Gem News International

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TUCSON 2020

In early February, despite the early phase of the COVID-19 outbreak, the Tucson shows were well attended and sales were brisk. Several vendors indicated that they had their biggest single day of sales ever this year (figure 1). This anecdotal evidence was supported by the strong demand for identification and origin services reported by the GIA Show Service Lab. This year, it was hard to identify any one particular item leading demand or any game-changing new gem material finds. Instead, we found that vendors were carrying high-quality material in terms of color, clarity, and cut. In fact, many were carrying items that had been meticulously carved, fantasy-cut, or recut for ideal proportions (figure 2).

Surpassing its strong momentum from the past few years, teal blue sapphire from Montana was a prominent and well sought-after item (figure 3). Sapphire was doing very well at the shows, including parti-colored, fancy-colored (electric colors such as fuchsia and pinks as well as pastels such as lavender), and slabs displaying zoning or trapiche-like patterning (figure 4).

Emerald from around the world could be found, including some untreated smaller sizes from Russia (figure 5), melee and small-sized finished stones from Pakistan, attractive material from Ethiopia, and an abundance of material in a wide variety of color, clarity, and size from Colombia, Brazil, and Zambia.

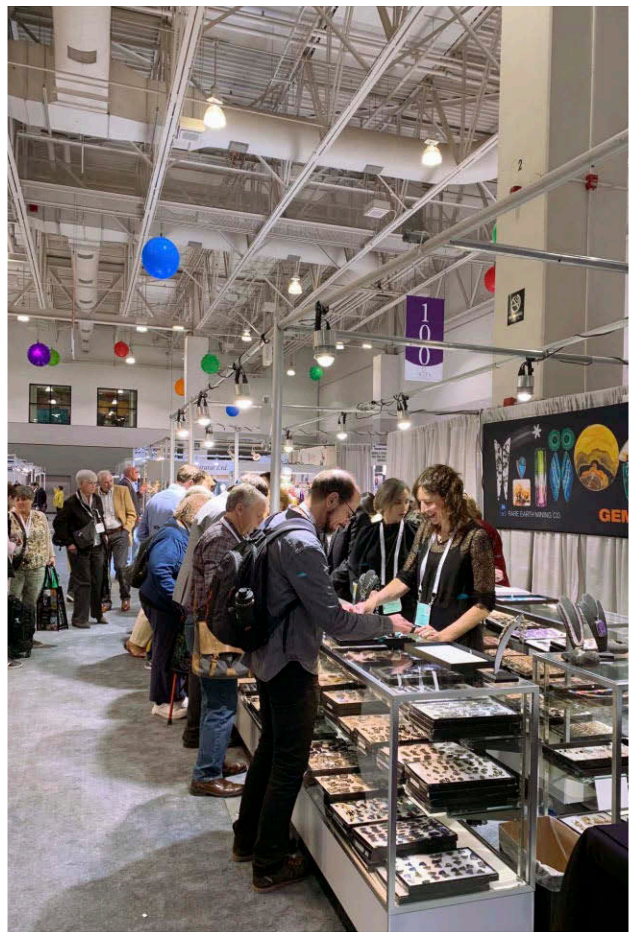

Figure 1. A busy booth on the first day of the AGTA show. Photo by Tao Hsu.

Editors' note: Interested contributors should send information and illustrations to Stuart Overlin at soverlin@gia.edu or GIA, The Robert Mouawad Campus, 5345 Armada Drive, Carlsbad, CA 92008.

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Outstanding brilliant green garnets in both demantoid and tsavorite varieties were available, including several larger-sized, ideally colored Russian demantoids (figure 6).

Figure 2. A 72 ct gem silica carving by Nick Alexander showing a highly desirable intense shade of blue. The material is from the Ray mine in Arizona. Photo by Kevin Schumacher; courtesy of Nick Alexander.

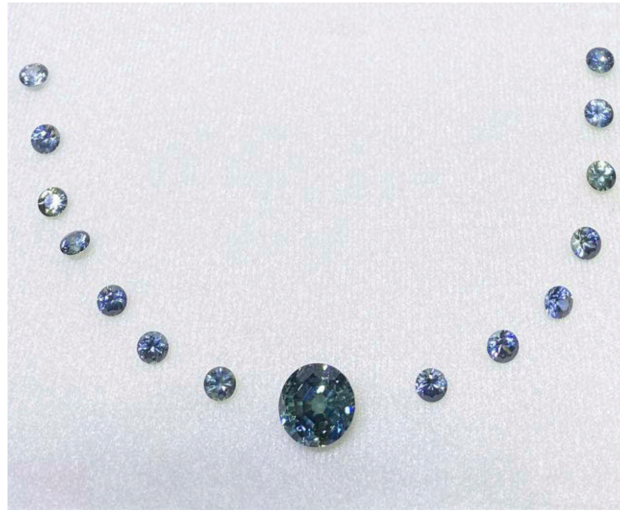


Figure 3. A suite of the popular teal blue Montana sapphires from Rock Creek. The center stone is 11.03 ct, and the other 14 stones total 8.38 carats. Photo by Jennifer Stone-Sundberg; courtesy of Pala International.

As "Classic Blue" is the Pantone color of the year and varieties of blue gemstones are very popular in general, gems prominently displaying a blue hue could be found throughout the shows. Along with sapphire, deep blue aquamarine from Nigeria (figure 7) was particularly popular, and many vendors displayed blue zircon, gem silica (again, see figure 2), apatite, cobalt spinel, blue topaz, haüyne, turquoise, blue moonstone, and lapis in their cases.

Electric-colored accent stones and melee in materials such as sapphire, spinel, apatite, and garnet varieties tsavorite and demantoid were easy to find both loose and in finished pieces (figure 8).

As has been the case for the past couple of years, gem slices in a variety of materials, shapes, and price points were very popular in both the AGTA and GJX shows. These are attractive to many designers, whether they are

Figure 4. Left: This set of 110 Australian sapphire "fancies" in 3 mm sizes was collected over several years. Right: A pair of trapiche-like Australian sapphire slices. Photos by Jennifer Stone-Sundberg; courtesy of Terry Coldham.

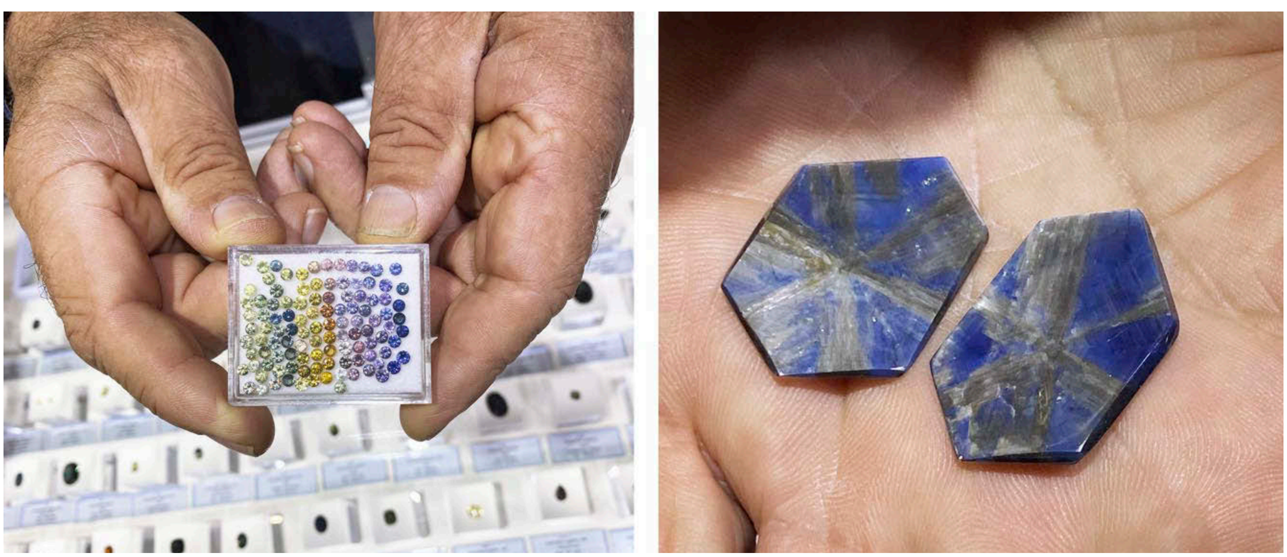


Figure 5. A 0.33 ct emerald from Malysheva, Russia, offered by Dudley Blauwet at the AGTA show. Photo by Kevin Schumacher.

