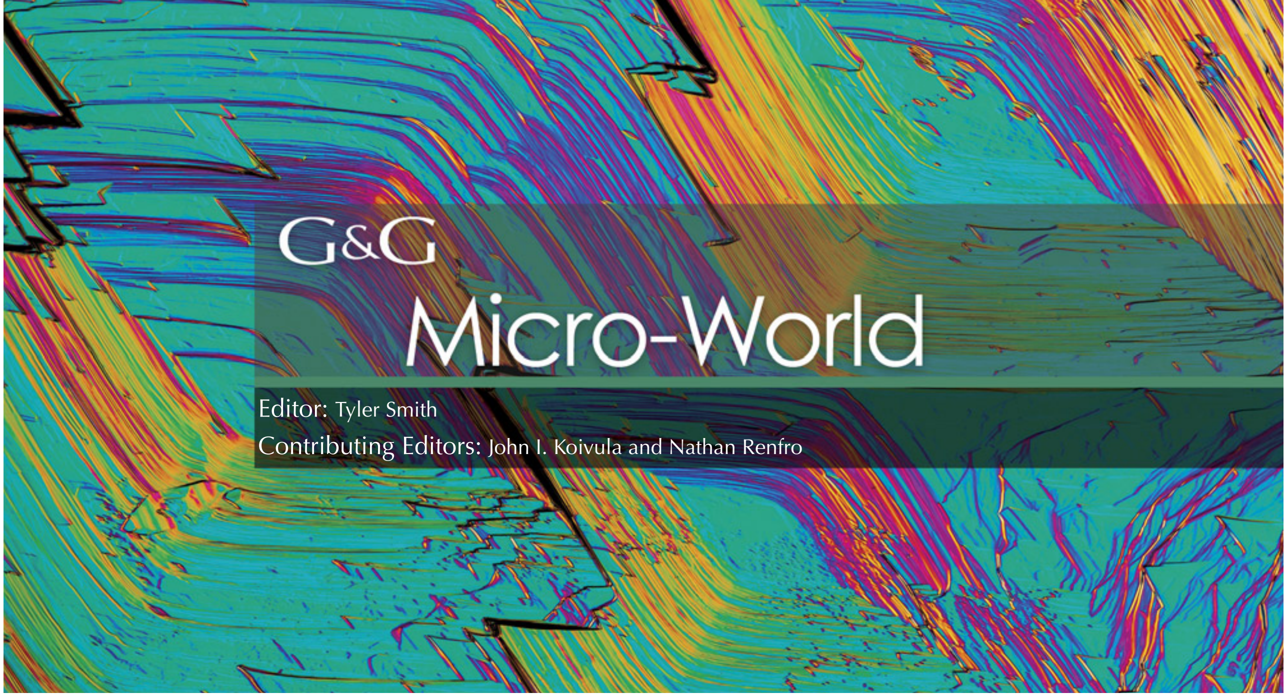


Figure 1. Goethite sprays in an apatite's surface-reaching fracture. Photomicrograph by Michaela Damba and John Koivula; field of view 1.26 mm.

Goethite Sprays in Apatite

The authors recently examined a 0.89 ct green-blue apatite that contained intriguing brownish yellow mineral inclusions trapped within a large fracture (figure 1). Visual examination revealed these inclusions were sprays of goethite, a hydrous ferric oxide named in 1806 in honor of German scientist and author Johann Wolfgang von Goethe. These sprays formed epigenetically where the preexisting apatite host encountered groundwater enriched with ferric oxide. This groundwater invaded the fractures of the apatite and then precipitated crystalline goethite as it dried out (J.I. Koivula, "Useful visual clue indicating corundum heat treatment," Fall 2013 *G&G*, pp. 160–161).

Michaela Damba and John I. Koivula
GIA, Carlsbad

Fireworks in Aquamarine

The author recently examined a large 25.08 ct greenish blue beryl (aquamarine) containing numerous oriented small two-phase (liquid and gas) thin film inclusions. These inclusions were hardly visible in brightfield

About the banner: Growth hillocks on the surface of a heliodor beryl from Volodarsk-Volynskii, Zhytomyr Oblast, Ukraine, using differential interference contrast microscopy. Photomicrograph by Nathan Renfro; field of view 1.44 mm.

Gems & Gemology, Vol. 62, No. 1, pp. 78–85.

