Imitation Rainbow Moonstone ASSEMBLAGE

The Carlsbad laboratory recently received for examination four semi-transparent to translucent cabochons with a white bodycolor (figure 1), ranging from 1.74 to 10.57 ct. These stones appeared similar to white plagioclase feldspar with multicolor iridescence, known in the trade as "rainbow moonstone" (Summer 1997 Gem News, pp. 144–145). However, a cursory examination proved they were distinctly different: assembled materials composed of a colorless, transparent base cemented to a fibrous white top and coated with a colorless plastic. The stones also displayed an unusual iridescence.

The colorless plastic coating had an RI of 1.55, but this was not useful in identifying the substrate components. The assembled stone fluoresced medium blue to long-wave UV and weak blue to short-wave UV. In polarized light, a bull's-eye optic figure was resolved in the colorless base material, confirming rock crystal quartz; small fluid inclusions and reflective particles in the bottom sections indicated natural origin. Raman spectroscopy conclusively identified the fibrous top as gypsum.

Microscopic examination revealed an iridescent coating on the quartz section, much like that used on "Aqua Aura" quartz (Fall 1990 Gem News, pp. 234–235). Closer inspection revealed that the iridescent coating was located on the quartz in the join. The colorless plastic coating contained numerous gas bubbles and was easily deformable with a pointer probe. This plastic layer was apparently added to give a vitreous luster to the otherwise dull, waxy gypsum. Gas bubbles in the colorless cement layer made it quite easy to recognize these stones as assemblages.

Figure 1. These assembled cabochons (1.74–10.57 ct) with multicolor iridescence are a skillful imitation of rainbow moonstone. They are composed of a natural rock crystal quartz base with an iridescent coating cemented to a gypsum top, and the entire assemblage is coated in colorless plastic.

When viewed face-up, the assemblages made an attractive imitation of rainbow moonstone due to their white bodycolor, milky appearance, and rainbow iridescence. This is the second time the Carlsbad laboratory has examined an assemblage containing plastic-coated gypsum (Fall 2012 Lab Notes, pp. 210–211). Coupling a luster-enhancing coating with an iridescent layer created an interesting imitation rainbow moonstone from two common materials.

Amy Cooper, Nathan Renfro, and Tara Allen

An Enormous South Sea CULTURED PEARL Filled with Cultured Pearls

Known for their size, South Sea cultured pearls can attain a diameter of 20 mm or more. A massive baroque white South Sea cultured pearl weighing 49.55 ct and measuring 27.12 × 23.23 × 21.67 mm (figure 2) was recently submitted to the New York laboratory for identification. Besides its remarkable size, we noted a small corner section

Figure 2. The large 49.55 ct South Sea cultured pearl (left) is shown alongside a typical 13 mm South Sea cultured pearl.

Editors' note: All items were written by staff members of GIA laboratories.

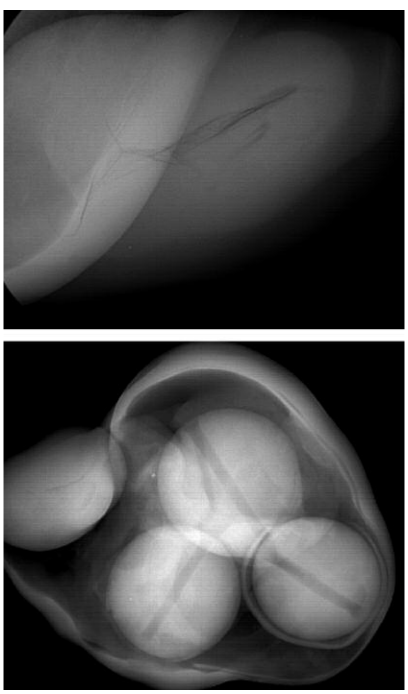
GEMS & GEMOLOGY, Vol. 49, No. 3, pp. 172–177, http://dx.doi.org/10.5741/GEMS.49.3.172.

Figure 3. A small pearl was plugged into this opening in the baroque pearl.

with a circular gap highlighted by a yellowish glue-like material (figure 3). This feature suggested that a smaller pearl with similar color and luster had been used to fill an opening in the baroque cultured pearl.