Figure 7. Deep blue aquamarine from Nasarawa, Nigeria (left to right: 1.94, 2.84, and 1.84 ct). Photo by Emily Lane; courtesy of Jeff Hapeman.

working with higher-price-point material such as parti-colored sapphire (figure 9), diamond, and trapiche emerald, or more moderately priced material including amethyst, rhodochrosite, and petrified wood.

As always, Tucson was the place to find the unusual and phenomenal, with several vendors carrying exotic gem materials such as fluorescent hyalite opal (figure 10), star peridot, brilliant green fluorite (figure 11, left), hackmanite, triphylite, grandidierite, axinite, and an array of bicolor stones in materials such as garnet, chrysoberyl (figure 11, right), tanzanite, and sphene.

Figure 6. A 6.73 ct round brilliant Russian demantoid of top quality showing a horsetail inclusion. Photo © Christian Wild.

Figure 8. Sea star pendant by Paula Crevoshay featuring 4.04 carats of ruby, 5.06 carats of lavender sapphire, 9.40 carats of purple sapphire, 3.87 carats of fuchsia sapphire, 6.79 carats of crystal spinel, and 0.43 carats of amethyst, set in 18K yellow gold. Photo by Emily Lane; courtesy of Paula Crevoshay.

Figure 9. Parti-colored sapphire slices from Montana (left) and Australia (right). Photos by Jennifer Stone-Sundberg; courtesy of Warren Boyd (left) and Terry Coldham (right).

2020 also marked the first Tucson edition of the Ethical Gem Fair. The exhibitors showed a wide range of gemstones, prices, and origins. They were all united in their commitment to responsible sourcing, traceability, transparency, and social awareness. The variety of exhibitors reflected the different approaches taken to address these diverse challenges around the world. During its inaugural Tucson show, the Ethical Gem Fair mainly attracted young independent jewelry designers looking for gems with a transparent chain of custody from the mine to their use in finished jewelry.

Duncan Pay, Jennifer Stone-Sundberg, Tao Hsu, Wim Vertriest, Aaron Palke, and Nathan Renfro

Burmese star peridot. Asterism in peridot is a rare treat that has been reported on occasionally (S. Borg, "An unusual star peridot," *Journal of Gemmology*, Vol. 17, No. 1, 1980, pp. 1–4; Summer 2009 Lab Notes, pp. 138–139). In

Figure 10. Fluorescent hyalite opal flower pendant by Loretta Castoro, photographed in daylight-equivalent (left) and lower-power daylight-equivalent light with added short-wave UV light (right). The 12.63 ct fluorescent opal is from Zacatecas, Mexico. It is set in 18K yellow gold and has 48 yellow diamond accents (1.14 carats total) and 72 white diamond accents (1.27 carats total). Photos by Robert Weldon; courtesy of Loretta Castoro.

January 2020, Tom Trozzo submitted to Stone Group Laboratories a 20.13 ct oval cabochon peridot (figure 12, left) that exhibited a soft yet prominent four-rayed star. Comparisons were made with an in-house lab sample that also exhibited reflection effects from tiny acicular inclusions. For purposes of this study, this comparison stone was recut to a 7.67 ct pear-shaped cabochon (figure 12, right) to enhance any potential asterism. However, the result appeared to be more of a cat's-eye effect, presumably due to the

Figure 11. An extremely diverse selection of unusual stones was on display at the GJX show. Left: Bright green fluorite offered by a European vendor; photo by Tao Hsu. Right: Bicolor chrysoberyl carried by United Colour Stone Co. from Bangkok; photo by Jennifer Stone-Sundberg.

Figure 12. The 20.13 ct star peridot (left) and the 7.67 ct peridot exhibiting weak asterism with more prominent chatoyancy (right), presumably due to cutting style. Photos by Bear Williams.

Figure 14. A top-quality 9.49 ct Russian demantoid from the Korkodin mine. The horsetail inclusion under the table is the telltale signature of its origin. Photo by Kevin Schumacher; courtesy of Tsarina Jewels.

prominent keel from the original faceted pear shape. It is presumed that, based on the arrangement and concentration of inclusions, a more prominent asterism will be revealed upon further cutting. Apparent clarity was good on both stones, but with a slightly diffused effect; no large eye-visible inclusions were present. While the asterism was more pronounced on the oval, the acicular inclusions were more plentiful and of higher relief in the pear-shaped stone. Both stones had a yellowish green color, with the oval exhibiting a very slight grayish modifier.

Microscopic observation of the larger oval peridot revealed evenly distributed concentrations of extremely fine, short, brownish, acicular inclusions oriented in two directions (figure 13, left). In the pear shape, the needles were evenly dispersed throughout and oriented in three directions. The needles were also short and whitish to colorless (figure 13, right). Reflection effects in some materials may be difficult to define. There may be reflection effects from nonacicular inclusions, creating schiller as well as asterism. This was the case with the oval peridot, although asterism was clearly the dominant phenomenon.

The spot RI reading of approximately 1.65 and hydrostatic SG of 3.33 were consistent with peridot. The identification of both peridots was confirmed by GemmoRaman532-SG. Their provenance was reportedly Myanmar (Burma), and all tests were consistent with a Burmese origin. Interestingly, all known star peridots to date have been of Burmese origin. Although Pakistani peridot may often feature acicular inclusions of ludwigite, these are presumably protogenetic and not oriented consistently to the crystal structure of the host peridot.

Bear Williams and Cara Williams
Stone Group Labs
Jefferson City, Missouri

Large and fine demantoid from Russia. The green to yellowish green variety of andradite garnet was first found in the Ural Mountains. It was identified by Finnish mineralogist Nils von Nordensheld in 1864 and presented at the Ural Industrial Exhibition as a new mineral in 1887. Due to the garnet's high RI and dispersion, it was named demantoid, meaning "diamond-like."

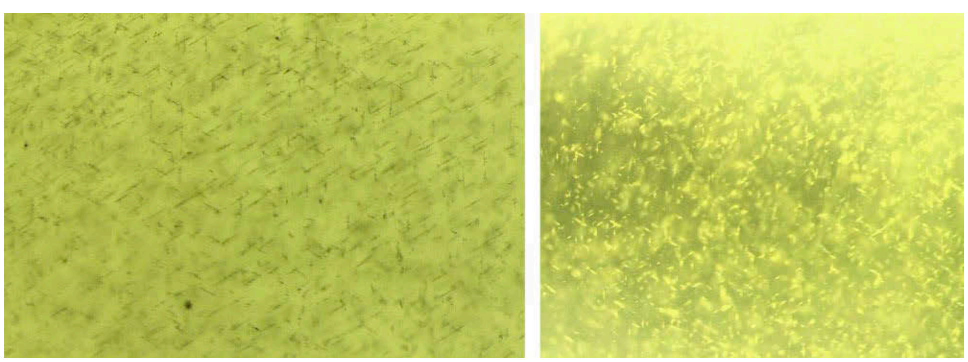


Figure 13. Brownish, acicular inclusions in the 20.13 ct star peridot (left, field of view 4 mm). Short, feathery, whitish needle-like inclusions in the 7.67 ct pear-shaped peridot (right, field of view 3.5 mm). Photomicrographs by Bear Williams.