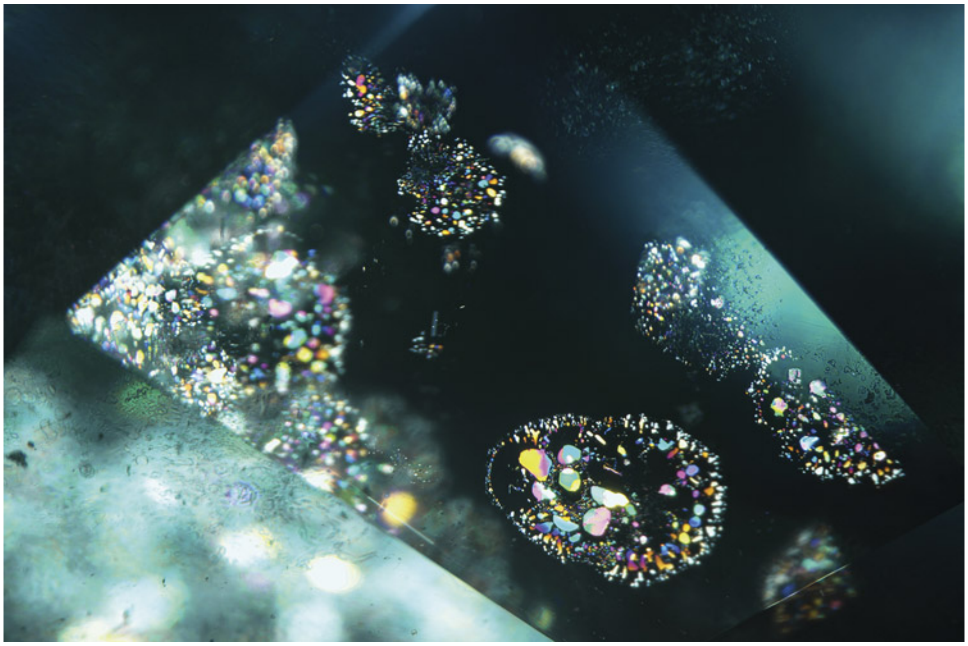


Figure 2. Iridescent thin films in aquamarine viewed with fiber-optic illumination. Photomicrograph by Michaela Damba; field of view 7.19 mm.

illumination but became reflective and iridescent when viewed with fiber-optic illumination (figure 2). The most diagnostic of beryl inclusions (E.J. Gübelin and J.I. Koivula, *Photoatlas of Inclusions in Gemstones, Volume 2*, Opinio Publishers, Basel, Switzerland, 2005, pp. 312–314), the thin films were situated in planes perpendicular to the *c*-axis of the host. The thin films in this aquamarine resembled fireworks in the night sky.

Michaela Damba

"Basketball Player" in Diamond

During routine examination, a natural D-color round brilliant diamond with SI_1 clarity, weighing 0.84 ct and measuring 5.98 × 6.02 × 3.78 mm, captured the author's attention for its interesting combination of internal features. A cloud subtly formed the outline of a human figure, complete with arms and legs, while a nearby rounded crystal evoked the shape of a ball (figure 3). Together, the inclusion scene provided a perfect snapshot of a basketball player dribbling a ball down the court. The overall visual impression was not only rare but uniquely expressive, giving the diamond a personality beyond its standard gemological attributes. This captivating internal structure is a prime example of how nature can create art that mirrors human life and movement.

Tejas Jhaveri
GIA, Mumbai

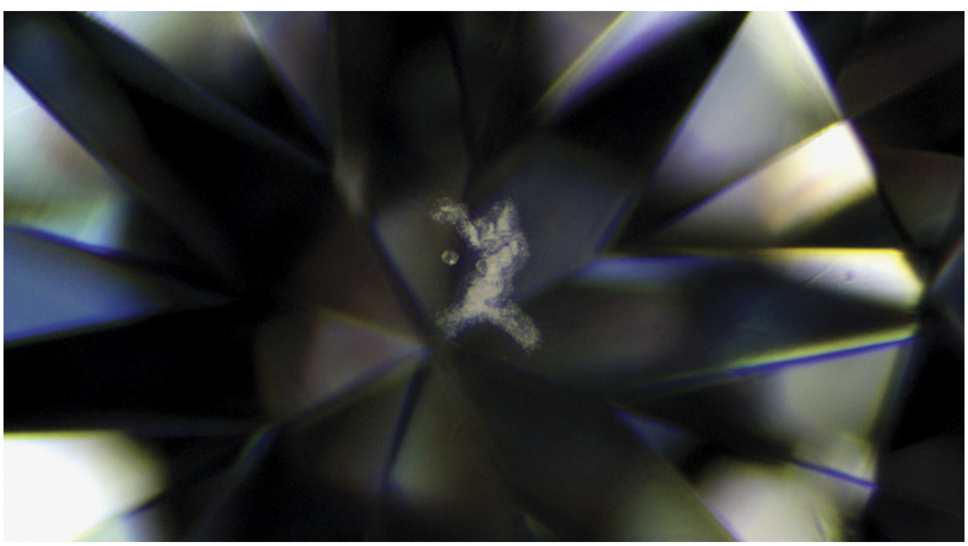


Figure 3. This diamond's cloud and crystal inclusions resemble a basketball player in action. Photomicrograph by Tejas Jhaveri and Nishant Shah; field of view 3.20 mm.

