumatolytic product of quaternary volcanism. It crystallized directly from fluorine-rich, gas-bearing volcanic vapors in the cavities and vesicles of alkali-rich lavas, basalts, and sanidinite xenoliths. Aesthetically, Eifel topaz manifests as microscopic to sub-centimeter waterclear prisms. These transparent crystals display exceptional geometric perfection, sharp orthorhombic terminations, mirror-smooth faces, and a glasslike vitreous luster. Because they grow unhindered inside small basaltic or slaglike vugs, their crystal faces are often extraordinarily crisp and free of mechanical damage.
The main crystal in this group is 0,8 mm high.

19. Truscottite

France, Île de Réunion, Bras de Cilaos

The primary attraction of truscottite lies in its elegant pearly luster and soft white to creamy-tan coloration. Chemically a complex hydrated calcium silicate, it crystallizes in the trigonal system. Rather than forming blocky individual crystals, it typically manifests as translucent, ultra-thin hexagonal plates, micaceous scales, radiating rosettes, or delicate spherical aggregates. Under magnification, these micaceous rosettes catch light across their perfect basal cleavage planes, emitting a silky-to-pearly sheen that resembles miniature mother-of-pearl flowers.
For collectors, truscottite's appeal is further heightened by its rarity and specific geological occurrences. It is typically found in altered, silica-rich hydrothermal environments, zeolitic cavities in altered basalts, or epithermal gold-silver deposits.

Truscottite is a phyllosilicate, and that can be seen: these trigonal crystals are ultrathin, if not the ultrathinnest of all. The location of origin is La Réunion, the French island in the Indian Ocean, and to be precise a dry river bed called Bras de Cilaos, where this mineral is relatively abundant. Picture width 2 mm.

20. Wavellite

Australia, South Australia, Koonunga, Tom’s Quarry

Wavellite from Australia - most famously sourced from classic phosphate deposits such as the one where this find comes from, as well as select occurrences in Victoria and New South Wales - holds a high reputation among mineral collectors.
The main attraction of Australian wavellite lies in its remarkable aesthetic presentation and vibrant color range. While classic global localities often produce apple-green or forest-green globes, Australian specimens frequently exhibit striking waterclear glassy crystals arranged in perfect radiating spheres, hemispherical rosettes, and fanlike sprays. When broken open or viewed under stereomicroscopy, the cross-sections reveal intricate, silky, radial-fibrous internal structures that catch light with an exceptional vitreous-to-silky luster. What further elevates Australian wavellite for collectors is its rich mineralogical paragenesis. At localities like Tom's Quarry, it occurs alongside an extraordinary suite of rare secondary aluminum and iron phosphates.
The delicate rosettes in this picture measure approximately 4 mm.

3. Perfectly matching the ideal structure

There is a particular pleasure that comes from holding a micromount up against an idealized crystal drawing and seeing them align almost perfectly. The drawing is a schematic, geometric abstraction produced by crystallographers to represent the ideal form of a mineral species. The specimen is a real object, grown under messy, imperfect conditions inside the earth. And yet, with surprising frequency, the two match so closely that it seems the crystal grew with the drawing in mind. This is not an arcane pleasure. It is the pleasure of seeing theory and reality agree, of confirming that the laws of crystallography really do operate in the smallest, most overlooked corners of nature.

I came to this method gradually, over many years of trying to identify specimens whose visible features offered too little to go on. Color alone can mislead. Luster helps but does not clinch it. What reliable fingerprints remain then ? The answer is crystal form: the angles between faces, the symmetry of the habit, the specific geometry that arises from a mineral's internal atomic structure. And the most practical way to assess crystal form at micromount scale is to compare what you see under the lens with the ideal drawings published in various reference sources. The drawing is the key. The specimen is the lock. When the key turns, the identification clicks into place with a satisfaction that never fades.

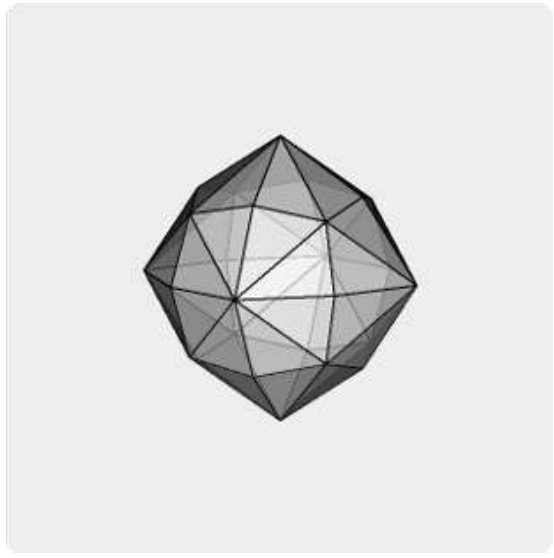
This process became, over time, something more than a practical tool. It became a personal obsession, a detective game I play with myself and with anyone willing to join in. I take a specimen that I don’t immediately recognize, study its external geometry under magnification, and then search for the drawing that matches its form. The moment of recognition, when a tiny crystal's angles and faces align with the drawn ideal, is really rewarding. It transforms an anonymous fleck of rock into a named, understood, verified member of the mineral kingdom. The drawing tells me what I am looking at. The specimen confirms that the drawing describes something real. Together, they create certainty.

Why do microminerals match their drawings so well? Part of the answer lies in scale. Large crystals often suffer from crowding, competition for space and nutrients, and the accumulated stresses of long growth periods, all of which can distort their external form. Microminerals, by contrast, often grow rapidly in small cavities or as late-stage mineralizations where conditions favor clean, simple development. A crystal that reaches only a millimeter in size may have grown in a matter of days or weeks, and its faces often remain sharp, its angles true, its habit as close to the geometric ideal as nature ever permits. This is why the world's most perfect textbook pyrite cubes, galena cubes, and rutile prisms are often found at micromineral scale. The drawing is not a fantasy. It is a target that small crystals frequently hit.

I want to be clear that this method is not a secret known only to professionals. Anyone with a microscope, a specimen, and access to reference materials can do it. The thrill of the match is available to every collector, from the seasoned expert to the curious beginner. If anything, beginners may find it especially satisfying, because the act of matching forces you to look closely, to measure mentally, to compare systematically. It teaches you to see. That is the larger lesson of the method: attention, directed with patience, can turn the unknown into the obvious.

Why do I call it an obsession rather than simply a useful habit? Because it has become part of how I tackle unknown microminerals. When I receive an unknown specimen, I thumb through references in my mind, mentally comparing the crystal's geometry to dozens of idealized forms, narrowing possibilities until a candidate emerges. Then I check, and often the match is so clean it seems preordained. That feeling, repeated thousands of times over forty years, has never once grown dull. Trying to identify an unknown crystal on the basis of comparison with crystal drawings is my personal most important and reliable activity - with one precondition though: you have to know the location of origin, so you know where to begin, and use lists and information on the location as starting point. Without knowing the location you have little or no chance to get on the right track.

This chapter shows 10 crystals that closely match the ideal structure, in accordance with the crystal drawing(s).



The drawings, with friendly permission, are derived from www.smorf.nl and/or www.mineralienatlas.de.

21. Anatase

Spain, Catalunya, Lleida, Vielha e Mijaran

This extraordinary specimen captures the captivating beauty of anatase, celebrated for its sharp tetragonal symmetry, exceptional adamantine luster, and striking deep blue coloration. The crystal showcases classic geometric precision. Its double-pointed dipyramidal habit creates clean, intersecting triangular facets that converge with crisp angularity. Fine horizontal growth striations run parallel across the dominant pyramid faces, reflecting light in razor-sharp lines and highlighting the mineral's high refractive index.

Visually, the crystal exhibits a rich, velvety indigo-to-sapphire blue hue. Blue anatases are an exception to the rule that strange trace elements in the crystal grid cause the color. The blue is caused by the absence of oxygen in some places of the grid, when the crystal forms in an oxygen low environment. The oxygen atoms are replaced by free electrons, to keep the electric neutrality intact, resulting in the absorption of red and infrared, leaving the highly appreciated metallic blue color.

Surely this is one of the most appealing anatase crystals I have. The crystal is 0,5 mm wide.

22. Cobaltite

Sweden, Södermanland County, Tunaberg

Cobaltite holds a premier position among metallic mineral species, appreciated by collectors for its brilliant luster, dense weight, and fascinating crystallographic symmetry. Although its internal atomic structure is orthorhombic (pseudo-cubic), cobaltite macroscopically mimics the highest-order isometric forms. It typically crystallizes as sharp, brilliant cubes, pyritohedrons, and octahedrons, frequently displaying complex, multi-faceted modifications. These crisp geometric crystals reflect light with an intense, mirror-like metallic luster, exhibiting a distinct reddish-silver to steel-gray metallic sheen that sets it apart from related sulfides like pyrite or arsenopyrite.
Found primarily in high-temperature hydrothermal veins and contact metamorphic deposits - most famously at historic locations -, cobaltite serves as a primary ore of cobalt.

One of the best historical locations for crystals of this quality is the mentioned locality in Sweden, where this one indeed comes from. The crystal is 2 mm wide.

23. Cuprite

Australia, Queensland, Cloncurry, Great Australia Mine

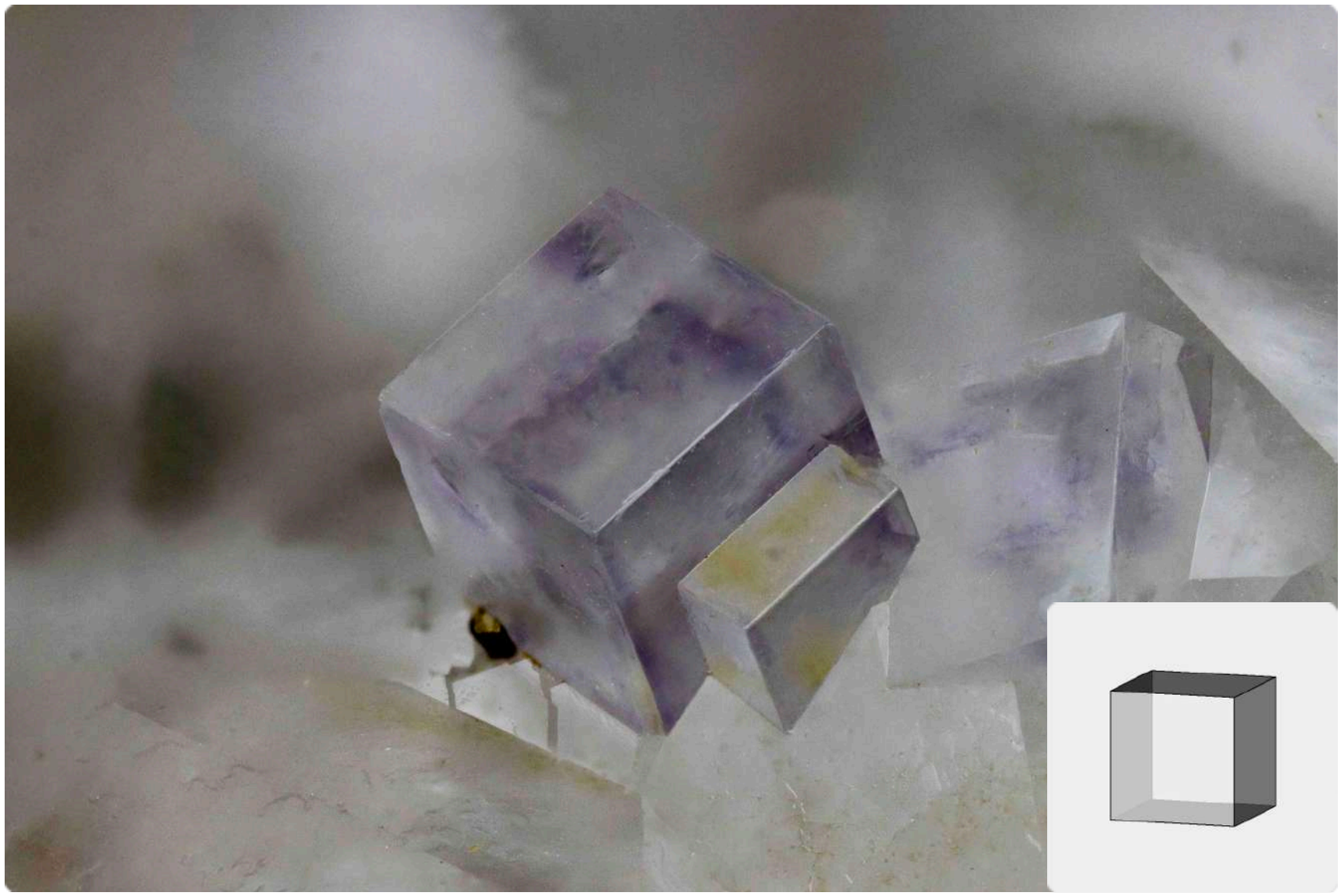
The mesmerizing beauty of cuprite displays intense red color, high refractive index, and sophisticated isometric symmetry. Crystallizing in the isometric system, these crystals present a modified geometric habit. The primary forms show sharp octahedral and cubic faces truncated by small, mirror-like rhombic dodecahedral modifications, creating clean, multi-faceted edges. This geometric precision reflects light vividly across smooth, vitreous-to-subadamantine faces.

Set against a rugged, neutral limonitic matrix, these lustrous red gems form a striking visual contrast. Their rich color, gem-like clarity, and balanced isometric symmetry make this cuprite specimen a true highlight of micro-crystallography and a prized micromount. One outstanding feature of this specimen is that there are different habits visible in one piece.

This beauty was included in a collection of some 350 Australian micromounts that I received some five or six years ago. Picture width 2,5 mm.

24. Fluorite

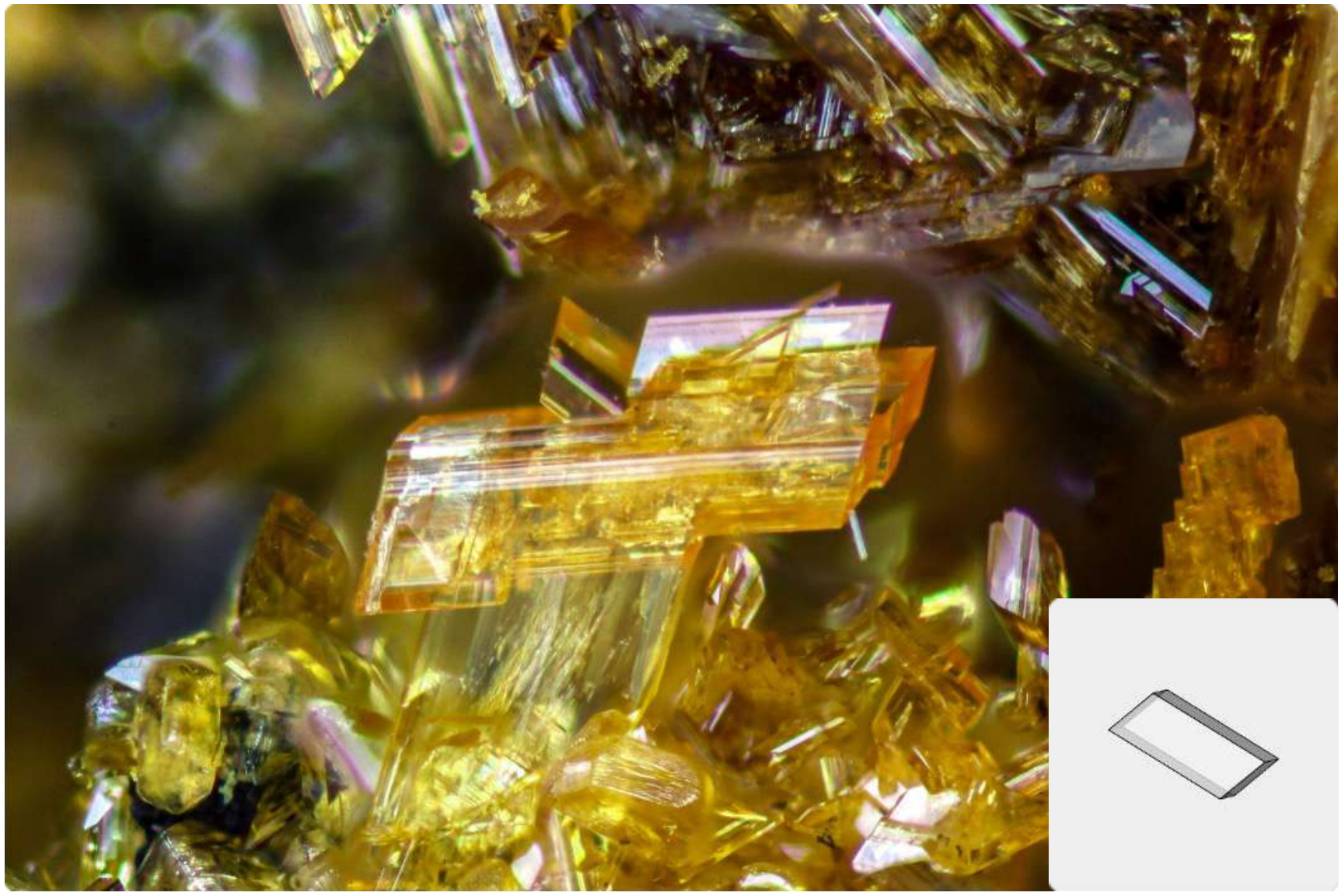
Germany, Black Forest, Wolfach, Clara Mine



The symmetry of fluorite represents the ultimate union of architectural order and natural sculpture. Belonging to the highest-order isometric hexoctahedral class, its perfect spatial balance transforms raw chemical elements into pristine geometric art.
What captivates is how this internal lattice translates into sharp, macroscopic forms. Whether presenting as razor-sharp cubes, sharp octahedrons, or complex dodecahedrons, fluorite expresses pure mathematical proportion.
Aesthetic delight deepens in penetrative twin crystals - where two cubes intersect along a shared three-fold axis - creating complex, interlocking geometries that play dramatically with light. This structural perfection is further enriched by color zoning, where phantom cubes of purple, green, or yellow map earlier growth stages in perfect concentric symmetry. Combined with its famous four-directional octahedral cleavage, fluorite allows us to admire both the growth and internal cleavage planes of isometric geometry. In a display cabinet or micromount box, fluorite stands as a timeless masterpiece of natural crystallographic balance.
I have a lot of fluorites from Clara, but I chose this one for the book because of its almost perfect symmetry. The crystal is 2 mm wide.

25. Laueite

Gemany, Bavaria, Hagendorf-South



Laueite may count as a prized secondary phosphate, highly enjoyed by micromount collectors for its rich golden coloration, complex triclinic crystal habit, and glassy transparency.
Crystallizing in the triclinic crystal system, laueite lacks high-order rotational symmetry or mirror planes, resulting in uniquely asymmetric, thin tabular to bladed prisms. In this image, the dominant central crystal exhibits sharp, stepped growth features and fine parallel striations running along its length. These mirror-smooth, chisel-like terminations reflect light with a brilliant vitreous-to-subadamantine luster.
Forming as an alteration product of triphylite or ferroan rocks in complex granite pegmatites, laueite often nests among other secondary phosphates. Nestled against a darker, iron-stained cavity, these sharp, golden blades present a captivating study in fine triclinic symmetry, optical clarity, and intricate micro-aggregate architecture.

This laueite comes from a classic location, that is no longer accessible: the pegmatite of Hagendorf-South, Bavaria, Germany. It is certainly the best laueite in my collection. Picture width 0,5 mm.

26. Olivenite

Germany, Black Forest, Wolfach, Clara Mine

Few secondary copper minerals display as many distinct morphological forms as olivenite. It can be hairlike, fibrous, globular, but the most striking are the prismatic to short blocky, well-defined, stout crystals with sharp chisel-shaped terminations.

Visually, the deep olive-green to yellowish-green tone of these translucent prisms provides a striking chromatic contrast when perched against a pale, sparkling matrix of rhombohedral calcite or quartz crystals, making olivenite a masterpiece of polymorphic geometry.

The Clara Mine is without doubt one of the best places for olivenite crystals in all kinds of habits. Of course this one comes from there, one of over 100 from there in my collection, none of which are the same - could easily write a monography on olivenite. Picture width 2 mm.

27. Osumilite-(Mg)

Germany, Eifel, Burgbrohl, Herchenberg Quarry

This image beautifully illustrates the classic hexagonal symmetry of osumilite, in this case osumilite-(Mg), a cyclosilicate belonging to the milarite group. In this specimen, the symmetry manifests as a sharp, thin tabular plate perched edge-on in the host matrix. The crystal's upper perimeter displays stepped hexagonal prism faces meeting at clean 120 degrees angles, capped by a flat basal pane. This architectural geometry directly reflects its underlying atomic framework of double six-membered silicate rings.
The crystal exhibits a delicate translucent blue-gray to smoky lavender-violet hue, typical of iron-rich osumilite. Under magnification, its vitreous luster catches light along the crisp bevels of the hexagonal rim, emphasizing the razor-thin profile of the plate.
Set against a warm, granular yellowish-orange matrix, the cool blue-gray tone and strict geometric contours create a striking aesthetic contrast. For micromount collectors, this crystal stands out as an exquisite, textbook example of high-order hexagonal symmetry, captured in a rare volcanic cavity environment.
In the Eifel in Germany there are several locations where you can find attractive microcrystals of osumilite. Mostly however they are very small and hard to detect.
Personal find in the 1990s. Picture width just 1 mm.