Figure 15. The Korkodin demantoid mine is an open-pit operation. Trucks transport the ore from the bottom of the pit to the nearby washing plant. Photo by Tao Hsu.

Russia remained the only source for demantoid until the mid-1990s, when the gem was discovered in Africa and later elsewhere. Today, Russian demantoid is still highly desired. At the GJX show, the authors saw an 8.49 ct fine-quality demantoid (figure 14) carried by Tsarina Jewels, the largest demantoid seen by the authors at this year's Tucson shows. It was from the Korkodin mine, located about 80 km south of Ekaterinburg, one of the two active mining operations in this area (figure 15). The Poldnevaya mine lies about 7 km to the north of Korkodin. Both operations are working on primary demantoid deposits with machinery. Together the two mines supply the majority of Russian demantoid.

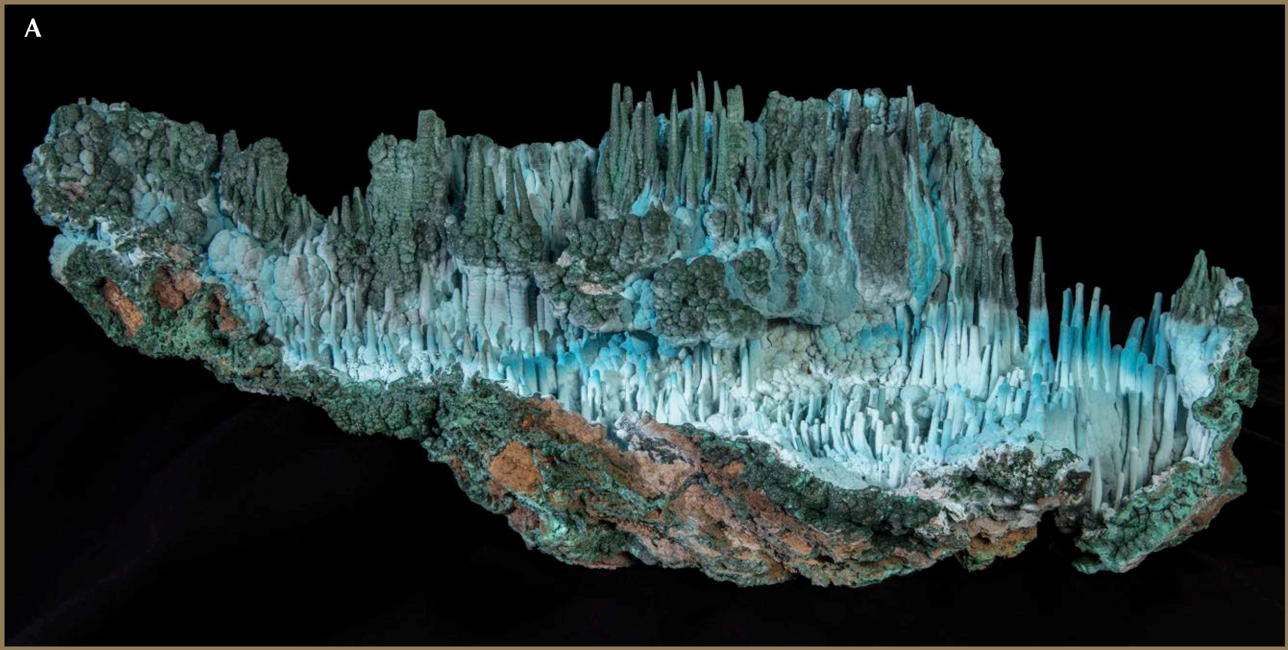
Another impressive Russian demantoid was a 6.73 ct stone carried by Constantin Wild at the GJX show. This stone was also of top quality, showing high brilliance and fire. The owner informed the authors that the stone was cut from rough obtained in 2019 and possessed the best color he had seen in this material in decades (see figure 6 on p. 158).

Since Russian demantoid often occurs as small grains with no well-developed crystal forms in the matrix (figure 16), any finished stone above one carat is considered rare.

Illustrating the attention being given to this material, the 2019 AGTA Spectrum Award winner under the classical category featured a perfectly matched suite of 15 standard round brilliant cut Russian demantoid garnets. The bracelet by Jeffrey Bilgore included a 3.00 ct center Russian demantoid accented with 14 smaller Russian demantoids gradually decreasing in size (12.20 carats total) and 14 step-

Figure 16. Demantoid generally occurs as very small grains in the host rock (left). It is very difficult to find large size rough (right) of quality. This makes faceted stones over 1 ct very rare. Left photo by Tao Hsu; right photo courtesy of Constantin Wild.

2020 Tucson Photo Gallery



A: "Atlantis," a malachite and chrysocolla specimen from the Democratic Republic of the Congo measuring 70 × 25 cm. B: Lightning Ridge black opal and diamond ring, courtesy of The Gem Garden. C: Jellyfish design by Loretta Castoro displaying fluorescence, featuring a 49.37 ct moonstone and a Mexican hyalite opal. D: 5.74 ct cushion-cut spinel from Vietnam, shown in daylight and incandescent lighting, courtesy of Bryan Lichtenstein.

Photos by Robert Weldon (A, C, D), Emily Lane (B, E–H, J), and Kevin Schumacher (I).

E

F

G

H

I

J

E: Bulgari multi-colored sapphire and diamond necklace with 36 sapphires totaling 72.29 carats, courtesy of M. Kantor & Associates. F: South Sea cultured pearl necklace, courtesy of Tara & Sons, Inc. G: Jadeite earrings, 16.77 carats total, courtesy of Jye's International. H: Paula Crevoshay brown-eyed Susan brooch featuring an orange Montana sapphire with multi-colored sapphires and diamonds. I: 7.35 ct Fantasy-cut heliodor carving by Nick Alexander. J: 1940s diamond and sapphire link bracelet by Oscar Heyman with 27 carats of blue sapphire, courtesy of M. Kantor & Associates.

Figure 17. Russian demantoid garnet and diamond bracelet set in platinum. The center stone is 3.00 ct, while the accent garnets total 12.20 carats and the accent diamonds 4.18 carats. Photos courtesy of Jeffrey Bilgore.

cut (4.18 carats total) diamonds all set in platinum (figure 17). Mr. Bilgore said he considers Russian demantoid to be on par with top gems such as Kashmir sapphire, Burmese ruby, and Colombian emerald. The suite came from the estate of a collector and attracted much attention from gem dealers familiar with Russian demantoids before ultimately being used in this award-winning piece of jewelry.

Tao Hsu, Jennifer Stone-Sundberg, and Aaron Palke
GIA, Carlsbad

Russian emerald. On the long list of emerald-producing countries, Russia is one of the more mysterious to the trade and consumers. Emerald was found in the Ural Mountains in the early nineteenth century. Malysheva was the most famous of these deposits and the world's largest emerald producer at the start of World War I. During the Soviet era, this deposit was nationalized and mined for beryllium instead of emerald. Today, underground mining is going strong and actively producing emeralds (figure 18).

Figure 18. The Malysheva emerald mine outside of Ekaterinburg, Russia. The giant open pit was originally mined for emerald and then beryllium. Now the mine operation is underground below the processing facility (the green building on the other side of the pit). Photo by Tao Hsu.

Figure 19. A collection of Russian emerald offered by Dudley Blauwet Gems. These stones range from about 0.1 to 3 ct. Photo by Tao Hsu.

At this year's show, the authors found two exhibitors with Russian emerald ranging in quality from commercial to fine without any treatment. Dudley Blauwet Gems offered Russian emeralds from 0.1 to about 3 ct at the AGTA show. The light to slightly dark green stones were offered as singles, pairs, and sets (see figure 19 and figure 5 on p. 158). Worth noting is that most of the Russian stones the authors saw showed bright colors and high clarity.

