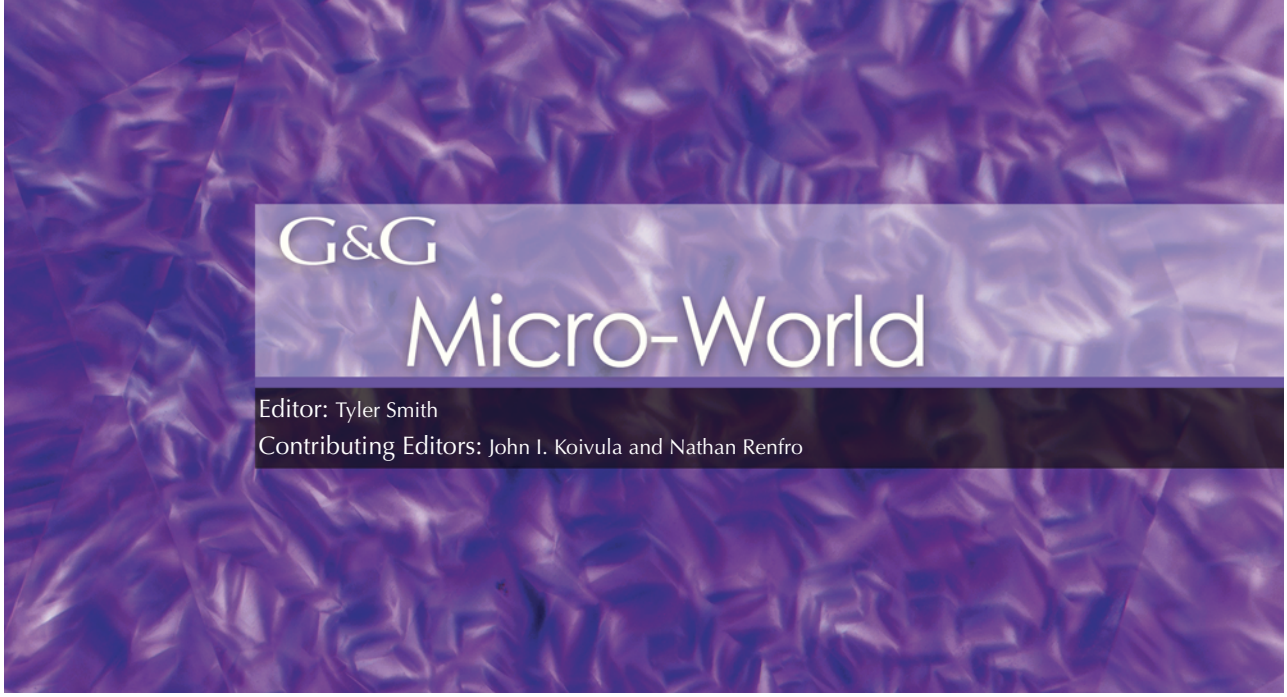


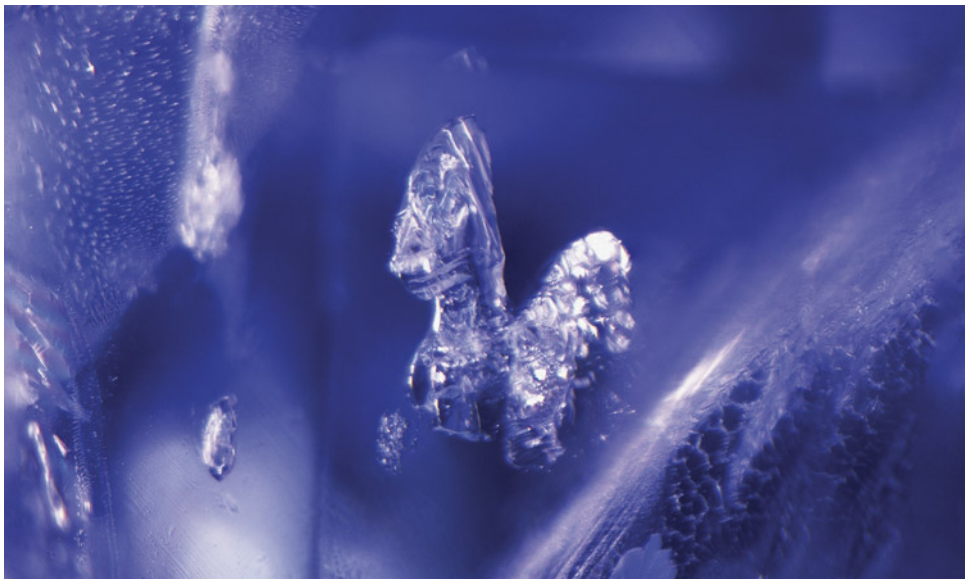


Figure 1. The negative crystal in this blue sapphire is reminiscent of a Chinese mythological qilin. *Photomicrograph by Yuxiao Li; field of view 3.57 mm.*

Chinese Mythology Inside Corundum

Recently, the author observed two corundum samples with intriguing inclusion scenes: an unheated 0.89 ct blue sapphire and a heated 1.39 ct ruby. Believed to have been mined in Kashmir, the sapphire hosted a unique negative crystal that resembled a *qilin*, a dragon-like creature from Chinese mythology (figure 1).

The ruby also evoked Chinese imagery through a thin film inclusion reminiscent of an antique mural depicting the sky at dusk (figure 2). The healed fingerprints