28. Skutterudite

Morocco, Ouarzazate Province, Bou Azzer Mining District

Crystallizing in the isometric system, the cobalt arsenide skutterudite displays exceptional geometric variety. It routinely forms sharp octahedrons, bright cubes, and complex pyritohedrons, often truncated by secondary dodecahedral facets. Under magnification, these mirror-smooth face modifications converge at precise angles, catching direct lighting to produce an intense, mirror-like metallic luster with a distinctive tin-white to steel-gray sheen. Named after its type locality in Skutterud, Norway, skutterudite forms in hydrothermal veins alongside other cobalt and nickel arsenides. Over time, surface weathering can coat skutterudite with vibrant magenta-pink crusts of erythrite ("cobalt bloom"), offering a vivid indicator of its cobalt content.

Skutterudite captivates through the sharp contrast of its brilliant, silver-white geometric crystals set against dark, calcitic or quartzose matrix. Its dense metallic habit, combined with textbook isometric forms, makes skutterudite a cornerstone species for any collection.

Crystals of skutterudite in this quality are rare, the best of them, and this one too, coming from the Bou Azzer region in Morocco. Diameter of the crystal 2 mm.

29. Spinel

Italy, Piedmont, Turin, Valchiusa, Vico Canavese

Black spinel occupies a bold, dramatic niche in mineral collecting, because of its razor-sharp isometric symmetry, high refractive index, and intense jet-black brilliance. Chemically an aluminium oxide within the spinel group, black spinel crystallizes in the isometric system. Its defining crystallographic signature is the classic, textbook octahedron. These eight-sided double pyramids feature exceptionally straight edges and smooth, mirror-like faces.

Because of its high refractive index and sub-adamantine to vitreous luster, black spinel reflects light with a sharp, glassy reflectivity despite its complete opacity.

Aesthetically, the power of black spinel lies in high-contrast display. Perched as jet-black, geometrically perfect octahedrons against pale white marble, sugary calcite, or light skarn matrix, black spinel stands as a timeless emblem of structural balance and obsidian-like optical drama. This crystal is 1,5 mm wide.

30. Vanadinite

Morocco, Midelt Province, Mibladen Mining District

Red vanadinite from Morocco is world-renowned among for its intense crimson-red coloration, crystallographic perfection, and brilliant luster.
Crystallizing in the hexagonal suystem, vanadinite forms razor-sharp, six-sided tabular plates, blocky prisms, and barrel-shaped crystals. The top pinacoid faces are typically smooth and mirror-like, meeting the vertical prism faces at exact angles with architectural precision.
What sets Moroccan specimens apart is their extraordinary visual power. The crystals display a rich, saturated fiery red to deep ruby hue, driven by vanadium within the lead-phosphate-vanadate lattice. Combined with vanadinite's high refractive index the crystals possess an intense adamantine-to-resin luster that sparkles intensely under display lighting.
The brilliant red hexagonal crystals frequently sit in high contrast against a pale white-to-cream baryte matrix or dark manganese oxides. This combination of intense color, high refractive sheen, and sharp hexagonal geometry makes red vanadinite one of the most recognizable and coveted mineral species in all of mineralogy. Picture width 12 mm.

4. Shapes that defy geometry

In the previous chapter, I showed you crystals that seem to have been pulled straight out of a textbook — perfect cubes, clean prisms, ideal terminations. Those are the satisfying ones, the ones that make you nod and say, "Yes, that's exactly what a fluorite should look like." But nature doesn't always play by the rules we expect. Sometimes you find a crystal that looks nothing like the drawing, and for a moment you wonder if you've misidentified it entirely.

That moment of doubt is where the fun begins. Because when a crystal defies the expected geometry, it's not breaking the laws of crystallography - it's expressing them in a way you haven't seen before. The angles are still there. The symmetry is still there. It just takes a little more patience and perseverance to find them, a little more willingness to look past the surface and see the structure underneath.

What you'll see in this chapter are crystals that turned away from the ideal. Some of them grew too fast, leaving hollow spaces and stepped edges. Others were crowded by neighboring minerals and had to extend in one direction instead of another. None of them are mistakes. All of them are masterpieces.

I want you to approach these specimens with curiosity rather than confusion. When you see a crystal that looks like a staircase to nowhere, ask yourself what conditions might have caused it to grow that way. When you see a rosette of thin blades, consider how pressure and available space shaped the final form. The more you ask, the more the crystal reveals - and the more you'll appreciate just how flexible and creative nature can be.

This chapter builds on what you've learned about the perfect match, but it takes a different path. Here the drawing is a starting point, not a destination. It gives you a framework, a set of expectations, that makes you amazed as well as determined to figure it out.

The connection between the 10 crystals in this section is, that none of them seem to match the drawing, the reason of which being that the individual crystals are so unexpected and stubborn that they mask the underlying atomic geometric shape.

31. Aurichalcite

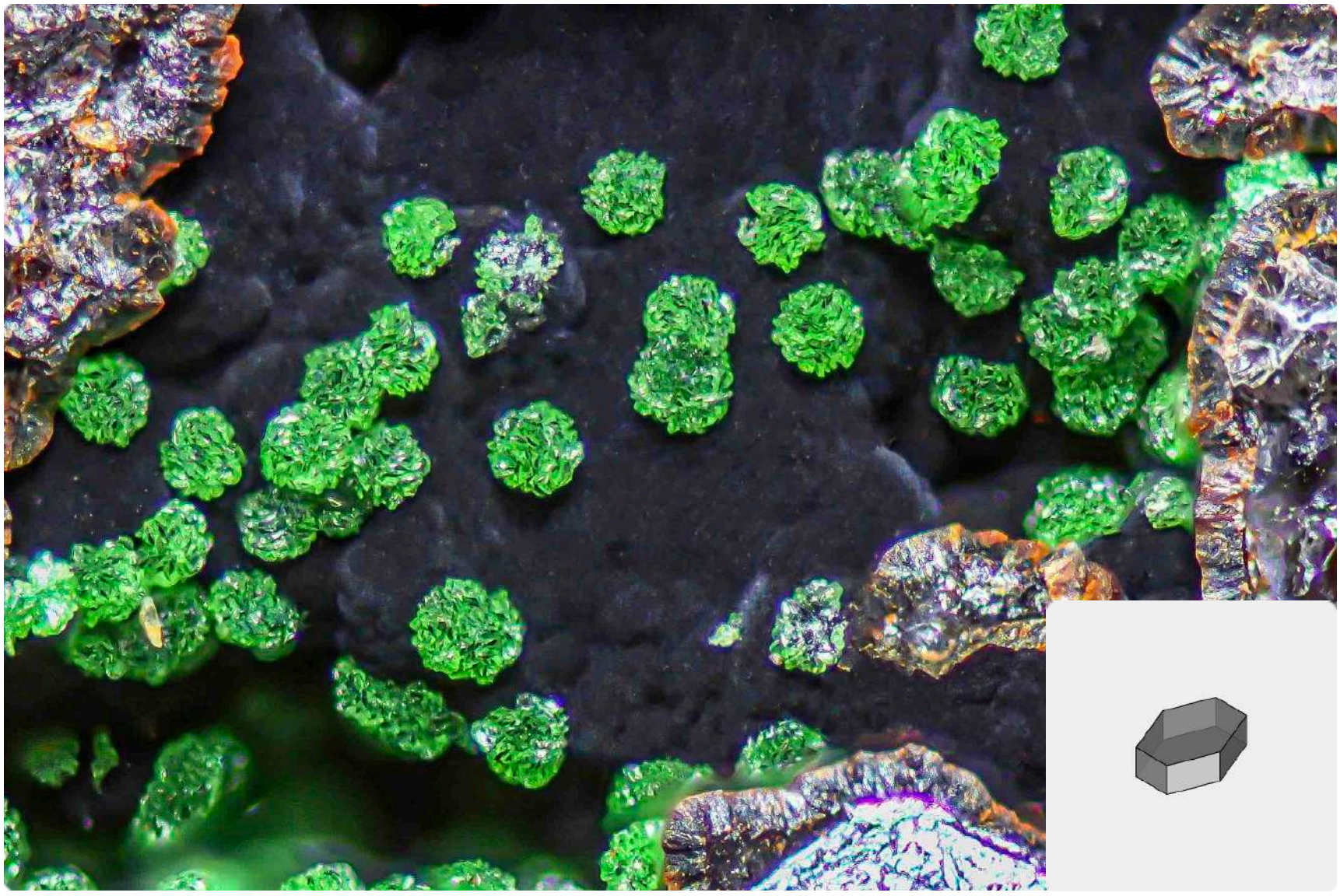
Germany, Düsseldorf, Wülfrath, Rohdenhaus Quarry

Aurichalcite is a relatively common zinc-copper carbonate, that forms extremely thin, flattened laths, needle-like acicular prisms, and delicate bladed crystals. These ultra-fine blades typically aggregate into radiating, fan-shaped sprays, tufted rosettes, or velvety carpet-like crusts lining cavity walls in oxidized base-metal deposits. Visually, aurichalcite is defined by its vibrant sky-blue, aquamarine, or pale turquoise-green color, produced by the co-presence of copper and zinc within its carbonate structure. Under magnification, the thin blades exhibit a striking pearly-to-silky luster. When light passes through the semi-transparent, paper-thin blades, the edges shimmer with a soft, ethereal glow.

The charm of aurichalcite lies in its extreme fragility and textural contrast. Perched as brilliant blue, feather-light bladed sprays inside vugs of dark brown goethite or rusty limonite, aurichalcite creates a stark, dramatic visual pairing. Its exquisite bladed habit and delicate structure make it one of the most elegant species in the secondary oxidation universe. Picture width 5 mm.

32. Bayldonite

Germany, Black Forest, Wolfach, Clara Mine



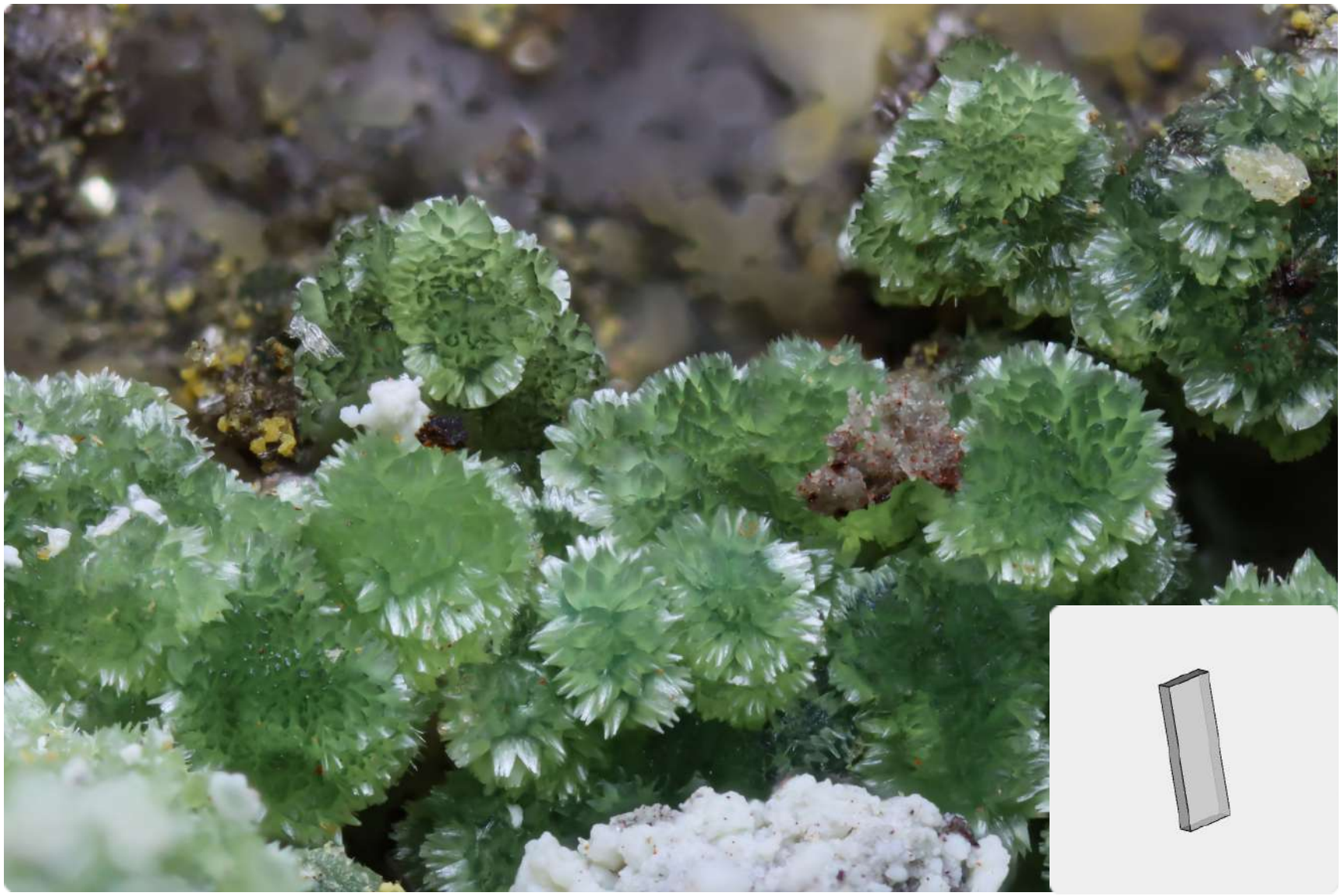
Bayldonite rarely presents as large, well-formed single crystals. Instead, as vividly captured here, it thrives in distinctive, sub-spherical micro-aggregates. The specimen features bright, apple-green to grass-green spherulites and rosettes composed of densely packed, overlapping micro-scale tabular or bladed crystals. Each rounded cluster exhibits a shimmering, sub-adamantine to resinous luster that glints intensely under reflected light.

The EDX analytical confirmation adds scientific rigor to this aesthetic beauty, verifying the exact lead-copper arsenate chemistry behind the vivid secondary mineralization. The specimen represents a textbook display of bayldonite's classic botryoidal-spherulitic growth habit and chromatic brilliance within an oxidized gossan environment.

This great piece was found by my friend Eric Nieuwenhuis in 2019 at the Clara Mine, who gave me a part of it. For quite some time we were uncertain as to what it could be, but eventually it was formally EDX-analysed to be bayldonite - which is a pleasant surprise, because bayldonite often encrusts other minerals, and not too often forms these separate crystals. Picture width 1 mm.

33. Hilarionite

Greece, Attica, Kamariza, Hilarion Mine



Hilarionite, in the monoclinic system, rarely forms well-isolated, sharp single crystals. Instead, its growth behavior is dominated by rapid, sub-microscopic crystallization that produces distinctive, highly fibrous micro-aggregates.
The primary habit consists of spherical to hemispherical aggregates up to 1 mm in diameter. These spherulites display a delicate, silky luster resulting from thousands of ultra-thin, radiating micro-fibers. Also it forms fan-shaped sheaves, sheaves-of-wheat clusters, and open, divergent sprays composed of curved, hair-like acicular "individuals" up to 0.5 mm long.
Under micromount magnification, hilarionite captures attention through its soft, organic curvature and silky light reflection, providing a striking contrast against rugged gossanous host rock.
Hilarionite is utterly delicate and extremely difficult to handle - the crystals will very easily fall off their just as brittle matrix. As you may infer from its name, the Hilarion Mine is the type locality. Picture width 2 mm.

34. Metatyuyamunite

DR Congo, Kolwezi Mining District, Mashamba West Mine

Orthorhombic metatyuyamunite typically forms flattened, thin tabular plates or scaly crusts. In this remarkable specimen, however, the growth pattern exhibits a dramatic divergent bowtie or sheaf-like aggregation. Hundreds of ultrathin, bladed-to-acicular microcrystals radiate outward from a central pinch point, creating two expanding, fan-shaped sprays that mimic a flower or bowtie.

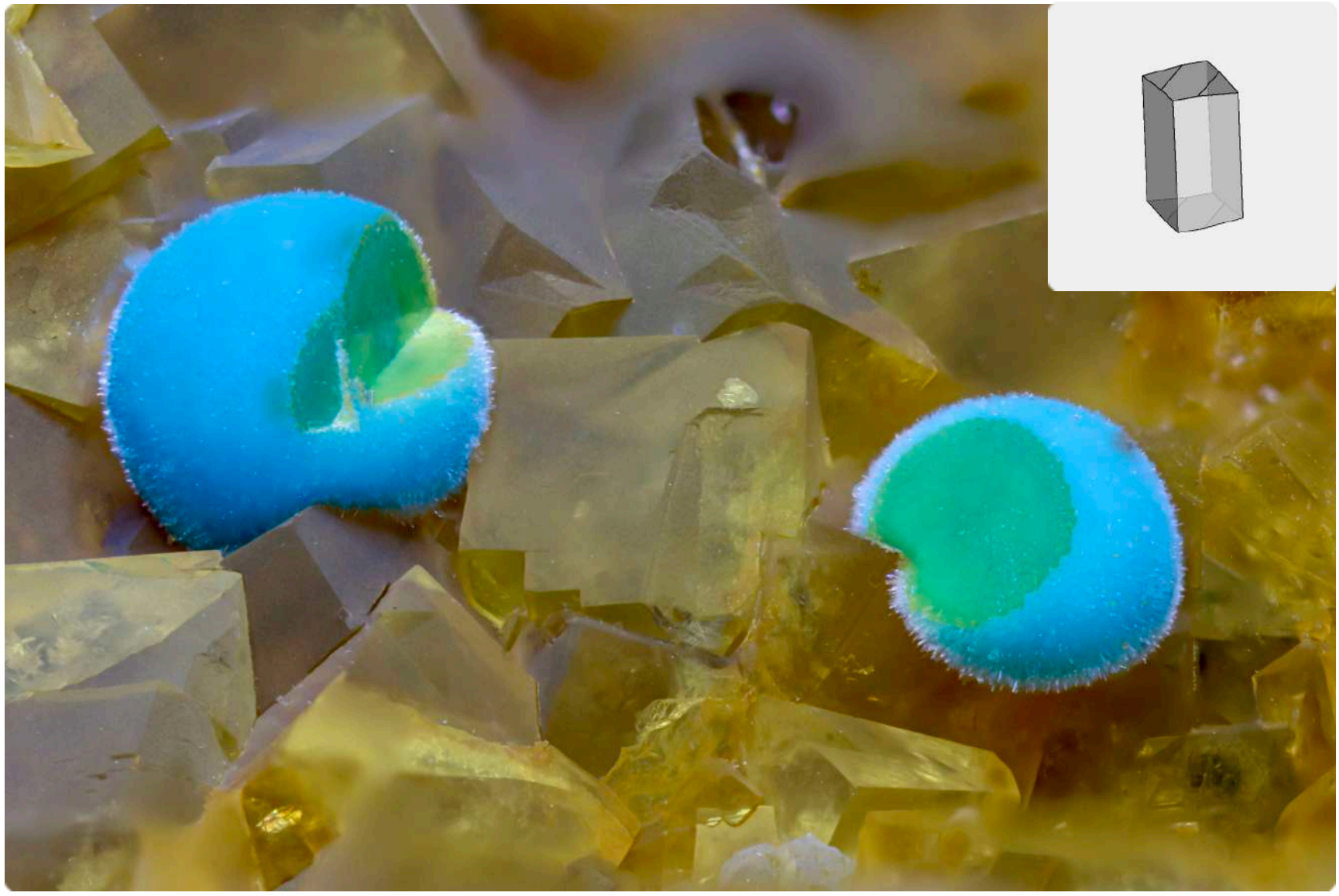
The aggregate blazes with an intense, canary yellow to electric lemon yellow hue, characteristic of the uranyl chromophore paired with vanadate groups. Under focused light, the delicate, feathery terminations of the needles produce a silky, pearly-to-adamantine sheen.

The visual impact is magnified by the surrounding environment: the vibrant yellow bow-tie sits perched in stark contrast against a dark, deep green, fibrous matrix of acicular malachite. This striking combination of radial geometry, electric color contrast, and architectural delicacy makes this metatyuyamunite a standout centerpiece for a micromount reference collection.

Metatyuyamunite is one of the U-minerals that are abundant in DR Congo. Picture width 3 mm.

35. Rosasite

Italy, Trento, Levico Terme, Monte Fronte Assay



Rosasite and its zinc-dominant relative zincrosasite occupy a cherished niche in secondary copper and zinc minerals. Both form as alteration products in oxidation zones of base-metal ore deposits.
Color in this case serves as primary visual clue. Usually, rosasite, driven by its higher copper-to-zinc ratio, displays saturated sky-blue, aqua-blue, or vibrant turquoise-green hues. In contrast, zincrosasite shifts toward lighter, paler sky-blue or greenish-white tones as zinc replaces copper within the monoclinic carbonate lattice.
Nestled within cavity vugs, these velvety, spherical microstructures provide exceptional aesthetic contrast and textural elegance again.

However, in contrast to the text above this is what may be called an unexpected surprise. On a matrix of fluorite these are, according to the analysis as I've been told, two spheres of green rosasite, covered with a layer of blue zincrosasite - which I feel as counterintuitive, because in my experience it should just be the other way around - as the text indicates. I can only hope the information given is indeed correct, but I keep having my doubts. Picture width 5 mm.

36. Rutile

Switzerland, Valais, Binn Valley, Wanni Glacier

Rutile is renowned for its spectacular crystallographic twinning, offering some of the most dynamic geometric forms in the tetragonal crystal system. Its twinning predominantly obeys the twin law, where two individual prismatic crystals share a common lattice plane. This contact angle produces several iconic twin habits:

- Geniculate (knee) twins: the most famous manifestation, where two prisms meet at a sharp, characteristic angle, creating a bent, "knee-like" joint.
- Cyclic (ring) twins: repeated twinning across six or eight individual segments can form closed, wheel-like or ring-shaped cyclic aggregates with open central cavities.
- Sagenite networks: delicate, multi-directional intergrowths of needle-like acicular twins forming intricate, lattice-like webs within quartz or as delicate surface sprays.