Microradiography revealed that this smaller pearl was a nonbead-cultured pearl with an irregular linear dark central growth feature (figure 4, top). Both pearls originated from a saltwater environment, according to energy dispersive X-ray fluorescence (EDXRF) spectroscopy. Surprisingly, microradiography revealed three additional bead-cultured pearls within the large baroque specimen (figure 4, bottom). These three cultured pearls showed their own distinct bead demarcations and had all been drilled through. The large void was filled with an unknown substance that prevented the three pearls from moving around.

Figure 4. The baroque pearl's internal structure suggested a nonbead cultured pearl (top). X-radiography showed that three bead cultured pearls were used to fill the void (bottom).



Although we occasionally see filled or plugged pearls (see D. Hargett, "Unusually large worked and plugged cultured pearl," Winter 1991 Lab Notes, p. 251), this was the first time we had encountered a South Sea cultured pearl filled with multiple bead-cultured pearls. We believe this enormous pearl was originally cultured with a single bead nucleus, but that somehow the bead emerged through an opening. To maintain the specimen's weight and durability, the three bead-cultured pearls were used to fill the void and the opening was plugged with a smaller nonbead-cultured pearl.

Surjit Dillon Wong and Joyce WingYan Ho

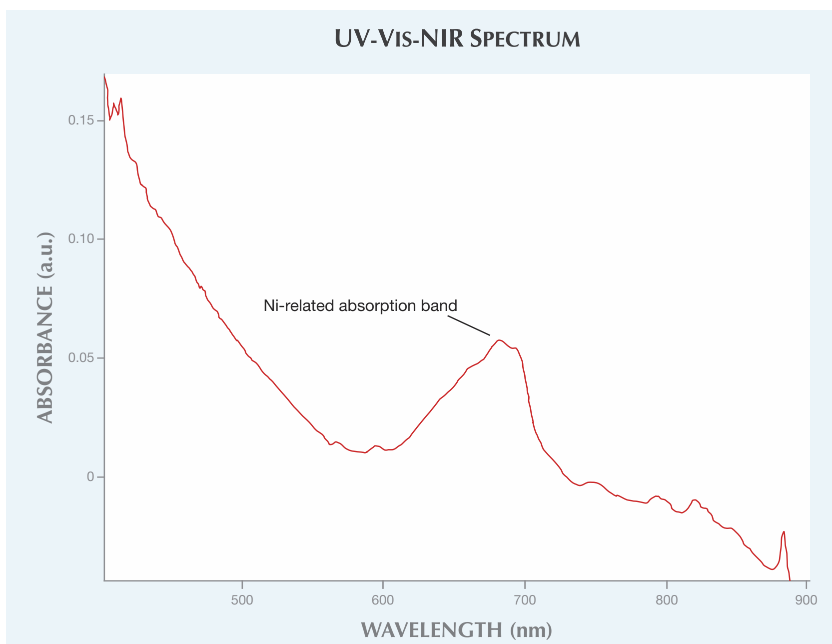
Figure 5. This 2.54 ct Fancy Light greenish yellow diamond showed a high quantity of nickel, believed to be related to its fancy color saturation.

DIAMOND

With High Concentration of Nickel

A 2.54 ct cushion-cut diamond (figure 5) was color graded as Fancy Light greenish yellow. Its UV-Vis-NIR spectrum showed a large absorbance caused by nickel-related defects (figure 6). It is unusual for a diamond to be solely colored by nickel, and more so for the diamond to be graded in the

Figure 6. This UV-Vis-NIR spectrum shows an unusually large absorption band related to nickel defects in diamond.