in the lower part of the image appear as thick clouds, while the upper portion is suggestive of the sky dyed red by the setting sun. In the center, a *loong* (Chinese dragon) seems to emerge through the clouds, disappearing into the sky. Trace element chemistry obtained by laser ablation–inductively coupled plasma–mass spectrometry indicated a Thailand origin for

About the banner: Strongly developed chevron-shaped and triangular growth structures with colorless and purple zonation are present in this Russian-grown hydrothermal synthetic amethyst. Photomicrograph by Nathan Renfro; field of view 8.18 mm.

Gems & Gemology, Vol. 62, No. 3, pp. 300–307.

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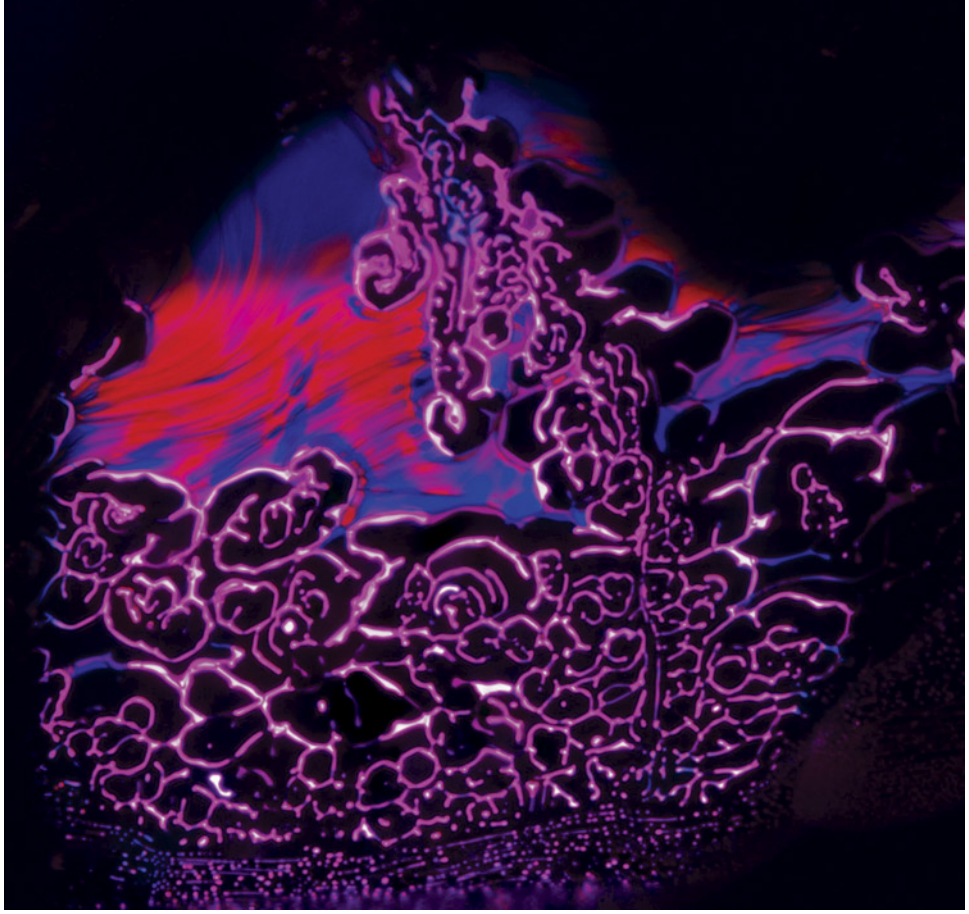