Rutile also exhibits polysynthetic twinning on creating fine, parallel striations across crystal faces.

This is a rutile from the Binn Valley in Switzerland, in its typical brownred color, but in a habit with very complex twinning. A find from somewhere in the 1990s. Picture width 2,5 mm.

37. Smithsonite

Greece, Attica, Agrileza, Mine No. 6 (“Exi”)

Under magnification, these crystals exhibit a high glassy-to-pearly luster, with light refracting softly through the gemmy, translucent green interiors. Perched directly atop a dark, iron-rich gossanous matrix - accompanied by tiny tufts of pale blue secondary rosasites - this specimen offers a sensational interplay of trigonal modification, trace-element color variance, and stark matrix contrast. Smithsonite most commonly presents as smooth, botryoidal crystals. Here, however, it displays an exceptional spheroidal to composite-rhombohedral growth habit. The crystal clusters form sub-spherical, rounded aggregates with stepped, curved rhombohedral faces, resulting from sub-parallel micro-crystal growth during rapid precipitation in an oxidized vug environment.
What makes this specimen visually extraordinary is its rare, saturated apple-green to vivid lime-green coloration. This striking chromatic hue is driven by traces of copper substitution replacing zinc in the carbonate lattice.

This photo represents a small section of roughly 6 mm of a larger piece of some 5 cm.

38. Spessartine

Spain, Andalucia, Malaga, Cartama, Trascastillo

This picture highlights a captivating, highly unusual growth habit in spessartine garnet, quite different from the species' typical smooth-faced rhombic dodecahedra or trapezohedra.

Rather than developing pristine, planar faces, this gemmy orange-amber crystal exhibits a complex skeletal, hoppered, and etched surface architecture. The face is dominated by concentric, stepped geometric terraces and geometric pits (etch figures) that trace the underlying isometric symmetry of the garnet lattice. This extraordinary pattern arises from rapid late-stage growth fluctuations in pegmatitic vugs - where crystal edges grew faster than face centers - followed by corrosive dissolution by late-stage hydrothermal fluids. The result is a labyrinthine, architectural topography reminiscent of a miniature step-pyramid or circuit board.

Visually, the specimen excels in optical brilliance. Its fiery cognac-to-mandarin orange color glows from within, catching light along dozens of micro-step edges to create dynamic internal reflections and a fiery, sub-adamantine luster. The crystal is 2 mm wide.

39. Turquoise

Norway, Notodden, Tinfoss Jernverks Quartz Quarry

Turquoise is a secondary hydrated copper aluminum phosphate prized for its sky-blue to robin's-egg green hues. Macrocrystals are extraordinarily rare. Instead, turquoise usually forms cryptocrystalline, massive, or fine-grained vein fillings and botryoidal crusts within oxidized copper deposits in arid environments.
While turquoise is traditionally associated with desert regions like in Arizona, Norway hosts notable, highly localized micromineral occurrences. Unlike the massive, gem-grade material cut into cabochons for jewelry, Norwegian turquoise is renowned for yielding distinct, small crystalline aggregates and microcrusts nestled in matrix seams.
Visually, Norwegian specimens range from pale robin's-egg blue to mint green. Under micromount magnification, these tiny encrustations showcase delicate porcelain-like to vitreous luster, standing out as a rare geographic specialty that demonstrates the surprising versatility of secondary phosphate mineralization within Scandinavian pegmatitic and hydrothermal environments.
This shiny crystal is really top quality, it is around 1 mm wide.

40. Wulfenite

Australia, Western Australia, Whim Creek Copper Mine

Wulfenite is one of those minerals that surprises you every time. Its idealized drawing shows a tetragonal tablet, a thin square plate with beveled edges. That's straightforward enough. But pull a wulfenite micromount under a lens and you'll find that real crystals sometimes twist, stretch, or warp those tablets into shapes that seem to mock the drawing entirely. Some are so thin they're almost translucent windows. Others pile on top of each other in stacks that look like pages in a tiny book.

What makes wulfenite so fascinating is the way it plays with the concept of a crystal face. The drawing suggests a crisp, flat surface with sharp corners. But many wulfenite crystals have slightly curved faces, as if they softened during formation. The edges aren't razor-straight. The corners aren't perfect right angles. And yet the tetragonal symmetry is unmistakable once you know how to look for it - the four-fold axis running through the center of the tablet, the way the bevels catch light at predictable angles.

As can be seen, there are several different habits in this 5 mm wide picture. A group like this on a good contrasting background, for me is a highly appreciated photo-object.

5. Playing with reflections

You can hold a micromount in your palm, tilt it toward a lamp, and see nothing but a speck of dust. Then you put it under the microscope, adjust the angle of the light just a fraction, and suddenly the whole thing ignites. A face that looked gray and dead becomes a polished mirror. A surface you thought was dirt reveals a deep internal glow, as if the crystal had swallowed a tiny sun and decided to share it with you. This is the moment that luster stops being a word in a textbook and becomes a physical event, something that happens between the crystal and your eye, mediated by light and surface and angle. I have spent countless hours chasing that moment, and it never loses its strangeness. The crystal does not change. The light does not change. But when they meet at the right angle, something shifts.

Luster is not just beauty, though. It is information. When I photograph a micromount and the light behaves in a certain way, that behavior tells me things about the crystal that its shape alone might not reveal. A mirror-bright reflection suggests a metallic mineral. A soft, silky sheen hints at something fibrous, little needle-like crystals bundled together. A glassy surface with a faint depth to it points toward a transparent mineral with a relatively high refractive index. Luster is not the same as color, and it is not the same as form. It is a third voice in the identification chorus, and sometimes it is the voice that sings the loudest. As I have explained earlier, color can mislead, and as we did explore in our discussion of crystal drawings, form is the most reliable fingerprint. But luster sits between them, a clue that can confirm or complicate, and you learn to search for it.

The lesson I carry from years of playing with light is simple. Luster is not a category to memorize; it is an event to experience. Metallic, glassy, pearly, silky, adamantine - these words are useful, but they are only pointers. The real thing happens when the light meets the surface and your eye receives the result. That moment cannot be captured in a definition. It can only be seen, and only at the scale where these tiny treasures live. When I photograph a micromount, I am not just recording a mineral. I am recording the light as it dances. The mineral is the stage. The light is the performer. And the photograph, if I am lucky, is the applause.

In all the pictures in this section the emphasis has been laid on making the crystal faces as clear as possible. Without this play with the light you would mostly only see unclear crystals without much detail or distinction between the faces.

41. Baryte

USA, Alabama, Tallapoosa. Co., Lowe Mine

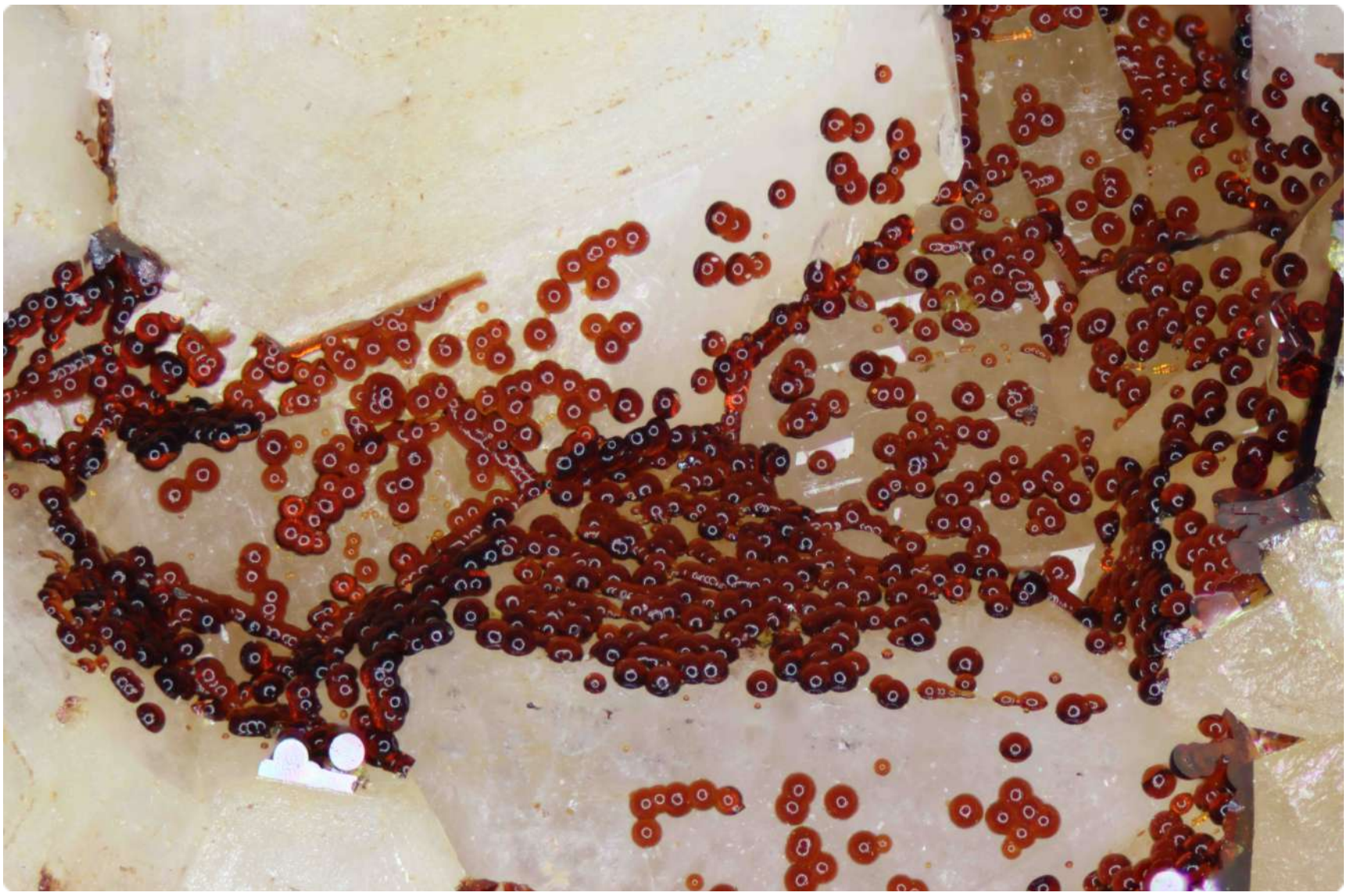
This photo emphasizes exactly the reason why reflecting faces should be made visible. The two crystals that show the reflection are well visible with sharp edges, whereas the ones without it are not very easy to observe and distinguish from the background.

The gemmy, golden-yellow crystals are dominated by broad, flattened basal pinacoids, creating clean, rectangular mirror-like panes. Under magnification, these principal faces exhibit fine, vertical growth striations and silky surface textures parallel to the crystal axes.

I don’t know what the matrix could be. Picture width 5 mm.

42. Goethite

Germany, Black Forest, Wolfach, Clara Mine

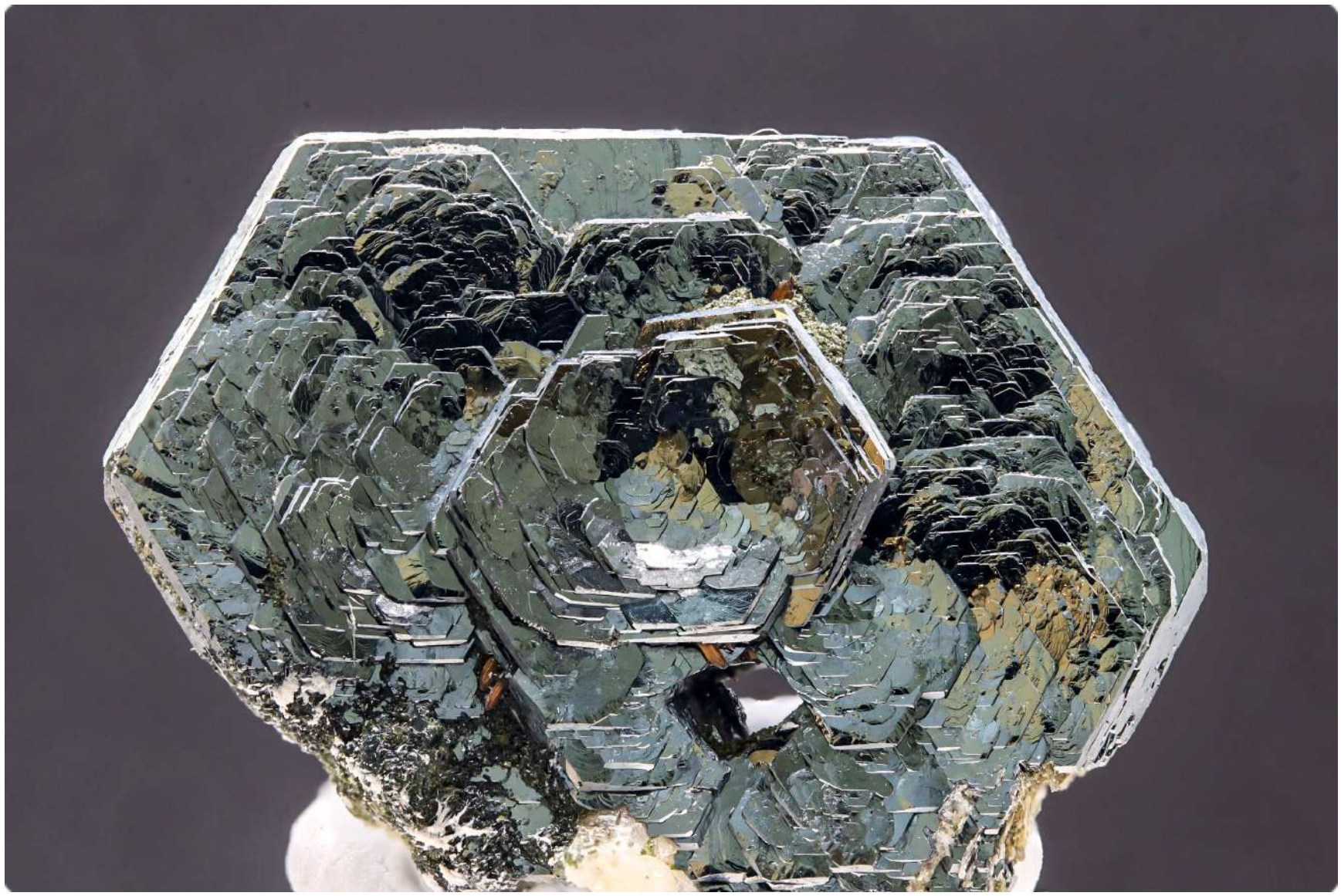


The striking "bullseye" or "light ring" effect visible within these goethite spherulites included in quartz is a captivating catadioptric optical phenomenon. Rather than being a physical color band within the mineral, these halo-like rings are produced by a combination of internal light refraction and reflection driven by geometry and refractive index contrast.

Goethite is translucent in micro-scale dimensions with an exceptionally high refractive index. When light enters the rounded, hemispherical surface of each spherulite, the curved boundary acts as a tiny dome lens, bending incoming rays inward toward the central core. As light hits the inner boundary where the goethite meets the host quartz, a portion of the light reflects backward toward the viewer. Because the spherulites consist of tightly packed, radially oriented sub-microscopic fibers, light scatters outward symmetrically along the radiating crystal axes. This creates a bright internal focal ring surrounding a darker central axis, glowing like a luminous halo within the reddish-brown iron oxyhydroxide volume. Perched across clear quartz faces, these illuminated halos transform simple inclusions into a dynamic, optics-driven. Picture width 5 mm.

43. Hematite

Switzerland, Valais, Binn Valley, Kriegalp



This habit of hematite develops extremely thin, tabular plates bounded by dominant basal pinacoid faces. In this specimen, hundreds of micro-thin, six-sided hexagonal plates overlap in a delicate rosette, oriented sub-parallel to one another like architectural glass panes.
What elevates this specimen to reference catalog quality is its optical brilliance. Hematite possesses an extraordinarily high refractive index and an opacity that concentrates light reflection purely at the crystal surface. As direct light strikes the smooth pinacoid planes, each thin plate acts as a silver-black mirror pane.
Under magnification, these specular reflection panes catch the light in tiered, razor-sharp steps. Brilliant metallic highlights flare off the bevels and crisp hexagonal perimeters, creating an intricate play of mirror-like flashes and dramatic shadowing.
Set against a neutral background, these overlapping metallic panes offer a spectacular masterclass in trigonal symmetry, surface reflectivity, and architectural rosette growth.

This hematite is approximately 15 mm wide - actually more of a thumbnail than a micromount. Its specific habit is often called “iron rose”.

44. Mimetite

Australia, New South Wales, Broken Hill, Kintore Open Cut

Belonging to the apatite group, mimetite crystallizes in the hexagonal crystal system.
In this specimen, the species exhibits a robust, modified hexagonal habit.
The main crystals present as stubby hexagonal prisms capped by steep dipyramidal faces and flat basal pinacoids. Several other crystals display rounded, barrel-like contours where adjacent prism and pyramidal faces merge smoothly, a habit characteristic of classic Broken Hill mimetite.

The optical brilliance relies on mimetite’s high refractive index. The crystals show a rich, resinous-to-adamantine luster, with direct lighting creating bright, mirror-like specular reflections off the sharp crystal facets.
The saturated amber-to-canary yellow translucency glows brilliantly against the dark, textured "coralloidal" manganese background, creating textbook micromount color contrast and geometric elegance.

This group of compact crystals sits on a bed of coronadite. Picture width 3 mm.

45. Proustite

Morocco, Tinghir Province, Imiter Mine

Few discoveries match the pulse-quickening thrill of encountering high quality proustite. Known reverently as "ruby silver," this sulfosalt embodies a tantalizing interplay of sharp crystallography, fiery optics, and extreme preservation. In this remarkable micromount, a complex cluster of striated, prismatic crystals bursts forth from a dark, sparkling metallic matrix.

The true collector’s thrill lies in the optical fire - proustite possesses an exceptionally high refractive index. Under targeted illumination, light penetrates the deep vermilion exterior, igniting a fiery, blood-red internal glow that pulses from within the translucent core. The dominant prismatic faces feature razor-sharp longitudinal striations that catch direct light, creating brilliant silver-to-crimson specular highlights across its adamantine surface.

Morocco is one of the best sources for fine proustite crystals, and the Imiter Mine, where this group comes from, is one of the most outstanding locations. Picture width 4 mm.

46. Pseudobrookite

Germany, Eifel, Drees, Niveligsberg

While typically sub-metallic jet-black to dark reddish-brown, this specimen displays an extraordinary optical spectacle: thin-film interference iridescence. As light encounters a microscopic, nano-scale surface film of secondary oxidation or alteration products, light waves reflect off both the outer film boundary and the underlying crystal face. Constructive and destructive light interference produces a brilliant, continuous rainbow spectrum. Electric royal blue, magenta, violet, gold, and turquoise shift across the smooth planar pinacoids and prismatic faces as the angle of incident light changes. The high sub-metallic-to-adamantine luster of the host crystal amplifies this chromatic sheen, transforming what is usually a dark oxide into a dazzling iridescent ribbon.

In normal light the color of this specimen is dark brown to black, but under the bright light of my photo setup and positioned at a specific angle this iridescence effect becomes visible. The crystal is 3 mm long, the matrix consists of sanidine crystals.

47. Pyrite

France, Occitanie, Tarn, Peyrebrune, Le Rivet Quarry

This photo showcases a mesmerizing, hemispherical dome composed of tiny, interlocked pyrite microcrystals resting atop a dark pedestal of galena.
Both species crystallize in the isometric crystal system, but their contrast in optical reflectivity creates a striking visual interplay.
The curved outer dome consists of dozens of sub-parallel micro-cubes and pyritohedra. As light sweeps across the rounded surface, each individual facet acts as an independent metallic mirror pane, throwing off sharp, brassy-gold to silvery-blue specular reflections in a brilliant, mosaic-like grid.
Anchoring the dome, the galena pedestal presents broader, lead-gray cubic faces. Its sub-metallic sheen absorbs and softly diffuses ambient light, providing a muted, low-reflectivity pedestal that pushes the bright pyrite dome into vivid relief.
The geometric curvature of the dome, paired with the tiered, step-like specular flashes bouncing off dozens of tiny isometric facets, turns this sulfide association into an extraordinary study in micro-scale light reflection and architectural aggregation.
Picture width 3 mm.

48. Pyroxferroite

Germany, Eifel, Ettringen, Bellerberg

The striking interplay of light across this pyroxferroite crystal highlights the precise geometry of its micro-world. Because pyroxferroite is a single-chain inosilicate belonging to the triclinic crystal system, its surfaces naturally lack high-symmetry perpendicular angles, resulting in complex, slanted facets that catch incoming light in distinct, localized bands.
The most prominent feature are the bright, metallic-like specular reflections along the crystal's stepped ridges and striations. As directional illumination hits the smooth growth terraces along the prism, each micro-facet acts like an tiny mirror. These parallel bands of intense reflection emphasize the growth steps of the crystal, creating a rhythmic pattern of bright highlights contrasted against shadowed grooves.

Pyroxferroite is the iron end member of the so-called pyroxferroite-pyroxmangite series, with pyroxmangite being the manganese end member. Both are present at the Bellerberg. Fun fact: the type locality for pyroxferroite is Mare Tranquillitatis on the Moon ! Picture width 1 mm.