Figure 4. A collection of needle inclusions in a 2.30 ct pyrope-almandine garnet. Photomicrograph by Isabelle Corvin; field of view 2.5 mm.

"Comet Tail" Needle Cluster in Garnet

While needles are common inclusions in many garnet species, this 2.30 ct pyrope-almandine garnet showcased them in a spectacular fashion (figure 4). The cluster of needles resembled a comet's tail, with the needles intersecting at approximately 70 degrees in the center of the gemstone. The contrasting color of the needles with the red bodycolor of the garnet helps highlight this striking group of inclusions. Needle inclusions can provide important clues about a garnet's formation, including pressure and temperature conditions during the growth process (J.A. Axler and J.J. Ague, "Oriented multiphase needles in garnet from ultrahigh-temperature granulites, Connecticut, U.S.A.," *American Mineralogist*, Vol. 100, No. 10, 2015, pp. 2254–2271).

Isabelle Corvin
Olympia, Washington

"Meteor Shower" in a Pearl

Recently, the authors examined a natural nacreous pearl from the Mytiloidea superfamily of marine mollusks. The gray and violet button-shaped pearl weighed 4.13 ct and measured 8.70 × 8.46 × 7.91 mm. Under magnification, distinct natural curved striations were observed on the pearl's surface, resulting from unusual stacking of its nacre layers. Regularly spaced microscopic gaps within these striations allowed incident light to penetrate the inner subsurface layers of the pearl. When gently tilted away from direct light, these small rays appeared as radiant streaks resembling shooting stars (figure 5). This intriguing surface phenomenon was reminiscent of a meteor shower traversing the night sky.

Rajesh Patel and Abeer Al-Alawi
GIA, Mumbai

Play-of-Color on a Pen Pearl

Pearls from *Pinna* species are commonly referred to as "pen pearls," belonging to the Pinnidae family, and can be found in both nacreous and non-nacreous forms. Recently, the authors encountered a non-nacreous pen pearl with a unique surface phenomenon. This dark brown drop-shaped pearl, weighing 7.85 ct and measuring 11.75 × 9.97 mm, exhibited prominent surface-reaching cracks. Under high magnification with fiber-optic illumination, its surface dis-

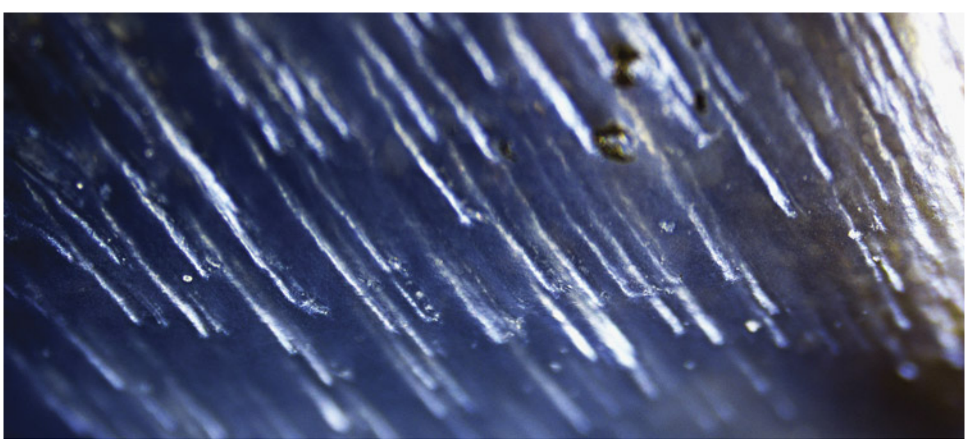


Figure 5. A natural nacreous pearl from the Mytiloidea superfamily displays an effect reminiscent of a meteor shower. Photomicrograph by Rajesh Patel; field of view 4 mm.

