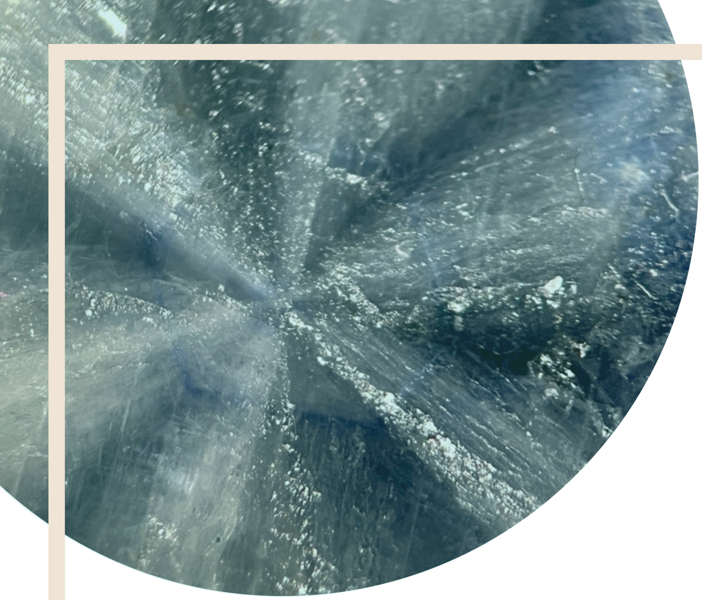


JUNE 13 - 16, 2024

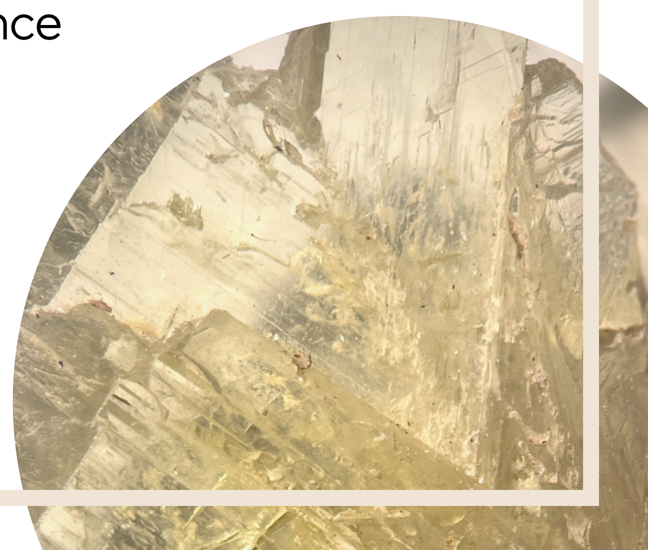
MINERAL ODDITIES

Twinning, Pseudomorphs, Inclusions, and More!

SYMPOSIUM

Program & Abstracts

Berthoud Hall &
Mines Museum of Earth Science
Colorado School of Mines,
Golden, Colorado



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Twinning, Pseudomorphs, Inclusions, and More!

JUNE 13 - 16, 2024

Berthoud Hall &
Mines Museum of Earth Science
Colorado School of Mines,
Golden, Colorado

Editor: Anne Fulton

Sponsored by:

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Cover Images: (upper left) Trapiche Corundum, var. sapphire, Zahir Shah Valley Sar-i-Sang, Badakhshan, Afghanistan. (lower right) Chrysoberyl V-twin, Lake Alaotra, Alaotra-Mangoro, Madagascar. Courtesy of Anne Fulton.

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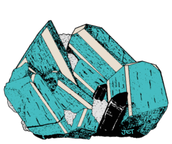
Renata Lafler
James Hagadorn
Nicole Neu-Yagle
Marie Huizing
& everyone else who helped make this symposium possible
Thank You!

TABLE OF CONTENTS



WELCOME

Welcome to the 2024 Friends of Mineralogy Colorado Chapter Symposium, with the theme of "Mineral Oddities: Twinning, Inclusions, Pseudomorphs, and More"! After a six-year hiatus (largely due to a global pandemic), we are pleased to continue with our semi-annual symposium series.

As the title suggests, our symposium this year focuses on unique and peculiar aspects of mineralogy, from famous to esoteric, and from megascopic to microscopic. With this symposium, we take an expansive view of the term "oddity," including classic mineralogical curiosities, such as twinning and "*morphs" (pseudomorphs, epimorphs, etc.), as well as subject matters that push the bounds of typical or everyday mineralogical inquiry, such as fakes and frauds. Pursuant to the goals of the Friends of Mineralogy organization, our symposium aims to seamlessly connect the aesthetic aspect of the mineral collecting hobby with the scientific side of this subject matter; consequently, our symposium also focuses on placing these "oddities" within their scientific context. The symposium technical program features presentations by an array of experts from across the globe under this broad umbrella of "oddities." We are tremendously grateful to our speakers for their willingness to present at this symposium, and we look forward to learning from their expertise!

We are also pleased to offer a mineral photography workshop, a field trip to the St. Peters Dome area in the Pikes Peak batholith, and behind-the-scenes tours of the Denver Museum of Nature & Science (DMNS) collections as part of our symposium this year. We are grateful to Mark Cross, Mark Ivan Jacobson, and James Hagadorn and Nicole Neu-Yagle at DMNS for facilitating these additional program features.

Our symposium this year was organized as a joint effort by the Mines Museum of Earth Science at Colorado School of Mines and the Friends of Mineralogy Colorado Chapter. We thank Renata Lafler, Samara Rhett Tebo, and Ed Raines our colleagues at the Mines Museum, for all their efforts in helping us to get this event organized, including particularly with the Friday evening reception at the Mines Museum.

The Mines Museum of Earth Science features a prestigious collection of minerals from Colorado, many of which date to the early 1880s and were acquired by pioneers of Colorado mineralogy, in addition to an impressive collection of specimens from around the world. We hope that you enjoy your time in the Mines Museum during the opening reception on Friday evening, and we invite you to visit the Museum again in the future to explore their spectacular collections and displays. (Additional information can be found at https://www.mines.edu/museumofearthscience/)

The Friends of Mineralogy Colorado Chapter was founded in 1977-1978 as a service organization with the purpose of increasing knowledge about minerals and their deposits. As a chapter of the national Friends of Mineralogy organization, our overarching goal is to promote, support, protect, and expand the collection of mineral specimens and to further the recognition of the scientific, economic, and aesthetic value of minerals and collecting mineral specimens. Our organization comprises collectors, professionals, and curators who share a love of mineral specimens and the desire to promote understanding and appreciation of mineralogy. We welcome all who may be interested to join our organization. (Additional information can be found at https://friendsofmineralogycolorado.org/)

Thank you for joining us at our symposium this year, and we hope you enjoy the event!
On Behalf of the Organizing Committee,

Benjamin S. Murphy
President, Friends of Mineralogy Colorado Chapter

PROGRAM SCHEDULE

Thursday, June 13th

Field Trip Option A (all day)	**Select Pegmatites in the St. Peters Dome Area, El Paso County, Colorado** Leader: Mark Jacobson
Field Trip Option B (11am - noon)	**Denver Museum of Nature and Science Behind the Scenes Tour** 2001 Colorado Blvd, Denver, CO 80205

Friday, June 14th

Field Trip Option C (11am - noon)	**Denver Museum of Nature and Science Behind the Scenes Tour** 2001 Colorado Blvd, Denver, CO 80205
Photography Workshop (9am - 5pm)	**Mineral Photography with Mark Cross** Berthoud Hall, Room 241 - 1516 Illinois Street, Golden, Colorado
5:00 PM - 7:00 PM	**Reception at the Mines Museum of Earth Science - 1310 Maple St, Golden, CO 80401** Drinks, Hors d'oeuvres, & On-site Registration **Silent Auction** (will include autographed Minerals of Colorado, by the authors)

PROGRAM SCHEDULE

<u>Saturday, June 15th</u>

Berthoud Hall, Room 241 - 1516 Illinois Street, Golden, Colorado
(all presentation times are inclusive of Q & A)

8:00 - 8:45 AM	Badge/Program Pickup, Walk-in Registration, Coffee & Tea
8:45 AM	WELCOME REMARKS
9:00 AM	**Carl Francis** -*Quartz: Dauphiné habit vs. Dauphiné twins*
9:50 AM	**Terry Huizing** -*Calcite Twinning, Inclusions, and More*
10:40 AM	MORNING BREAK
11:00 AM	**Erin Delventhal** - *What is a Pseudomorph?*
12:00 PM	LUNCH BREAK
1:30 PM	**Nathan Renfro** - *The Unusual Microworld of Gem Minerals*
2:20 PM	**Caleb Chappell** - *A Common Thread: On the Nature of the Faden Habit*
2:50 PM	**Michael J. Gobla** - *Color variation in minerals and gems: zoning, phantoms, and other oscillations*
3:20 PM	AFTERNOON BREAK
3:40 - 4:30 PM	**Ed Raines** – *There Are No Mineral Oddities*

PROGRAM SCHEDULE

<u>Sunday, June 16th</u>

Berthoud Hall, Room 241 - 1516 Illinois Street, Golden, Colorado
(all presentation times are inclusive of Q & A)

8:30 - 9:00 AM	Coffee & Tea
9:00 AM	**Isabella Pignatelli** – *Colombian trapiche emeralds: Recent advances in understanding their formation*
9:50 AM	**Terry Wallace** –*Mineral Oddities: Is that specimen too good to be true?*
10:40 AM	MORNING BREAK
11:00 AM	**Phil Persson**– *The Mineralogy and Geology of the Franklin-Sterling Hill Mining District, Sussex County, New Jersey, with Special Emphasis on Mineral Fluorescence*
12:00-12:15 PM	CONCLUDING REMARKS

GRL201 (classroom across from Mines Museum)
1310 Maple St, Golden, CO 80401

1:30 - 4:00 PM	**Micromineral Summit** (Sponsored by Rocky Mountain Micromineral Association): Micro Minerals from the Sherman Tunnel, Leadville District, Lake County, Colorado, a microphotography demonstration, and a swap meet and micromineral give-away.

ABSTRACTS
&
AUTHOR BIOS

Quartz: Dauphiné habit versus Dauphiné twins

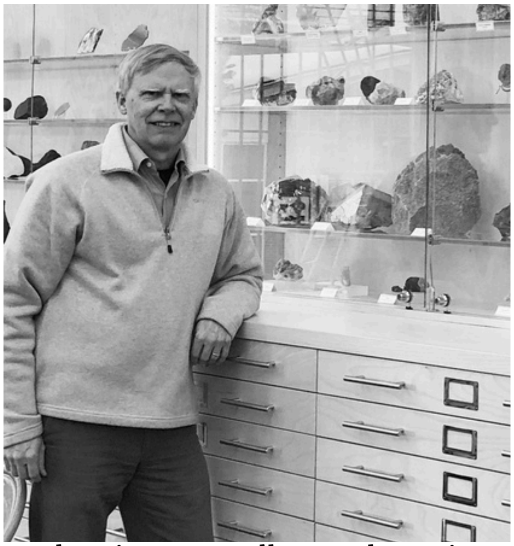
Carl A. Francis
Maine Mineral & Gem Museum, Box 500, Bethel, Maine 02417
carlfrancis62@gmail.com

Dauphiné was a province of the Kingdom of France in southeastern part of the county. Crystals from hydrothermal veins there, notably the La Gardette gold mine near Grenoble were the subject of some of the earliest studies of quartz by European mineralogists. Both a crystal habit and a twin law were named for the province, which can be confusing.