49. Sturmanite

South-Africa, Northern Cape, N’Chwaning Mines

Sturmanite is a striking member of the ettringite group, celebrated for its high luster, intense yellow-to-amber color, and hexagonal crystal symmetry.
When evaluating sturmanite under display or studio lighting, the interaction of light across its crystal faces presents a classic lesson in mineral optics and surface reflection. Subtle lighting setups reveal soft, gradational reflections across the flat dipyramidal truncations. These highlights map out fine growth striations and surface step-terraces, defining the crystal's 3D hexagonal architecture without washing out its vivid yellow hue. Perched on dark manganese oxide matrix from classic South African localities (like this one), these sharp optical reflections give sturmanite its signature gemmy, architectural brilliance.
Sturmanite is a Ca-Fe sulfate that may count as utterly rare. So far it’s only been described from two countries worldwide, South-Africa and one other. The best crystals are highly lustrous, sharply edged and fully transparent, in a sparkling yellow to yellowgreenish color. The picture width is 6 mm.

50. Zincite

Germany, Sauerland, Neheim-Hüsten, “An der Seilbahn”

The primary specular reflections appear as sharp, bright white lines running parallel to the prism length. These intense highlights trace the sharp edges where hexagonal faces meet, as well as fine, longitudinal striations on the crystal surface. The crispness of these reflection lines indicates exceptionally smooth, planar micro-facets, which act like tiny, precise optical mirrors reflecting the light source directly back into the lens.
Because zincite possesses a exceptionally high refractive index, light entering the crystal undergoes strong internal refraction and partial reflection off internal growth boundaries and basal cleavages. This internal light trapping creates a vivid, sub-surface luminescence, making the crystal appear illuminated from within. The small, side-attached crystal offshoot displays bright, blocky facet reflections, while the surrounding matrix shows softer, diffused highlights, creating a sharp optical contrast between the highly reflective, gemmy zincite needle and its background.

Looks like rocket science, doesn’t it ? The highly glossy main crystal is 0,8 mm long.

6. When nature gets weird

There comes a moment in every micromounter's life when they lower a specimen under the lens and think, quite simply, that they are looking at something that should not exist. Not because it lacks beauty, but because it lacks shape. It does not look like the crystal drawing in the book. It does not look like any crystal drawing, from any book, in any language. And that is where the fun begins.

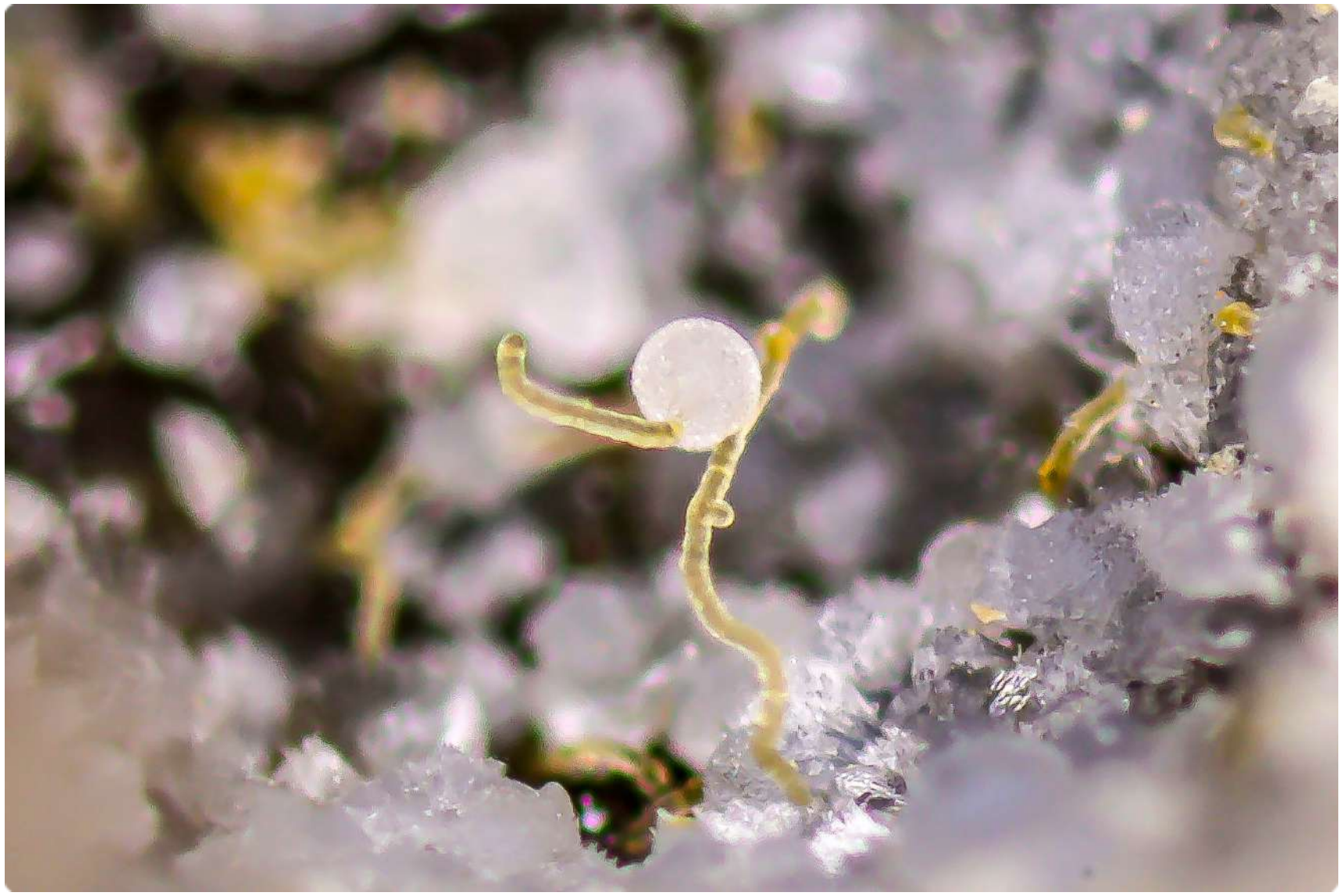
When examining a sample under the microscope you are trained to expect the familiar. A cube is a cube. A prism is a prism. The ideal drawing is a comfort, a handhold in the dark, because it tells you that nature obeys rules you can learn and trust. But sometimes nature has a different sense of humor. It takes the same atoms, subjects them to the same laws of physics, and produces something so alien that you find yourself checking the label on the box to make sure it has not been swapped with a prop from a science fiction film.

This chapter is about the specimens that made me pause, frown, and then feel amazed. The hairs that bend. The blades that fan. The spheres that should not be spheres. The crystal that discarded its own drawing and grew a completely different habit instead. These are not failures of crystallography. They are demonstrations of its flexibility. They remind me that the idealized drawing is a starting point, not a destination. When I encounter one of these oddities, my first reaction is almost always disbelief. Then curiosity. Then a quiet determination to figure out what happened. Because even the weirdest object has a hidden structure. Sometimes it is an acicular crystal that has abandoned the cubic form it should have embraced. Sometimes it is an amorphous lump with no crystal drawing at all, and I must rely on other clues entirely. Sometimes it is a shape that seems impossible until you understand the growth conditions that produced it. And understanding it is what separates a collector from a hoarder. Another collector once told me that micromounts are just nature's way of checking whether we are paying attention. I think of that every time I find a goethite fan or a wire knot of native silver. The drawing does not help me here. The identification key does not help me here. I have to use everything else: associations, locality data, the luster, the paragenesis, the stubborn little facts that eventually snap together in a moment of recognition. That is the thrill of the unexpected shape. Not the confusion. The resolution.

What follows is a gallery of the weird. Each of these 10 specimens taught me something about how crystals grow, how impurities alter habit, how amorphous materials can hold their own kind of fascination, and how a patient eye can decode almost anything.

51. Calcite on fluorite

Greece, Attica, Lavrion, Passa Limani



This micro is radically weird - an absolute morphological anomaly that completely subverts the classic crystal habits of both species involved. Seeing fluorite grow as smooth, curved, tendril-like "worms" (vermiform or filiform habit) requires extreme, non-equilibrium crystallization conditions, often driven by gel-like growth media, organic templates, or constrained micro-channels during low-temperature fluid transport. The calcite here forms a near-perfect, snow-white translucent sphere (spherulite) composed of radiating micro-fibers.
The combination creates a surreal visual narrative: the spherical calcite appears almost floating, impaled directly at the junction of the translucent, yellowish fluorite tendrils like a pinhead or a miniature lollipop.

This remarkable piece was a personal find several years ago in the slags of the location. The “building” is only 0,3 mm high.

52. Cassiterite

Germany, Sauerland, Letmathe-Iserlohn, Genna Zinc Smelter

Cassiterite normally crystallizes slowly under stable hydrothermal conditions into stubby, prismatic, or bipyramidal crystals with well-developed planar faces. However, this skeletal, highly branched structure occurs when the crystal formation is driven by extreme supersaturation or rapid undercooling. Most probably the fluid or vapor phase was so heavily saturated with tin that tin and oxygen ions attached instantly to the fastest-growing tips (corners and edges) rather than spreading evenly across flat faces.

This unique specimen is one of dozens similar odd cassiterites that I have in an old collection from this location. And they are all different and highly intriguing. The crystal is 0,75 mm high.

53. Perovskite

Germany, Eifel, Hillesheim, Graulai Quarry

This specimen shows a striking skeletal-dendritic growth, which stands in complete contrast to the sharp cubes, octahedra, or cuboctahedra typical of perovskite. Usually perovskite forms blocky, pseudo-isometric crystals under slow cooling in alkaline igneous rocks or skarns. The feather-like, comb-like morphology seen here points to severe growth kinetic anomalies:

- Extreme thermal quenching: the feather-like side-branches formed during ultra-rapid cooling, where liquid or vapor transformed into solid so quickly that ions lacked time to migrate across the growing crystal faces.
- Directional diffusion instability: growth spiked along preferred crystallographic axes where heat/material loss was fastest. This created main backbone shafts lined with closely spaced, parallel side needles (herringbone or comb-like structure).
- Slag origin: This intense skeletal "herringbone" habit is characteristic of crystallization in industrial slags, blast furnace residues, or combustion wastes, where high-temperature silicate/titanate melts cool rapidly at surface pressures.

Picture width 1 mm.

54. Plumbogummite

Australia, New South Wales, Broken Hill, Kintore Open Cut

This photo showcases a textbook example of a multi-stage epimorph formation involving secondary lead minerals. Three things happened here.

1. Hexagonal prismatic crystals of pyromorphite originally grew in an oxidized lead vug, establishing a sharp, columnar geometric scaffolding.
2. Fluctuating, aluminum-and-phosphate-rich secondary fluids precipitated plumbogummite as a micro-crystalline, pale greenish-white crust directly over the outer surfaces of the pyromorphite prisms. Belonging to the alunite supergroup, plumbogummite rarely forms large distinct crystals, but instead develops as dense, dull-to-waxy coatings.
3. Later-stage, chemically aggressive hydrothermal or meteoric fluids flooded the vug. These fluids completely dissolved the original, core-phase pyromorphite, leaving behind these delicate, hollow "pipe-like" shells or casts that perfectly preserve the original hexagonal geometry.

The sample was one of a large Australian micromount collection that I acquired several years ago. Picture width 6 mm.

55. Thomsonite on nepheline

Germany, Eifel, Hillesheim, Graulai Quarry

What makes this micromount so delightful is its joyful, whimsical geometry - it looks like a tiny, sugar-dusted snowball balancing atop a crystalline lamppost.
Nepheline forms the slender vertical scaffold and arm stretching into space, while thomsonite abandons its typical bladed arrays to form a near-perfect, translucent sphere. The sphere's surface is encrusted with hundreds of glittering, sub-millimeter blocky micro-faces that catch the light like fine sugar crystals.

The Graulai Quarry hosts as a lot of other strange combinations of different minerals. I have been there many times, and the surprises still keep coming. This combo is approximately 0,5 mm high.

56. Topaz on volcanic glass

Germany, Eifel, Ochtendung, Wannenköpfe Quarry

This specimen is exceptionally peculiar because it captures a rare pneumatolytic growth habit: needle-like (acicular) micro-crystals of topaz, forming tiny, radiating sprays on a matrix of volcanic glass. What makes this extraordinary are a few factors. Topaz usually crystallizes into robust, stubby, or blocky orthorhombic prisms, but in the Eifel delicate, hair-like needles arranged in spherical, dandelion-like sprays are not uncommon. The needle-like form indicates a very high degree of supersaturation in the escaping gas phase. The volatile gas vented so rapidly that topaz grew preferentially along its long axis, creating these delicate radial clusters instead of well-developed, flat-faced gemmy crystals. The glassy host rock formed from ultra-rapid cooling (quenching) of silica-rich lava, suppressing normal crystal formation entirely. Consequently, the perched topaz crystals grew *after* solidification, as volatile, fluorine-rich volcanic vapors escaped through gas bubbles (lithophysae) and deposited minerals directly onto the glassy host rock. It serves as a striking microscopic record of two vastly different physical processes - rapid thermal quenching alongside volatile vapor crystallization -, captured within a single specimen. Old personal find in the 1990s, picture width 1,5 mm.

57. Tridymite

Germany, Eifel, Drees, Niveligsberg

This specimen is compelling because it showcases a trilling twin - a cyclic triplet where three individual crystals intergrow along a shared axis to form a six-pointed "star" or rosette. In fact, tridymite derives its name directly from the Greek *tridymos*, meaning "triplet."

While tridymite typically forms thin pseudo-hexagonal plates, a fully symmetrical, star-like trilling perched intact on matrix is an most unusual aesthetic eye candy. Tridymite is a high-temperature quartz polymorph that crystallizes above 870 ° C in volatile-rich volcanic cavities. As the host rock cools, the internal structure transforms into low-temperature phase forms while perfectly retaining its high-temperature exterior geometry. The colorless, highly reflective star contrasts strikingly against the dark, elongated needles of the underlying amphibole group mineral, making it an exceptional display subject for high-magnification photomicrography.

Picture width 1 mm.

58. Whitmoreite

Belgium, Hainaut, Blaton, Mont-des-Groseillers

This location was - it is no longer accessible - celebrated among microcollectors for its unique phosphate paragenesis within pyritiferous shales. The oxidation of pyrite, coupled with acidic, iron- and phosphate-rich solutions, created the perfect environment for rare secondary phosphates to precipitate. Among these, whitmoreite stands out as one of the locality's absolute highlights.

The radial-fibrous or spherulitic habit (often referred to as a "sunburst" or "pompom") represents a distinct crystallographic form for whitmoreite. While this species typically forms isolated, chisel-ended or fan-shaped prismatic needles in pegmatitic environments, the specific geochemical conditions at Blaton fostered a remarkably symmetrical radial geometry.
The spherical geometry is driven by rapid nucleation within a highly supersaturated secondary solution. Dozens to hundreds of capillary microneedles initiate simultaneously from a single central point, expanding uniformly in all directions.
The crystal’s diameter is 0,4 mm. From an exchange in 2019.

59. Zalésiite on malachite

USA, Utah, Tooele Co., Gold Hill Mine

This is definitely the quality of microminerals that I’m always looking for: a completely freestanding spray of pale green zalésiite crystals on a column of malachite. The whole building is just 0,5 mm high, so the needles are about 0,2 mm long.

Zalésiite frequently develops ultra-fine, hair-like acicular microprisms in its hexagonal structure. Here, the needles radiate from a single central nucleation point to form a pristine, dandelion-like "pompom" sphere perched at the peak of a malachite pedestal.

The paper-thin, translucent white-to-mint-green needles catch incident light along their length, creating a soft, silky luster that glows against the soft-focus background. The perfection of the 360-degree radial spray atop a vertical stalk endows the micromount with a botanical, flower-like elegance. The silvery-white to pale celadon-green of the zalésiite spray stands out crisply against the richer, forest-green underlying malachite matrix.

60. Zincaluminite on zincite

Germany, Aachen, Stolberg, Concordia Eisenhütte

This micromount is exceptionally peculiar, both geometrically and paragenetically. What immediately commands attention is its startling, near-perfect cruciform architecture, a structure exceedingly rare for any mineral combination.
Paragenetically, this represents a multi-stage hydrothermal/post-mining mineral interaction: primary or high-temperature zincoxide (zincite) serving as a physical scaffold, followed by the precipitation of zinc-aluminium sulfate-hydroxide platelets during late-stage acidic/sulfate-rich fluid alteration.
Visually, the frosted white texture of the hexagonal zincaluminite plates gives the miniature cross a snow-covered, sculptural quality. Peeking out near the base, tiny gemmy, pinkish unencrusted zincite tips reveal the original core species, adding a subtle color accent to an extraordinarily rare, cross-shaped micro-formation.

The location where it comes from is - or rather: was - very close to where I live, just across the border in Germany. The cross is 0,4 mm high.

7. The tiniest of the tiny

Within my total collection of 23000 micromounts I have many that measure less than 0,5 mm - and even a number that are so small that I simply cannot photograph them decently, due to the limitations of my current equipment. In this section therefore a selection of pieces that are between 0,2 and 0,4 mm wide or high.

At scales beneath 0,4 mm, crystal growth is frequently undisturbed by the spatial constraints, mechanical strain, and chemical fluctuations that affect larger specimens. As a result, species across all major crystal systems display exceptionally sharp face boundaries, unmarred pinacoids, and textbook terminations. Light interacts with sub-millimeter minerals in ways that are physically impossible in massive hand samples. Because the physical volume of a 0,4 mm crystal is miniscule, light easily penetrates translucent-to-transparent structures, producing extraordinary optical behavior.

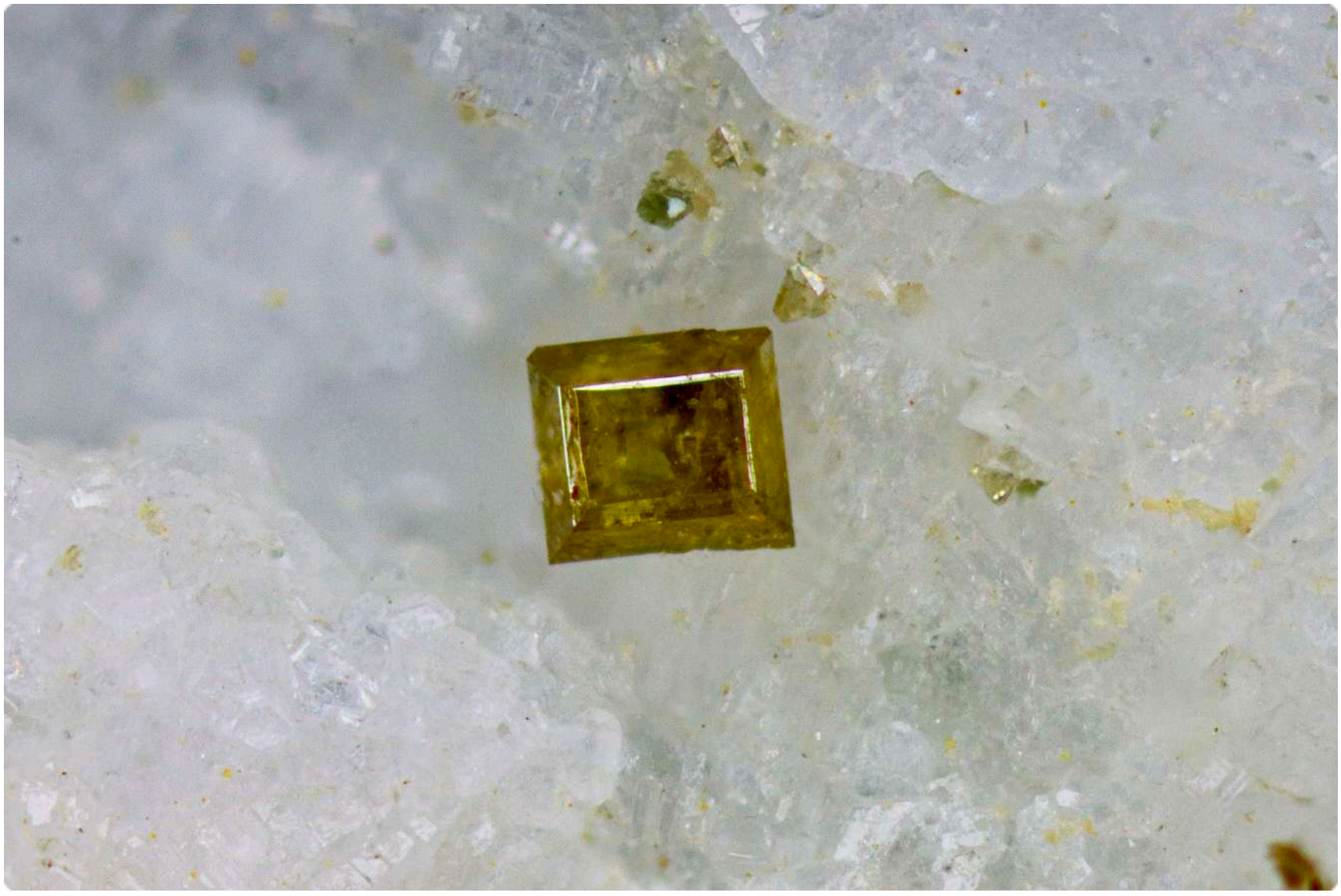
Capturing these micro-scale wonders in a photo requires a specialized fusion of technical mastery and artistic vision, as standard photography completely breaks down at sub-millimeter scales. At high magnifications, the physical depth of field shrinks to a fraction of a millimeter - often just to a few micrometers. To capture a complete 0,4 mm crystal in focus, you must take tens or even hundreds of sequential images at precise step intervals using motorized stacking rails. Advanced algorithms then merge the sharpest zones of each frame into a single, fully in-focus digital plate.
The lighting is essential. It should be diffused as much as possible. Direct, harsh lighting creates devastating blown-out highlights and high-contrast shadows on reflective crystal facets.