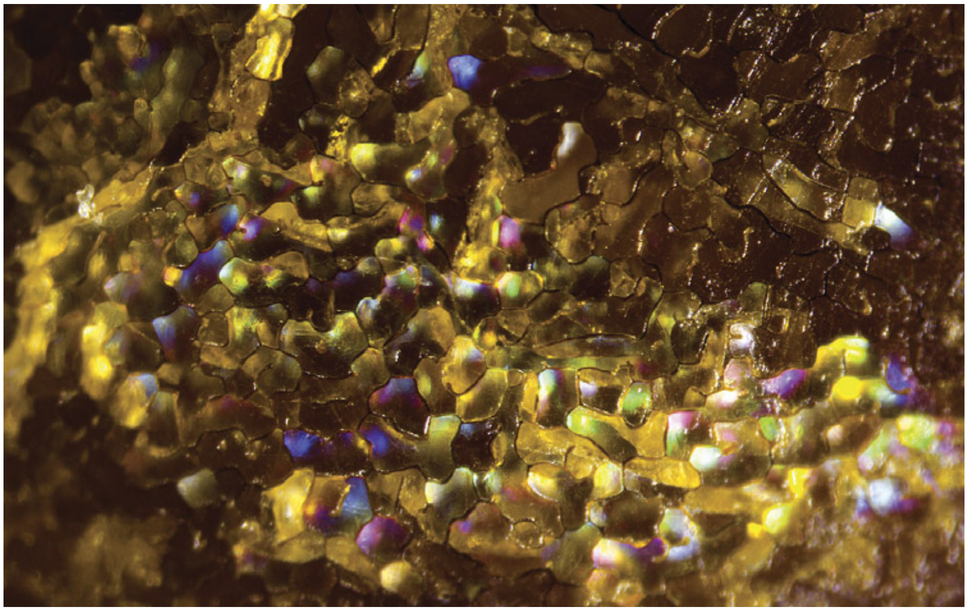


Figure 6. Cellular arrangement of calcitic crystals on the surface of a pen pearl showing play-of-color caused by their interaction with light. Photomicrograph by Gauri Sarvankar; field of view 3.30 mm.

played a pseudo-hexagonal mosaic pattern, with each cell revealing a vertical columnar arrangement of calcitic crystals (N. Sturman et al., "Observations on pearls reportedly from the Pinnidae family (pen pearls)," Fall 2014 *G&G*, pp. 202–215). The semitranslucent nature of these cells allowed light to diffract, producing a vibrant play-of-color featuring shades of pink, blue, yellow, and green (figure 6). Although natural opals also exhibit a similar surface phenomenon, it is rare to see this phenomenon in pearls.

Gauri Sarvankar and Abeer Al-Alawi
GIA, Mumbai

"Spiderweb" Structure on a Pearl's Base

The authors recently examined a natural light cream near-button pearl weighing 4.27 ct. Externally, the pearl exhibited a dark brown non-nacreous base with significant surface-reaching cracks. Notably, the center of the base displayed a cavity formation with a web-like structure (figure 7). When viewed under higher magnification, very thin thread-like filaments containing small yellow globules trapped between them were observed (figure 8), resembling the delicate and intricate features of a spiderweb. However, the identity of the fibrous formation remains unknown as its fragile nature prevented any analytical testing that might cause damage to the pearl.

Spiderwebs are renowned for their fascinating structures, often showcasing complex patterns and fine, silky threads. The web-like formation observed in this pearl possesses qualities that are both enchanting and peculiar.

Eram Shaikh and Abeer Al-Alawi
GIA, Mumbai

Figure 7. Spiderweb-like structure on the non-nacreous base of a natural pearl. Photomicrograph by Eram Shaikh; field of view 2.00 mm.

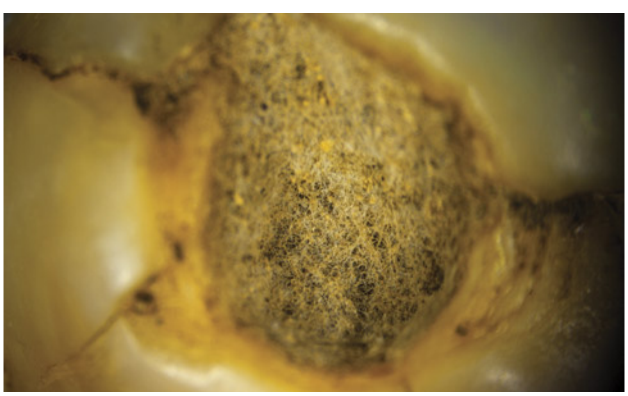


Figure 8. Thread-like filaments of the webbing with yellow globules trapped between them were observed on the non-nacreous area of the pearl. Photomicrograph by Eram Shaikh; field of view 8.00 mm.