A crystal habit is a specific combination of crystal forms that gives a distinctive shape to a crystal. The normal habit of quartz is a prism terminated by two rhombohedrons designated r and z. Tapering crystals with three-fold symmetry are the Muzo habit. Tapering crystals with six-fold symmetry are the Tessin habit. Equant crystals with slight or no prism development are the Cumberland habit. Crystals with one (or two) exceptionally large rhombohedral face(s) display the Dauphiné habit.

Dauphiné twins are crystals or portions of a crystal related by a two-fold rotation about the c-axis. They may be either contact twins or interpenetrating twins. Two parallel crystals are likely contact twins, which may be verified by inspecting the terminal rhombohedra. If the large rhombohedral faces (r) on one crystal are parallel to the small rhombohedral faces (z) on the other it is a Dauphiné twin.

Interpenetrating Dauphiné twins, which are almost universal in quartz, may be recognizable in subtle ways. Six different manifestations of interpenetrating Dauphiné twins will be illustrated.



In the DiscoveryGallery at the Maine Mineral & Gem Museum

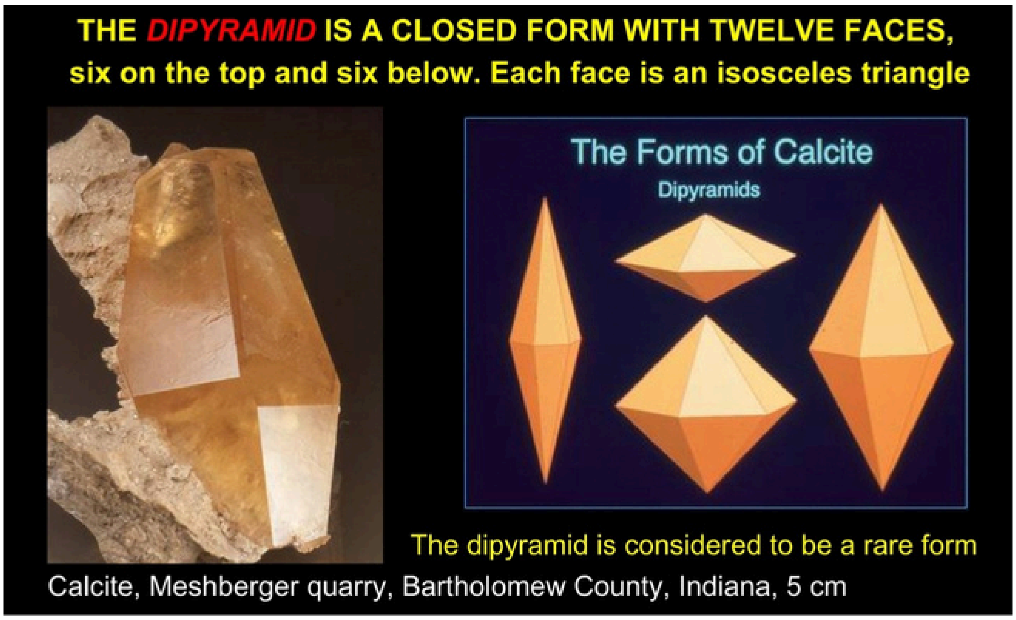
Dr. Carl A. Francis earned his BA in geology from Amherst College in 1971 and his MS and PhD from Virginia Polytechnic Institute and State University. His professional interests include crystal morphology and growth features as well as the geology of pegmatites. He retired in 2011 after thirty-four years as curator of the Harvard University Mineralogical Museum. He also taught museum studies in the Harvard Extension School for twenty years. He is currently curator at the Maine Mineral & Gem Museum in Bethel. He received the Carnegie Mineralogical Award for 1992 from the Hillman Foundation of the Carnegie Museum of Natural History. He is a Fellow of the Mineralogical Society of America and served as chairman of the International Mineralogical Association Commission on Museums.

Notes:

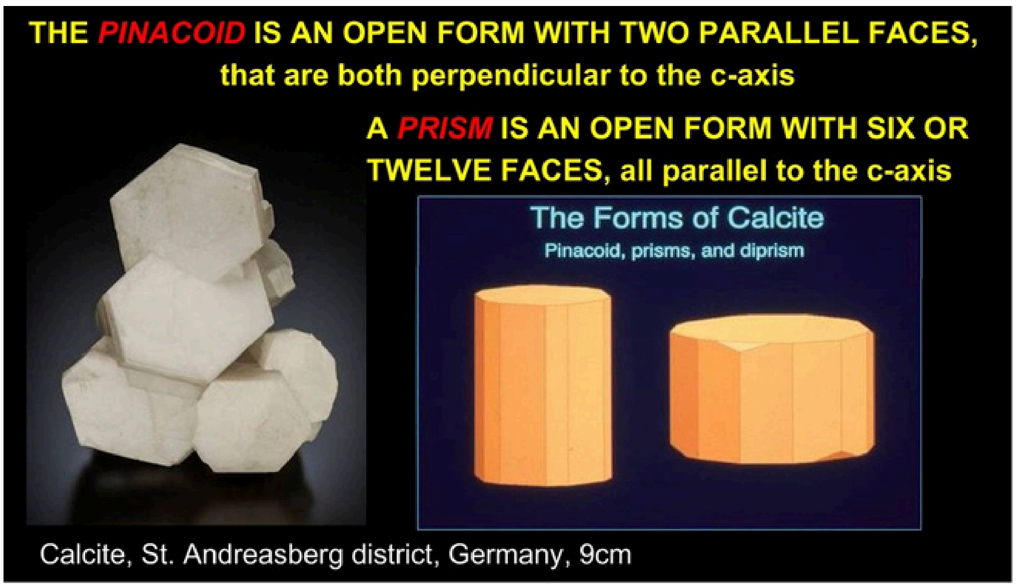
Calcite Twinning, Inclusions, and More

Terry Huizing
5341 Thrasher Drive, Cincinnati, Ohio 45247
513 / 910-6235 (cell) - tehuizing@fuse.net

As one might expect, success in collection building depends less on the random results of brief collecting experiences, and more on setting personal collection goals. When these standards are met, opportunities arise that often trigger specimen acquisition. My most productive collecting tool was the "silver pick" and it was carefully used in my travels. My standards for acquiring calcite are simple: specimens must be without damage; feature one of calcite's five crystal forms; be twinned by one of calcite's four twin laws; and, if not transparent, it must be colorful. These simple goals are not easy to achieve, so collections of this common mineral are not at all alike. This presentation takes a quick look at the twin-laws for calcite and some other calcite oddities that occur. Being analytical aside, there's always that one specimen that jumps out, captures your heart, and you just gotta have it!



Calcite, Meshberger quarry, Bartholomew County, Indiana, 5 cm



Calcite, St. Andreasberg district, Germany, 9cm

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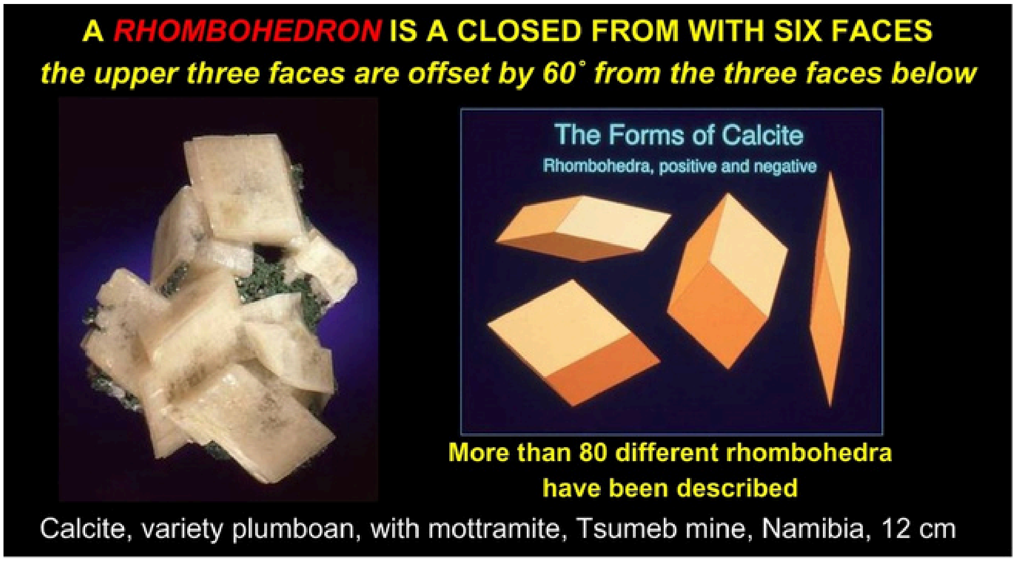
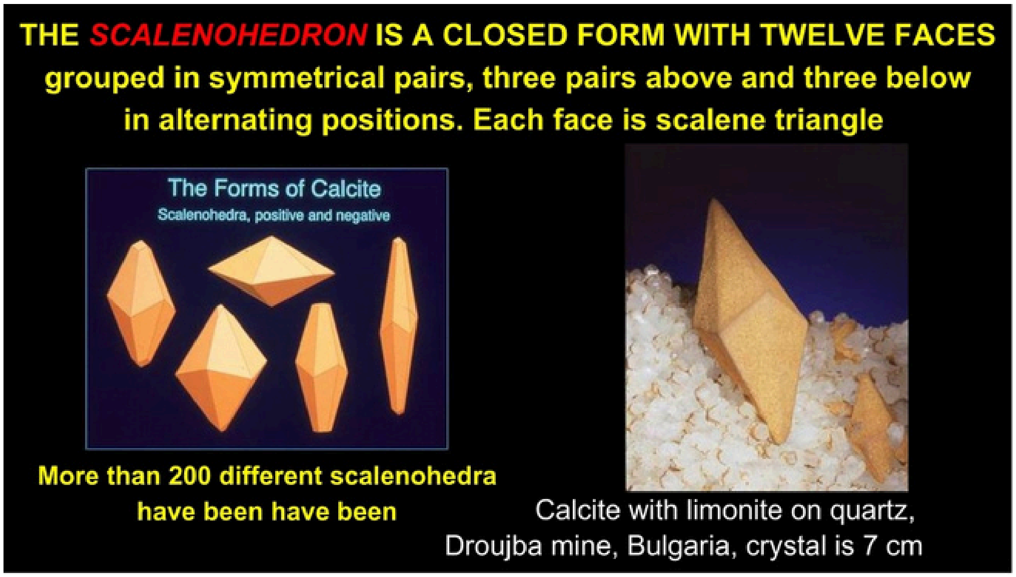
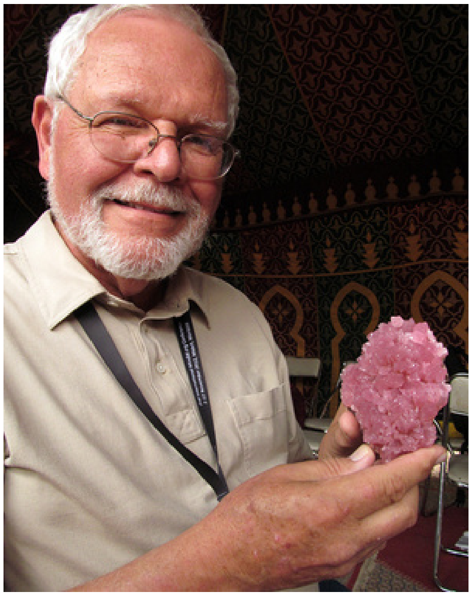