At the GJX show, Tsarina Jewels offered Russian emeralds of larger sizes and fine quality. This exhibitor carried stones as large as 8 ct or more (figure 20). These stones also displayed a wide range of various shades of green colors.

Figure 20. A selection of fine Russian emerald from Tsarina Jewels ranging from 1.27 to 8.38 ct. All stones are natural with no filling. Photo by Kevin Schumacher.

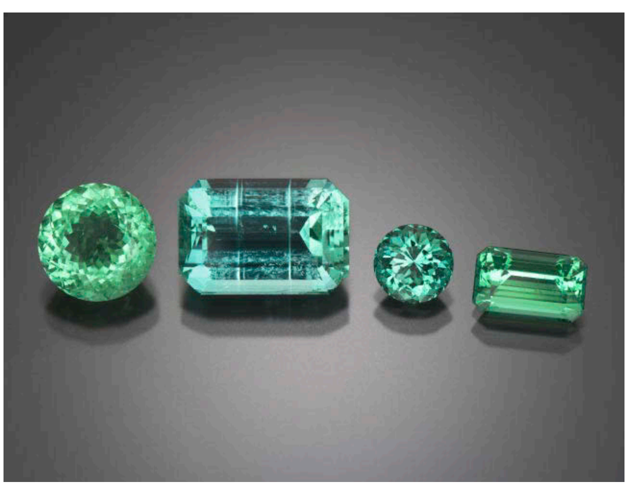


Figure 21. This bead strand is from Pakistan (9 mm beads), while the bead bracelet is from Siberia (20 mm beads). Green nephrite from Pakistan has a very similar appearance to material from British Columbia. The Siberian beads are much brighter. Photo by Kevin Schumacher.

The authors noticed that Russian emeralds are still quite rare to find on the market, while emeralds from Colombia and Zambia dominate the market.

Tao Hsu and Jennifer Stone-Sundberg

Nephrite jade from multiple sources. Green nephrite deposits are found at many locations around the globe, with British Columbia, Siberia, and northwestern China as the leading producers. Old and still active subduction zones with ophiolite have the potential to produce green nephrite. This is because green nephrite bodies are closely associated with their serpentinite host rocks, part of the ophiolite exposed on land when an ocean basin closes. All major green nephrite deposits cluster in this type of convergent-margin environment.

At the 2020 GJX show, Nikki Makepeace from Jade West in British Columbia showed the authors nephrite pieces from Pakistan, an emerging green nephrite source. The green to dark green appearance and the quality of these pieces (such as the bead strand in figure 21) are very similar to the production from British Columbia. In comparison, green nephrite from Siberia shows brighter colors (the bracelet in figure 21 and the pendant in figure 22). Ms.

Figure 22. High-quality nephrite from Siberia can sometimes show a color similar to that of green jadeite. Photo by Tao Hsu.

Makepeace informed the authors that the production from Pakistan is quite substantial.

The earliest report on Pakistan nephrite was published in 1963, with the positive identification of two pebbles collected in 1955 in the riverbed of the Teri Toi in Kohat District of Pakistan (B.C.M. Butler, "Nephrite jade in West Pakistan," *The Journal of the Royal Asiatic Society of Great Britain and Ireland*, No. 3/4, 1963, pp. 130–139). The geographical location of this deposit placed it in the collision belt along the Himalaya Mountains. This is the convergent margin between the Eurasian and Indian Plate when the Tethys Ocean closed about 50 million years ago, providing an ideal geological environment for nephrite formation.

In addition to the goods from Pakistan, the authors saw a large koru, a spiral shape often used in Maori art, made of nephrite from Afghanistan. Currently, Afghani materials are scarce on the international market. The only information the authors could find was that the rough comes from the Kohi-Safi District of central Parwan Province. This location is not far from the Pakistani deposit.

While buyers are still waiting to see more production from these emerging sources, green nephrite from British Columbia and Siberia still dominate the market. Siberian goods in general demand higher prices than materials from the rest of the world due to their brighter colors. British Columbian production is still high and can supply finished goods of all price ranges.

Tao Hsu and Jennifer Stone-Sundberg

Nigerian gems and jewelry. During the JCK show in Tucson, GIA had the opportunity to meet up with Amina Egwuatu, founder of Mina Stones. Mrs. Egwuatu, a GIA Graduate Gemologist from Abuja, Nigeria, started the company with the aim of promoting African culture through gems and jewelry. Mina Stones sources, cuts, designs, and manufactures everything in their workshops to keep as much value as possible in Africa. Mrs. Egwuatu works directly with the miners and has visited many of the sites where her stones are produced. This allows traceability throughout the entire supply chain. Mina Stones helped to establish the AGJES Sparkle Foundation, which supports miners through education about their stones, helps them with administration, and provides tools. By working this way, Mina Stones improves the conditions of its miners and suppliers.

Nigeria is known for tourmalines that possess a wide range of colors, rubellite being the most famous. A more recent rubellite discovery near Calabar, Cross River State, has produced higher volumes (though slightly lower quality) than the original find in Oyo State, which has not produced for a long time.

Apart from the red variety, this gem is also found in green, pink, and various combinations of these colors. About 20 years ago, there was even a discovery of cuprian tourmaline in western Nigeria that produced some fine material for a short period. According to various sources, a new pocket was discovered in early 2020 that made this material available in the market.

Another common stone from Nigeria is beryl. Various regions in the country produce fine aquamarine, morganite, heliodor, and green beryl (figure 23). While there are many emerald deposits known throughout the country, facet-grade material is limited to an area in Nasarawa State.

Sapphires are found throughout the eastern and central parts of Nigeria. In several areas such as Antang, Bauchi, Kaduna, and Gombe, the production is exclusively from artisanal miners. The better-known Mambilla

Figure 23. Strands of Nigerian beryl in assorted colors. Photo by Kevin Schumacher.

Figure 24. This necklace makes use of the Arewa knot, a symbol of unity. Photo by Kevin Schumacher.

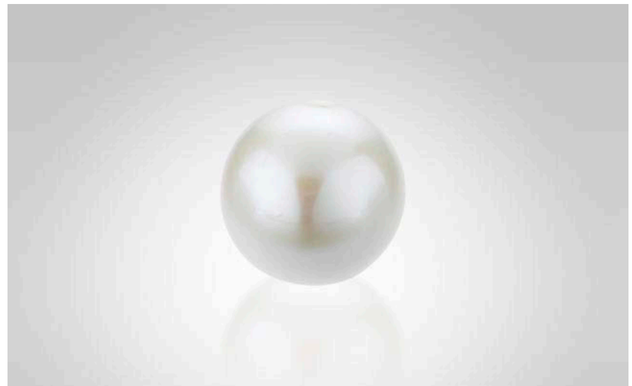


Figure 25. This 16.23 mm, near-round 28.38 ct natural freshwater pearl was found along the banks of the Cumberland River in 2019. Photo by Emily Lane; courtesy of Gina Latendresse.

Plateau has a few larger operations, but small-scale mining is prevalent.

Nigerian sapphires are typically dark blue, although goods found in the southeastern part of the country tend to be lighter in color. Parti-colored, yellow, purplish, and green sapphires are also common.

Mina Stones' jewelry is inspired by Nigerian traditions. The country has long been known for its blacksmiths and goldsmiths, resulting in a strong jewelry culture. Mina Stones is trying to revive the skills, patterns, and heritage by making use of traditional alphabets and symbols. One example is a necklace featuring the Arewa knot (figure 24), a symbol that represents the unity of the different people in northern Nigeria.

Another collection draws inspiration from the city of Ife, in southwestern Nigeria. According to local beliefs, the city was found by a supreme deity and served as the seat for a long line of dynasties.

Mina Stones aims to represent Nigerian gems and jewelry. The country is an important supplier of many colored gemstones that have remained largely unknown to the general public.