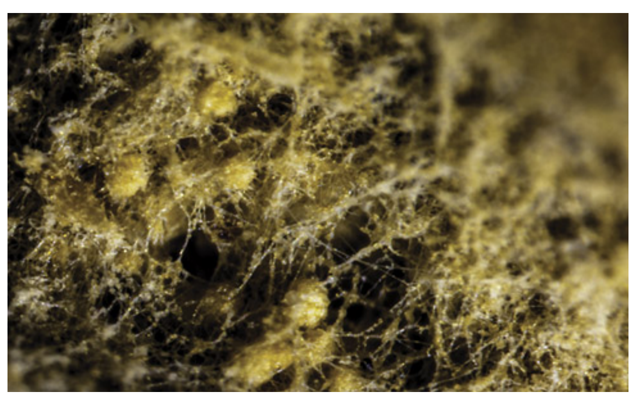


Figure 9. A well-formed aquamarine crystal embedded within colorless quartz. Photomicrograph by Wingtak Lui; field of view 3.2 mm.

Euhedral Aquamarine Crystals in Quartz

A 1.87 × 1.53 × 1.17 cm colorless quartz specimen containing interesting inclusions was recently studied by the authors. Microscopic examination revealed multiple well-formed blue hexagonal prismatic crystals embedded within the quartz (figure 9). These inclusions exhibited moderate pleochroism from greenish blue to light greenish blue, distinct from the non-pleochroic quartz host. Their morphology and optical properties suggested a beryl-group mineral. Spectroscopic analyses (infrared and Raman) confirmed the inclusions as beryl. Ultraviolet/visible absorption features attributed to Fe^{2+}–Fe^{3+} intervalence transition indicated iron as the chromophore responsible for the blue coloration, further identifying the inclusions as aquamarine. This specimen illustrates the diagnostic value of crystal morphology, pleochroism, and spectroscopic analysis in inclusion identification.

Rui Rui Xing and Wingtak Lui
Min De Minerals & Gem Research Co., Ltd.
Nanjing, China

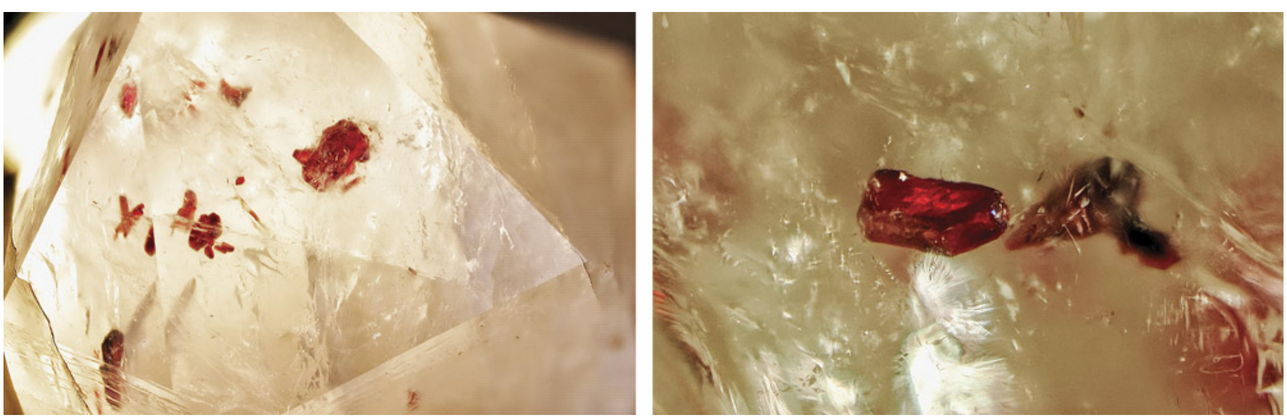
Yu-Chen Huang
Taiwan Central Gem Laboratory Co., Ltd.

Cinnabar in Quartz

A fascinating quartz specimen with bright red inclusions was recently analyzed. It originated from the Chatian mine, Xiangxi, Hunan Province, China—a locality known for its fine cinnabar and mercury ore deposits.

Visual inspection revealed striking red inclusions scattered throughout the quartz, appearing as high-luster, intensely red crystals, with some exhibiting well-defined habits (figure 10). Their vivid color and brilliant internal reflections were consistent with cinnabar. Microscopic

Figure 10. Bright red to dark red crystals of cinnabar in colorless quartz. Photomicrographs by Wingtak Lui; fields of view 16 mm (left) and 5 mm (right).



examination showed that many inclusions were transparent to translucent with short prismatic or barrel-shaped habits embedded at various depths. To confirm their identity, Raman microspectrometry was performed. The spectrum showed characteristic cinnabar peaks, definitively identifying the inclusions as cinnabar.