Terry in Morocco, 2012

Terry Huizing is a lifelong mineral collector who has indulged his interest in calcite by collecting on every continent except Antarctica, but typically much closer to home in the mines and quarries of the American Midwest. His childhood interests in minerals led him to pursue electives in mineralogy while completing a degree in chemical engineering at the University of Michigan. Gainful employment followed in Cincinnati, Ohio, where he interacted with the mineral community accepting volunteer responsibilities such as show manager (GeoFair), from 1965; mineral curator (Cincinnati Museum Center), from 1968; and consulting editor (Rocks & Minerals), from 1975. Terry is a seasoned exhibitor, a published author, and an occasional speaker. In 2015 the mineral huizingite-(Al), from an occurrence in northern Ohio, was named for Terry and Marie Huizing. Terry's collection of about 1,300 specimens focuses on worldwide calcite with an emphasis on twinning, aesthetic pseudomorphs, and minerals from the American Midwest.

What Is a Pseudomorph?

Erin Delventhal • erindelventhal@gmail.com

Pseudomorphs have captured the attention of scientists and collectors for centuries, yet those who have delved into the study of these mineralogical oddities may have noticed a distinct problem: when the question "What Is a Pseudomorph?" is asked, the answer often seems to depend entirely on who is asked. This presentation does not seek to answer that question definitively but to provide an overview of how that question has been answered over time.

Western accounts of the history of the study of pseudomorphs often begin at the turn of the 19th century, when the term pseudomorph (Greek; pseudo = false, morph = form) enters the lexicon from René Just Haüy's Traité de Mineralogie (1801). In an intriguing example of simultaneous invention, however, other authors concomitantly began to describe the same phenomenon. Afterkriſtalle (German; After = after, kriſtall = crystal), a term generally attributed to Abraham Gottlob Werner as it appears in the works of his students, appears as early as 1794 (Estner).

It is fitting that the story of pseudomorphs begins in disunity over what to call them, as the rest of the story continues in disunity about everything else: the definition of a pseudomorph, which classification scheme should be used for studying them, how they are formed, what should and shouldn't be considered as a "true" pseudomorph, and so on – for some time, it was even debated as to whether pseudomorphs exist.

It is important to note that much of the literature concerning pseudomorphs known to the Western world is written in German, occasionally in French, and more recently in English. Many of these works have not been translated into other languages, rendering the study of the subject difficult. This record is also undoubtedly perforated by the absence of works in non-Western languages such as Arabic, Russian, Chinese, etc.

Though the study of pseudomorphs is rife with inconsistency and debate, investigation of these discrepancies provides an opportunity to question and redefine our understanding of what a pseudomorph is. The matter will not be settled today, but only further conversation can propel us towards an ultimate consensus: after all, no conflict can be resolved without understanding the disagreement.

Fig. 1: Malachite ps. Copper ps. Aragonite • Corocoro, Pacajes Province, La Paz, Bolivia • 2.0 cm • Erin Delventhal collection & photograph

Notes:

Fig. 2: Copper ps. Azurite with Crinoids • Copper Rose Mine, Grant County, New Mexico, USA • 3.3 cm • Erin Delventhal collection & photograph

Fig. 3: Malachite ps. Azurite • Burra Burra Copper Mine, Burra, South Australia, Australia • 3.2 cm • ex. Alex Venzke • Erin Delventhal collection & photograph

Fig. 4: Dolomite ps. Aragonite • Cottonwood Draw, Chavez County, New Mexico, USA • 3.9 cm • Erin Delventhal collection & photograph

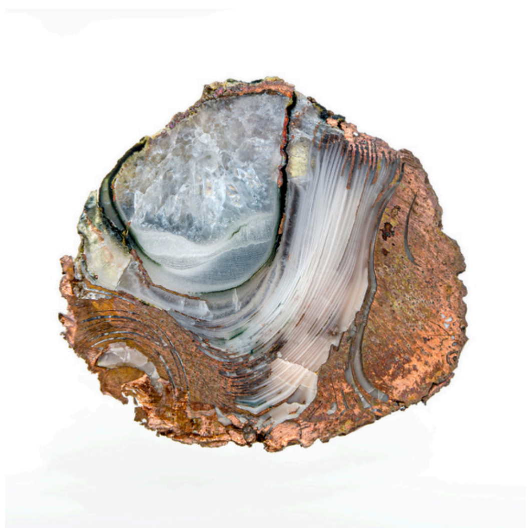
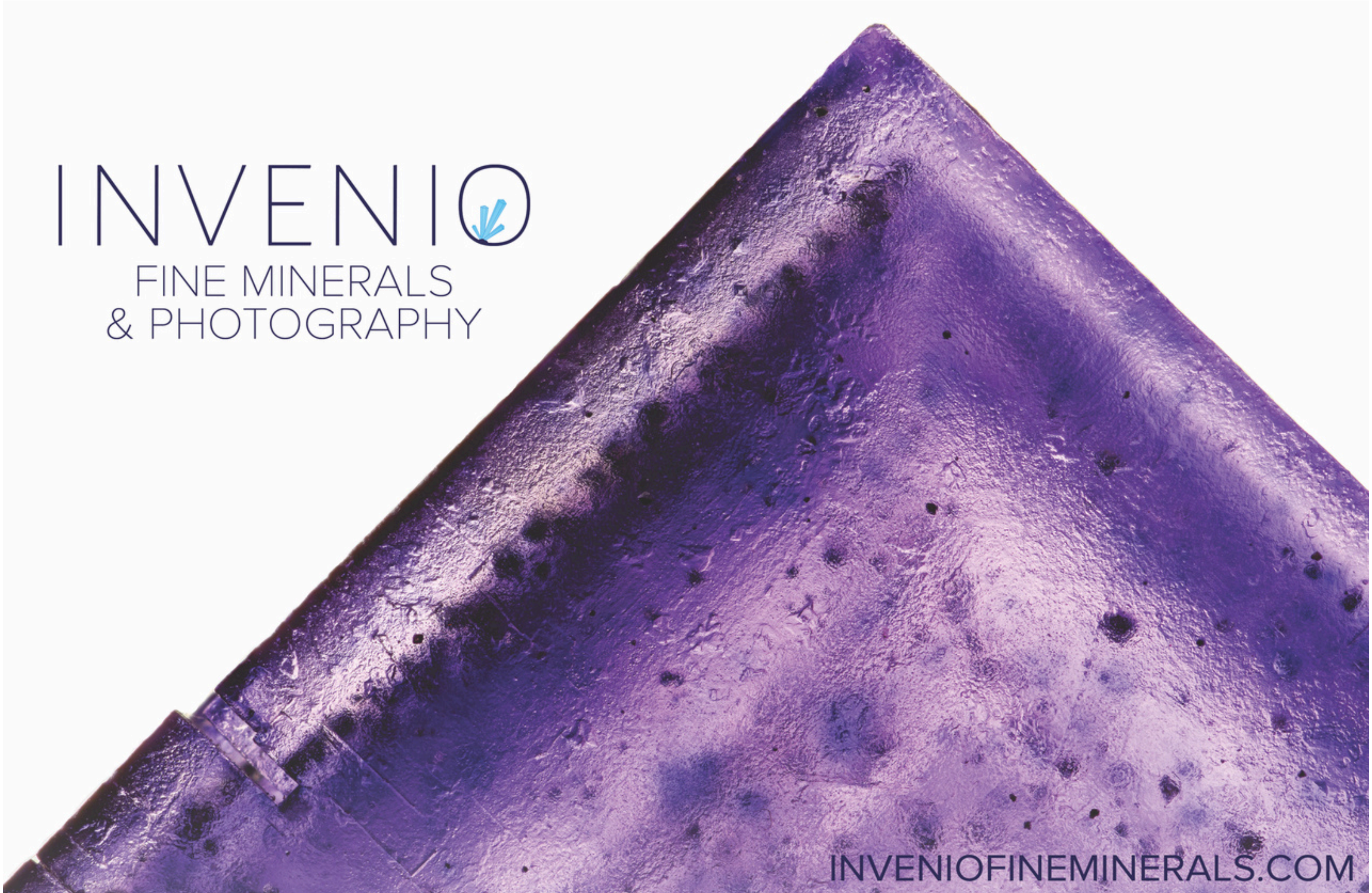


Fig. 5: Copper ps. Quartz var. Agate • Wolverine No. 2 shaft, Wolverine Mine, Wolverine, Houghton County, Michigan, USA • 2.1 cm • Erin Delventhal collection & photograph

Erin out collecting at the Harding Mine, NM.