Wim Vertriest
GIA, Bangkok

Exceptional natural freshwater pearl. At the AGTA show, we visited Gina Latendresse at the American Pearl Company of Tennessee booth to find out about anything new in the pearl industry. We were excited to learn that an exceptional pearl, both in size and quality, was discovered last year in the Cumberland River (figure 25). The pearl was found by a fisherman along the bank of the river in a "Pistol Grip" (*Tritogonia verrucosa*) mussel (figure 26). This 28.38 ct white pearl with natural color measured 16.23 mm in diameter and was near round with good luster. This was the first pearl of such size and quality found in the Ten-

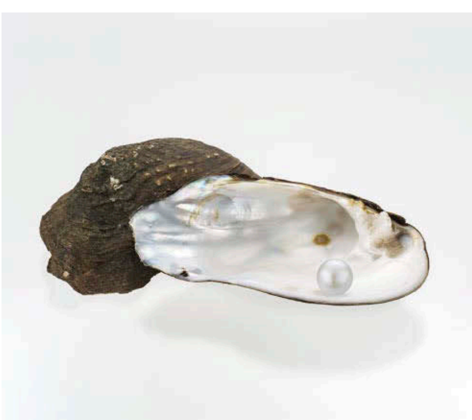


Figure 26. The natural pearl from figure 25 shown in its shell (left), and the "Pistol Grip" shell exterior (right). Photos by Emily Lane; courtesy of Gina Latendresse.

Figure 27. Bicolor sapphires from the Rock Creek mine, Montana. Cutters took advantage of the color inhomogeneity of the rough to create these interesting color combinations. These stones range from 1.61 to 7.36 ct. Photo by Emily Lane; courtesy of Potentate Mining.

nessee region since the 1970s. The pearl is so unusual that Ms. Latendresse described it as either a collector specimen or suitable for museum display.

For context, the eastern portion of the United States was a source of many natural freshwater pearls to native Americans as evidenced by John Smith's 1608 writings noting the "many chains of great pearls about his [Chief Powhatan of the Powhatan Confederacy near present day Richmond, Virginia, also the father of Pocahontas] neck" (P.L. Barbour, Ed., *The Complete Works of John Smith (1580–1631)*, Vol. 1, University of North Carolina Press, Chapel Hill, 1983, p. 53). Two and a half centuries later, a pearl rush started with the discovery of pearls of notable size and quality by fishermen in New Jersey, which resulted in people searching streams and rivers throughout the country. In 1857, David Howell found a near-round 100 ct pearl in a fried mussel he fished from Notch Brook in New Jersey (which unfortunately had its luster destroyed by the frying process). Shortly thereafter, Jacob Quackenbush discovered a 23.34 ct pink baroque pearl of fine luster, later named the "Queen Pearl," that he sold to Charles Tiffany for $1,500. Good-quality pearls were found in the Cumberland, Tennessee, and Clinch Rivers in the state of Tennessee for many years thereafter (G.F. Kunz and C.H. Stevenson, *The Book of the Pearl: The History, Art, Science, and Industry of the Queen of Gems*, The Century Co., New York, 1908).

The recent discovery of such an extraordinary pearl proves that it is prudent to check the inside of mollusks known to produce pearls before consuming them!

Jennifer Stone-Sundberg and Tao Hsu

Interesting sapphires from Montana and Australia. While sapphire has always been popular at trade shows, occasionally the authors find some interesting stones with attractive color distribution or growth patterns that have a niche in the market.

At this year's AGTA show, Potentate Mining carried some spectacular bicolor faceted sapphires and a variety of slabs from its Rock Creek mine in Montana. The Rock Creek operation is one of four active sapphire mines in Montana. Stones from this deposit tend to be flat, showing pastel colors, and many stones show bicolor or have an orange or yellow core called "yolk" by the local miners. Gem cutters and jewelry designers have been finding innovative ways to take advantage of these challenging attributes. Through careful design and cutting, some stones show attractive color combinations such as yellow/green, yellow/light blue, orange/blue, or simply different shades of yellow (figure 27). This type of bicolor is very characteristic of Rock Creek sapphires.

As for the flat rough, Potentate offers several categories based on color, pattern, and weight (figure 28). According to the company's marketing director, Warren Boyd, both cutters and designers have shown strong interest in these slabs, especially those weighing half a gram and above. Designers seem to prefer slabs with patterns while cutters or carvers prefer slabs with solid colors to make special cuts.

Figure 28. Flat rough sapphires from Rock Creek attract jewelry designers and cutters. The slabs are grouped and sold by their weight. Photo by Tao Hsu.

Figure 29. This pair of blue sapphire thin slabs displays a very attractive color. They were sliced off a dark blue sapphire crystal from Inverell, Australia. Mr. Coldham also offered thin slabs of blue and parti-colored sapphires from Australia. Photo by Tao Hsu.

At the GJX show, Terry Coldham from Intogems showed the authors a pair of thin blue sapphire slabs with characteristic hexagonal growth patterns. The pair in figure 29 is from the Inverell sapphire field of New South Wales, Australia. Blue sapphires from this area tend to show a very saturated and dark inky blue color. Slicing them into thin slabs makes the blue color much lighter and more desirable. However, the size and quality of this pair are extremely rare to find. Mr. Coldham also carries many parti-colored and fancy-color Australian sapphires (see figure 4 on p. 157), which also sold well at the show.

To watch videos of the sapphire slabs from Montana and Australia, go to https://www.gia.edu/gems-gemology/spring-2020-gemnews-sapphires-montana-australia.

Tao Hsu and Jennifer Stone-Sundberg

Exceptional rough and cut blue sapphire from Rock Creek, Montana. The Rock Creek sapphire deposit in Montana has been active since the 1890s and is known as the state's most fruitful deposit (T. Hsu et al., "Rock Creek Montana sapphires: A new age of mining begins," https://www.gia.edu/gia-news-research/rock-creek-montana-sapphires-new-age-mining-begins, August 29, 2016). This year in Tucson, Jeffrey Hapeman of Earth's Treasury showed the authors a very fine untreated blue sapphire rough with a yellow spot in the center, as well as a top-quality faceted light teal blue untreated stone with some yellow zoning (figure 30). Since 2014, Mr. Hapeman has been focusing on Rock Creek material in these nontraditional lighter blues to greens. They have proven to be very popular, as several AGTA vendors this year reported strong demand for these colors, not only in Montana sapphire but from other sources as well. When it comes to unheated material, only about 5% of the rough from Rock Creek is cut without treatment, and most of these are either fancy pinks, yellows, or lighter blues. In the past year Mr. Hapeman has seen a shift in demand to parti-colored and green sapphires, particularly deep bluish green.

Jennifer Stone-Sundberg, Tao Hsu, and Robert Weldon

New blue sapphire from Rakwana, Sri Lanka. The town of Rakwana, in southern Sri Lanka, has been known for decades as a premier source of royal blue sapphires. Often, a simple mention that a gemstone is from Rakwana will immediately explain the price and quality. In August 2019

Figure 30. The 17.65 ct "Lucky Sapphire" rough crystal and 3.92 ct oval cut using the custom "Helena" design, both from Rock Creek, Montana. Photo by Robert Weldon/GIA; courtesy of Jeffrey Hapeman.

Figure 31. A 49.99 ct rough sapphire crystal (5.8 cm in length) and a 33.16 ct cut stone with exceptional color from the 2019 Rakwana find. Photo by Robert Weldon/GIA.

a small pocket yielding numerous large sapphire crystals was discovered in the nearby Sinharaja Forest area of the Ratnapura District, Sabaragamuwa Province. What was unique about this find was the quality and size of the lustrous crystals. The 49.99 ct rough crystal in figure 31, measuring 5.8 cm in length and 1.6 cm at its widest point, was one of about 60 found in August 2019. It was also the largest complete crystal found. The beautiful 33.16 ct gem beside it was cut from a 207 ct piece of rough, the end of a large portion of a crystal. This crystal and cut gem rival the famous ones from Kataragama found four years ago.