Figure 2. The thin film inclusion in this Thailand ruby resembles an antique Chinese mural depicting the sky at dusk. Photomicrograph by Yuxiao Li; field of view 1.76 mm.

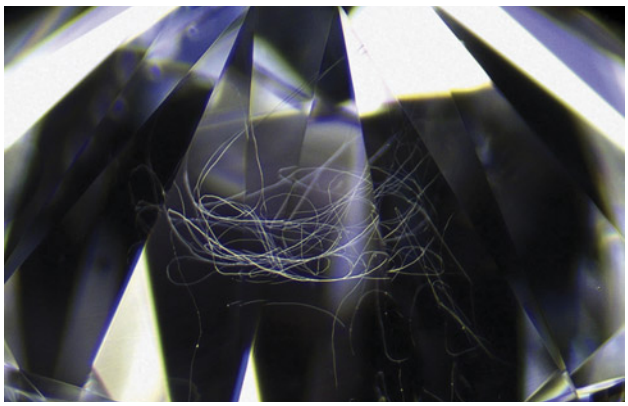
the ruby, a conclusion supported by the features of its inclusion scene. Rubies from Thailand typically contain colorless crystals surrounded by thin film inclusions, which display iridescent colors under fiber-optic illumination.

Yuxiao Li
GIA, Tokyo

Hair-Like Loops in Diamond

The authors recently examined a 0.57 ct J-color round brilliant natural diamond with an SI_1 clarity grade based on a rare formation of hair-like loops (figure 3). This inclusion, which resembled the "horsetail" fibrous inclusions in demantoid garnet, was best showcased when viewed through the pavilion under a microscope. These loops seemed to defy the monocrystalline structure of diamond, in which angular and straight-edged internal features are typical and distinctly curved structural features are rare. Diamonds often undergo plastic deformation in the earth, and linear surface and internal graining are visible manifestations of this process. During diamond growth, both plastic deformation and the precipitation of microscopic to submicroscopic foreign matter on growing surfaces can increase dislocation density, and the presence of one dislocation may lead to the development of more (Spring 2007 Lab Notes, pp. 48–49).

Figure 3. Pavilion view of hair-like loops in natural diamond. Photomicrograph by Khushal Hindocha.



Nilay Patel, Jaydip Dhameliya, and Raju Jain
GIA, Surat

Vestige of Hornblende (Amphibole) in Mexican Opal

Due to the way they form, opals can encapsulate a wide range of inclusions. Among them, it is possible to distinguish two main categories. The first comprises inclusions that are present in the environment during the opal's formation, such as the plant remnants extensively observed in material from Ethiopian deposits. The second consists of inclusions that crystallize simultaneously with the opal. They typically form rapidly, remain nano- to micro-sized, and are often responsible for changes in



Figure 4. Pseudomorphosed hornblende into a mixture of rutile and hematite in a 4.69 ct precious opal-CT rough from Mexico. Photomicrograph by Tyler Smith, field of view 4.79 mm.

bodycolor. The colorless Mexican opal shown in figure 4 frames a rather unique scene that belongs to the first category: a dark monolithic hornblende (dark amphibole) pseudomorph comprised of rutile (TiO_2) and hematite (Fe_2O_3). The pseudomorph is partially covered by acicular red and gray secondary phases of the same composition, all enwrapped by bright, vivid green, blue, and pink colors resembling the aurora borealis.