Erin Delventhal grew up collecting minerals with her family – long road trips were punctuated with detours where she and her brothers could get dirty (and very tired) while collecting minerals. Photography and design took precedence as a hobby and a profession for many years, but a visit to the Tucson Gem & Mineral Show rekindled her love for minerals. She rejoined the mineral community with enthusiasm and has since been an active member in several organizations ranging from local to international, has been involved in mineral museums, symposia, and other educational programs, and has joyously returned to a life punctuated by getting dirty (and very tired) while collecting minerals. Among other things, Erin works as a freelance photographer, photo editor, and graphic designer.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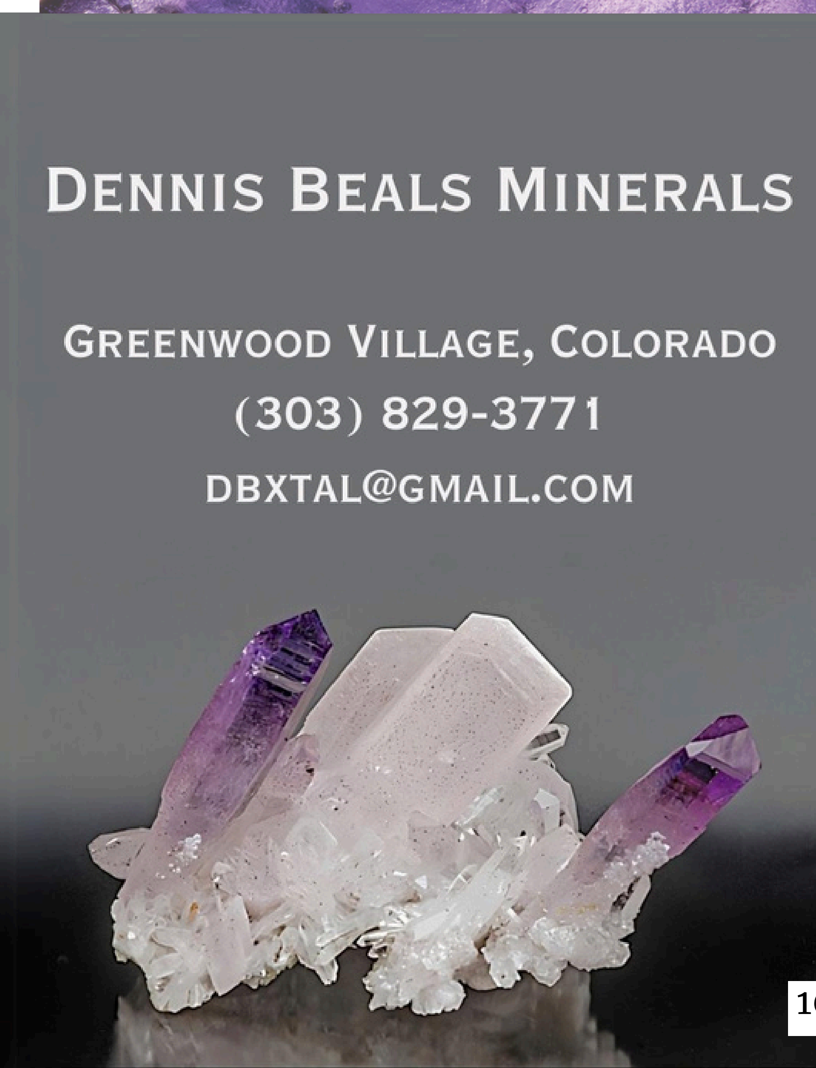
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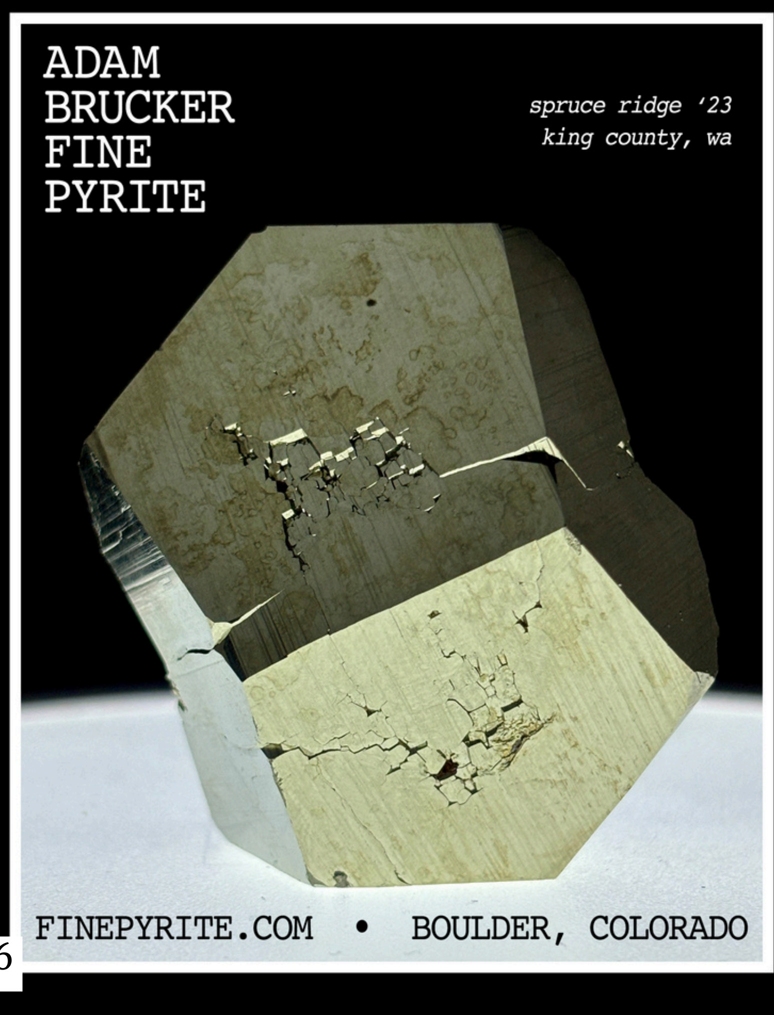
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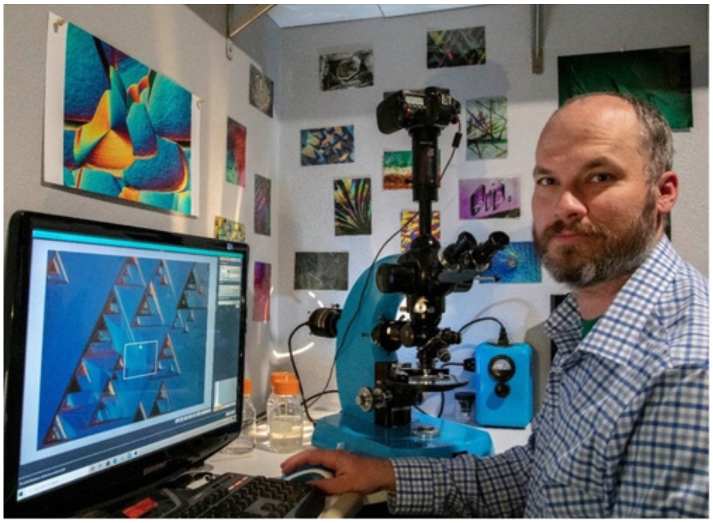
The Unusual Microworld of Gem Minerals

Nathan Renfro

Gems are often appreciated for their beauty when transparent and durable minerals are cut and polished. Examining them under the microscope can often reveal a strange and also beautiful and interesting world that often goes unnoticed. This presentation will focus on a number of the most interesting and unusual and sometimes remarkably beautiful inclusions or microscopic features that Nathan Renfro, the Senior Manager of the Colored Stones department at The Gemological Institute of America has encountered in his career as a gemologist/microscopist.



Bio:

Nathan Renfro, a native of western North Carolina, developed an interest in minerals during his late teens, which was sparked by his grandfather's rock collection. In 2006 he completed his undergraduate studies in geology at Appalachian State University and then went on to enroll at GIA for the resident Graduate Gemologist (GG) program as a recipient of the William Goldberg Diamond Corporation scholarship. After finishing the Graduate Gemologist program at GIA, he was hired by the GIA laboratory as a diamond grader and soon transferred to the Gem Identification department in 2008. Since then, Mr. Renfro has authored or co-authored more than one hundred gemological articles and lectured to several gem and mineral groups internationally. His work has also been featured by Ziess and National Geographic. His primary areas of gemological interest are photomicrography and identification of inclusions, gemstone cutting and defect chemistry of corundum. Mr. Renfro is currently the Senior Manager of the Colored Stone department in Carlsbad, CA and New York, NY. He is also a microscopist in the Inclusion Research Department. Mr. Renfro is the editor of G&G's Microworld quarterly column which is published in the journal Gems and Gemology, where he is also a member of the editorial review board.

Notes:

A Common Thread: On the Nature of the Faden Habit

Caleb Chappell

The faden habit has been observed in quartz, orthoclase, epidote, and apatite for decades, dating back to observations by Scharff in 1864 who was the first to officially observe the faden habit in quartz crystals. For many years the French and Swiss localities dominated the specimen scene for fadens, and more generally the 'Alpine' habit for quartz, orthoclase, apatite, epidote, hematite, etc., which includes of course the famous Gwindel habit quartz specimens. That is, until the now exceedingly abundant (and often superior quality) faden specimens of quartz, orthoclase, epidote, apatite, and diopside (among others) began entering the worldwide market in particular abundance from the Alpine-cleft deposits of the Himalayas, principally Pakistan, in the late 90s/ early 2000s.

We now observe the faden habit in more than a dozen different mineral species and from hundreds of localities around Earth, from Trift Glacier, Switzerland, to Alchuri, Pakistan, to Yuma Co., Arizona, there is clear evidence that the development of the faden habit is a ubiquitous feature of crystal growth. This talk will review the history of observations regarding faden development and discuss current scientific hypotheses on how these exquisite and often bizarre habits form, i.e. the common thread of geologic processes in the growth of faden habit crystals.

Fig. 1: Quartz faden from Zhob district, Balochistan Region, Pakistan

Caleb Chappell is a project geologist with Falcon Butte America and Falcon Copper Corp focused on identifying Cu porphyry-skarn systems in the underexplored American West. His specialties include mineralogy and geochemistry with specific application to the realm of economic geology. He has been a co-author on 10+ geoscience publications and conference abstracts, including first author on a publication in the prestigious American Mineralogist. Caleb obtained a Professional Masters in Mineral Exploration from Colorado School of Mines in 2022 and an M.S. in Geology from Miami University in 2019. He specializes in collecting apatite group minerals, siderite, and Alpine-cleft style minerals. Caleb and his partner Hillary can often be found exploring the beautiful state of Colorado where they live or at home with their cats Winston and Moira.

Notes:

Color Variation in Minerals and Gems: Zoning, Phantoms, and Other Oscillations

by Michael J. Gobla

Color variation in minerals, typically referred to as color zoning, produces many interesting and unusual specimens. Most commonly known are the concentric color banding seen in agates, malachite, and rhodochrosite, and the concentric zoning causing "phantoms" seen in crystals of quartz and fluorite. Color zoning also has a significant influence in the gemstone trade where many different descriptive terms such as parti colored, chevron striped, bird's eye, watermelon, picture stone, and other names are used. Color zoning can add to the value of a gemstone if it enhances the beauty of the stone, but it also can reduce the value if the zoning is irregular and detracts from the aesthetic aspects of the gem. In a similar manner, color zoning can have a profound impact upon the value of a mineral specimen, for example attractive color-zoned crystals of fluorite are typically valued at 10 to 100 times the price of a similar crystal that is of uniform color. The color variations seen in minerals are caused by changes during crystal growth which occur for various reasons. The causes of color zoning includes changes in chemical composition, changes in grain size and shape, and the incorporation of inclusions. The presentation identifies the causes of color zoning seen in minerals and gemstones and is illustrated with intriguing examples of both common and rare types of occurrences.

Fig. 1. Fluorite, Warm Springs Mine, Powell County, Montana. The color zoning is due to a change in composition during crystal growth.