Jennifer Stone-Sundberg, Tao Hsu, and Robert Weldon

Dudley Blauwet
Dudley Blauwet Gems
Louisville, Colorado

Trapiche gems. Jeffery Bergman is known in the trade as a collector of trapiche gems. These gems, characterized by their six-rayed patterns, are elusive and seldom found in high quality. Mr. Bergman believes people are attracted to the symmetrical pattern, which reflects a natural order in the chaotic world we live in. According to Bergman, trapiche gems are too rare to support a business, so he has also traded many other gemstones during his 50-year career.

As with most gemologists, the first trapiche gems he saw were Colombian emeralds. But it wasn't until 10 years after this initial encounter at the Tucson gem show that he purchased his first trapiche gemstone: a thick Colombian emerald weighing about 20 ct. Mr. Bergman sliced it in two, increasing the value after it became a matched pair of acceptable thickness.

Figure 32. A pair of trapiche emerald slices from Colombia, 10.92 carats total. Photo by Kevin Schumacher; courtesy of Mayer & Watt.

He saw his first non-emerald trapiche gems at the Mae Sot gem market on the Thai-Burmese border in the early 2000s. Mr. Bergman was handed three Burmese trapiche sapphires from Mogok, something he never knew existed. Other collectors were equally surprised and paid high amounts for these stones, encouraging Mr. Bergman to expand his collection. During those days, many fine Burmese trapiche rubies came out of Mong Hsu while Mogok provided the trapiche sapphires.

Trapiche rough is extremely difficult to judge since the patterns often do not extend throughout the entire stone. In most cases, the most desirable pattern can only be found in the middle of the crystal length.

Trapiche and non-trapiche emerald evaluation are very similar, as the most important characteristics are always the color and transparency of the emerald itself (figure 32). The symmetry and shape of the pattern are only of secondary importance, followed by size and potential treatments.

Trapiche emeralds from Colombia are well known, with the Muzo mine producing the majority. The patterns can exhibit many variations, from perfect six-ray symmetry with high clarity to cloudy stones with broken or incomplete rays. Trapiche-like emeralds have recently been found in Swat, Pakistan, but they show a very different appearance and formation (Fall 2019 GNI, pp. 441–442). Beryls such as aquamarine and bixbite (red beryl) are known to exhibit trapiche or trapiche-like characteristics but they are even rarer than emeralds.

Trapiche corundum gems are mostly known from Myanmar. Trapiche ruby from Mong Hsu is often small. In his 20 years of trapiche experience, Mr. Bergman has only encountered two gem trapiche rubies from Mong Hsu that were over 1 carat. The material is fairly dark, which means it must be sliced thin to appreciate any color, thus reducing the weight of the stone drastically. Heat treatment rarely improves the appearance; it alters the trapiche pattern, making it chalkier and less pronounced.

The Tajik ruby mines have also produced trapiche rubies, as well as the mines in Nepal. Batakundi (Pakistan) and Orissa (India) are other sources of ruby with six-rayed patterns (Spring 2019 *G&G* Micro-World, p. 114).

Trapiche sapphires from Mogok (figure 33) are often dominated by gray tones or very saturated blues bordering black colors. Only the finest stones show a snow-white bodycolor with vivid blue arms. To date, these are the only true trapiche sapphires. Trapiche-like sapphires are much more common from basalt-related sources such as southern Vietnam, Australia, and even lesser-known areas such as Scotland.

Quartzes, including amethyst and smoky quartz, can exhibit trapiche patterns. A pocket of Zambian tourmalines and some extremely rare garnets also show a six-rayed pattern.

In Mr. Bergman's opinion, trapiche only applies when the symmetry is sixfold. This excludes more common materials with similar growth patterns like chiastolite. Asteriated diamonds, most often found in Zimbabwe,

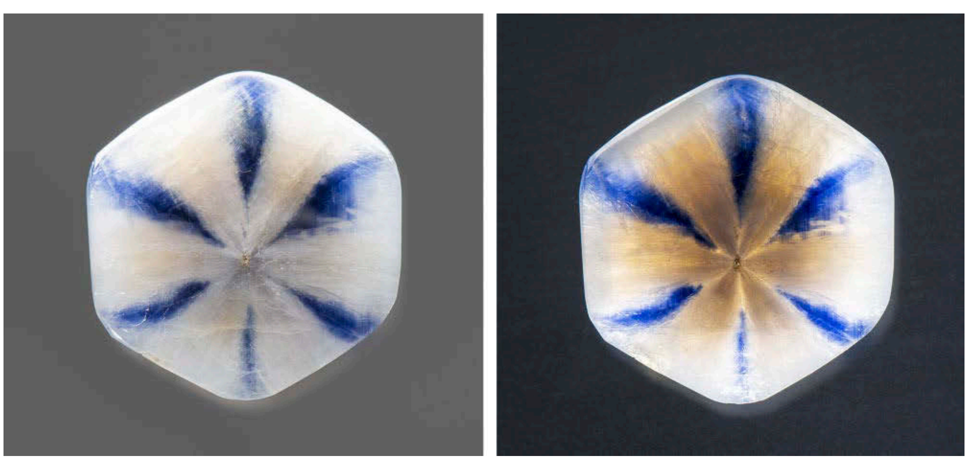


Figure 33. Trapiche sapphire from Mogok, Myanmar. This stone shows a regular pattern of snow white and blue zones. Photos by Kevin Schumacher.

Figure 34. These miniature opal carvings are favored by designers. They are hand-carved in Bali from different varieties of Australian opal. Photos by Tao Hsu and Jennifer Stone-Sundberg.

resemble trapiche when viewed in certain angles, but in reality they contain clouds extending in three dimensions at 90º angles.

In the last decades, knowledge and appreciation of these unique stones has spread and they are now actively sought after by collectors, bespoke designers, and gem enthusiasts. This increased demand and availability has driven gemologists to take a deeper look at these gems and their formation, but there remains much to be discovered.

Wim Vertriest

CUTS AND CUTTING

Carvings from Bali. Picturesque beaches and lush green jungles are not the only attractions that make Bali the most popular tourist destination in Indonesia. The local carving tradition, derived mostly from woodcarving, adds a layer of artistry and craftsmanship to this tropical paradise. Now many carvers there are also involved in different types of gem materials.

At the GJX show, the author found some authentic and attractive Balinese carvings of Australian opal, mammoth tusk, and bovine bone. Mr. Terry Coldham from Intogems brought opal carvings of pendant sizes, which are highly desired by jewelry designers (figure 34). Mr. Coldham utilizes rough from different Australian mining areas, primarily black and white opal, but some crystal opal as well. The carvings feature natural themes such as plants, flowers, and animals, as well as profiles of faces from different cultures. The carving style includes both relief panel and three-dimensional sculpture. Some pieces show color blocks being skillfully arranged, a technique commonly used by the Chinese in jade carving. The quality of the rough dictates the price, ranging from hundreds to thousands of dollars for each finished piece. According to Mr. Coldham, opal carvings have sold well over the past several years. He enjoys working with the Balinese carvers and added that after a couple of years of collaboration, the products have improved to better fit the international market.

Another exhibitor that caught the author's eye is Susan Tereba. Ms. Tereba moved to Bali over 30 years ago and still lives there today. She brought to the show amazing hand-carved mammoth tusk and bovine bone. Ms. Tereba appreciates the remarkable talent of the Balinese carvers, who are fast learners and can easily grasp themes that are not indigenous. These exquisite carvings also show a wide variety of motifs, with animals and goddesses the most popular and some pieces are gem studded (figure 35). The bovine bone carvings are dyed, and according to Ms. Tereba

Figure 35. Balinese carved mammoth tusk of a garden goddess. Photo by Tao Hsu.