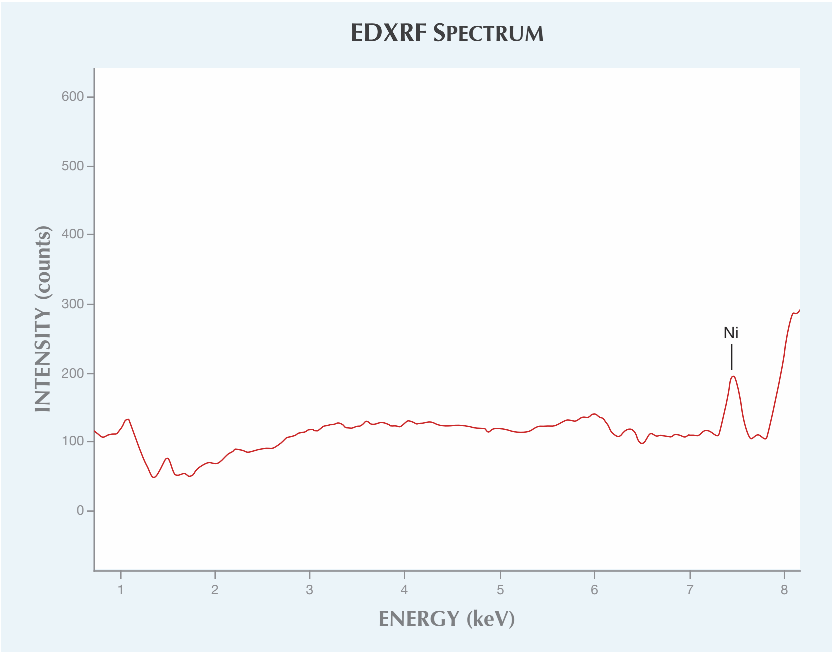


Figure 7. The greenish yellow diamond's EDXRF spectrum shows a clear peak at 7.5 keV, a characteristic peak of nickel.

fancy color range. Such diamonds have been previously reported (W. Wang et al., "Natural type Ia diamond with green-yellow color due to Ni-related defects," Fall 2007 *G&G*, pp. 240–243), but this was the first time energy-dispersive X-ray fluorescence (EDXRF) spectroscopy has been run to detect the presence of nickel. As seen on the XRF spectrum (figure 7), the nickel content was high enough to be detected. This is likely related to the diamond's fancy color saturation.

In addition to its unusual color origin, the diamond contained a mineral inclusion with a color-change effect. It appeared purple under the incandescent well light of a gemological microscope and dark blue under the fluorescent overhead light on the same microscope. We suspected the inclusion was a color-change garnet, and this was confirmed using Raman spectroscopy. The stone also contained a small cloud of oriented reflective inclusions associated with type IaA diamonds, consistent with this sample's diamond type. The diamond showed weak green transmission, which was unusual because it had no defects commonly associated with green transmission (i.e., the H3 feature). Whether the transmission is related to the nickel content is not known.

Troy Ardon

Unusual Laser Manufacturing Remnant

It is common to see laser manufacturing remnants on diamonds, especially stones in blocked form where the cut is not finished. Cutters may use lasers to show where to cut, which features to remove, or the desired shape. The remnants usually appear as straight or sinusoidal lines along the areas to be cut or removed.

Figure 8. The 0.9 mm diameter laser manufacturing remnant on this diamond showed an interesting pattern.

A 3.59 ct Fancy Light brownish greenish yellow diamond recently submitted to the Carlsbad laboratory for examination displayed an unusual laser feature.

The table of the blocked heart shape showed a laser remnant with an interesting pattern that resembled a watch face (figure 8). Unlike the typically linear remnants, this feature was circular and located directly on the table. The cutter's intentions for placing the 0.9 mm diameter circle on the table are unclear, but it makes for a striking pattern rarely seen on diamonds, especially finished stones.

Tara Allen

Purple JADEITE Rock

The Carlsbad laboratory recently took in a semi-translucent mottled purple bead for identification. Under microscopic examination, the material displayed an aggregate structure composed of fibrous lavender grains with a brownish white component (figure 9). Reddish orange minerals and small needle-like brown crystals were also observed. A spot RI reading of 1.55 was obtained on most of the stone, with a few places giving a reading of 1.66. The bead had a hydrostatic SG of 2.99 and was inert to both long- and short-wave UV radiation.

Basic gemological testing was inconclusive, but Raman spectroscopy performed on the various components of the stone confirmed the lavender and white portions were a mixture of

Figure 9. This 13.60 mm mottled purple bead consists primarily of jadeite and quartz.

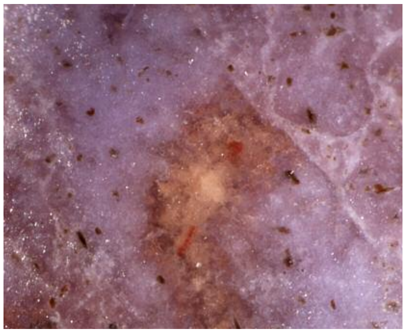


Figure 10. Upon closer examination, the jadeite rock also contains reddish orange cinnabar and brown aegerine crystals. Magnified 30×.

jadeite and quartz, while the reddish orange portions were cinnabar. Additional spots on the scattered needle-like inclusions matched aegerine, a sodic-ferric clinopyroxene (figure 10). In addition to Raman testing, an infrared (FTIR) spectrum was collected to confirm the stone was not polymer-impregnated (E. Fritsch et al., "Identification of bleached and polymer-impregnated jadeite," Fall 1992 *G&G*, pp. 176–187; Spring 1994 Lab Notes, p. 43).