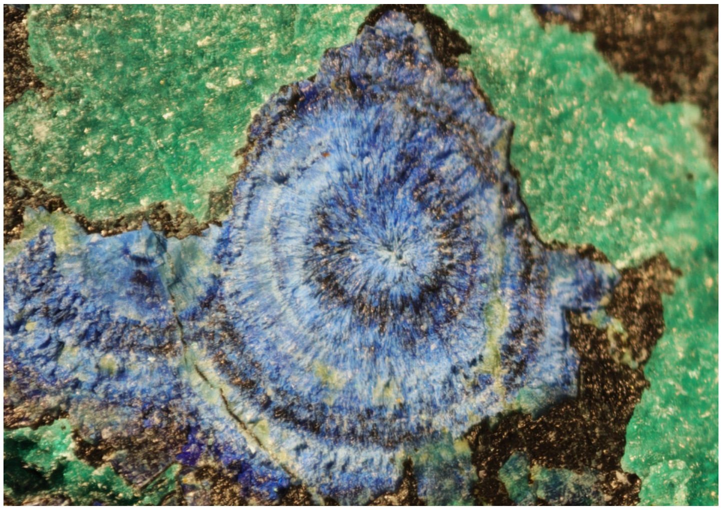


Fig. 2. Azurite, with malachite and tenorite, Copper Flat Mine, Sierra County, New Mexico. The color banding in the azurite is caused by variations in the crystal grain size, larger crystals create dark-blue bands, smaller crystal grains result in the light-blue bands.

Michael Gobla began collecting minerals in his native New Jersey in 1962. He graduated from the Colorado School of Mines in 1976 with a BS in Mining Engineering, and holds a MS in Mining Engineering 1991 from New Mexico Tech. He has worked as a professional engineer in the coal and hard rock mining industries. He worked for the U. S. Bureau of Mines and for the past 26 years he has been a geotechnical engineer with the Bureau of Reclamation where he works on large dams and has assisted other government agencies in mine reclamation. Mr. Gobla specializes in the collecting of Montana minerals, mineral photograph, is an avid micromounter, and is currently the president of the Rocky Mountain Micromineral Association that meets monthly on the Colorado School of Mines Campus.

Notes: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Braunite II, Kalahari Manganese Fields, South Africa
Photo by Mark Cross, in a private collection

There Are No Mineral Oddities

by Ed Raines

We live in a solar system in a galaxy which is composed of elemental building blocks. It is now believed that the elements were/are created through various nuclear reactions in the stars, from Cosmic Ray Spallation to Nuclear Decay to various reactions in Low Mass and High Mass stars as well as various processes in exploding Massive, Neutron, and White Dwarf Stars. While there is much left to learn, plausible theories for the origin of the elements continue to develop.

The elements (as atoms and ions) fit together like blocks to create the substances of our world. The combinations of elements exist as atoms held together by electrical charges. The positive charge in an atom is in the form of protons in the nucleus, and the negative charge exists as a "cloud" of negatively charged electrons surrounding the nucleus. Basically, chemical reactions involve negatively charged ions bonding with positively charged ions.

Sometimes two or more atoms share a charge in what is called a covalent bond. One of the major building blocks in the mineral world is formed by covalent bonding between silicon and oxygen atoms forming a complex molecule with a negative charge of -4. That complex molecule, known as the SIO4 tetrahedron acts as an anion (negatively charged ion) bonding with positively charged ions (cations) to form the largest chemical class of minerals, the silicates.

In our solar system we can observe the results of an entire series of chemical reactions that have interwoven the elements into the mineral fabric that we see on earth and in the meteoroids that have landed on earth providing evidence the steps and sequences of mineral formation. The latest studies by Bob Hazen and Shaunna Morrison identify 57 paragenetic modes responsible for the formation of more than 5600 mineral species. These modes have acted for more than 7 billion years from the genesis of the solar system to the present day (with the last 4.5 billion years representing the evolution of the earth). To a casual observer, it may seem unusual, but no matter how unusual, it is always the result of the basic chemical and physical laws that control our world.

Ed is the Curator for the Colorado School of Mines Museum of Earth Science. He is a past president of both the Mining History Association and the Colorado Chapter of Friends of Mineralogy. He has written numerous papers on the geology, mineralogy, and mining history of many Colorado mining districts, several of which have received special awards from Friends of Mineralogy. In 2009, his book Historic Photos of Colorado Mining was published by Turner Publishing. In 2019, received the Rodman Paul Award for Outstanding Contributions to Mining History.

Colombian Emerald Oddities: Review and Formation Mechanisms

Isabella Pignatelli[1], Gaston Giuliani[1,2]

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2 Université Paul Sabatier, GET/IRD, UMR CNRS-IRD-CNES 5563, 14 avenue Edouard Belin, F-31400 Toulouse, France

Exceptional mineralogical oddities of gemmological interest have been found in Colombia's emerald deposits. Their particular sedimentary-hydrothermal geological environment is characterised by large fluid circulations and changes in thermodynamic conditions during emerald precipitation. In this context, various etching processes and growth perturbations affected the crystals in both the eastern and western belts of these emerald deposits. The most the famous Colombian emeralds are various peculiarities, such as trapiche emeralds from the Muzo, Coscuez and Peñas Blancas deposits, which are renowned for their distinctive texture resembling a wheel with six spokes (e.g. Pignatelli et al. 2015).
In the eastern belt, variations in post-growth etching are responsible for the formation of 'vaso' (cup), 'spongy' and spear-shaped emeralds, and etching associated with near-parallel growth of elongated crystals resulted in fibrous emerald specimens. In addition, rare sceptre emeralds formed by epitaxial lateral overgrowth due to the arrival of a later mineralising pulse in the hydrothermal system. 'Emerald gastropods' are also found in the eastern belt, and formed by the replacement of fossil aragonite by calcite which later dissolved away and was replaced by emerald. In the western emerald belt, hydrothermal fluid circulation sometimes resulted in non-uniform crystal growth, giving rise to horseshoe-shaped emeralds characterised by an incomplete hexagonal prismatic habit. An unusual sample of a calcitised trapiche emerald—due to fluid circulation affecting trapiche emerald-bearing black shale—is also described.

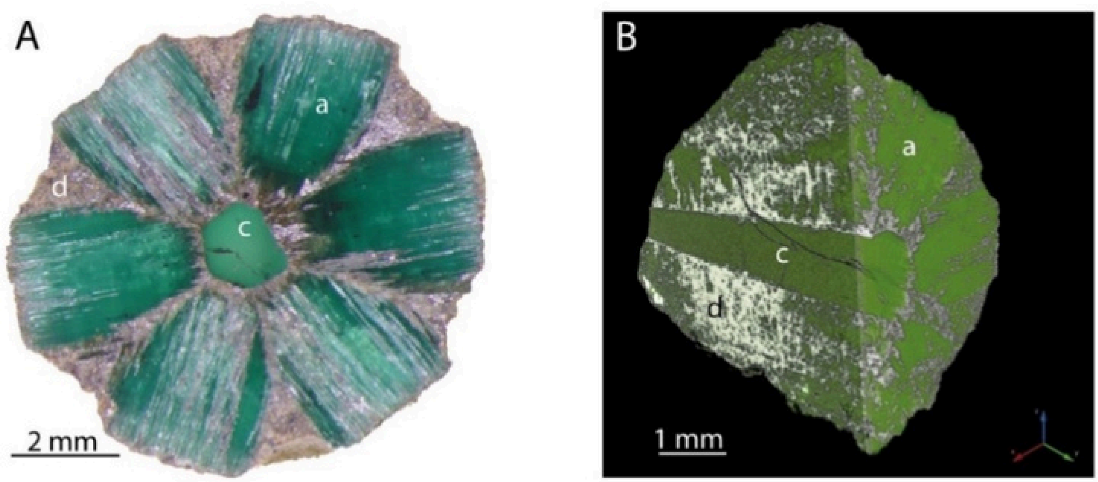


Figure 1: Typical trapiche texture (A) with a central core (c), six arms (a) and dendrites (d). X-ray computed tomography image (B) showing the reduction of the core from the top to the bottom of the sample and how the dendrites develop laterally in the arms. Both samples come from Muzo mine.

Isabella Pignatelli Bio:
I am Assistent Professor at the Université de Lorraine (Nancy, France), Department of Geosciences. I studied Geology in Italy, where I specialized in mineralogy. After a PhD in crystallography and post-doc researches in France, I went to UCLA of Los Angles for a 2-years post-doc. During the last years, I went several times abroad for schools (Denmark, Spain, Italy, Czech Republic) and for scientific collaborations (Germany, Italy and USA at Oak Ridge Laboratory in Tennessee).
I am interested in the link between the composition and structural features of minerals and their formation/alteration conditions. I studies minerals found in terrestrial samples (e.g. gem materials) and extraterrestrial ones (meteorites). I also worked with minerals formed in anthropic contexts, i.e. in clay barriers for the storage of radioactive wastes and in concrete used in nuclear power plants. I also collaborated with the UCLA hospital to study the re-/de-mineralization of hydroxyapatite in dental enamel.

Notes:

Mineral Oddities: Is that specimen too good to be true?

Terry Wallace

During the end of the 17th and into the 18th century it was extremely popular to create a "curiosity cabinet" among the wealthy. These collections focused on all thing nature, but minerals were one of the primary components. Passionate collectors contracted naturalists to find new and exciting specimens to enhance their cabinets; a surprisingly large number of these "prized specimens" turned out to be enhanced or total fakes. The desire to have the best fuels the creative and entrepreneurial nature, and mineral collecting history is littered with thousands of examples of mineral fraud. Even today, mineral fraud is a thriving business – and everything from color enhancement, attaching natural crystals to fake matrix, and growing crystals in a laboratory setting and passing them off as naturally occurring are quite common. In general, collectors are aware that fakes exist; but most collectors are extremely skeptical when extraordinary specimens – often the best ever known – appear on the market. These are the mineral oddities known as "too good to be true."

How does one evaluate these oddities? The analytic tools that are available today allow imagining, chemical composition and isotopic characterization that was unimaginable only a decade ago. Further, there are statistical methodologies to test hypothesis (ie, is this a natural gold, or a manmade artifact) that allow a quantitative assessment on a mineral specimen's authenticity. I present two detailed examples: the extraordinary wire silvers from Freiberg that appeared on the market in 1992 (and still grace many mineral dealer's stocks), and the large gold cubes and octahedrons that are reported to be from the Lena River in the Russian Far East.

Terry Wallace is Director Emeritus at Los Alamos National Laboratory. He was the 11th Director of the Laboratory; previously he was the Principal Associate Director for Global Security and the Senior Intelligence Officer. He received B.S. degrees in mathematics and geophysics from New Mexico Institute of Technology in 1978, and a PhD in geophysics (seismology) from the California Institute of Technology in 1983. Before coming to Los Alamos in 2003 Wallace served a professor of geosciences and an associate in the applied mathematics program at the University of Arizona for 20 years. Wallace is a Fellow of the American Geophysical Union (AGU), and in 1992 he received the AGU's Macelwane Medal. Wallace has served as President of the Seismological Society of America, and Chairman of the Incorporated Institutions for Research in Seismology. Wallace is also an expert in mineralogy, and received the Carnegie Mineralogical Medal in 2003 in recognition of his contributions to mineralogy and mineral preservation. He has published more than 30 articles and books on minerals for the public.