At high magnifications, even a passing footstep or a soft breeze can ruin an image sequence. Cameras have to be mounted on massive steel or stone vibration-isolation rigs, paired with ultra macro objectives or specialized microscope objectives, designed to resolve microscopic detail without chromatic aberration.

Exploring microminerals smaller than 0,4 mm reshapes our understanding of geological aesthetics. Through the lens of high-magnification photomicrography and focus-stacking, these miniature structures prove that nature’s most compelling artistic and crystallographic expressions do not require grand scale - tiny micros are much better at that than larger pieces.

61. Aeschynite-(Y)

Italy, Piedmont, Baceno, Alpe Bionca



At a width of just 0,3 mm, this aeschynite-(Y) crystal is a remarkable gemmological and crystallographic surprise.
While rare-earth oxides of the aeschynite group frequently grow as crude, elongated prisms or irregular mass inclusions, this micro-crystal forms a perfectly tabular, near-rectangular pane bounded by prominent pinacoid faces and razor-sharp, beveled prismatic edge modifications. The sharp, step-like border geometry makes it look almost like a precision-cut baguette gemstone embedded in matrix.
Because aeschynite-(Y) is a complex rare-earth titanium-niobate oxide containing traces of uranium and thorium, it is notoriously prone to metamictization - the gradual breakdown of its internal crystal lattice into an opaque, pitchy, amorphous glass due to alpha radiation. At this 0,3 mm scale however, the lattice remained intact and non-metamict, allowing its rich, olive-to-honey-yellow color and high resinous-to-adamantine luster to shine through with full transparency.
Lately I was searching for anatase crystals on a rock piece that I already had for quite some time, when I discovered this small treasure. The sample was labeled anatase, I got it in an exchange from an Italian collector, who must have overlooked this little gem.

62. Caledonite

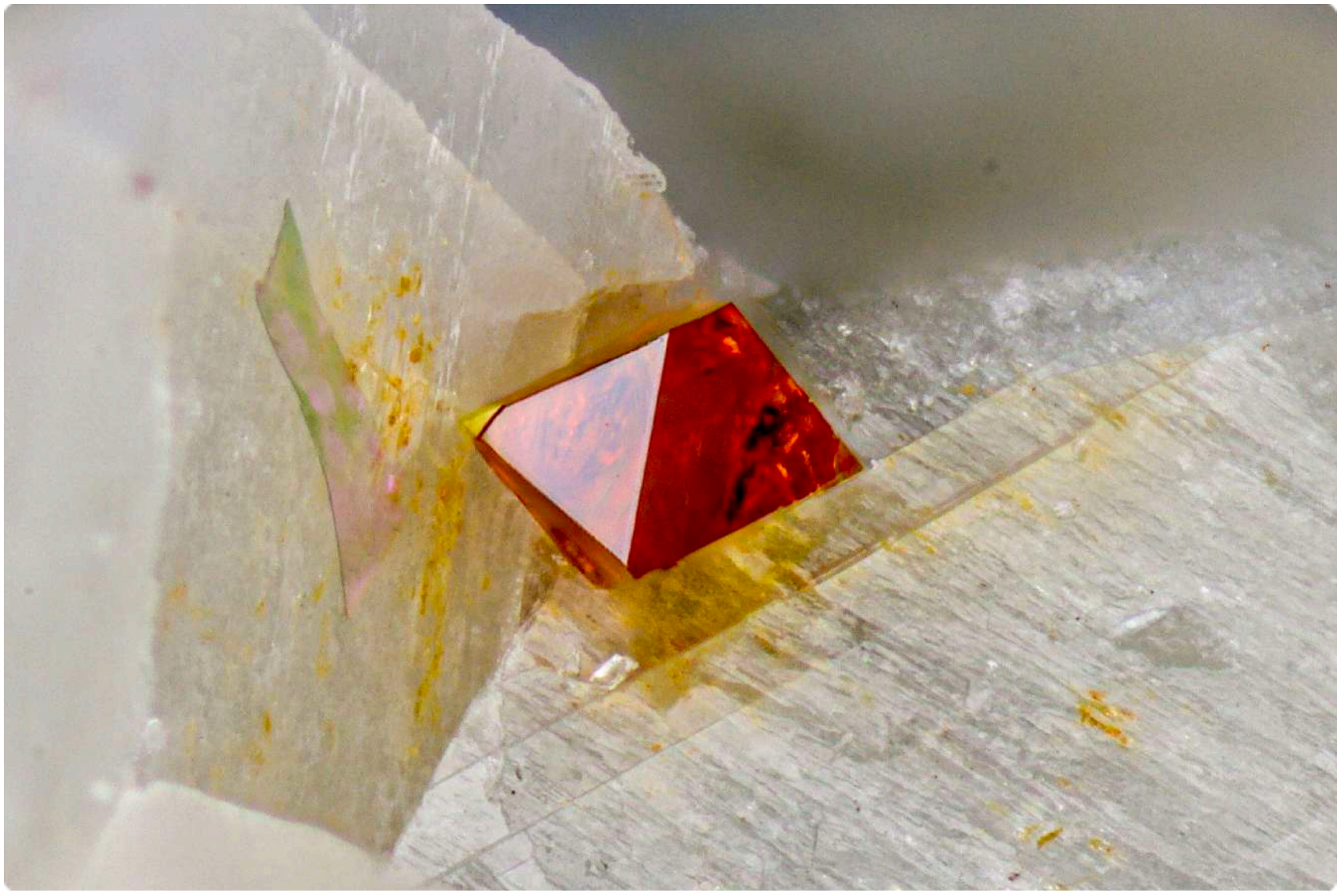
UK, Scotland, Wanlockhead, Meadowfoot Smelter

At an ultra-miniature scale of just 0.2 mm, this caledonite specimen displays extraordinary architectural elegance, striking optical brilliance, and complex chemical composition. Caledonite is a basic copper-lead sulfate-carbonate. Belonging to the orthorhombic crystal system, it typically forms bladed to acicular crystals elongated along the c-axis. Rather than growing as a single isolated blade, this microspecimen forms a tiered, sub-parallel "sheath" or fan-like bouquet of micro-prisms terminating in sharp, chisel-like domes. The intense, luminous sky-blue to teal-cyan coloration is driven by divalent copper coordination within the lead-sulfate matrix framework. At 0.2 mm, the high transparency allows light to travel completely through the bladed bundle, generating vivid internal reflection highlights along the vertical striations.

Caledonite forms as a rare secondary mineral in the oxidized zones of lead-copper deposits, typically arising from the chemical alteration of galena and chalcopyrite in the presence of carbonate-rich fluids. The colorless, sixsided accompanying crystals are leadhillite.

63. Fluornatropyrochlore

Portugal, Azores, São Miguel, Pumice Quarry



At just 0.3 mm, this fluornatropyrochlore crystal from the Azores archipelago is a breathtaking example of isometric perfection and alkaline volcanic petrogenesis. Belonging to the pyrochlore supergroup, fluornatropyrochlore crystallizes in the isometric crystal system. This specimen presents an exceptionally sharp, textbook octahedron. The planar faces are mirror-smooth, meeting at razor-sharp edges without the rounding or corrosion commonly seen in larger, metamict pyrochlore group species.
Many niobium-tantalum-bearing oxides become "metamict" - their crystal lattices break down into an amorphous state over geological time due to internal radiation from trace uranium or thorium. But this microcrystal remarkably is non-metamict, displaying a gem-clear, fiery amber-orange transparency and high adamantine luster that acts like a polished gemstone under directional lighting.
In the oceanic volcanic setting of the Azores, such rare REE-Nb-Ta oxides precipitate within miarolitic cavities of peralkaline syenite nodules. Perched neatly against the white, cleavage-rich matrix, the deep reddish-amber octahedron presents an exquisite, high-contrast focal point. I found literally dozens of these beauties in 2007.

64. Forsterite

Germany, Eifel, Ochtendung, Wannenköpfe Quarry

Unlike typical mantle-derived olivines found as rounded nodules in basalt, Eifel forsterites formed via late-stage pneumatolytic (gas-phase) crystallization within volcanic cavities and xenolith vugs. This allowed the crystals to grow unhindered, developing sharp, highly modified orthorhombic prismatic habits bounded by pristine pinacoids and domes.
The vibrant reddish coloration localized within parts of the water-clear crystal body is driven by two distinct mechanisms. During growth, micro-scale flurries of specular hematite or goethite micro-crystals precipitated onto specific growth faces before being encased by a subsequent layer of clear forsterite, creating a "phantom" phantom interior. Along with that, high-temperature volcanic gases rich in oxygen caused localized oxidation of trace ferrous iron into ferric iron along specific structural zones or fluid conduits, producing the characteristic reddish-brown "red olivine" zones.
Olivine actually is not one single mineral, but forms a series with fayalite as the iron end member and forsterite as the magnesium end member. Both are relatively abundant in the Eifel, fayalite mostly being brownred and opaque, and forsterite in different colors and fully transparent. The main crystal at the lower left is no more than 0,2 mm wide.

65. Glauconite

Italy, Veneto, San Pietro Mussolino, Bertocchi Quarry

Formally confirmed as glauconite from this specific Italian locality, this piece becomes an absolute mineralogical gem - a world-class rarity that fundamentally challenges typical textbook assumptions about the species.
Glauconite is a monoclinic dioctahedral mica. Across almost all global occurrences, mostly typical sedimentary marine greensands, it forms amorphous, rounded pellets or microcrystalline earthy masses. For glauconite to crystallize in well-defined, needle-sharp acicular-to-capillary prisms radiating in a perfect starfish look requires extraordinary hydrothermal or late-stage cavity conditions. Hydrothermal vugs in this locality provided the ideal low-strain environment, allowed temperature-chemical stability, and supplied localized iron-potassium fluids to foster true free-standing crystal growth rather than typical sedimentary pellets.
The glauconite is 0,3 mm wide, the matrix is quartz.

66. Iodargyrite

France, Auvergne-Rhône Alpes, Échassières, Les Montmins Mine

Iodargyrite, as one of the minerals within the chlorargyrite group, belongs to the hexagonal crystal system. It is famous for displaying hemimorphic symmetry, meaning the top and bottom terminations of the hexagonal crystal develop different face forms. This 0,4 mm crystal highlights this geometry beautifully. The upper termination exhibits mirror-smooth dipyramidal faces meeting at a prominent basal pinacoid.

Like many silver halides, iodargyrite is light-sensitive and can gradually darken upon prolonged UV or intense light exposure. At sub-millimeter scales, however, specimens often retain their gemmy quality - but keeping it in the dark would be advisable.
Find from 2013.

67. Jeremejewite

Germany, Eifel, Üdersdorf, Emmelberg Quarry

Jeremejewite is famously known from pegmatites in Namibia and Tajikistan, where it forms gemmy hexagonal prisms. However, its occurrence at the Emmelberg volcano in the Eifel in Germany represents an entirely different geological mechanism: high-temperature, late-stage pneumatolytic gas reactions within sanidinite xenoliths. Boron-rich volcanic gases escaping through cooling sanidine-bearing lava allowed this rare aluminium borate species to nucleate inside micro-vugs. The delicate cornflower-to-sky-blue color is driven by trace iron substitutes within the borate crystal structure.

The Wannenköpfe Quarry near Ochtendung, as well as the Emmelberg Quarry near Üdersdorf - where I found this one decades ago - are the places to be for fine microcrystals of jeremejewite, that is surely one of the most appreciated species in the Eifel. In this case a pale bluegray tuft of 0,3 mm on a bed of sanidine.

68. Roedderite

Germany, Eifel, Ettringen, Bellerberg

Roedderite is a member of the osumilite group, a family of cyclosilicates defined by complex double six-membered silicate rings. Fun fact: originally roedderite was discovered in a meteorite, and for a long time was considered to be a purely extra-terrestrial species forged during cosmic impact events. But a good story never holds.
Its occurrence at the Bellerberg volcano represents one of the world's most famous terrestrial localities. Here, roedderite formed not by cosmic collision, but through extreme pneumatolytic processes - high-temperature volcanic gas reactions with xenolith inclusions trapped within the cooling.
In this specimen, roedderite presents as a stocky, tabular-to-blocky hexagonal prism bounded by distinct pinacoid faces. The top face displays delicate parallel growth striations and slight corner bevels, capturing the subtle micro-step growth during rapid cooling. The saturated blue-green to teal-green hue stems from the coordination of magnesium and divalent iron, replacing sodium and potassium in the silicate framework. Nestled inside a frosted, bubbly, silicate glass vug, the deep green gemmy prism provides a striking focal point, showcasing how extreme volcanic heat can yield pristine micro-scale geometry. The crystal measure around 0,4 mm.

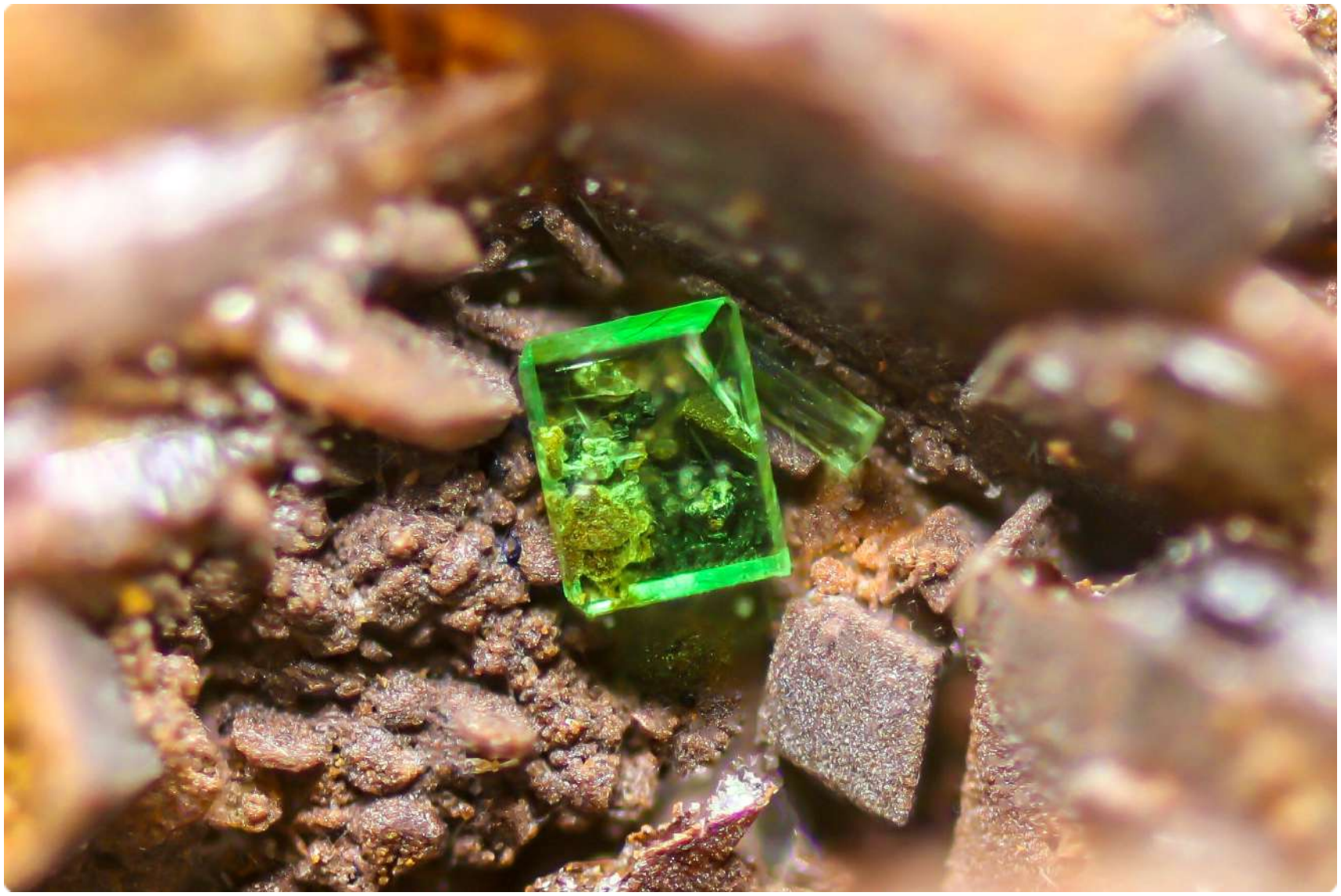
69. Titanite

Italy, Lazio, Valentano, Casale Rosati

Located in the famous Sabatini volcanic complex of Lazio, this location where I found this beauty in 2024, is celebrated among mineralogists for its high-temperature pneumatolytic vugs within pyroclastic ejecta and sanidinite xenoliths. Casale Rosati is not a mine or a quarry, but an area on the rim of an ancient volcano, where a lot of volcanic ejecta can be found, that can contain a number of highly rare mineral species. During late-stage volcanic activity, fluorine- and titanium-rich supercritical fluids reacted within these gas cavities, precipitating an exceptional suite of rare, gemmy microminerals - with titanite standing as one of the more well-known representatives of the locality.
Standing just 0.3 mm high, this crystal is completely double terminated. Rather than growing embedded or attached along a broad facet, it nucleated at a single minimal point, allowing both top and bottom pyramidal terminations to develop with crisp, unhindered symmetry.

70. Zeunerite-torbernite

Germany, Black Forest, Wolfach, Clara Mine



The Clara Mine is world-renowned for its complex polymetallic vein mineralogy, where secondary copper and uranium species frequently intermingle. At 0,4 mm, this gemmy square tabular plate is a textbook representative of the autunite/torbernite group. Zeunerite and torbernite form an isomorphous series within the autunite group, sharing the exact same crystal structure and copper uranyl framework. Torbernite is a hydrated copper uranyl phosphate, while zeunerite is its direct arsenate equivalent. Without full analysis the distinction, at least here, is impossible to make. At the Clara mine, arsenic-rich hydrothermal solutions drive the complete substitution of phosphorus by arsenic, crystallizing true zeunerite. Because both species share identical layer structures, complete solid-solution series exist between them.
Personal find from around 1994.

8. Slag minerals are fabulous

The world of mineralogy is often celebrated for its natural wonders - crystallized treasures forged deep within the earth's mantle or deposited by ancient hydrothermal fluids. Yet, a parallel universe of extraordinary beauty exists at the intersection of geology, metallurgy, and human history: the realm of slag minerals. Far from being mere industrial waste, historical metallurgical slag serves as a synthetic incubator for some of the most intricate, highly aesthetic, and crystallographically pristine microminerals known to science.

Slag is the vitrified byproduct left behind after the smelting and refining of ores. Whether originating from ancient Roman lead mines, medieval silver furnaces, or 19th-century iron foundries, slag is rich in heavy metals, fluxing agents, and complex silicates. When dumped into coastal waters, buried in moist soils, or exposed to atmospheric weathering, these anthropogenic material heaps become dynamic chemical laboratories.

The genesis of slag minerals occurs across two distinct regimes.
1. As high-temperature smelting phase: when molten slag cools, rapid thermal quenching gives rise to unusual high-temperature primary species. Minerals crystallize directly from the liquid melt, often trapping volatile gas bubbles that form perfectly spherical micro-vugs.
2. As secondary post-mining alteration phase: over decades, centuries, or even millennia, ambient fluids - such as saline seawater, rainwater, and acidic groundwater - permeate the porous slag. These solutions react with the residual metals, dissolving host ions and re-precipitating them inside microcavities as secondary oxides, carbonates, sulfates, halides, and silicates.

What makes slag minerals exceptionally attractive to collectors and mineralogists is their astounding structural perfection, particularly at the micro- and sub-millimeter scale. Because slag vugs are often completely sheltered from the intense tectonic pressures and mechanical stresses that deform natural rock formations, crystals precipitate with ideal, unhindered symmetry.
Secondary lead, copper, and zinc species within slag cavities routinely form razor-sharp crystals. Species like phosgenite, laurionite, paralaurionite, anglesite and cerussite display flawless pinacoids, steep dipyramids, and mirror-smooth crystal facets.
Slag environments possess unique chemical ratios rarely matched in natural ore deposits. The presence of chlorine from seawater combined with heavy metal residues yields extraordinary halide and oxychloride species. The famous slag heaps of Lavrion in Greece, for instance, have yielded dozens of valid mineral species, that were either first discovered in slags or occur almost exclusively within industrial residues.

To examine a slag micro-specimen under magnification is to enter a world of vibrant chromatic contrast and architectural brilliance.
Secondary slag species display some of the most striking colors in the mineral kingdom. Divalent copper produces brilliant electric-blue connellite, emerald-green atacamite, and sky-blue devilline. Lead and zinc species generate water-clear, adamantine crystals that reflect light with diamond-like brilliance against dark, iron-rich slag walls. The diversity of crystal habits within slag vugs is virtually endless. Curved, vermiform formations, rosettes, and hollow epimorphic casts frequently occur alongside gemmy, blocky prisms.

Because slag microcrystals often grow in protected microcavities, their faces remain uncorroded. Under directional fiber-optic lighting, high refractive index minerals exhibit vivid specular highlights and internal light dispersion that rival fine gemstones.

Beyond their obvious visual beauty, slag minerals hold a unique historical and scientific significance. They represent an inadvertent collaboration between ancient metallurgical artisans and geological time. Every crystal of laurionite or anglesite growing inside a piece of ancient furnace residue is a tangible link to human ingenuity - a remnant of the silver that funded classical Athens or the copper that built medieval empires.
Ultimately, the splendor of slag minerals lies in this captivating paradox: out of industrial waste and forgotten refuse, nature crafts some of its most exquisite, geometrically flawless, and colorful masterpieces. They remind us that beauty in the natural world is not limited to wilderness, but can blossom wherever chemistry, time, and physics converge.