Purple rock containing jadeite and quartz has been reported in the Bursa region of western Turkey (M. Hatipoğlu et al., "Gem-quality Turkish purple jade: Geological and mineralogical characteristics," *Journal of African Earth Sciences*, Vol. 63, 2012, pp. 48–61). To date, the composition of this material is unique to the area. It occurs as a metamorphic product in the contact zone between a large blueschist belt and a granodiorite stock. While neither mercury nor cinnabar (a mercury sulfide) is mentioned in the literature on purple jadeite rock, mercury mining in western Turkey has been reported (M. Yildiz and E.H. Bailey, "Mercury deposits in Turkey," *U.S. Geological Survey Bulletin 1456*, 1978).

The presence of mercury deposits in the region makes it highly likely that cinnabar or other mercury-bearing minerals would occur in the purple jadeite rock, consistent with a Turkish origin, though the origin of this sample has not been confirmed. Because jadeite and aegerine are both sodic pyroxenes, their occurrence together is understandable.

Purplish jadeite rock is being used in the jewelry trade and fashioned into beads, cabochons, and carvings.

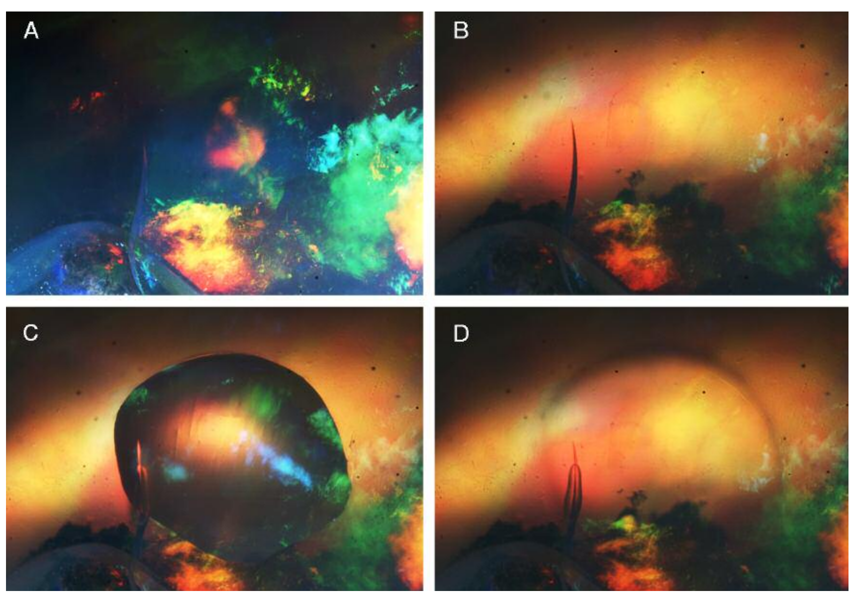
Amy Cooper and Tara Allen

A Useful Technique to Confirm the Hydrophane Nature of OPAL

With the emergence of opal production in Wollo, Ethiopia, the supply of hydrophane opal has increased significantly. This deposit offers beautiful material at a fraction of the price of similar-looking opal from several other sources, including Australia and Brazil. However, most of the opal from Wollo is hydrophane, which simply means it is porous enough to readily absorb water, much like a sponge. This property can occasionally cause durability issues that may lead to significant cracking, depending on the porosity of the material and how included it is. In general, it is difficult to predict if this material will crack when immersed, but the potential is certainly higher in hydrophane opal than in nonporous material. In hydrophane opal with a bodycolor other than white, there is the distinct possibility of artificial coloration, since stones that absorb water also absorb dye (N. Renfro and S.F. McClure, "Dyed purple hydrophane opal," Winter 2011 *G&G*, pp. 260–270). While this ability to absorb water is not proof of dye, it calls for extra caution when examining an opal for color modification, especially if it has a bodycolor that can exist naturally, such as orange.