The Mineralogy and Geology of the Franklin-Sterling Hill Mining District, Sussex County, New Jersey, with Special Emphasis on Mineral Fluorescence

Philip M. Persson
Persson Rare Minerals - P.O. Box 17748, Golden, CO, 80402

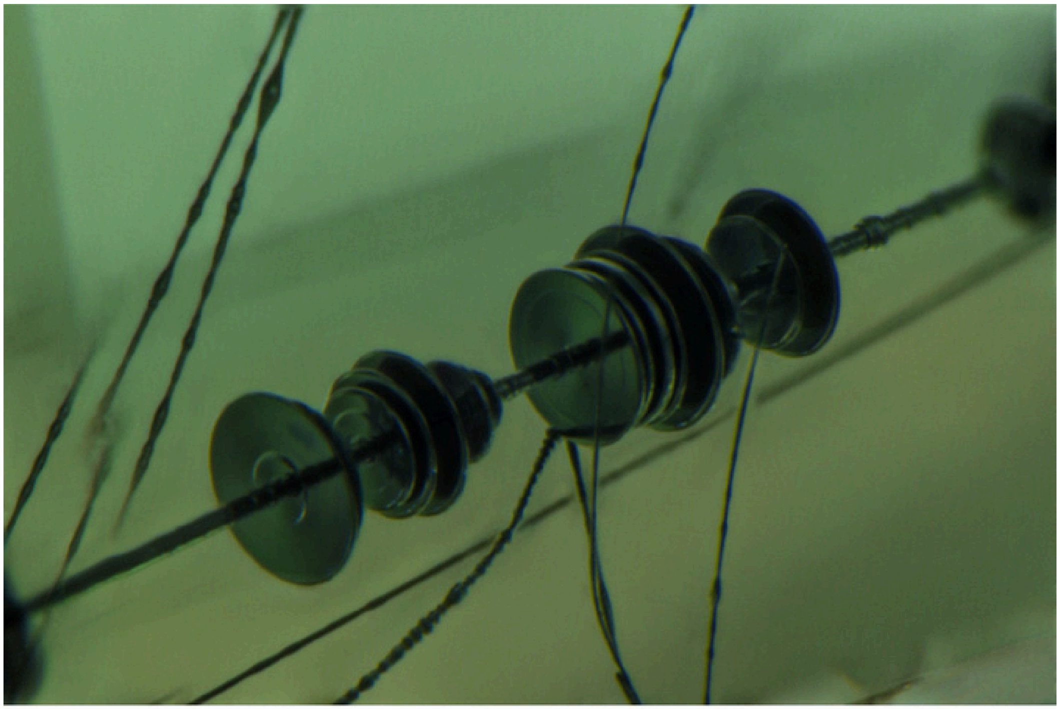
East Limb of the Sterling Hill Orebody illuminated by shortwave U.V. light at night. (Image copyright Sterling Hill Mining Museum.)

The two Zinc-Manganese-Iron ore deposits at Franklin and Sterling Hill, New Jersey are widely considered the premier localities on earth for fluorescent minerals. What makes them such a mecca for minerals which emit light under ultraviolet radiation? This talk will explore the history, geology, mineralogy and present-day collecting opportunities at these fascinating localities, and also explain the physics behind mineral fluorescence in general. Mining at Franklin and Sterling Hill dates back nearly 400 years and the rich history of miners, geologists, and collectors is part of what makes the district so interesting. While mining for zinc and other metals ceased in 1986, two world-class mining and mineral museums now fill the space left by the closure of the mines themselves, and a local mineral club in addition to two annual mineral shows help sustain the vibrant mineral collecting culture which has surrounded the district for many years. The geology of the deposits themselves is enigmatic as well and is still being unraveled. Believed to have originally formed at seafloor hydrothermal vent sulfide ore deposits (also known as volcanogenic massive sulfide deposits) over 1 billion years ago, the ore deposits at Franklin and Sterling Hill then underwent regional metamorphism around 980 Ma which converted surrounding limestone into marble and led to the explosion in rare and unique mineral species which comprise the deposits today. At present over 350 different mineral species are known from the district, making it one of the world's 'mineralogical rainforests.'

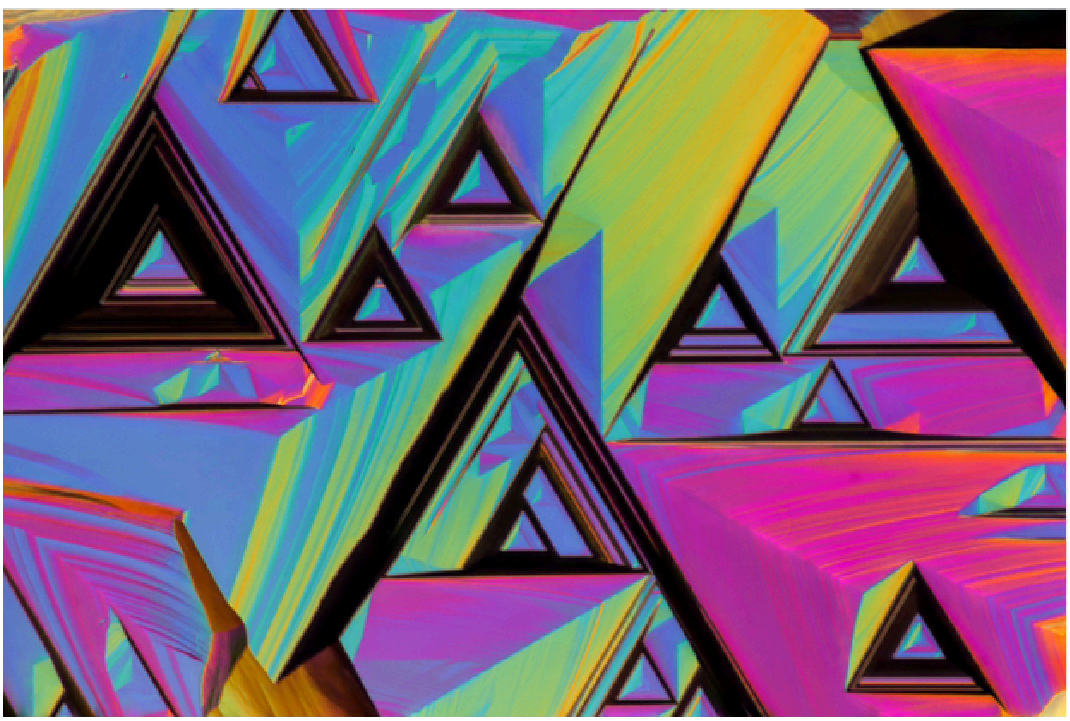
Phil Persson is a geologist, mineral dealer, and collector living on the west side of Denver, Colorado. His passion for geology and mineral collecting began as a child living near the "fluorescent mineral capital of the world", Franklin, New Jersey, and eventually led to a BA in geology from the University of Colorado at Boulder in 2012 and an MSc. in economic geology with a focus on geochemistry and petrology at the Colorado School of Mines in 2017. He has been a co-author and collaborator on numerous scientific papers, abstracts and magazine articles on mineralogy and geology, with a focus on rare earth element minerals and pegmatites of Colorado. He enjoys public speaking and has given dozens of talks for mineral clubs and events, as well as helped organize several scientific symposia in Colorado. He has been involved in the mineral dealing and collecting community for close to 20 years and is currently employed full-time as a mineral dealer in the Denver, Colorado area.

PHOTOMICROGRAPH GALLERY OF ODDITIES

In the following section, we highlight mineral oddities not typically visible to the naked eye while celebrating the intersection between scientific study and art. These photomicrographs were captured by some of the most talented microscopists/photographers in the industry who have generously allowed us to feature their work.



(1) Diopside with merelaniite inclusions. Field of view: 1.03mm Copyright GIA. Stone courtesy of the John Koivula Inclusion Collection.



(2) This diamond from Hudson Resources, Garnet Lake in Western Greenland shows classic trigon etching on the surface of an octahedral crystal face as seen using differential interference contrast microscopy. Field of View 0.72mm, Copyright GIA. Stone courtesy of the John Koivula Inclusion Collection.

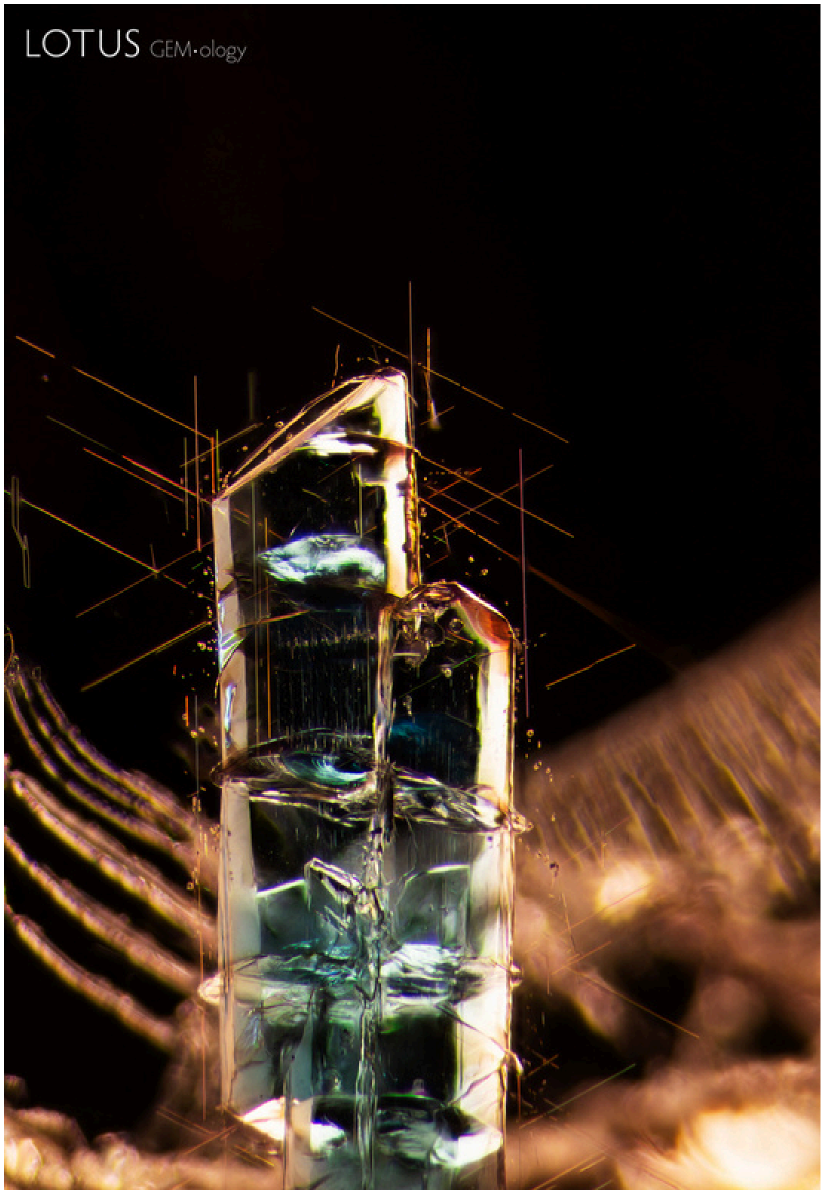
Nathan Renfro is Senior Manager of the Gemological Institute of America Colored Stone department in Carlsbad, CA and New York, NY and microscopist in the Inclusion Research Department. See page 17 for his full bio.