Too bad that the IMA still hasn’t fully accepted slag minerals as being real minerals…yet, I hope…

71. Connellite

Italy, Tuscany, Piombino, Baratti Beach

Baratti Beach is one of the world's most famous coastal slag localities, located along the Gulf of Baratti, more of less opposite of Elba Island. During the Etruscan and Roman eras, iron ore mined on Elba was shipped across the channel and smelted here, leaving behind extensive deposits of copper- and iron-bearing industrial slag along the shore. The best time to do good finds - although it seems to get more and more difficult by the year - is end of winter or early spring, when slag material is washed up on the beach after the winter storms. This one was one of my own holiday finds in the early nineties. At that time the finds were still good. In later years I have been there a few more times, but with lesser and lesser success. The spray is approximately 1 mm wide.
Connellite typically forms exceptionally fine, acicular (needle-like) crystals arranged in striking, fan-like radial sprays, tufts, or fibrous rosettes, as shown in this specimen. It is famous for its vibrant, deep electric-blue to azure color and vitreous to silky luster. Connellite develops within small slag vugs, often associated with other marine-slag secondary minerals like atacamite, paratacamite, and cuprite. Its intense blue shade and delicate needle geometry make it an iconic, highly prized micromount classic.

72. Gerhardtite

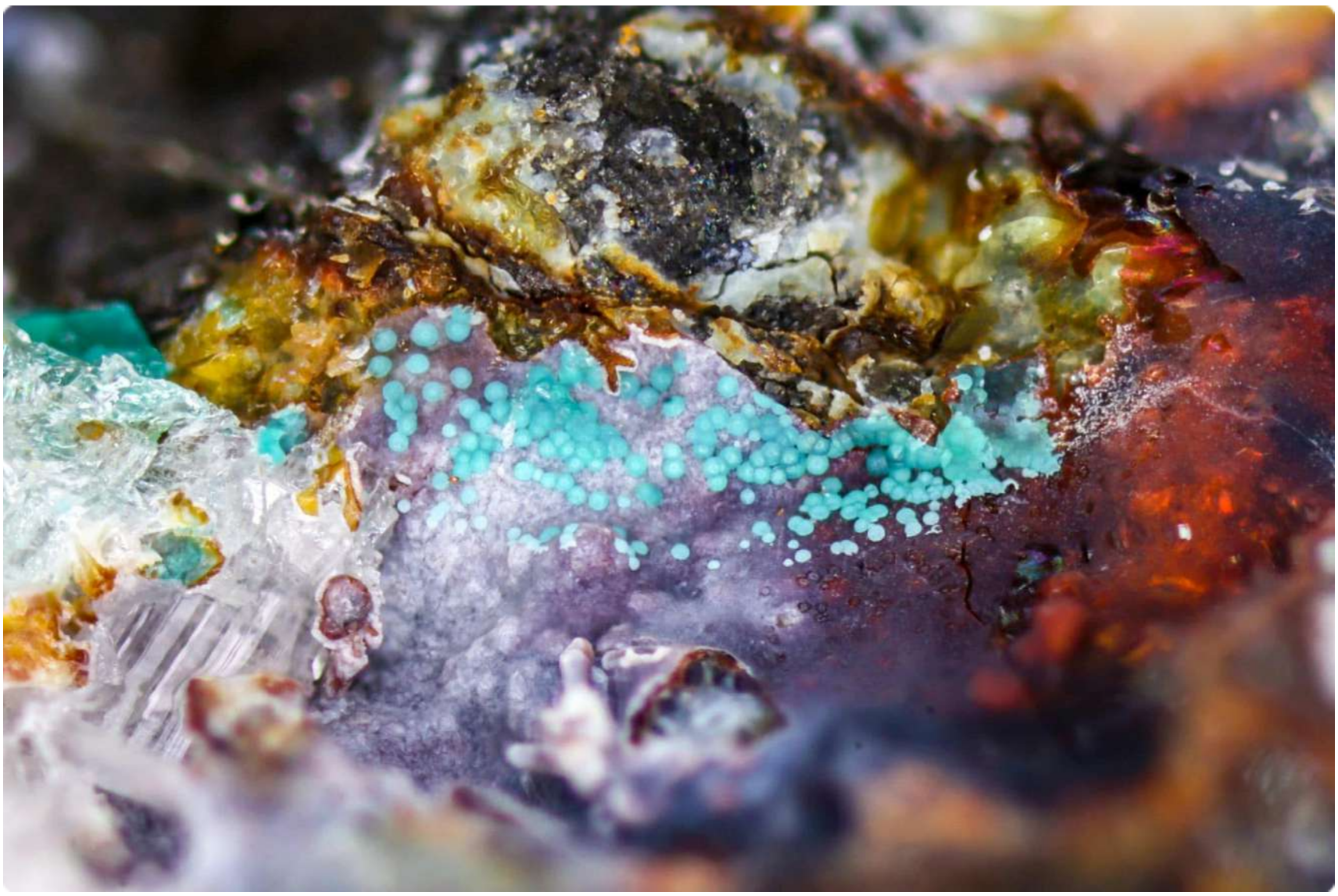
Italy, Tuscany, Campiglia Marittima, Madonna di Fucinaia

The Madonna di Fucinaia slag locality is one of Europe's most famous historic archaeometallurgical sites. Dating back to Etruscan and medieval periods, the area was a major smelting center for copper and silver-bearing lead ores mined from the surrounding Colline Metallifere.
Gerhardtite is a rare basic copper nitrate mineral, that forms in the oxidized zones of copper deposits - often in arid environments or unusual geochemical settings. It stands out due to its distinct, rich emerald-green to deep bluish-green color and glass-like vitreous luster. Crystallographically, gerhardtite belongs to the orthorhombic crystal system. It typically develops well-defined, thick tabular or dipyramidal crystals that display a characteristic gemmy transparency and sharp geometry, as prominently shown in micromount specimens. It is dimorphous with the monoclinic mineral rouaite.

This single crystal of gerhardtite is not formally analysed, but closely matches the crystal drawings of the species. Therefore visual recognition. From an old 1980s collection.
Picture width 0,8 mm.

73. Herbertsmithite

Greece, Attica, Lavrion, Vrissaki Point



Herbertsmithite is polymorphous with the kapellasite on the previous page, as well as with paratacamite. It typically forms rhombohedral to dipyramidal crystals or delicate, rounded botryoidal aggregates and tiny spheres, as clearly seen in this specimen. Exhibiting a vibrant light blue-green to sea-green color with a vitreous luster, it nucleates within tiny slag cavities on dark or glassy matrices. Verified self-collected finds like this represent true micromount treasures.
The Vrissaki slag site near Lavrion in Greece is the location where I found this one. Groundwater leaching through porous slag vugs has fostered an extraordinary suite of secondary copper halides.
In 2022 during our visit to Lavrion I found this piece, but none of us had any idea what it could be. Until I got the analysis results. It turned out to be herbertsmithite - which hadn’t been described from the locality before. So this result may count as a surprise and therefore is one of my most valued personal finds.

74. Kapellasite

Germany, Harz Mountains, Astfeld, Herzog Julius Smelter

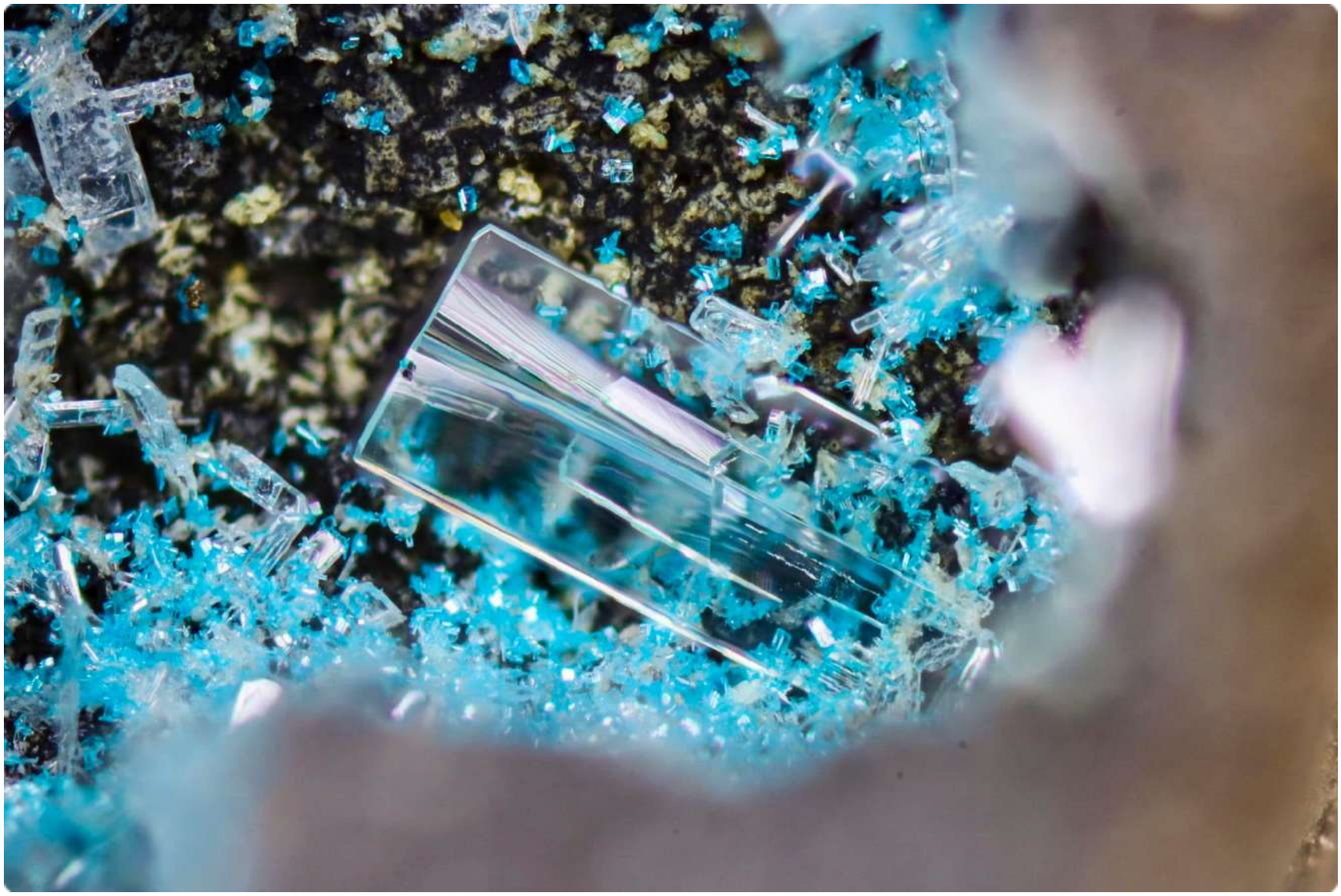
The historic Herzog Julius smelter (*Juliushütte*) was founded in the 16th century by Duke Julius of Brunswick-Lüneburg. Processing polymetallic ores from the nearby Rammelsberg deposit, the metallurgical operations produced extensive heaps of heavy slag rich in lead, copper, and zinc. Today, this iconic slag locality is celebrated among micromount collectors for producing an extraordinary diversity of secondary copper, lead, and zinc halides and carbonates.

Kapellasite belongs to the atacamite group. In the trigonal system, it features a distinctive kagome lattice structure formed by corner-sharing copper triangles. It forms exquisite, delicate, needle-like to fibrous or bladed microcrystals arranged in striking, radiating spherical clusters or tufts, as seen in this 4 mm specimen. Exhibiting a bright sky-blue to vivid turquoise color with a vitreous to silky luster, kapellasite grows within slag vugs on dark or pale matrices. Its vibrant color and fibrous geometry make it a prized micromount finding.

Maybe good to know: until not so long ago these specimens were thought to be botallackite. That was wrong: they are all kapellasite. So if you still have old samples….

75. Laurionite with pseudoboleite

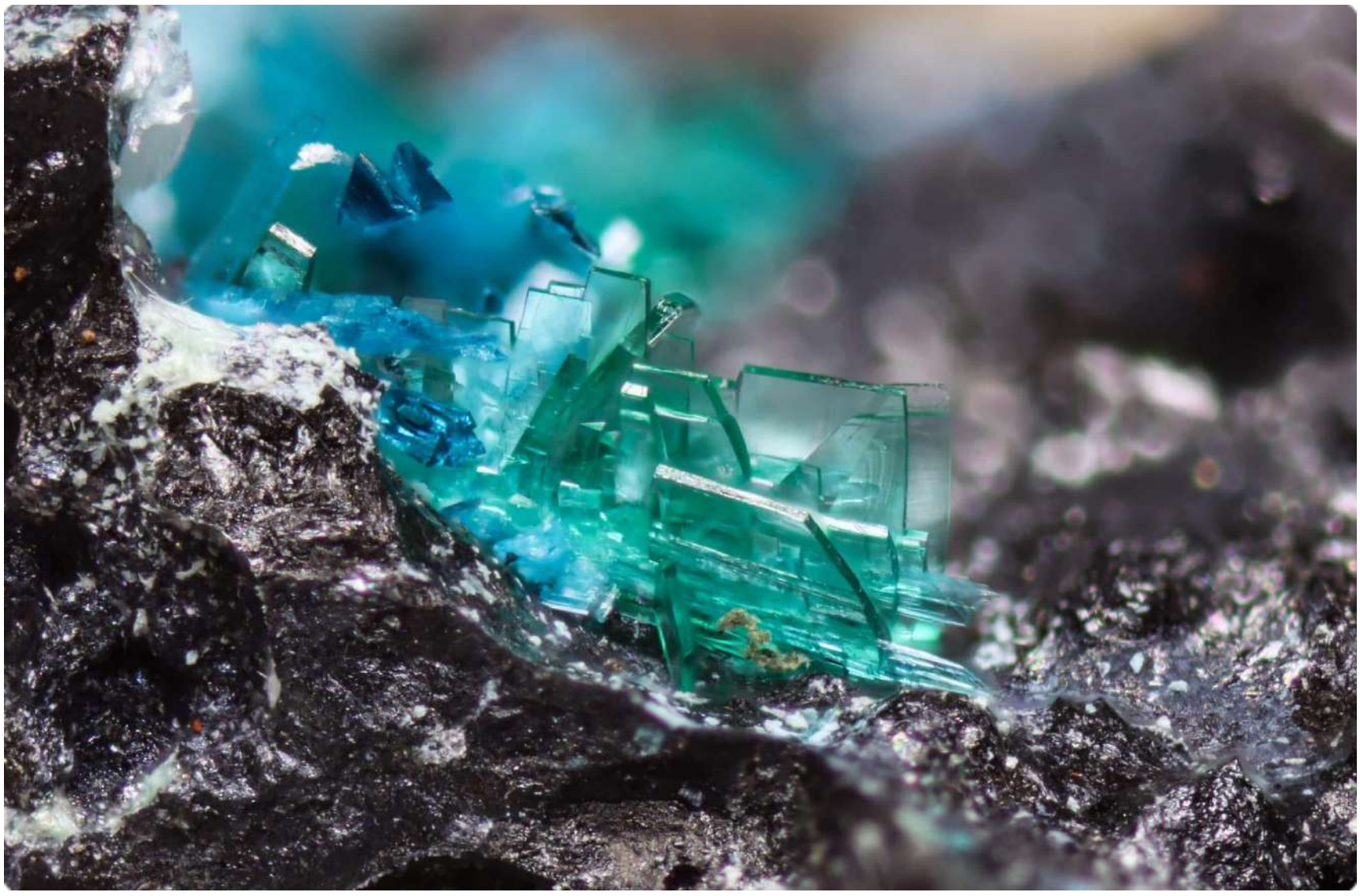
Greece, Attica, Lavrion, Thorikos Bay



This specimen showcases the classic secondary mineralization created when seawater interacts with ancient metallurgical waste.
Smelting waste produced over two millennia ago during classical Athenian silver and lead extraction was discarded along the shoreline. Submersion in hyper-saline, oxygen-rich seawater initiated long-term chemical reactions between metallic lead/copper slag inclusions and dissolved marine salts.
Laurionite crystallizes as a basic lead halide when lead-bearing slag alters under marine brine conditions. The bright sky-blue to deep-blue pseudoboleite crystals highlight localized copper riching within the micro-cavity environment. The image captures high luster and razor-sharp crystal terminations on the tabular laurionite prism, with its characteristic striations, and contrasting with the dense mantle of numerous microcrystalline pseudoboleite scattered across the matrix slag vug.
Personal find in 2019. The laurionite is 1 mm long.

76. Lautenthalite

UK, Scotland, Wanlockhead, Meadowfoot Smelter



The Meadowfoot Smelter was a central lead-smelting operation during the 18th and 19th centuries. Processing galena from the surrounding Lowther Hills, the industrial plant left behind vast piles of metallic, galena-bearing slag byproducts. Over centuries, exposure to Scotland's damp, rainy climate caused chemical leaching within the porous slag matrix. The interaction between residual lead, copper, and zinc phases produced a renowned post-mining micro-environment. Today, the Meadowfoot slag remains a famous Scottish locality among collectors for yielding exceptional secondary sulfate micro-minerals in slag cavities.

Lautenthalite is a quite rare hydrated lead-copper sulfate hydroxide, belonging to the devilline group. Named after its type locality in Lautenthal, Germany, it crystallizes in the monoclinic system. The mineral forms delicate, transparent to translucent, tabular to bladed micro-crystals exhibiting a striking pale sky-blue, bright turquoise, or blue-green color with a vitreous to silky luster.

The slightly bended side faces of lautenthalite are so characteristic, that they can serve for proper recognition. Picture width 0,4 mm.

77. Oxyplumboroméite

Germany, Sauerland, Letmathe-Iserlohn, Genna Zinc Smelter

The historic Genna Zinc Smelter (*Genna Zinkhütte*) represents an iconic metallurgical slag site. Active during the 19th century, industrial smelting deposited heavy lead- and zinc-rich slag remnants across the area. Over decades of weathering, moisture and chemical interactions within the porous matrix transformed these metallurgical byproducts. Today, the long gone location is celebrated among mineral collectors for yielding diverse, well-formed post-mining species hosted within slag vugs.

Oxyplumboroméite is a rare lead-antimony oxide belonging to the pyrochlore supergroup that until not so long ago was named bindheimite. Crystallizing in the cubic system, it forms striking micro-crystals ranging in color from vibrant golden-yellow and bright orange to deep reddish-brown. As dramatically shown in slag specimens, it can develop intricate, skeletal, branch-like, or dendritic crystal aggregates with brilliant resinous to adamantine luster. Occurring inside tiny slag cavities alongside other secondary lead and antimony phases, its sharp geometry and fabulous coloration make it an appreciated micromount specimen.

If you look closely you can see that the arms of the sample are a build-up of small octahedral crystals on top of eachother. Picture width 6 mm.

78. Penfieldite with cumengeite

Greece, Attica, Sounion, Harakas Beach

Penfieldite is a rare lead oxychloride mineral originally discovered for the first time in the Lavrion slag deposits. It forms elongated hexagonal prisms or dipyramidal crystals featuring sharp terminations and prominent striations, that can be horizontal as well as vertical. Colorless, pale blue, or sea-green with a adamantine to vitreous luster, penfieldite is relatively soft and fragile. In notable micro-specimens like this, transparent to pale blue penfieldite prisms serve as a host matrix, sprinkled with tiny, vibrant blue crystals - in this case identified as secondary cumengeite, creating an extraordinary visual contrast under magnification.

As said penfieldite was first discovered in the Lavrion slags, but apparently the exact slag location hasn’t been recorded, which means that the real type locality can’t be mentioned - just “the slags of Lavriotiki”.

This particular piece comes from Harakas Beach in the Sounion area south of Lavrion. Picture width 1,5 mm. Unlike Baratti on the previous page Harakas Beach is still a paradise for micromounters. My last visit was in may 2026, and once again I was able to collect a good quantity of slags, still waiting to be explored at home.

79. Ramazzoite

Germany, Saxony-Anhalt, Hettstedt, Lichtloch 26

At first sight you might think that this is something like boleiete, but it’s not. It’s a complex Mg-Cu sulfate, called ramazzoite. To my best knowledge it was described for the first time just a few years ago, around 2018. It is named after the Mt. Ramazzo mine near Genova In Italy, the type locality. This one however comes from the only other location where it is found so far, the slags of Lichtloch 26, Hettstedt.

Located in the Mansfeld Basin of Saxony-Anhalt, Germany, Hettstedt has a rich, multi-century history of copper smelting. Industrial processing of local Kupferschiefer (copper shale) ores produced extensive heaps of heavy, metal-bearing metallurgical slag.

There are two reasons why this is one of the most precious micromounts in my collection. First the absolute rarity, as it is known from only two places on earth, and second and most of all, because of the sheer perfection of the cube. The crystal is tiny: just 0,2 mm.

80. Rapidcreekite

Poland, Upper Silezia, Katowice, Piekary Slaskie

This historic industrial site is renowned for its zinc and lead smelting activity. Decades of processing rich Silesian-Cracovian lead-zinc ores generated extensive dumps of heavy metallurgical slag.
Rapidcreekite was originally discovered at Rapid Creek, Yukon, Canada, which explains the name. Crystallizing in the orthorhombic system, it forms delicate, needle-like (acicular) to thin bladed crystals that typically assemble into striking, fan-shaped sprays, radial clusters, or tufts, as seen in this specimen. Colorless to snow-white with a vitreous to pearly luster, it forms on dark slag matrices within sheltered vugs. Relatively soft with a Mohs hardness of 2, its delicate geometry and sparkling fan formations make it an exceptional micromount species.
This specimen is the one and only rapidcreekite that I have ever seen or encountered, so I was quite pleased with the exchange in 2024. Picture width 3 mm.