With white or colorless opals, checking for dye is not necessary, but the gemologist may find it valuable to determine if they are hydrophane so the client can be warned to avoid immersing them in liquid. Micro inclusions often present in these stones are sometimes the source of minute internal cracks. When these opals are saturated with water, the cracks often enlarge due to the strain and propagate through the entire stone. In these cases,

Figure 11. This Ethiopian hydrophane opal with a small crack was examined at 15× magnification in reflected light (A). The lighting environment has been changed to direct transmitted light or brightfield illumination by opening the baffle in the microscope well (B). A drop of water placed on the surface (C) and absorbed by the stone creates an optical aberration (D) that confirms the opal's hydrophane nature. Note that the water has also produced a more pronounced optical aberration in the crack.



the only option is to recut several small stones from the broken fragments.

To safely determine if an opal is hydrophane and avoid further propagation of existing cracks (figure 11), the stone should be examined using a standard gemological microscope and direct transmitted light (with the microscope in brightfield mode). Simply place a single drop of water on the surface and observe how the water drop interacts with the opal. After a few seconds of allowing the water to either evaporate or soak into the stone, reexamine the appearance. If the water is absorbed into the stone, that area's refractive index will be slightly different, creating an optical aberration where the drop is placed and confirming that the stone is hydrophane. This method poses less risk of breakage than complete immersion.

Nathan Renfro

Green SAPPHIRE Filled with Glass

In recent years, one of the most problematic gem treatments has been the filling of ruby with lead glass, due to its unstable nature. In 2007, a new application for lead glass treatment in corundum began to appear in the market: sapphire filled with cobalt-colored lead glass (T. Leeawatanasuk et al., "Cobalt-doped glass-filled sapphire; an update," *The Australian Gemmologist*, Vol. 25, No. 1, 2013, pp. 14–20).

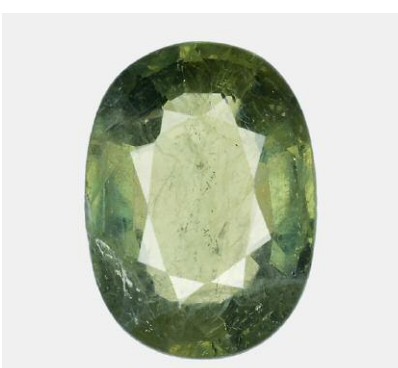


Figure 12. This 1.83 ct specimen proved to be a manufactured product consisting of lead glass and natural green sapphire.

Figure 13. Flattened gas bubbles and a blue flash effect suggest that this stone contains significant amounts of lead glass, which was confirmed by EDXRF spectroscopy. Field of view 1.57 mm.

Recently examined at the Carlsbad laboratory was a particularly unusual 1.83 ct green sapphire (figure 12) that proved to be filled with a significant amount of lead glass.

Standard gemological testing gave an RI of 1.762–1.770, a hydrostatic SG of 4.00, a prominent absorption band at 450 nm, and inert reaction to long- and short-wave UV. These properties are consistent with natural corundum. Microscopic examination, however, revealed numerous low-relief cracks throughout the stone that showed a prominent blue flash effect, as well as several flattened gas bubbles trapped within the filler (figure 13). Also observed were reflective rutile needles.

To determine if a leaded glass was used to hide the cracks in the corundum, we applied EDXRF spectroscopy, which confirmed the presence of lead. UV-visible spectroscopy was used to explore whether the color was intrinsic to the corundum (as in glass-filled ruby) or intrinsic to the filler glass (as in sapphire filled with a lead glass colored by cobalt). The UV-Vis spectrum revealed a prominent 450 nm series related to Fe^{3+} pairs responsible for the yellow component of the green color, which was consistent with the overall green bodycolor of the stone. The blue component was observed as diffuse planar color zoning unrelated to the network of fractures. This combination of natural yellow and blue components produced the overall green bodycolor.

This was the first lead glass–filled green sapphire examined at the Carlsbad laboratory. On a GIA identification report, this would be called a "manufactured product."