Simon Gouzy, Tyler Smith, and Elina Myagkaya
GIA, New York

Landscapes in a Fluorescent Opal

Opals are widely known for their play-of-color phenomenon, and although precious opals can also fluoresce, none are as vividly colored as the siliceous sinters that originate from Hokkaido, Japan (see Lab Notes, p. 296 of this issue). After volcanic activity 10,000 to 60,000 years ago dammed the Shikaribetsu River, andesitic volcanic ejecta deposited along the western banks of Lake Shikaribetsu formed these fluorescent sinters through the incorporation of organic material (S. Ogihara, "Characteristics of fluorescent organic matter entrapped in silica sinter from the western shore of Lake Shikaribetsu, Hokkaido, Japan," *Open Journal of Geology*, Vol. 15, No. 7, 2025, pp. 377–389).

The author recently examined an opal slab, weighing 159.59 ct and measuring 71.87 × 47.05 × 7.66 mm, from this location in Japan. The colors depicted in figure 5 are attributed to rare hydrocarbon crystal inclusions, including carpathite and the recently discovered hokkaidoite (F. Bosi et al., "IMA commission on new minerals, nomenclature and classification (CNMNC): Newsletter 71," *Mineralogical Magazine*, Vol. 87, No. 2, 2023, pp. 332–335). Microscopic examination revealed dendritic structures along the thin cyan bands, not visible under normal lighting conditions. Under daylight-equivalent lighting,

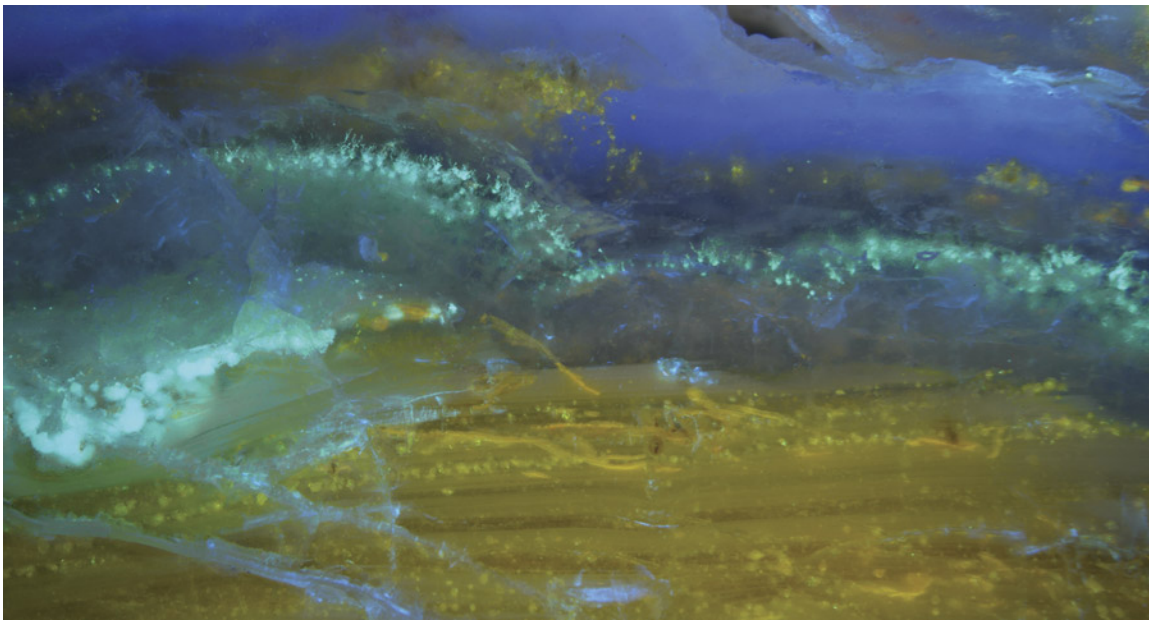


Figure 5. Long-wave UV light reveals a multitude of fluorophores in this slab of opal from Hokkaido, Japan. Photomicrograph by Jeffrey Hernandez; field of view 14.52 mm.

translucent yellow to orange bands were associated with bright yellow fluorescence. The semitransparent, near-colorless side of the slab exhibited a resinous luster and pastel blue to purple fluorescence under long-wave (365 nm) UV light, appearing blue in the photomicrograph. Together, the fluorescent colors and banded structures evoke a vivid natural landscape, resembling powerful ocean waves breaking along an eroding shoreline.