Wingtak Lui, Rui Rui Xing, and Yu-Chen Huang

Uniquely Patterned Clouds in Sri Lankan Sapphire

Corundum is found in many disparate locations. Similarly, the morphology of impurity clouds in corundum can vary between localities, from the ultrafine, wide-banded clouds of Kashmir to the layered geometric clouds of Madagascar. Although rarely endemic, they can be used by gemologists to support geographic origin determinations.

The author recently examined a 4.00 ct Sri Lankan blue sapphire from GIA's colored stone reference collection. The stone exhibited groups of intersecting needles, fingerprints, and a twinning plane. Additionally, particle clouds with a unique interlocking triangular pattern were found under fiber-optic illumination (figure 11). This is the first time the author has observed this pattern in a sapphire from Sri Lanka.

Titapa Tanawansombat
GIA, Bangkok

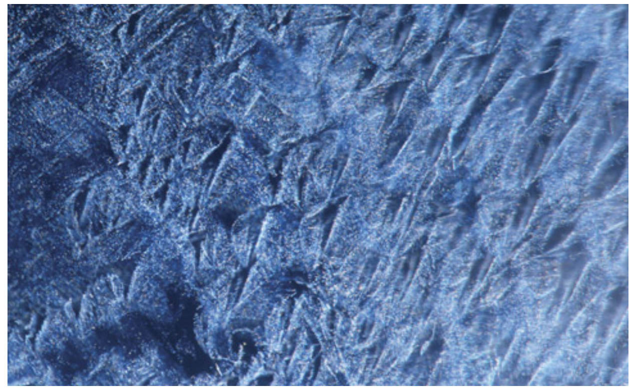


Figure 11. A unique pattern of particles in a Sri Lankan blue sapphire is observed under fiber-optic illumination. Photomicrograph by Titapa Tanawansombat; field of view 1.80 mm.

Mystery Bubble in Spinel

Gemology is a forensic science, and often what we don't know can be as interesting as what we do know. Recently, the authors encountered a fascinating spinel. The owner noted that the stone (reportedly from Myanmar, formerly Burma) contained an inclusion feature with a bubble inside. Closer inspection revealed a negative crystal or cavity that indeed contained a mobile bubble (figure 12). With gentle heating from the warmth of the microscope's light bulb, the authors were able to see the bubble expand and contract (see video at https://www.gia.edu/gems-gemology/spring-2026-microworld-bubble-in-spinel).

Both micro-Raman and micro–Fourier-transform infrared spectroscopy were used in attempts to identify the liquid, but the results were inconclusive. The inclusion was inert when exposed to both long-wave (365 nm) and short-wave (254 nm) ultraviolet illumination.

Sulfur-rich fluids have been reported in Burmese spinel (Winter 2017 *G&G* Micro-World, p. 468). However, the sample did not match sulfur-rich fluids, either in appearance (sulfur-rich fluids tend to have a yellowish