PHOTOMICROGRAPHS BY NATHAN RENFRO

(3) This fossil dinosaur bone from Colorado, U.S.A. resembles a red tire track across black pavement. Field of View 24.00mm Copyright GIA. Stone Courtesy of the John Koivula Inclusion Collection.

PHOTOMICROGRAPHS BY E. BILLIE HUGHES

(1) A mushroom-like cristobalite crystal is suspended in its quartz host. Natural, Quartz, Amethyst; Enhancements: None; Lighting Conditions: Dark Field + Diffuse Fiber Optic. Photographer: E. Billie Hughes; Image Number: R-003-2497-3; Field of View: 6 mm



(2) These blue crystals stand out in their host, a garnet from Tanzania. Analysis with micro Raman revealed they are apatite. Specimen courtesy of Mark Saul. Fabrication courtesy of Indy Khurana. Natural, Garnet, Pyrope-Spessartine, Malaya, Tanzania; Enhancements: None ; Lighting Conditions: Dark Field + Diffuse Fiber Optic; Photographer: E. Billie Hughes; Image Number: R-004-1267-3; Field of View = 3.5 mm

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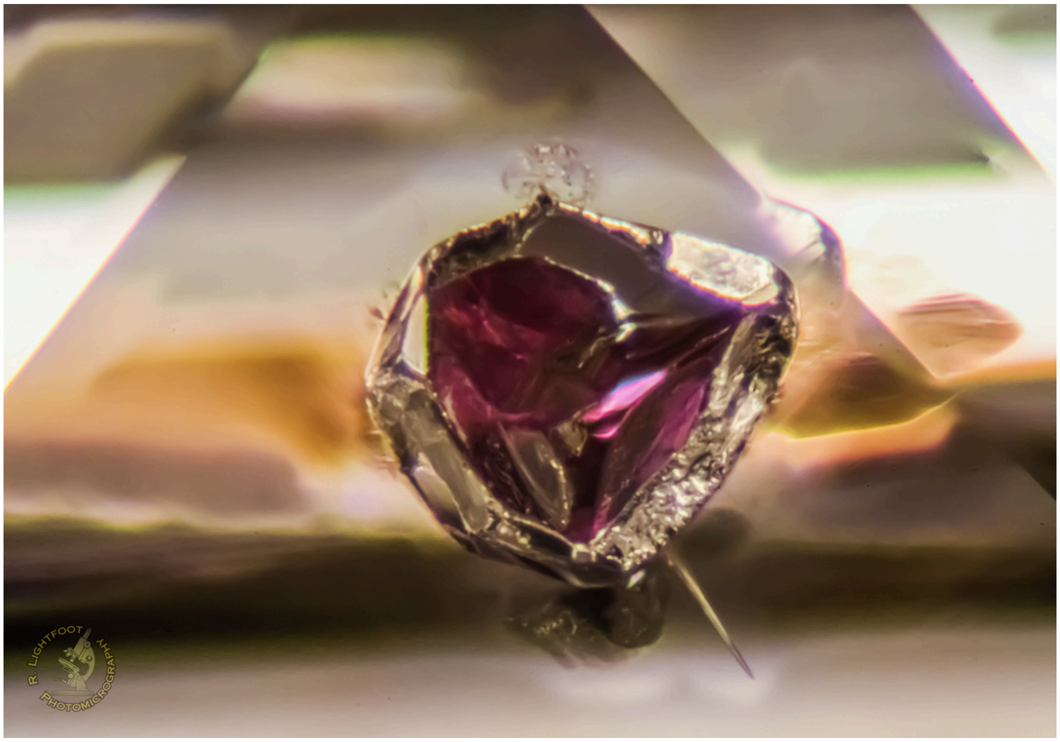
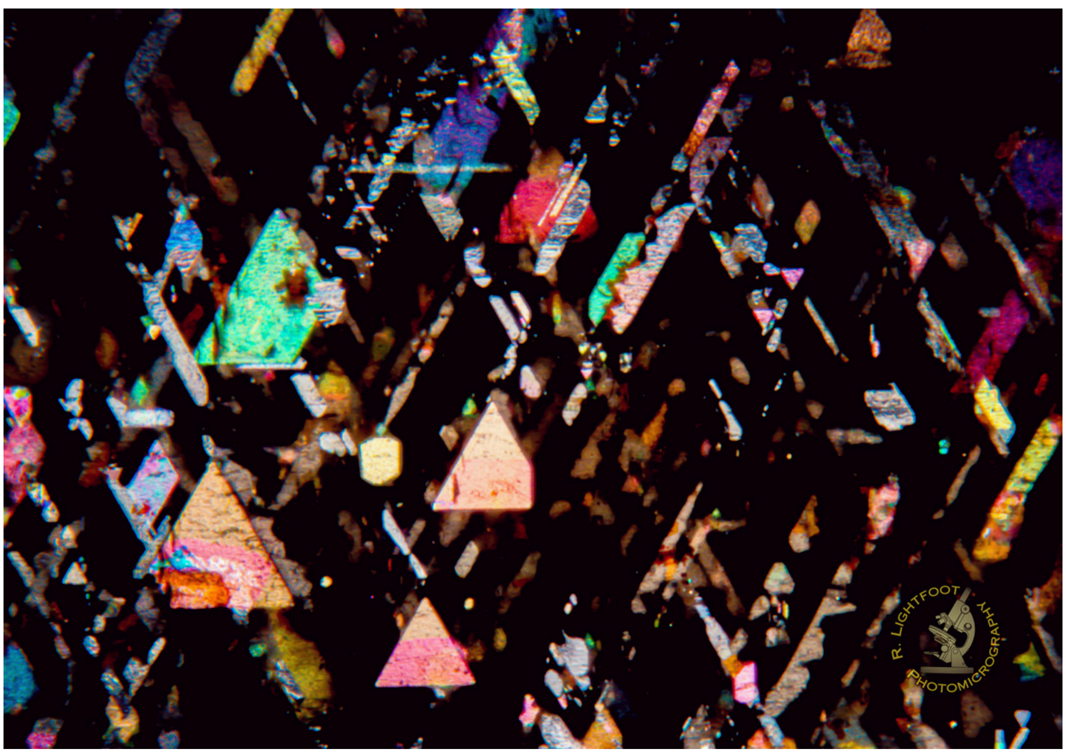
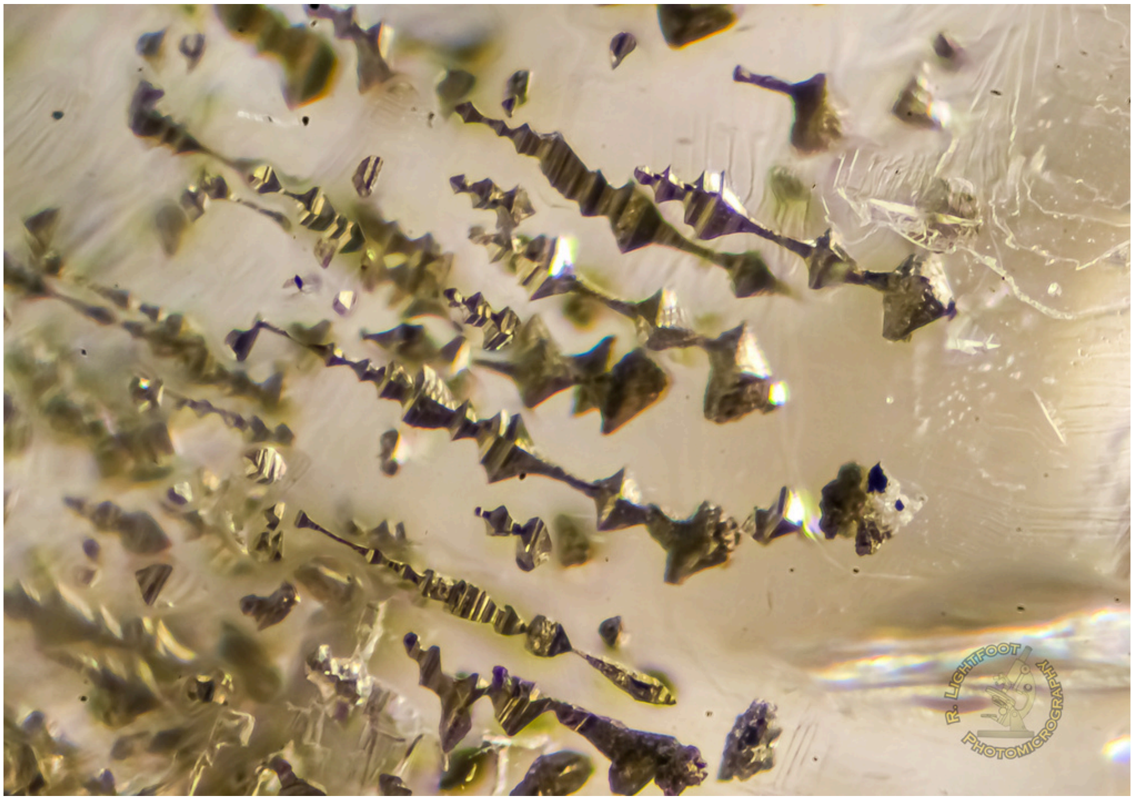
E. Billie Hughes, co-founder of Lotus Gemology, visited her first gem mine (in Thailand) at age two and by age four had visited three major sapphire localities in Montana. A 2011 graduate of UCLA, she qualified as a Fellow of the Gemmological Association of Great Britain (FGA) in 2013. An award winning photographer and photomicrographer, she has won prizes in the Nikon Small World and Gem-A competitions, among others. Her writing and images have been featured in books, magazines, and online by Forbes, Vogue, National Geographic, and more. In 2019 the Accredited Gemologists Association awarded her their Gemological Research Grant. Billie is a sought-after lecturer and has spoken around the world to groups including Cartier and Van Cleef & Arpels. In 2020 Van Cleef & Arpels' L'École School of Jewellery Arts staged exhibitions of her photomicrographs in Paris and Hong Kong.