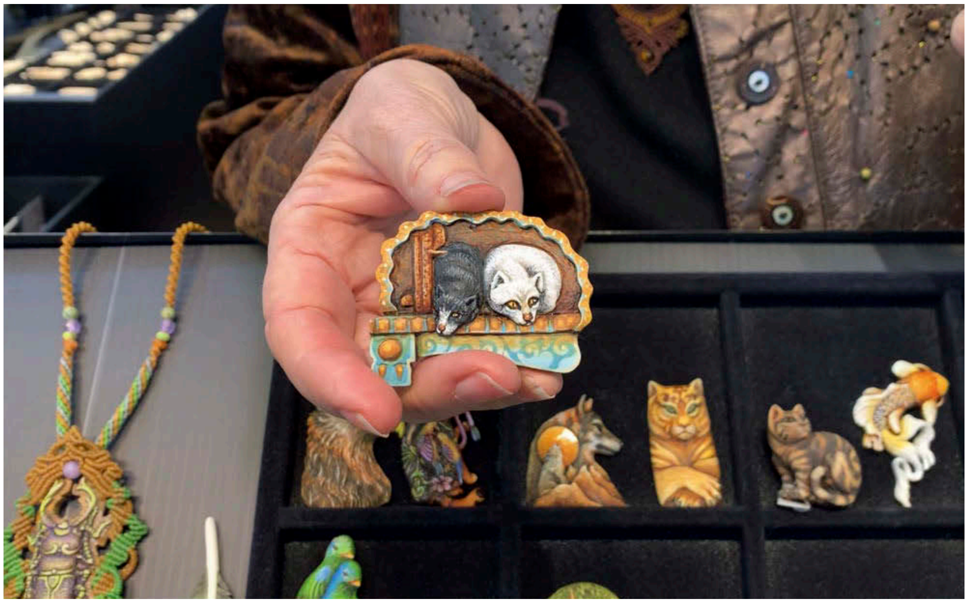


Figure 36. Bovine bone carvings are usually dyed to show vivid colors. The color is stable over many years. Photo by Tao Hsu.

the color is very durable and resistant to wear (figure 36). Jewelry designers and hobbyists are her main clients.

To watch videos of Terry Coldham and Susan Tereba displaying Balinese carvings, go to https://www.gia.edu/gems-gemology/spring-2020-gemnews-carvings-bali.

Tao Hsu

Gem carvings, fantasy cuts, and master recutting. This year at the AGTA show, the number of booths selling skillfully carved, fantasy cut, or expertly recut items was noticeably higher than in past years. These forms of working rough or previously cut material are a way to add significant value and desirability to material that might otherwise be cut into standard shapes or with the intent to maximize weight at the expense of beauty.

Nick Alexander (figure 37, left) of Alexanders Jewelers in Gilbert, Arizona, was exhibiting his work for the first time at the AGTA show. This year, Mr. Alexander won second place in the carving category of the AGTA Cutting Edge Awards with his 42.05 ct Oregon sunstone piece at the impressive age of 17. A favorite material of his is electric blue gem silica from the Ray mine in Arizona (see figure 2, p. 157). Mr. Alexander is also skilled at fantasy cutting with materials such as amethyst (figure 37, right) and beryl.

One of the carvers who has inspired Mr. Alexander, Glenn Lehrer of Larkspur, California (figure 38, right), was also at the AGTA show. Mr. Lehrer shared with us one of his newest works, an exquisite lotus flower carved out of a top-quality rose quartz from Madagascar (figure 38, left).

Figure 37. Left: Nick Alexander exhibits a selection of his work. Photo by Jennifer Stone-Sundberg. Right: A 64 ct fantasy cut amethyst from Bahia, Brazil. Photo by Kevin Schumacher; courtesy of Nick Alexander, Alexanders Jewelers.

Figure 38. A 322.72 ct Madagascar rose quartz lotus flower carving with grayish blue and padparadscha Montana sapphires in the center (5.56 and 0.65 ct, respectively), shown by the artist, Glenn Lehrer. Left photo by Robert Weldon/GIA, courtesy of Glenn Lehrer; right photo by Jennifer Stone-Sundberg.

This piece started as part of a museum collection project with designer Paula Crevoshay. It took two years to find the 3.8 kg rose quartz rough meeting his stringent demands: It had to be clean, clear, and with strong color. The finished carving measures 79.5 × 69.8 mm and weighs 322.72 ct. To complement the piece, the center features two sapphires from the Rock Creek area of Montana: a 5.56 ct grayish blue "torus ring" carving and a 0.65 ct padparadscha.

Master gem cutter David Nassi from New York City (figure 39, left) showed us an impressive set of unheated natural spinels and several other gems he had recut to maximize color and light return. Of particular interest was a phenomenal gem, a natural color-change cat's-eye alexandrite (figure 39, right) that was polished to a double-sided cabochon to display the cat's-eye effect on both sides of the stone. For videos of David Nassi displaying his work, go to https://www.gia.edu/gems-gemology/spring-2020-gemnews-carvings-fantasy-cuts-recutting.

Jennifer Stone-Sundberg, Tao Hsu, and Robert Weldon

JEWELRY DESIGN

Fine-quality jadeite jewelry. At this year's Pueblo Gem and Mineral Show, the authors met Frank Lau from Frank Lau

Figure 39. Left: David Nassi of 100% Natural, Ltd. showing a collection of unheated spinels he has recut, ranging in size from 7.10 to 18.53 ct. Photo by Jennifer Stone-Sundberg. Right: A 14.49 ct cat's-eye alexandrite from Sri Lanka cut by Nassi, showing reddish brown to green color change. Photos by Emily Lane; courtesy of David Nassi.

Figure 40. A selection of jewelry offered at Frank Lau's booth. Jadeite of fine quality is not commonly seen in Tucson. Photo by Tao Hsu.

Jewelry. What caught the authors' attention was the collection of fine-quality jadeite jewelry, which is predominantly found in the mainland China market but not in Tucson.

Mr. Lau's booth offered a wide variety of jadeite including green, colorless, lavender, and red ranging in quality from medium to fine (figure 40). The jadeites are polished and carved in Guangzhou, China, while the jewelry is manufactured either in China or Seattle, where the store is located. Clients of the jadeite jewelry include both Chinese and Americans, with many repeat customers.

While all of the jadeites are natural, Mr. Lau informed the authors that the reddish brown pendant is heated (figure 40). Reddish brown jadeite is extremely rare. This color is produced from a very thin layer of jadeite boulder (figure 41) leaving little material to make pieces of reasonable sizes. A good amount of reddish jadeite on the market is heated in air to oxidize the Fe-containing minerals to make the stone look red. This treatment is extremely hard to identify.

The colorless jadeite pieces, also called "ice jade," are of very fine quality. This variety is popular with younger consumers. The exceptionally fine texture and relatively high transparency make it an alternative to the top-quality imperial green stones. When inclusions are present in the colorless jadeite, sellers describe them as "snowflakes" to attract buyers of different tastes (figure 42).

Figure 41. A rough jadeite boulder shows a very thin layer of reddish brown skin. Red jadeite is even rarer than the green variety. This boulder was offered at the Myanmar Gem Emporium. Photo by Tao Hsu.

Figure 42. This colorless jadeite pendant is of very high transparency. Many sellers describe the whitish inclusions as "snowflakes." Photo by Tao Hsu.

Figure 43. A cordierite Viking "sunstone" set in silver with the "vegvísir" compass symbol. Note that Mr. Berger's ring also features a cordierite cabochon set in silver. Photo by Jennifer Stone-Sundberg.

Figure 44. Examples of contemporary Scandinavian designs in silver containing thulite. Photo by Jennifer Stone-Sundberg; courtesy of Atle Berger.

Mr. Lau sources his rough materials from Myanmar, though the skyrocketing price of rough makes this business increasingly difficult. He looks forward to the availability of more consumer-oriented jadeite education so Western consumers can better appreciate this gem.