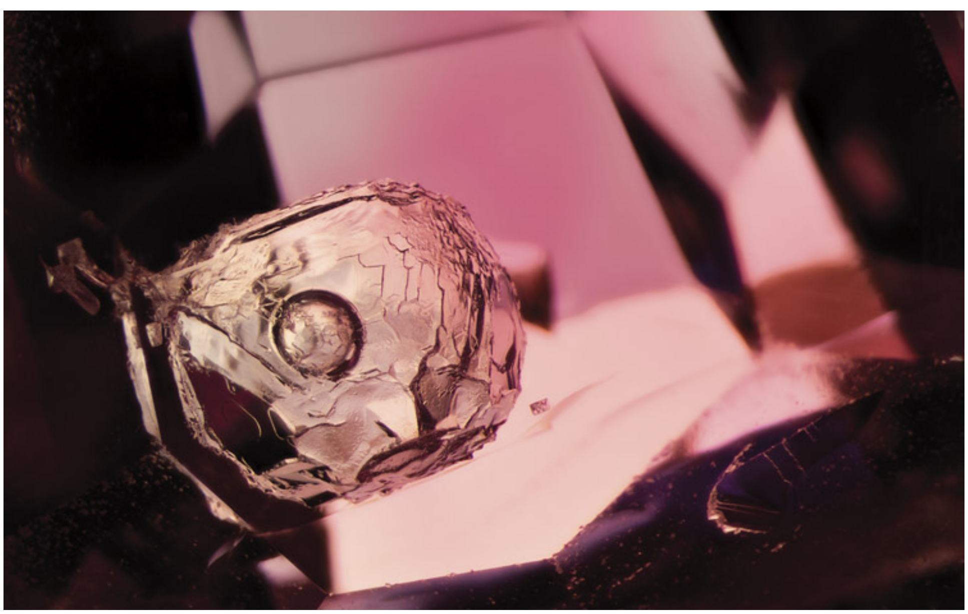


Figure 12. A mobile bubble floating in a cavity in spinel observed under diffused transmitted light. The nature of the substance inside the cavity remains a mystery. Photomicrograph by E. Billie Hughes; field of view ~3.5 mm.

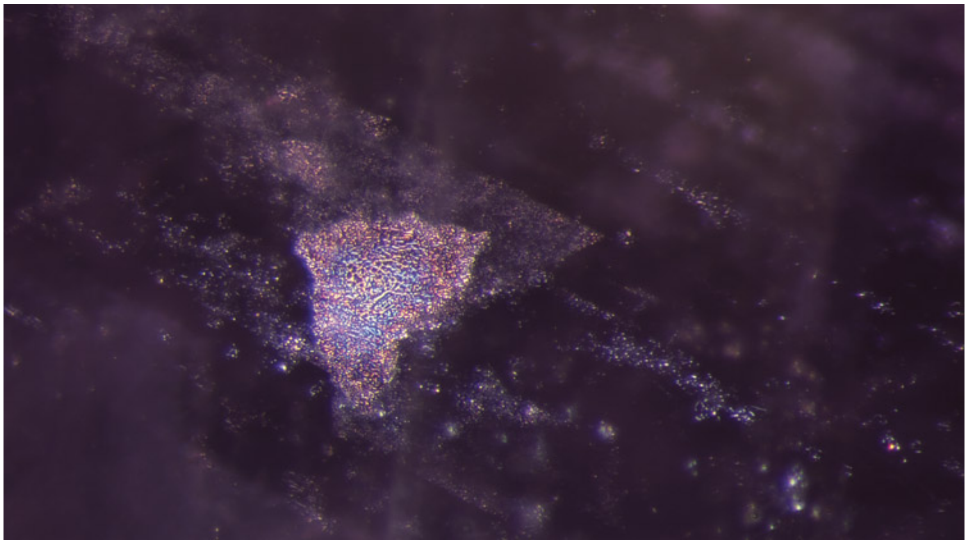


Figure 13. Complex planes with mottled particles in this heated spinel may be the remnants of oriented lamellae. Viewed in diffused fiber-optic lighting. Photomicrograph by E. Billie Hughes; field of view 1.6 mm.

color) or in its Raman spectrum. In many cases, cavities in corundum displaying a similar appearance have been found to contain carbon dioxide. However, in the authors' experience, it is often possible to identify carbon dioxide with Raman spectroscopy, whereas in this case, Raman spectroscopy did not yield a conclusive answer.

Currently, the exact nature of this inclusion remains a mystery.

E. Billie Hughes
Lotus Gemology, Bangkok

Wim Vertriest
GIA, Bangkok

Evidence of Heat Treatment in Spinel

Although most spinels that pass through gemological laboratories are untreated, treated samples are occasionally received. Oiling is the most common treatment, but heated spinels are observed on rare occasions.

A red spinel was recently examined, with a declared origin of Tanzania. Both the photoluminescence spectrum and microscopic observations provided evidence that the stone had been heated. Given how rarely heated spinel is encountered, the inclusion scenes were worth documenting.

One interesting characteristic was the presence of several flat plates with a mottled surface appearance (figure 13), which may have been heated remnants of the oriented lamellae sometimes seen in Tanzanian spinel. Partially healed fissures with a glassy appearance and irregular melted channels were also observed (figure 14). These features were quite different from the fingerprints often present in unheated spinel.