Jeffrey Hernandez
GIA, Carlsbad

Storm in a Tridacninae Pearl

Spirals are among the most admired and unique features in Tridacninae pearls. Recently, the author observed a captivating spiral pattern in a Tridacninae pearl under microscopic observation.

The white button-shaped pearl, weighing 10.06 ct and measuring 11.88 × 9.80 mm, displayed spiral formations on both poles. The spiral shown in figure 6 consisted of several blade-like structures radiating from the pole axis of the pearl, forming a pattern reminiscent of a storm. This type of spiral is believed to result from internal helices related to the pearl's genetic origin (J.-P. Gauthier et al., "Evidence of rotation in flame-structure pearls from bivalves of the Tridacnidae family," Summer 2019 *G&G*, pp. 216–228).

While previously documented spiral patterns have been reported using processed images, the spiral in this pearl was revealed solely through fiber-optic and strong transmitted lighting, making this pearl particularly intriguing.

Hazel "Wing Kiu" Fan
GIA, Hong Kong

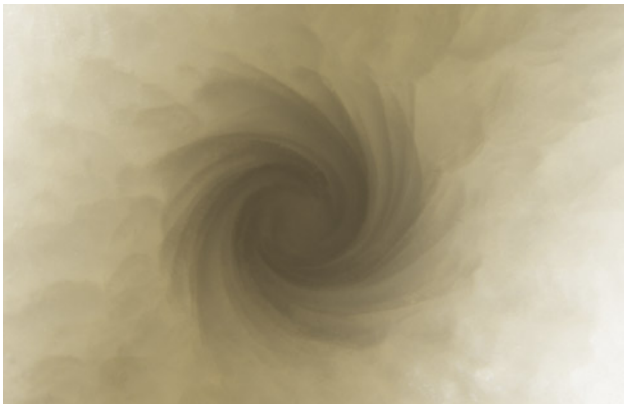


Figure 6. A 10.06 ct button-shaped Tridacninae pearl exhibiting a distinct spiral pattern reminiscent of a storm. Photomicrograph by Hazel "Wing Kiu" Fan; field of view 7.78 mm.

Vivid Green Tsavorite Inclusions in Quartz

Recently, the authors observed a series of well-formed vivid green crystals in a colorless quartz specimen. Under a gemological microscope, these inclusions displayed high transparency, vitreous luster, and isometric morphology (figure 7). Confocal Raman spectroscopy confirmed the identity of the inclusions as grossular garnet. The green coloration designates its variety as tsavorite.

While quartz hosted by garnet is common, the reverse scenario is highly unusual. Grossular typically crystallizes during the early stages of contact metasomatism, whereas the host quartz usually precipitates from late-stage silica-