(1) A relatively common inclusion in diamonds of peridotitic origin, this Cr-Pyrope garnet ($Mg_3Al_2(SiO_4)_3$) was showcased perfectly in the center, midway between the table and culet. Trace amounts of chromium are responsible for the rich purplish hue. (FoV: ~1.50mm) (Processing: uncropped stack of 32 frames @ 80x)



(2) A sample of Australian rainbow lattice sunstone from the Tucson Gem & Mineral show did not fail to delight. By reflecting light of this feldspar's metallic (hematite & magnetite) inclusions we are afforded the ability to see incredible colors, contrast and shapes. In transmitted light these inclusions take on their true colors. (FoV: ~4.00mm) (Light: oblique fiber optic)

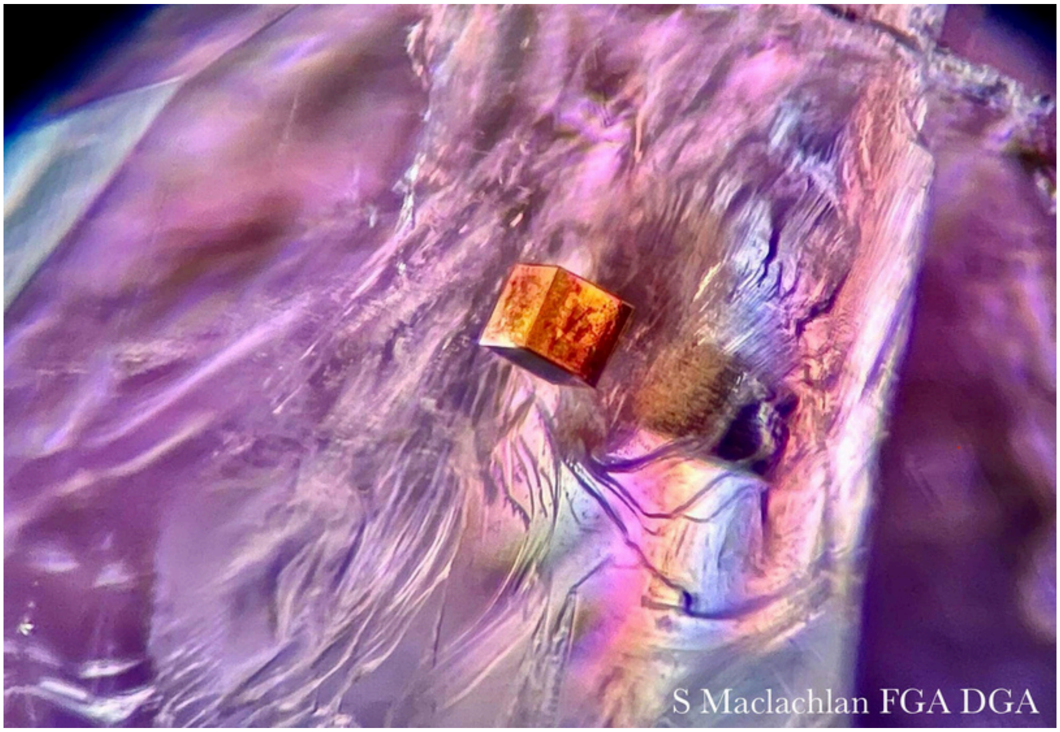


(3) Tremendous spires of marcasite inclusions suspended in its calcite host. Marcasite is a polymorph of pyrite, containing Fe and S. Marcasite is a common disulfide mineral inclusion in calcites in the midwest and often creates zones (outlines of the rhombic cleavage planes). (Field of view: ~2.00mm) (Lighting: standard transmitted illumination)

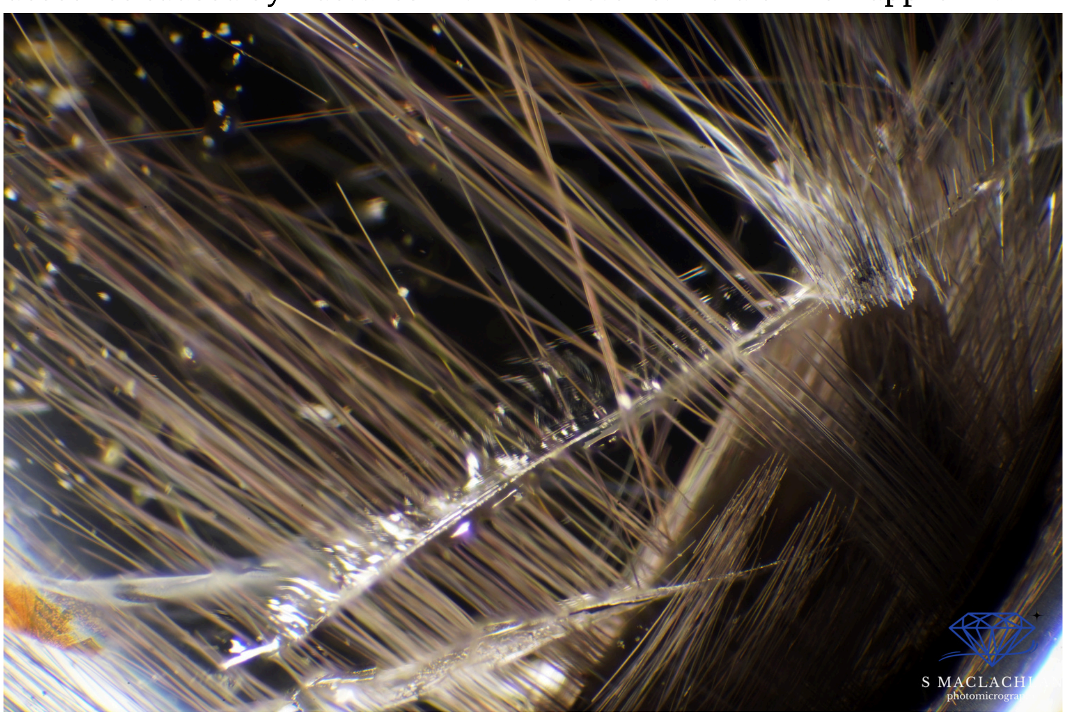
Randy Lightfoot, CG, earned a B.A. in Geology with an emphasis on volcanology, igneous petrology and mineralogy in 2013. Mr. Lightfoot is skilled in using illumination techniques such as cross-polarized filters (CPF) and UV-imaging to identify clues to diamond origin. He is knowledgeable in gemstone identification using standard non-destructive testing methods and enjoys the art and science of inclusion photomicrography.

Randy was a diamond grader for GIA (and volunteer diamond grading trainer) and is currently working at Mayflower Estate Buyers & Consulting in Towson, MD. Mr. Lightfoot's work can be found most recently in a co-authored research poster with Branko Deljanin titled CPF (Cross Polarized Filters) Technique for Screening & ID of Diamonds: Natural, Lab-grown & Post-Growth Treated, and in his recordeda lecture on CPF as an online instructor for Branko Gems Academy. You may also find his work involving CPF in Cross Polarized Filters as a Clue to Diamond Origin in Issue 2 of the 2022 AGS Spectra magazine with Wade Abel and as a co-author of the booklet Identifying Diamond Types and Laboratory-Grown Diamonds with CPF (Cross-polarized Filters) with Branko Deljanin & Dusan Simic.

Randy is a regular columnist for the National Association of Jewelry Appraisers (NAJA) quarterly newsletter, volunteers with The Appraisal Foundation, and won Gem-A's 2023 Photographer of the Year award.



(1) Pyrite Cube in Canadian Amethyst. A perfect cube of pyrite seems to float in this amethyst from Thunder Bay, Canada. Use of crossed polarising filters enhances the iridescence caused by fractures within the stone. Field of view approx 2.0 mm.



(2) Rutile and Brookite in Quartz. This is a stack of 42 images. Another of my finds from Tucson this year. 🔬Motic GM171 📷 Sony A7R IV 🔍 Magnification is around 60x

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SAMMANTHA MACLACHLAN
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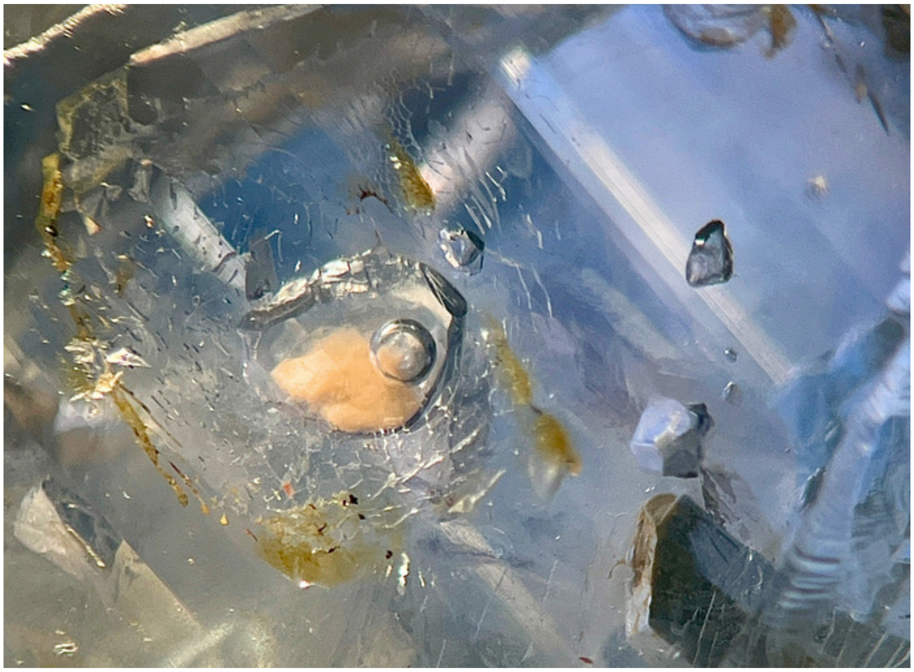

(1&2) Two different views of a fascinating three-phase fluid inclusion in a sapphire crystal from the Ratnapura District, Sri Lanka. A couple things make this inclusion especially odd: it is visible to the naked eye (with a mobile bubble, likely CO2) at over 2mm across, which is rare for corundum; and the unknown solid phase appears sandy/powdery and moves around within the inclusion (it is in different places in each of the two photos). Other inclusions, including negative crystals & iron oxides, are visible along with linear blue zoning patterns. Field of view approx. 4x3 mm above & 8x6 mm below.

Anne Fulton is a geologist, metalsmith, aspiring micro-photographer, and webmaster/graphic designer for the Friends of Mineralogy Colorado Chapter. She has graduate degrees from the University of Oregon in Volcanology, Colorado School of Mines in Economic Geology, and is almost finished with her Graduate Gemologist degree from GIA. Anne is also an avid field collector with a particular interest in hard-to-get-to localities off the beaten path and in esoteric, scientifically unique localities. Although aluminum oxides (corundum, chrysoberyl, and spinel) are her main mineralogical interest, she will happily pick up any nice rock she encounters.