9. Type locality minerals are special

In mineralogy, few concepts bridge the gap between rigorous analytical science and deep historical heritage like the type locality. Defined as the specific geographic occurrence from which a mineral species was first recognized, analyzed, and formally described, the type locality serves as the scientific birthplace of a mineral species. While modern mineralogy relies heavily on structural, chemical, and physical parameters to define species, the context provided by type locality minerals remains uniquely vital to both academic research and systematic collecting.

In biological taxonomy, a type specimen anchors a species name to a physical organism. Similarly, in mineralogy, a mineral species is tied to its type material - the actual physical sample analyzed by the original investigators and deposited in an institutional collection. The type locality is the precise environment where that foundational material originated.

Beyond raw chemical formulas, type locality minerals document the history of human scientific discovery. A mineral's type locality often reflects the historical centers of mining, industrial activity, or scientific inquiry of the period in which it was discovered.

For example, historic mining districts like Cornwall, Lavrion, and the Harz Mountains became famous type localities because nineteenth-century mineralogists were actively studying the rich, unusual secondary mineralization brought up by local mining operations. In this sense, a label bearing a type locality is a historic record linking a physical specimen directly to pioneering researchers, classic field expeditions, and lost mining eras.

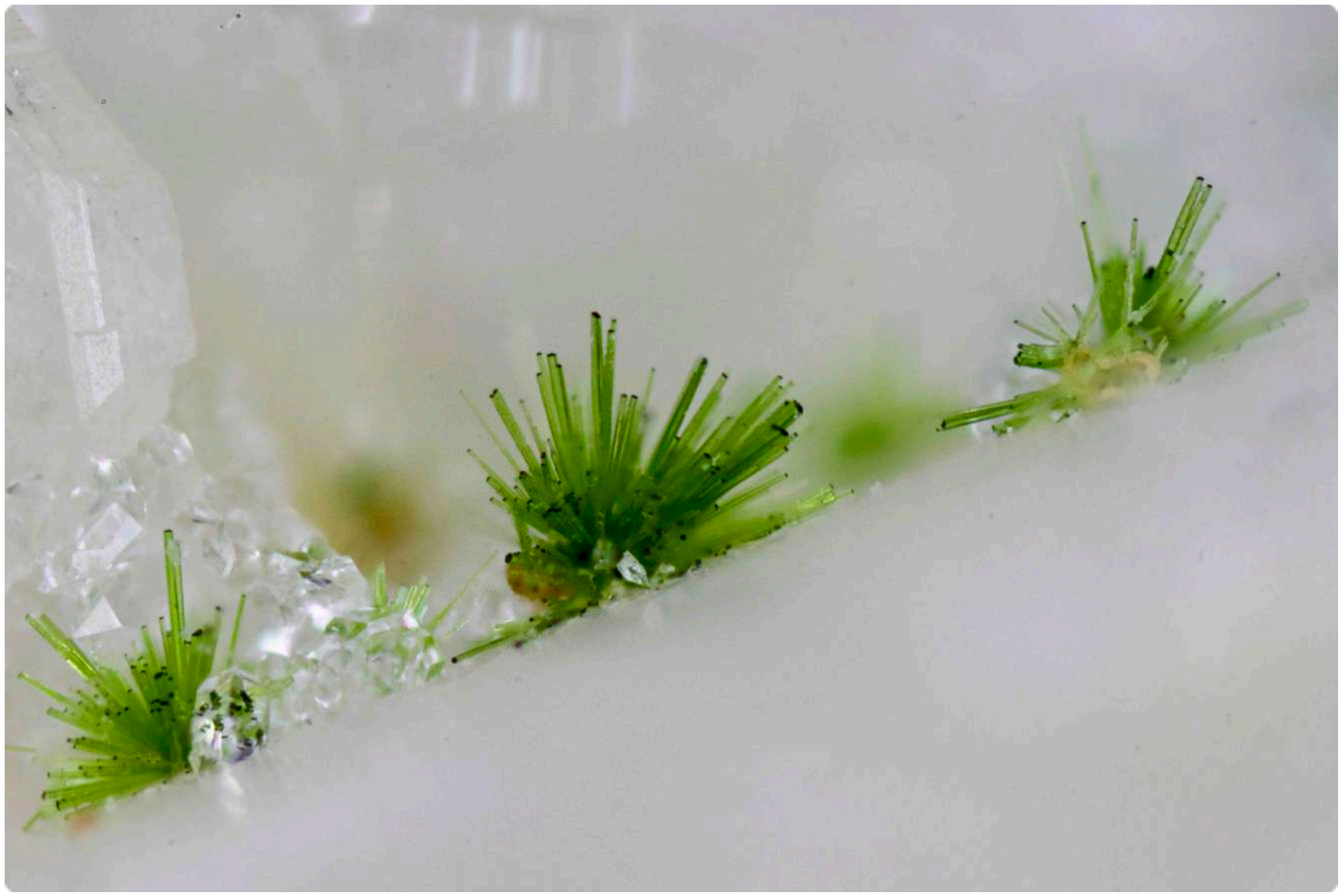
For systematic collectors - particularly micromounters - type locality specimens hold a cherished position. A type locality is rarely the place where the absolute largest or most aesthetically striking crystals of a species are found. Instead, its value stems from authenticity and historical importance. Many classic type localitie - such as closed 19th-century underground mines or altered slag dumps - are now entirely exhausted, sealed, or built over. Extant, well-documented specimens from these sites represent a finite, irreplaceable heritage. Assembling a "type locality suite" offers a structured, highly educational framework for building a collection. It allows collectors to study species within their original mineral associations, paragenetic sequences, and distinctive crystal habits.

Ultimately, type locality minerals connect the physical beauty of natural crystals with the history of science. They remind us that every recognized mineral species began with a moment of human curiosity at a specific spot on earth - forever linking geographic place, chemical identity, and mineralogical history.

In this section 10 minerals from my collection that are actually from their type locality.

81. Agardite-(Ce)

Germany, Black Forest, Wolfach, Clara Mine



Agardite-(Ce) is a rare secondary mineral belonging to the mixite group, formed through the oxidation of copper-bearing ore deposits. It is prized among collector species for its striking aesthetic, typically forming delicate, needle-like acicular crystals arranged in velvety sprays, radiating tufts, or small spherical rosettes. Its color ranges from a vibrant apple-green to pale yellowish-green with a silky or vitreous luster. Soft and brittle, agardite-(Ce) most commonly occurs in micro-pockets within quartz, barite, or fluorite matrix, often alongside other secondary copper arsenates in oxidized polymetallic vein systems. In this sample the hexagonal structure of the crystals is well visible.

Agardite-(Ce) is without exaggeration one of the iconic species of the Clara Mine. Picture width 1 mm.

82. Baiamareite

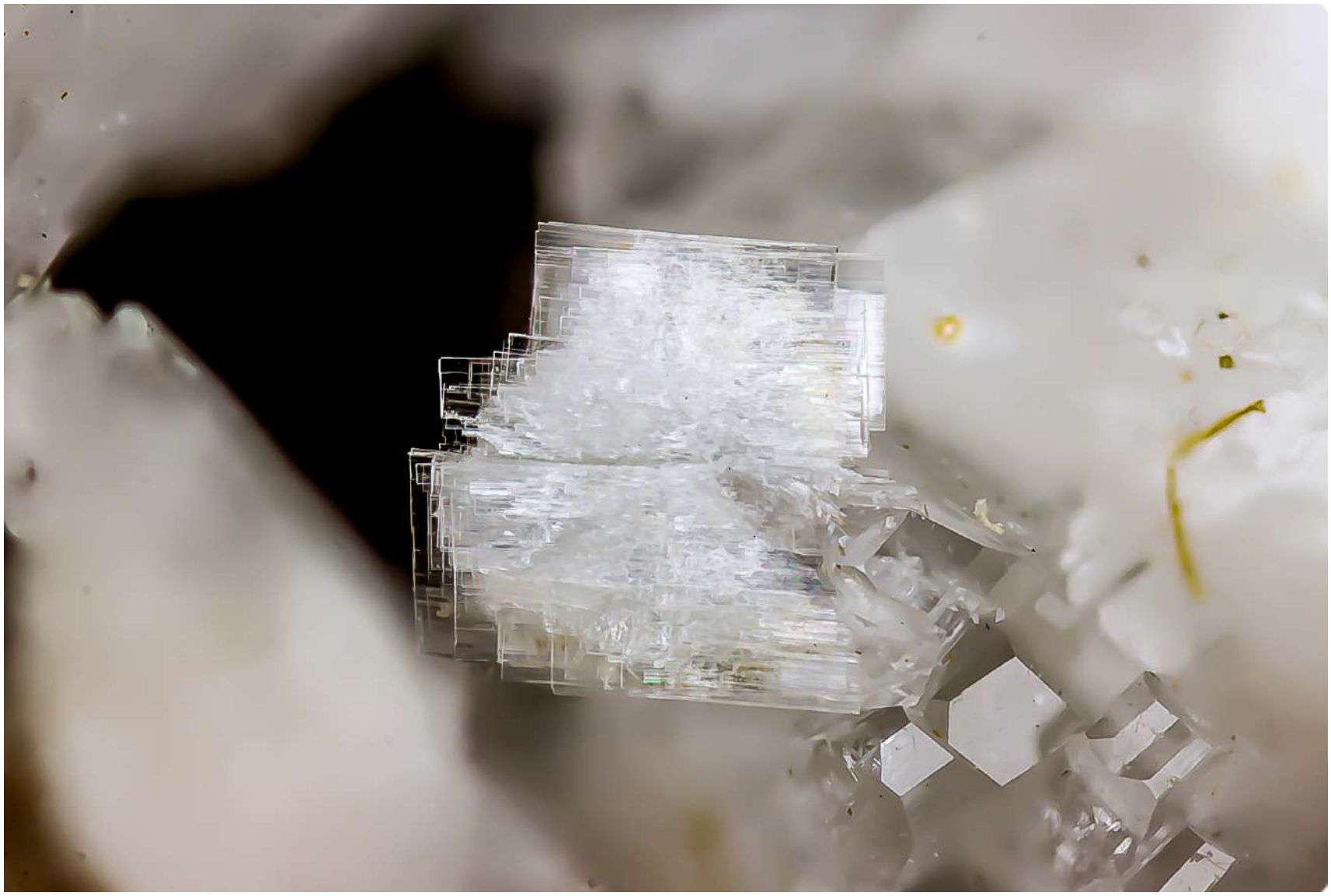
Romania, Maramures Co., Baiamare, Sãsar Mine

Baiamareite is an exceptionally rare sulfosalt mineral recently discovered at its type locality in Maramures County, Romania. Formed in complex hydrothermal polymetallic vein deposits, it occurs as tiny micro-crystals closely associated with other lead-antimony sulfosalts. Visually, it features an opaque, dark steel-gray to lead-gray metallic appearance with a metallic luster. Due to its extreme rarity and micro-scale habit, baiamareite is strictly a collector species, highly valued among micromount enthusiasts interested in obscure regional mineralogy and newly described sulfosalt species.

This fantastic piece is in the collection of my friend André Robbemond. Picture width 4 mm. The photo is the first one ever made of the species, even before it was ultimately approved as a new mineral.

83. Bavenite

Italy, Piedmont, Baveno



Bavenite is a calcium beryllium aluminosilicate mineral first discovered in the pink granite quarries of Baveno, Italy. Typically forming as a secondary mineral from the alteration of primary beryllium minerals like beryl, it is widely collected as micro-specimens. Visually, bavenite ranges from colorless and pure white to soft greenish, pinkish, or pale brown tints. It most commonly grows in delicate, radiating sprays of acicular crystals, thin tabular blades like this one, or velvety fibrous coatings inside miarolitic cavities and granite pegmatites. It exhibits a vitreous to pearly luster and a Mohs hardness of around 5.5.

Picture width of this ultrathin piled specimen is 0,5 mm.

84. Calderónite

Spain, Extremadura, Santa Marta, Las Colmenitas Mine

Calderónite is a not too rare lead iron vanadate mineral belonging to the brackebuschite group, formed as a secondary mineral in oxidized lead-zinc-vanadium deposits. It typically occurs as micro-sized, elongated prismatic to tabular crystals, or as subparallel aggregates and fan-like sprays. Visually, calderónite ranges in color from dark reddish-brown to orange-brown or amber-yellow, displaying an adamantine to resinous luster. It is translucent to sub-translucent and brittle, usually found perched on matrix alongside other secondary vanadates and lead minerals, making it a highly valued target for micromount collectors.

This piece is the only one that I have in my collection, from an exchange in 2024 - and the only one I have ever seen at all, for that matter. Picture width 0,8 mm.

85. Decrespignyite-(Y)

Australia, South Australia, Peterborough, Paratoo Copper Mine

Decrespignyite-(Y) is an extremely rare rare-earth copper carbonate hydrated chloride mineral, so far only found at this type locality and nowhere else. Formed as a secondary species in weathered, oxidized copper deposits enriched with rare-earth elements, it is instantly recognizable by its striking, intense royal blue to sky-blue color. It typically forms micro-spherical aggregates, tiny botryoidal crusts, or radiating pseudohexagonal platy crystals with a pearly to vitreous luster. Soft, fragile, and exceptionally scarce, decrespignyite-(Y) typically coats pale matrix rock alongside other secondary copper species. Here it is often accompanied by another rarity, kamphaugite-(Y).

Of course I didn’t find this mineral myself, it was a gift from one of my Australian friends. Picture width 4 mm.

86. Henmilite

Japan, Okayama Prefecture, Takahashi City, Fuaka Mine

Also extremely rare, only known from here, is this henmilite, a calcium copper borate mineral. It forms as a secondary mineral within borate-bearing skarn deposits. Visually, it is famous for its intense, deep blue-violet to royal blue color. It typically occurs as small dipyramidal or tabular crystals exhibiting a vitreous luster. Its dark, richly saturated blue crystals create a striking contrast against stark white matrix minerals - in this case olshanskyite.

In march 2026 I visited, as every time, the yearly mineral fair in Hannut, Belgium, and there I found this specimen of henmilite, of which I hadn’t ever heard before. Even when you have a large collection you can still find something new every now and then. Picture width 4 mm.

87. Marshite

Australia, New South Wales, Broken Hill., Proprietary Mine

Marshite is one of the members of the chlorargyrite group, a copper iodide mineral, formed as a secondary halide species in the deeply oxidized zones of copper-bearing ore deposits. It is notable for its cubic crystal symmetry. Visually, pure fresh crystals are transparent to translucent and range from pale oil-yellow to salmon-pink or reddish-brown, though they can tarnish darker upon exposure to light. Marshite typically forms sharp tetrahedral or octahedral crystals displaying an intense adamantine luster, often resting on iron-rich gossan matrix alongside native copper or iodargyrite. One of the most striking features, that is the best lead for its identification, is the intense red fluorescence under longwave UV-light.

The specimen came as part of a large collection from Broken Hill that I acquired several years ago. Picture width 2 mm.

88. Pachnolite

Greenland, Sermersooq, Arsuk Fjord , Ivigtut Mine

Pachnolite is a rare sodium calcium aluminum fluoride mineral first described from the Ivigtut cryolite deposit in Southwest Greenland. Formed as a secondary alteration product of primary cryolite and other aluminofluorides in granitic pegmatites, it typically grows inside cavities and small vugs. Visually, pachnolite is colorless, white, or pale yellowish-tan, featuring a vitreous luster. It forms fine elongated monoclinic crystals - often slender prismatic needles or blade-like terminations - that can occur as delicate cross-cutting sprays or interwoven clusters lining matrix cavities, making sharp, clean micro-crystals.

The location is closed and no longer accessible as far as I know. Pachnolite was often accompanied by other fluorides like ralstonite and thomsenolite - the latter being the dimorph of pachnolite. Picture width 4 mm.

89. Senegalite

Senegal, Saraya, Mount Kourou Diakouma

Senegalite is a rare hydrated aluminum phosphate mineral that forms as a secondary mineral in oxidized aluminum-rich iron ore deposits. It is renowned among phosphate species for its exceptional crystal clarity. Visually, senegalite ranges from colorless to pale yellowish-green or light straw-yellow with a vitreous luster. It forms sharp, well-developed orthorhombic crystals - frequently tabular or dipyramidal in habit - that commonly nestle in cavities atop bluish or greenish phosphate matrices like turquoise or wavellite, providing spectacular contrast.

Senegalite is also known from Brazil, but that’s it - it is very rare. Indeed the light blue material on this specimen is turquoise. What you see is a section of about 10 mm of a 4 cm piece.

90. Zanazziite

Brazil, Minas Gerais, Itinga, Ilha Claim

Formed as a hydrothermal alteration product in complex boron- and beryllium-bearing granitic pegmatites, zanazziite typically lines small miarolitic cavities. Visually, zanazziite ranges from pale yellow and olive-green to amber-brown with a vitreous to pearly luster. It commonly occurs as delicate spherical rosettes, botryoidal aggregates, or barrel-shaped micro-crystals resting on albite, quartz, or muscovite matrix, making its aesthetic tufted forms highly appreciated.
Zanazziite is a calcium beryllium magnesium phosphate belonging to the roscherite group.

This specimen is a very rich example, with a lot of these spherical crystals. What you see is a section of some 8 mm in a specimen of around 5 cm, that is completely scattered with these.

10. From famous collecting locations

For passionate collectors, mineral localities represent far more than mere geographical coordinates on a map. They are sanctuaries of geological wonder, historical monuments to human labor, and sacred grounds where nature's hidden geometry is brought into the light. Long after a deposit has been exhausted, its shafts collapsed, or its open pits reclaimed, the lore surrounding a great mineral locality survives. To the global collecting community, these famous sites occupy a transcendent place in the imagination - serving as symbols of perfection, historic legacy, geological anomaly, and the thrill of discovery. Above all, renowned mineral deposits function as benchmark standards of aesthetic perfection. Every mineral species displays a characteristic habit, color, and luster, but only under exceptionally rare geological conditions does a single locality produce specimens that define the ideal form of that mineral. When collectors speak of a iconic site, they are often referring to a location that yielded the world's benchmark examples of a specific crystal - whether that means an unparalleled, vivid saturation of color, extraordinary optical clarity, or unprecedented crystal size.

Beyond aesthetic appeal, legendary collecting sites carry profound historical and cultural weight. Many of the world's most revered mineral locations trace their origins back centuries, originating as ancient mining enterprises, industrial boomtowns, or historic scientific proving grounds. In these places, early miners and pioneering mineralogists labored under grueling conditions, often discovering species previously unknown to science or uncovering treasure troves that altered local economies.
Iconic mineral sites also hold symbolic importance as scientific anomalies - rare geological windows into the extreme processes of the earth's interior. Minerals do not form in a vacuum; they require precise combinations of element availability, temperature, pressure, fluid chemistry, and open space to grow without restriction. Legendary deposits represent places where planet-scale processes converged in perfect harmony. Whether born from deep-seated pegmatitic pockets, hydrothermal veins winding through ancient ore bodies, or complex secondary oxidation zones near the surface, these sites are celebrated as nature's ultimate laboratories. To field collectors and researchers alike, visiting or studying specimens from these localities offers a profound appreciation for the sheer statistical improbability of their creation.

The ten microminerals presented in this last section come from indeed iconic sites from all over the globe, of course without any pretense to be complete - there are many more..