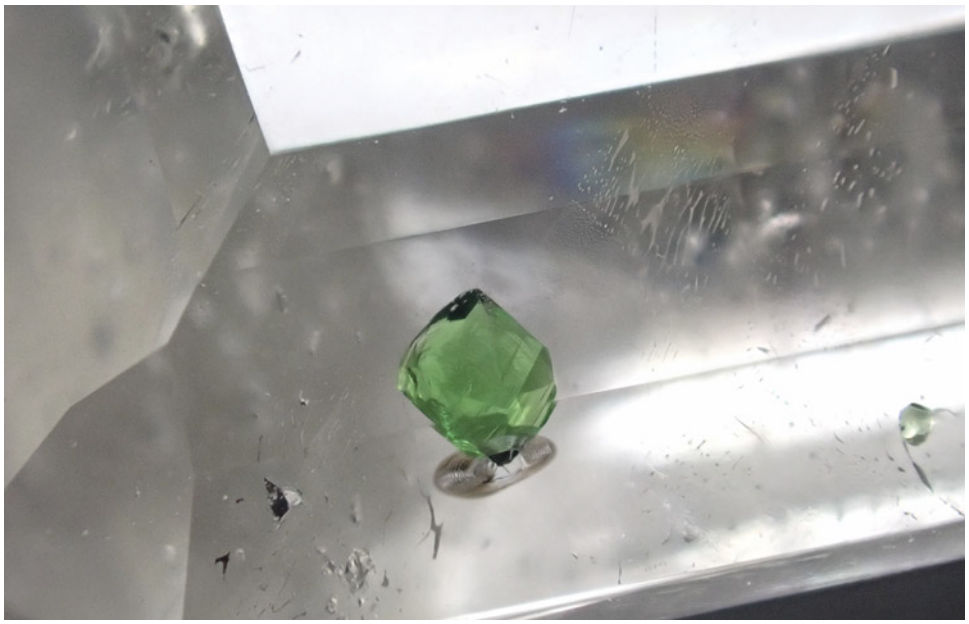


Figure 7. One of the vivid green tsavorite inclusions showing a rhombic dodecahedron formation in quartz. Photomicrograph by Liyan He; field of view 7.03 mm.

saturated hydrothermal fluids. The grossular garnets in this specimen are presumed to have crystallized before the host quartz, representing a typical protogenetic inclusion. Overall, fully intact euhedral tsavorite crystals included in such a highly transparent quartz are exceedingly rare.

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Wang Zhang
Min De Minerals & Gem Research Co., Ltd.
Nanjing, China

Oil-Bearing Inclusions in Quartz

The author recently examined a batch of oil-bearing quartz crystals from Madagascar. Microscopic observation revealed morphologically diverse multicolored fluorescent inclusions. Raman spectroscopy, infrared spectroscopy, and X-ray diffraction analyses confirmed that the fluorescence originated from hydrocarbon compounds.

A set of inclined inclusions exhibited orange-red fluorescence under long-wave (365 nm) UV light (figure 8). Further examination revealed their distinct polygonal forms arranged in a regular, parallel orientation. Unlike protogenetic inclusions, these inclusions exhibited a highly ordered structure typical of negative crystals. Combined with microscopic observations, these inclusions resembled crimson terraced fields within the crystal, which ranged from triangles to pentagons.

Another set of elongated negative crystals formed a pattern resembling a school of fish (figure 9). A compressed bubble observed in one of the negative crystals, which was inert under long-wave UV light, was reminiscent of a fish eye. While the negative crystals exhibited orange-red fluorescence, their crystal edges displayed bluish white fluorescence, suggestive of the shimmering luster of fish scales. This combination of vibrant fluorescent colors reveals the internal complexity of inclusions that otherwise appear homogeneous and monotone.

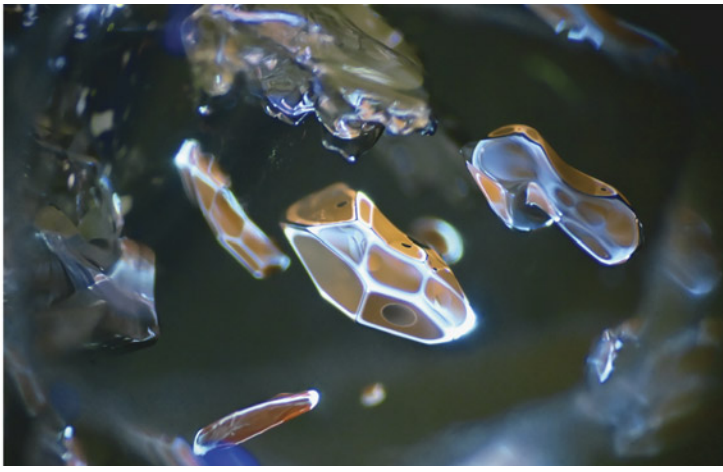


Figure 8. A set of inclined inclusions exhibiting orange-red fluorescence under long-wave UV light within an oil-bearing quartz crystal from Madagascar. Photomicrograph by Yecheng Lin; field of view 0.46 mm.

Yecheng Lin
Xiamen Xinchengxin Trading Co., Ltd., China

Figure 9. Left: In this aggregation of negative crystals within oil-bearing quartz, the center crystal displays a compressed vapor bubble near its terminus. Right: Under long-wave UV light, the negative crystal exhibits orange-red fluorescence, with its edges displaying bluish white fluorescence. Photomicrographs by Yecheng Lin; field of view 0.59 mm.