Phil York

Large Pinkish Brown CVD SYNTHETIC DIAMOND

Distinguishing diamonds of natural and synthetic origin is one of the most important tasks of any gemological laboratory. With the advances in technology and methodology available to manufacturers, a wider variety of synthetic diamonds has begun to emerge. Recently, a client submitted a 1.03 ct emerald-cut synthetic diamond (figure 14) to the Carlsbad laboratory. We determined it had been grown from the chemical vapor deposition (CVD) process. This was evident from the large silicon-vacancy peak at 737 nm seen in both the UV-visible and photoluminescence spectra of this type IIa synthetic diamond. A lack of tatami strain and the distinctive growth patterns observed in the DiamondView (see W. Wang et al., "Latest-generation CVD-grown synthetic diamonds from Apollo Diamond Inc." Winter 2007 *G&G*, pp. 294–312) confirmed the origin (figures 15 and 16).

As the vast majority of CVD synthetic diamonds submitted to the lab weigh less than one carat, this sample was unusual for its size, as well as its

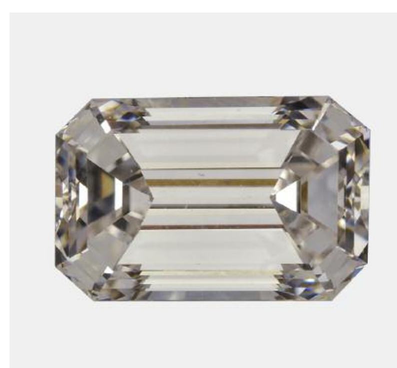


Figure 14. This 1.03 ct CVD synthetic is notable for its size and Faint pinkish brown color.

Figure 15. Viewed under crossed polarizers, this synthetic diamond shows mottled strain, but no tatami strain, consistent with its CVD growth origin.

Figure 17. A few of the natural, untreated turquoise beads in this necklace display a fingerprint pattern.

color grade of Faint pinkish brown. This is the first colored CVD synthetic diamond examined by GIA that did not merit a "Fancy" modifier, but instead fell in the Faint to Light range. While pink CVD-grown synthetics have been documented, in most cases the color was generated by post-growth treatment. Here the pinkish color seemed solely related to the growth process, with no subsequent treatments (HPHT annealing, irradiation, and then annealing) coming into play.

Troy Ardon and Sally Eaton-Magaña

TURQUOISE with Fingerprint Pattern

The Carlsbad laboratory recently identified a natural, untreated turquoise bead necklace with an interesting feature. The bluish green beads displayed a natural turquoise structure with thin black matrix veining (figure 17). During microscopic examination, a few of the beads showed a less-saturated greenish discoloration pattern resembling fingerprints. The bead selected for testing had a spot RI of about 1.60 and fluoresced weak bluish green under long-wave UV, with no short-wave fluorescence. To rule out polymer impregnation treatment, we collected an infrared (FTIR) spectrum. It showed no peaks in the polymer regions, ruling out polymer-impregnated turquoise (K.S. Moe et al., "Polymer-impregnated turquoise," Summer 2007 *G&G*, pp. 149–151). The unusual pattern may have been the result of glue or another contaminant present during the initial handling or drilling of the beads, preserving actual human fingerprints. With time and wear, the discoloration of the beads made the fingerprints more distinct (figure 18).

Untreated turquoise is porous and often absorbs skin oils and other contaminants, making the color more greenish. As a result, turquoise is commonly treated to enhance its appearance and protect it from discoloration. Most of the product on the market, especially lower-quality material, has been wax- or polymer-impregnated to improve its durability (S.F. McClure et al., "Gemstone enhancement and its detection in the 2000s," Fall 2010 *G&G*, pp. 218–240).

This interesting piece serves as a useful example of why turquoise is routinely treated. Simply handling it can affect the color and appearance over time, as illustrated by the fingerprint pattern preserved in this piece.

Tara Allen and Amy Cooper

Figure 16. DiamondView imaging remains one of the most reliable methods for confirming a CVD synthetic diamond. This image shows distinctive growth patterns.

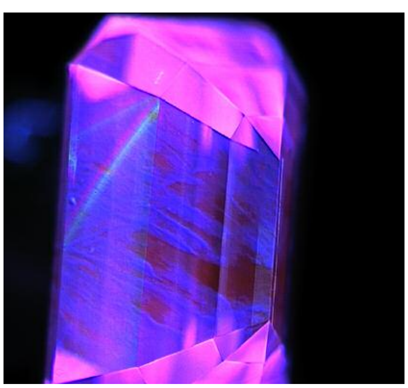


Figure 18. The light area shows a discoloration in the form of a fingerprint pattern.

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