E. Billie Hughes

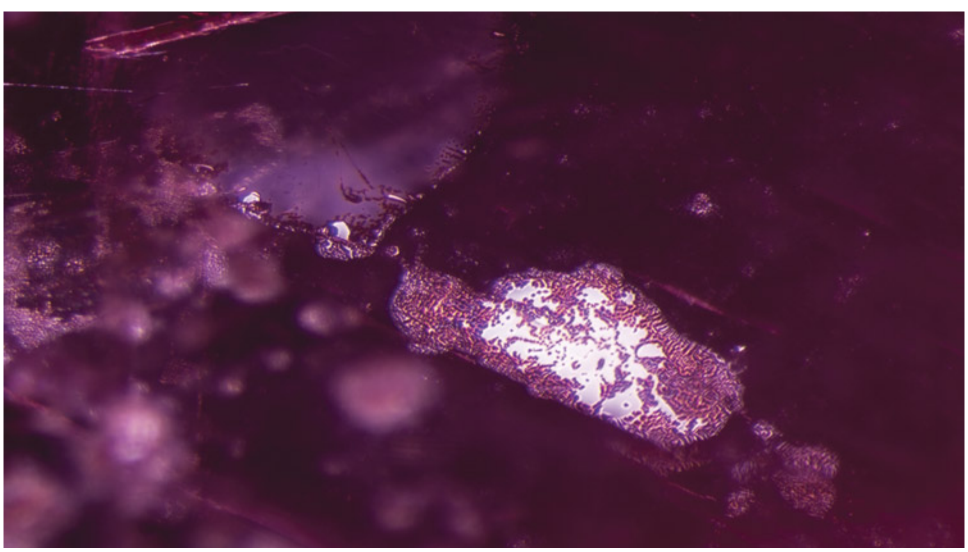


Figure 14. Partially healed fissures with melted channels and glassy areas provide evidence that this spinel underwent heat treatment. Viewed in darkfield and diffused fiber-optic lighting. Photomicrograph by E. Billie Hughes; field of view 1.9 mm.

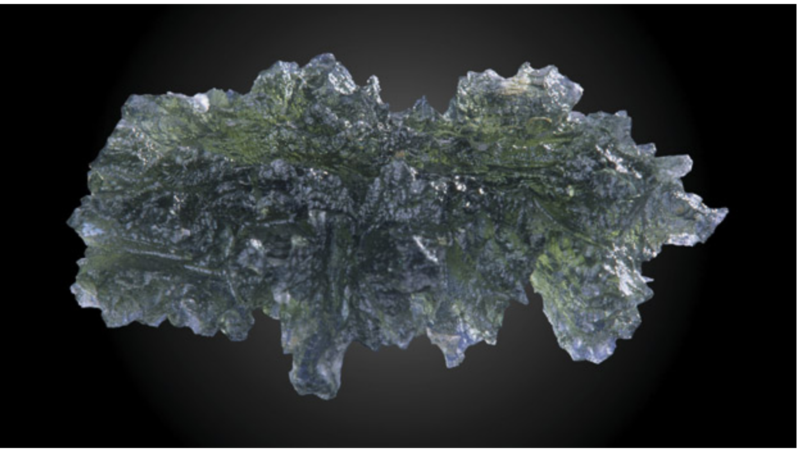


Figure 15. A true collector's item, this 32.06 mm long ornate leaf-shaped olive green moldavite is from the Besednice strewn field in the Czech Republic. Possessing unbroken spires and undamaged surfaces, this pristine condition is rare. Photo by Maha Calderon.

Quarterly Crystal: Spires on Moldavite

A well-formed moldavite tektite from the Czech Republic is the subject of this issue's Quarterly Crystal. As tektite is technically not a crystal but rather a naturally occurring glass, flexibility was required to include this 18.48 ct leafy moldavite tektite in this issue's column (figure 15). The recently examined specimen came from Norm Lehrman at the Tektite Source in Reno, Nevada.

The transparent to translucent slightly grayish green moldavite measured 32.06 × 19.83 × 9.74 mm and hosted numerous unbroken spires on its heat-sculptured surface (figure 16). The fresh unbroken nature of the spires on this tektite is unusual considering the violent formational process of tektites. This makes well-formed unbroken moldavites rather rare.

This moldavite is from Besednice in the Český Krumlov District in the South Bohemian Region of the Czech Republic. Besednice moldavites are widely considered the finest examples of the material, and the beautiful olive green glass is often faceted into gemstones. However, moldavites with detailed leafy natural ornamentation such as this one are not cut, but instead kept as natural specimens. Moldavites are derived from the meteorite impact at the Nördlinger Ries crater in Germany approximately 15 million years ago. Moldavite tektites were first found in association with the Venus of Willendorf archaeological site in Austria, dating back approximately 29,000 years.

John I. Koivula and Nathan Renfro
GIA, Carlsbad

Figure 16. Details of the unbroken spire tips and undamaged surface structure of the leaf-shaped moldavite are highlighted by the internal strain as revealed in polarized light with a first-order red compensator. Photomicrograph by John Koivula; field of view 11.50 mm.