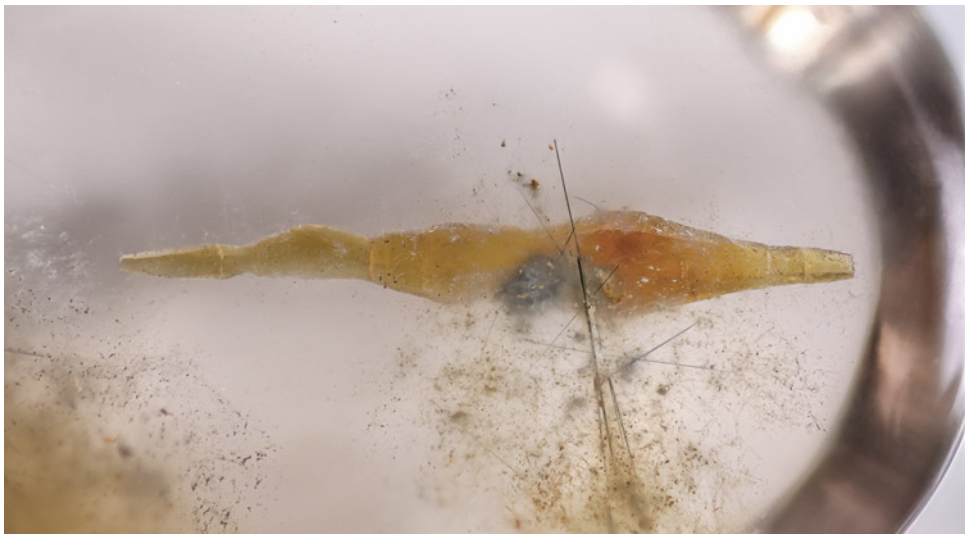


Figure 10. Prismatic doubly terminated orange parisite and black acicular riebeckite inclusions in quartz from Pakistan. Photomicrograph by Hongtao Shen; field of view 14.90 mm. Courtesy of Jinrui Dong.

Parisite in Quartz from Pakistan

The authors recently examined a smoky quartz specimen from Machi, Mardan District, Khyber Pakhtunkhwa, Pakistan, exhibiting spindle-shaped crystal inclusions (figure 10). These orange crystals were analyzed and identified as parisite-(Ce) ($Ca(Ce,La)_2(CO_3)_3F_2$) by Raman and electron probe microanalysis. The surfaces of the parisite crystals were coated with a thin layer of monazite-(Ce) containing minor calcium rare earth element fluorocarbonates. The associated black needle crystals were also analyzed by scanning electron microscopy with energy-dispersive spectroscopy and identified as riebeckite ($\square Na_2(Fe^{2+}_3Fe^{3+}_2)Si_8O_{22}(OH)_2$).

Although parisite inclusions have been found in quartz from Pakistan (Winter 2015 *G&G* Micro-World, pp. 443–444) and Colombia (E.J. Gübelin and J.I. Koivula, *Photoatlas of Inclusions in Gemstones, Volume 2*, Opinio Verlag, Basel, Switzerland, 2005, p. 621), this striking example is, to our knowledge, the first documented co-occurrence with riebeckite.

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Yinuo Wu, Qian Zhang, and Bahareh Shirdam
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Columbite "Croissant" in a French Sapphire

Dating back at least a century, gem-quality blue sapphire has been recovered from alluvial/placer deposits in the Puy-de-Dôme area, located in the Massif Central of France—the largest volcanic region in Europe (M.F. Gonnard, "Sur les gisements gemmifères du Velay et de la basse Auvergne, leur distribution géographique dans ces deux régions, et leurs rapports au point de vue des associations minérales qu'ils renferment," *Bulletin de la Société Française de Minéralogie*, Vol. 33, No. 3-4, 1910, pp. 152–161). Recently, several rough sapphires from this location were cut and examined by the authors. The sapphires revealed rich and diverse internal features, including numerous silk-like particles and various mineral inclusions. One specimen hosted a black crystal inclusion with an unusual curved croissant-like shape (figure 11). Under closer microscopic examination, the black color appeared dark red, viewed most clearly at the two termini.