91. Aluminium bearing adamite

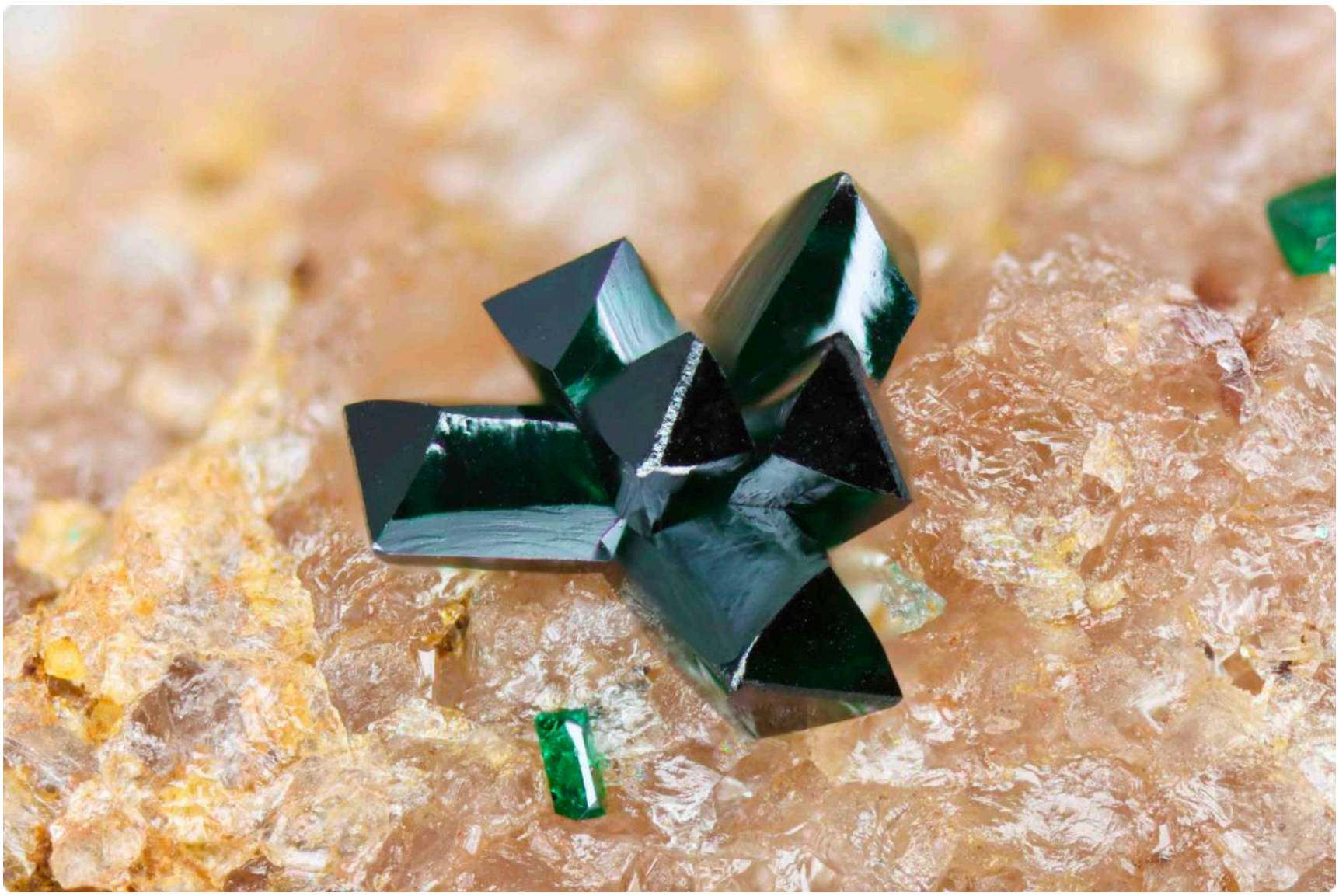
Greece, Attica, Kamariza, Hilarion Mine

Located near Kamariza (Agios Konstantinos) in the iconic Lavrion Mining District of Greece, the Hilarion Mine is a famous historical complex originally worked for silver, lead, and copper since antiquity.
It serves as the type locality for several species, most notably its namesake, hilarionite. Renowned for its rich supergene oxidation zone, the Hilarion is home to over 200 mineral species. It is particularly prized by mineral collectors for its exceptional secondary copper, lead, and zinc minerals, including vibrant turquoise cuproadamite, botryoidal smithsonite, and branching aragonite sprays on gossan matrix.

This is also adamite, but the aluminium-bearing adamite in its typical light blue color, on a bed of white to colorless hydrozincite. The color is typical for the variety, but not exclusive: copper bearing adamite can sometimes have the same color. Analysis therefore is required, which was done for this one. Picture width 4 mm.

92. Atacamite

South Australia, Stuart Shelf, Mount Gunson Copper Mines

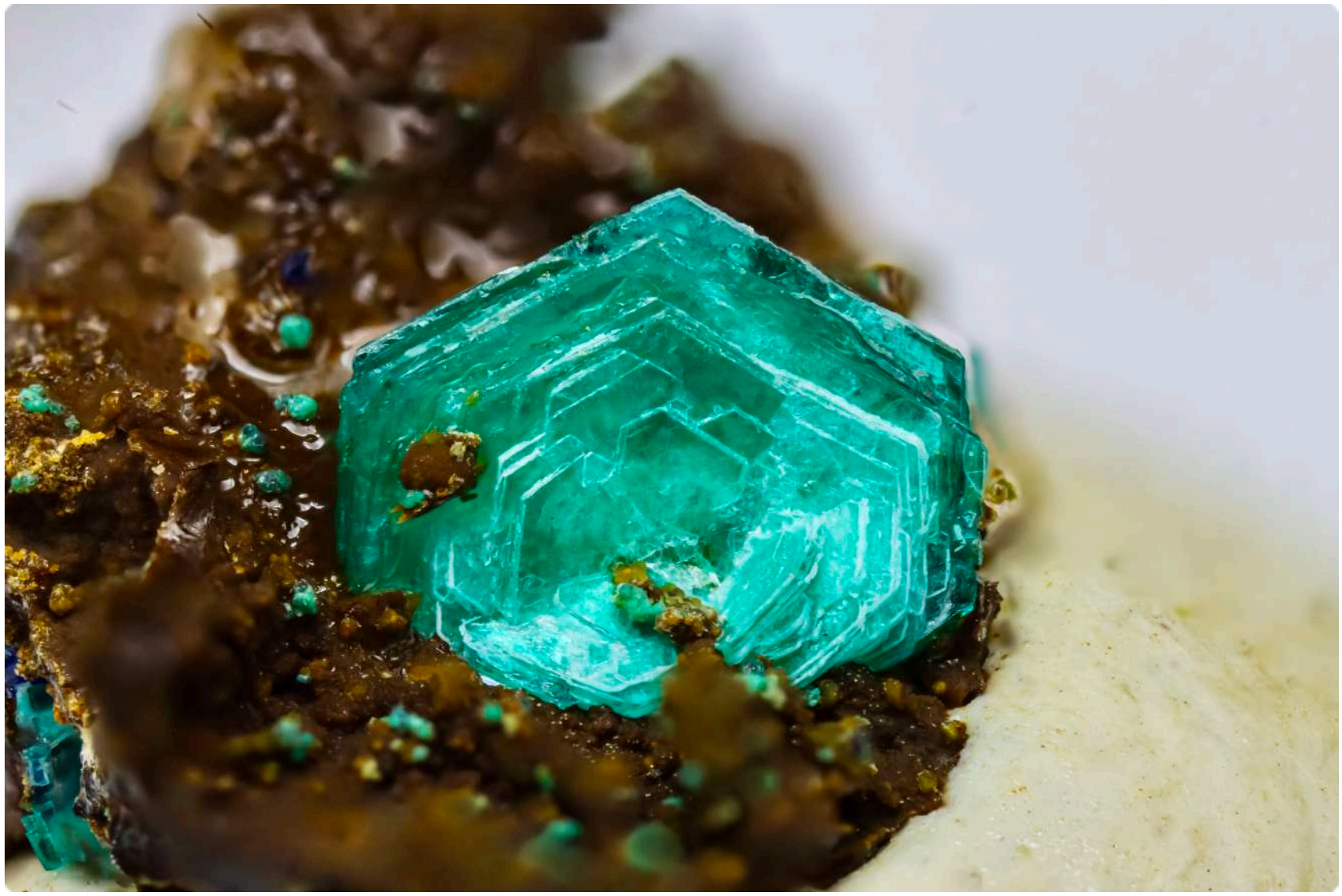


Situated near Pernatty Lagoon on the Stuart Shelf in South Australia, the Mount Gunson Copper Mines comprise a famous sediment-hosted copper district discovered in 1875. The district is mineralogically famous for producing world-class, sharp, lustrous crystals of exceptional dark forest-green atacamite, the rare copper-bismuth sulfosalt wittichenite, as well as unique green gypsum crystals colored by trace inclusions. Host to over 50 mineral species, Mount Gunson is a prized Australian locality among collectors.

This striking cluster displays pseudocubic / pseudo-octahedral cyclic penetration twinning. - one of the rarest and most desirable crystallographic habits for atacamite. While atacamite is naturally orthorhombic, multiple individual crystals have intergrown at precise geometric angles (penetration twinning). This creates a sharp, symmetrical starburst arrangement whose individual terminations mimic pseudo-octahedral or pseudocubic pyramidal points. Picture width 1,5 mm.

93. Chalcophyllite

France, Occitanie, Aude, Salsigne Mine



The Salsigne Mine was Western Europe's largest gold producer in the 20th century, extracting over 120 tons of gold alongside silver, copper, and bismuth.
Operating from Roman times until its 2004 closure, it was also one of the world's primary sources of arsenic. Mineralogically, the complex hydrothermal deposit yields over 200 species. It is particularly famous among collectors for producing world-class specimens of the iron silicate cronstedtite, lustrous arsenopyrite, native gold, and diverse secondary minerals hosted within dark slate and quartz matrix - one of which is this immaculate chalcophyllite.

Regularly I attend the yearly symposium of the British Micromount Society. Besides the very pleasant meeting with old and new friends and a program of presentations, the main part is exchanging of microminerals. This is one of the beauties that I was able to lay my hands on a few years ago. Actually this is not one single crystal, but a number of hexagonal plates grown together. Picture width 3 mm.

94. Clinoclase

Germany, Baden-Württemberg, Wolfach, Clara Mine

This truly is a classic - which goes for the location as well as the mineral. The Clara Mine needs no further introduction, I believe. For years already a nirwana for microminerals in the baryte and fluorite, 566 different species so far accounted for - and counting ! -, and an excellent cooperation between the company and us as collectors.

Clinoclase surely is one of the icons from the Clara. Not too easily found..but when, then fabulous crystals and crystal groups like this one can come to light. Actually this is one of many, and I really mean many, that my friend Felix Maassen stumbled on in spring 2026, and that he was friendly enough to share with me. The color is uncomparable, the crystals are shiny and flawless. A world class find, without any doubt. Height of the crystals 2,5 mm.

95. Chromium bearing grossular

Canada, Québec, Asbestos, Jeffrey Mine

The Jeffrey Mine was once one of the world's largest open-pit asbestos mines, operating for over a century before closing in 2012.
Beyond its industrial production of chrysotile, it is world-renowned among mineralogists as an iconic locality for exceptional garnet crystals - orange hessonite as well as this green Cr-grossular - and magnificent green vesuvianite crystals. Formed in rodingite dikes within an ophiolite complex, the mine has yielded over 100 species, making its lustrous garnet clusters and associated microminerals prized highlights in collections worldwide.

The specimen on the photo is really top class: the fantastic coloring, the razor sharp faces and edges, the textbook striations in all directions, the super transparency.. all features that makes it a super find. And to add a personal note: this specimen was the very one that made me wanting to learn photographing micro’s. The photo is one of my very first some 7 years ago… Picture width 4 mm.

96. Narsarsukite

Canada, Québec, Mont Saint-Hilaire

Just like the Clara Mine also Mont Saint-Hilaire needs no further introduction. My guess is that MSH, the Clara and Lavrion in Greece are the three most famous sites in the world. Mont Saint-Hilaire is an alkaline intrusive complex, its miarolitic pegmatites surely are a holy grail for micromount and systematic collectors. Until now according to Mindat over 440 mineral species from here are known, 75 of which are type locality minerals.

Narsarsukite, a sodium-titanium silicate, was first described in 1900 by Swedish mineralogist Gustaf Flink from its type locality, the Narsarsuk pegmatite within the Ilímaussaq alkaline complex in Greenland. It crystallizes in the tetragonal system, commonly forming flat tabular, equant, or short prismatic crystals. Colors range from honey-yellow, lemon-yellow, and tan to brownish-red or pink, with a vitreous to pearly luster. The crystal on the photo may count as textbook, because its sharp edges, typical corner faces and the pristine color. The crystal measures 1 mm in all directions.

97. Spangolite

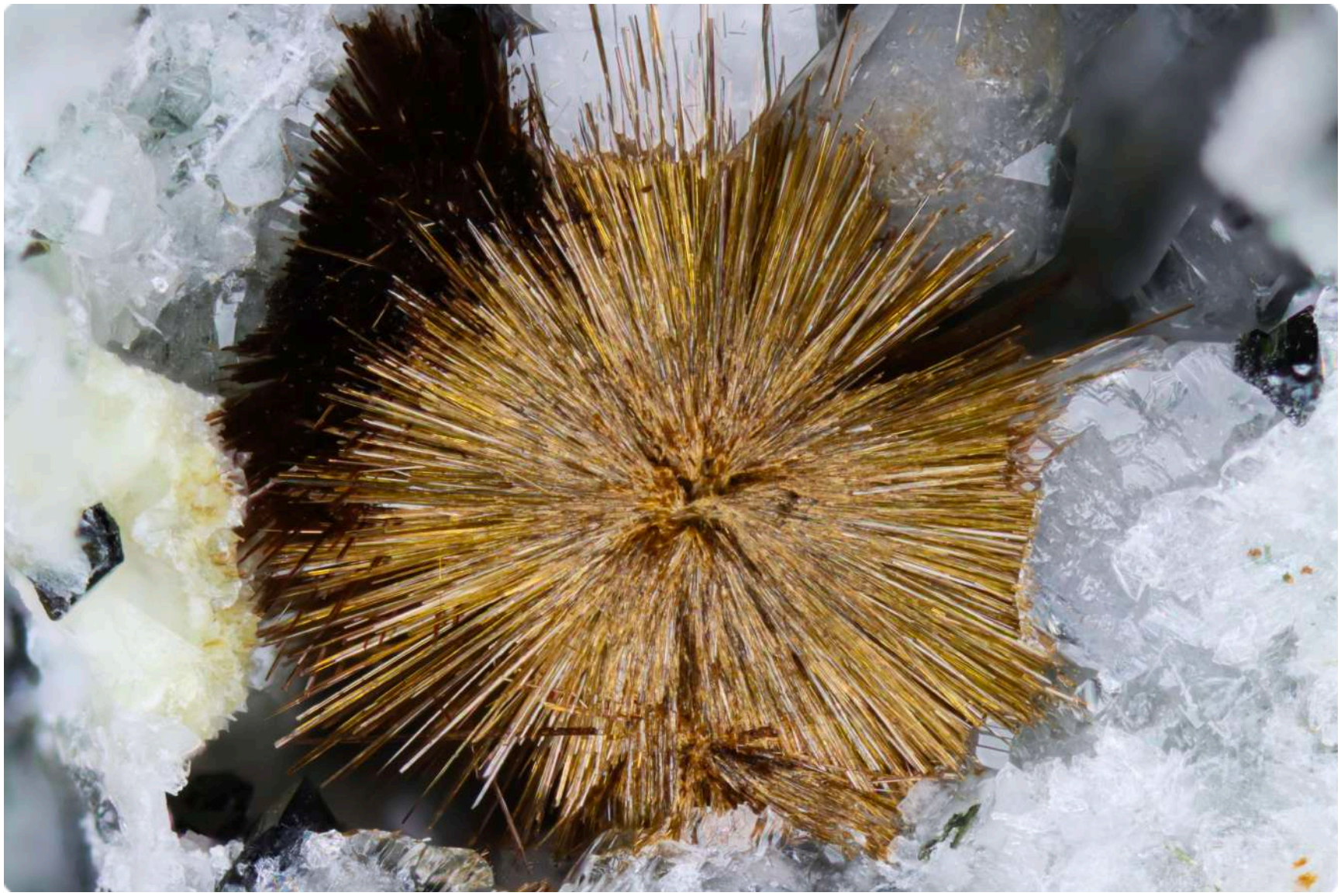
USA, New Mexico, Socorro Co., Mex Tex Mine

The Mex-Tex Mine is a celebrated locality famous among collectors for its vibrant, gemmy minerals. Formed in limestone cavity fillings (Mississippi Valley-type deposit), the mine is best known for producing brilliant cubic fluorite crystals ranging from deep violet-purple to sky-blue, often nestled among stark white, bladed baryte rosettes. It is also an exceptional site for secondary lead and copper species, yielding sharp micromount specimens of linarite, murdochite, wulfenite, and cerussite, and especially spangolite - making it an iconic Southwest US locality.

This specimen shows the hexagonal barrel shaped crystals, as they are more or less typical for the location. Picture width 3 mm.

98. Tuperssuatsiaite

Namibia, Windhoek, Aris Quarries



Though not the type locality, the Aris Quarries are without any doubt the best source in the world for ravishing tuperssuatsiaite crystal specimens. The host rock is phonolite, which is a challenge of its own: it’s so hard that working it, especially in the dry heat of Namibia, asks for a lot of strength and perseverance. And not only in loco - also formatting rock pieces in my basement takes blood, sweat and tears so to speak.

Tuperssuatsiaite is famous for its distinctive, visually striking habit—forming delicate, radiating tufts, sprays, or fibrous rosettes composed of hair-like, acicular needles. Its color ranges from warm reddish-brown and brick-red to yellowish-tan or orange-brown, with a silky to pearly luster. The explosion on the photo measures 4 mm.

99. Variscite

Australia, South Australia, Iron Knob, Iron Monarch Mine

The Iron Monarch open-cut mine is a historic iron ore deposit that laid the foundation for Australia's steel industry. It is globally renowned for its high-grade hematite and magnetite ore, reaching iron contents above 60 to 68 percent. For mineral collectors, the locality is legendary due to the extraordinary complexity of its supergene oxidation zone. It serves as the type locality for several rare species, including francisite, gatehouseite, waterhouseite, kleemanite - and I am very pleased to have all four of these in my collection.
Furthermore, it has produced world-class micromount specimens of manganese minerals and phosphates, among which this variscite, an aluminium phosphate.

Variscite often, if not almost always, has a spherical habit, and occurs in a variety of colors, depending on specific elements in its grid. Basically it is colorless. The raspberry red color of these beauties is caused by trace impurities of iron replacing part of the aluminium.
Picture width 5 mm.

100. Willemite

Portugal, Moura, Sobral de Adiça, Preguiça Mine

The Preguiça Mine is a historic zinc-lead deposit known since antiquity for its supergene carbonate ore body. Formed by the oxidation of primary sulfides in limestone host rocks, the mine is renowned for producing outstanding secondary minerals. Collectors value its sharp micromount specimens, including waterclear willemite crystals, lustrous hemimorphite, yellow-green adamite, smithsonite, and exquisite sprays of secondary lead and zinc arsenates.

Willemite crystals are trigonal. They can show a variety of colors, due to impurities, but basically it is colorless - and the best crystals are waterclear. A fine feature of this specimen are the complicated clusters, that seem to originate from a central point. Picture width 5 mm.

Conclusion: Why tiny things matter

Endless curiosity..

I have spent more evenings than I can count with my eye pressed to a microscope, the rest of the world fading into a blur beyond the lens. A specimen no bigger than a pinhead sits in front of me, and yet in that tiny space I see architecture, chemistry, history, and art all at once. People sometimes ask me whether I ever get bored after four decades of looking at rocks. The question makes me smile, because the answer is always the same: how could I get bored when every single one contains a universe I have not finished exploring?

And there is more. When I look at a perfect cube of galena no bigger than a grain of dust, I see the same geometric order that governs the planets in their orbits and the symmetry of a snowflake. The laws that shape the smallest crystal are the same laws that shape the largest structures we know. In that way, a micromount is not just a pretty object. It is a proof that the universe is consistent, that the same rules apply at every scale, and that order can emerge from chaos in the most unexpected places.

Perhaps the most surprising gift of all is humility. When you have spent decades trying to identify and understand the contents of a space smaller than a fingernail, you learn very quickly how much you do not know. Nature always has another surprise waiting, another form you have never seen, another color that should not exist, another habit that refuses to follow the rules. The micro-world is an endless education, and I remain a student in it, still learning, still wondering, still delighted after all this time.

The search for perfection…

There is something quietly satisfying about holding a real, imperfect, dust-covered fragment of the earth next to a crisp white drawing of what it should look like. The drawing is clean and ideal, every face at its proper angle, every edge sharp and true. The real crystal is hardly ever quite that perfect. It has grown in a cramped pocket, competing with other minerals for space, interrupted by shifts in temperature and chemistry. And yet, when you look closely enough, you can see the drawing inside it. The ideal is there, just wearing a disguise of reality. There is a deep pleasure in the act of matching. I have spent countless hours comparing a tiny crystal to an idealized drawing, rotating the specimen mentally, checking the angles, verifying the faces. The moment when everything snaps into alignment feels like solving a puzzle.

And here is a truth that has grown on me slowly: the search for the perfect match is really a search for clarity. In a world full of noise, distraction, and things that only pretend to be what they are, the disciplined act of comparing what you see to what you know — and checking again, and again, until you are certain — is a rare form of mental honesty. And that's what science in my view is about.

Looking closely…

You do not need a collection of 23000 specimens to begin. You do not need a fancy microscope, though any basic stereo microscope will open the door. You do not need to travel to distant mines or know the periodic table by heart. You only need to look at something small and ordinary with the intention of seeing it as if for the first time. A grain of sand from your local beach, a chip of quartz from a gravel path, a fragment of granite from a garden wall - any of these can be a starting point. The tiny treasures are not hiding in some exotic place. They are everywhere, waiting for someone to pay attention.

If you have never looked at a micromount before, I recommend starting with whatever is closest to hand. Borrow a magnifying glass, if that is all you have. Or find a friend with a microscope and ask for five minutes of their time. The first view is the one that changes people. I have watched it happen hundreds of times - the intake of breath, the widening eyes, the sudden silence that means a mind has just expanded. I have seen it many times when I let people take a look through my microscope for the very first time. Most of them had no idea that such things existed, and then suddenly cannot look away. That moment is a gift, and it belongs to anyone who is willing to look.

Sharing the passion…

This book would not exist without the people who have shared the journey with me. To the collectors who traded specimens, offered advice, helped me solving stubborn mysteries: you are the lifeblood of this hobby, and I am grateful for every single interaction. To the friends who have stood beside me at swap meets, peered into my microscope at odd hours, and celebrated my finds as if they were their own: your enthusiasm has kept mine alive for decades. To the readers of my website and the followers in my Facebook groups who have liked, commented, and shared my photographs: you have turned a solitary passion into a shared conversation, and that for me is the most precious of all !

I also want to thank everyone who has ever asked a question at a presentation, even the simplest one. Those questions remind me that curiosity is the most democratic thing in the world. It does not care how old you are, where you live, or how many degrees you hold. It only wants to know what happens next, what lies beneath, what that tiny thing over there really is. Every question I have ever been asked has pushed me to look more carefully, to explain more clearly, and to remember why I fell in love with this hobby in the first place…