Figure 11. A columbite mineral inclusion in a French sapphire exhibits an unusual curved croissant-like crystal shape under darkfield illumination. Photomicrograph by Jonathan Muyal; field of view 2.09 mm.



Raman microspectrometry identified the inclusion as columbite ($(Fe,Mn)(Nb,Ta)_2O_6$). Columbite-group minerals belong to the orthorhombic crystal system. While well-formed crystals typically exhibit a prismatic and rectangular shape, crystals that are uneven, thin, acicular, and reddish brown with curved faces have also been documented (A. Siachoque et al., "Occurrence and composition of columbite-(Fe) in the reduced A-type Desemborque Pluton, Graciosa Province (S-SE Brazil)," *Minerals*, Vol. 10, No. 5, 2020, article no. 411). In addition, columbite inclusions in basaltic sapphires have been reported by Gübelin and Koivula (*Photoatlas of Inclusions in Gemstones, Volume 1*, ABC Edition, Zurich, 1986, p. 359).

Nevertheless, the unusual curved inclusion makes this French sapphire a uniquely photogenic subject. Although basaltic sapphires are often underestimated, they can be as beautiful as their metamorphic counterparts—a quality that extends to their inclusion scenes as well.

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GIA, Carlsbad

Olena Rybnikova
Comenius University, Bratislava, Slovakia

Pierre-Yves Chatagnier
Tsara International, Baudemont, France

Columbite-Supergroup Minerals in Topaz

A recently examined transparent topaz, reportedly from Pakistan, hosted abundant dark mineral inclusions visible under low magnification. Microscopic examination revealed individual prismatic to lath-shaped crystals. In a few areas, several slender crystals occurred in close proximity with partial overlap, creating silhouettes reminiscent of birds in flight (figure 12). Some inclusions were accompanied by small feathers and localized stress features, consistent with the brittle nature and perfect cleavage of topaz.

Raman microspectrometry using 785 nm excitation on representative inclusions yielded spectra most consistent with wolframite-group minerals within the columbite supergroup. However, because Raman spectra among columbite-supergroup minerals can be similar and may not uniquely separate wolframite-group from columbite-group members, these inclusions are conservatively described as columbite-supergroup oxide minerals.

To further constrain composition, X-ray fluorescence screening was performed. Characteristic peaks attributable to manganese, iron, tungsten, and niobium were consistently observed. Expected tantalum peaks were also evaluated but remained below detection limits. This elemental signature is compatible with a columbite-supergroup oxide inclusion.

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

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



Figure 12. Multiple columbite-supergroup mineral crystals dispersed in topaz. Photomicrograph by Wingtak Lui; field of view 3.0 mm.



Figure 13. Measuring 17.74 mm and weighing 31.14 ct, this angular white block of quartz matrix rock is partially dusted with numerous tiny bright blue turquoise crystals. Photo by Annie Haynes.

Quarterly Crystal: Turquoise Crystals on Quartz

While turquoise is well known to gemologists and highly valued as a massive lapidary material, crystalline turquoise is extremely rare and was first recognized by geologists in 1909 at the Bishop copper prospect in Lynch Station, Campbell County, Virginia. The locality was rediscovered by collectors in 1941 but has since been largely forgotten.

Recently, we studied and photographed a 31.14 ct mineral specimen from the Bishop mine displaying turquoise crystals (figure 13). These euhedral triclinic crystals were situated on the quartz matrix in the form of tight clusters and single crystals (figure 14). Laser Raman microspectrometry confirmed the crystals as turquoise, and energy-dispersive X-ray fluorescence analysis revealed the dominant presence of copper.

This was our first opportunity to examine actual turquoise crystals, a form of turquoise rarely encountered by gemologists.

John I. Koivula and Nathan Renfro
GIA, Carlsbad

Figure 14. Under the microscope, the transparent to translucent triclinic turquoise crystals are sharp, lustrous, and very well formed. Photomicrograph by Nathan Renfro; field of view 4.61 mm.