Tao Hsu and Jennifer Stone-Sundberg

Nordic gems and jewelry. At the JOGS show, Arctic Jewelry (Axvalla, Sweden) featured a variety of Nordic gemmy materials set mainly in silver using ancient, traditional, and contemporary Scandinavian designs. The pieces spoke to the mineral diversity, history, and artistry of the region.

The Vikings made navigation stones from locally sourced transparent crystals of minerals such as cordierite, a biaxial magnesium iron aluminum silicate, to help cross the seas under cloudy weather. These Viking "sunstones" are backed up by science, as cordierite and other materials such as calcite and tourmaline can be used to identify the position of the sun through even thick clouds. These stones visibly split sunlight into two images that when rotated to make equally bright, show rings of polarized light around the sun's position. Cordierite was found to be the most accurate navigation stone in simulated journeys from Bergen, Norway, to the Viking settlement of Hyarf in Greenland (D. Száz and G. Horváth, "Success of sky-polarimetric Viking navigation: revealing the chance Viking sailors could reach Greenland from Norway," *Royal Society Open Science*, Vol. 5, 2018, No. 172187). An example of a silver pendant engraved with a vegvísir (a Nordic compass "wayfinder" symbol) and a cordierite center stone was shown to us by Atle Berger (figure 43).

Thulite, a manganese-containing pink variety of zoisite with some white calcite mottling, is the national gemstone of Norway, the country in which it was discovered by Anders Gustaf Ekeberg in 1820. The name comes from "Thule," the ancient name for the mythical island (believed to be modern-day Norway) that was considered the northernmost part of the world. At the Arctic Jewelry booth, contemporary Scandinavian designs in silver incorporating this stone were featured in jewelry ranging from rings to bracelets and necklaces (figure 44).

A bright and attractive blue material found at the booth is the slag byproduct of iron smelting in the Bergslagen region of central Sweden during the Middle Ages. This material was reported on previously in *G&G* (Winter 2006 GNI, p. 279) and characterized in the GIA lab. At that time, EDXRF was the method used for chemical analysis, but today with LA-ICP-MS we were able to more exactly determine the composition of this material from some rough

Figure 45. Rough "Swedish Blue" slag byproduct. Photo by Kevin Schumacher; courtesy of Atle Berger.

pieces given to us by Mr. Berger (figure 45). We identified it as a silica-rich glass with a composition of 56.35 wt.% SiO_2, 24.70 wt.% CaO, 7.68 wt.% MgO, 5.05 wt.% Al_2O_3, 2.23 wt.% FeO, 2.21 wt.% K_2O, 0.85 wt.% MnO, 0.27 wt.% Na_2O, and 0.65 wt.% other elements (average of 10 ICP spot analyses). This gave a calculated chemical formula of $(Na_{0.019}, Mg_{0.418}, Al_{0.217}, K_{0.103}, Mn_{0.026}, Fe^{2+}_{0.068}, others_{0.012})_{0.864}\ Si_{2.058}\ Ca_{0.967}O_6$, which is generally consistent with what was reported in 2006. The oxide components are fairly normal for iron foundry slag, but the silica-rich nature is what gives this material its fine glassy aspect compared to those slags that are more CaO-rich. The slightly greenish blue color comes from Fe^{2+} (FeO).

Jennifer Stone-Sundberg and Ziyin Sun

RESPONSIBLE PRACTICES

Ethical Gem Fair. Tucson's first Ethical Gem Fair, a platform for responsibly sourced gemstone suppliers to highlight their products and projects, was held February 3–6 at the Scottish Rite Cathedral. This was the first Ethical Gem Fair in the United States after being held in London and Edinburgh the last three years.

The Tucson event was a collaboration between suppliers Nineteen48, Capricorn Gems, Perpetuum Jewels, Nature's Geometry, Agere Treasures, Columbia Gem House, and Anza Gems. They share a commitment to supply chain ethics, mine-to-market traceability, environmental and health and safety regulations, and supporting artisanal miners and communities.

Monica Stephenson, founder and president of Seattle-based Anza Gems, said her travels to East Africa to purchase rough have shown her that miners need to be educated about the value they bring to the supply chain. Ten percent of Anza's proceeds go to education at the mining communities.

Anza Gems is a partner of Moyo Gemstones, a responsibly sourced gemstone program that was sparked by GIA's artisanal mining education program. The pilot effort, a collaboration between GIA, Pact, and the Tanzania Women Miners Association (TAWOMA), focused on women miners in Tanga, Tanzania. After initial training, they were more knowledgeable about the mined gemstones but lacked a platform to bring them to the market. Stephenson saw potential here, and together with Pact and TAWOMA she founded Moyo Gemstones. The program provides a marketplace for gemstone transactions, offers free occupational health and safety training, and helps ensure that all miners are legally registered.

Stephenson said that before the program these miners would get a few dollars for gems from a broker, with no visibility into their value in the supply chain. Moyo has changed this through education. "For the miner to understand what she has and the value of those gems, and also to be taking home more like 95% of the export price, and pay her broker, is a complete reversal of the roles," Stephenson said. "This is truly a paradigm shift in this region. For her to have the income and financial sort of independence is enormous."

Each gem can be traced back to the miner, Stephenson said, and it's important to share that story with the consumer. "They need to know that what they're buying not only makes a difference, and not only does it not cause harm, but it actually is beneficial."

Anza Gems' offerings (figure 46) included sapphire, multiple colors of garnet, tourmaline, citrine, amethyst, zircon, and Mahenge spinel.

Brian Cook, owner of Nature's Geometry (Tucson), began selling crystals as a geology student almost 30 years ago. This took him to a remote area of Bahia, Brazil, where rutilated quartz is mined. He felt a strong connection to the place and made it his second home. Since then he has advocated for the development of resources more sustainable than mining so the community can rely on them when mining ends.

Cook told us about their project in Bahia to benefit the artisanal mining community. The first initiative will raise funds for dust masks for the miners, at least half of whom have no dust protection for underground mining. Second, he envisions a model of investment in regenerative agriculture to create food security, improve nutrition, and implement carbon sequestration. The area's soil is so rich that it allows

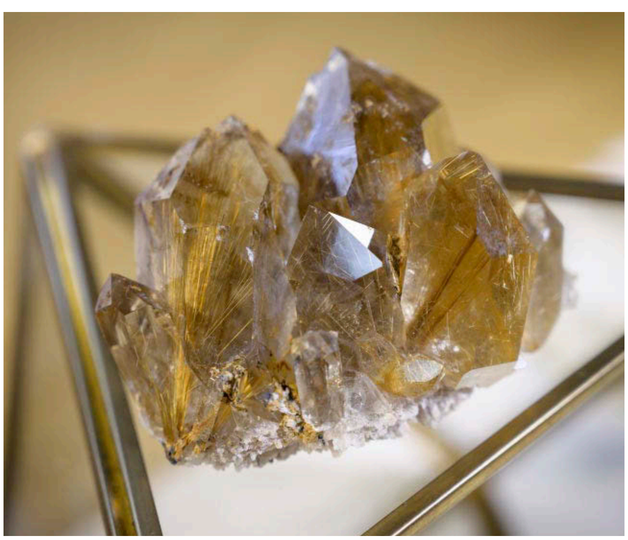
Figure 46. A selection of gemstones from Anza Gems. All of these stones were sourced in Tanzania, including the set of rough sapphires that was mined in Tanga province. Each stone can be traced back to the individual miner who unearthed the gem. Photo by Kevin Schumacher.

for farming of crops such as cacao, coffee, acai, and many others. The third component will be teaching lapidary skills.

Eighty percent of colored gemstones are mined by small-scale and artisanal miners, according to Cook. "This project could serve as a model for our industry at large," he said. While he recognizes that every situation is different, food, water, and energy will always be the basic needs of every being, and guaranteeing them can uplift a community.

Cook showed us several pieces of rutilated quartz from Bahia, including a sizable piece of rough (figure 47). Nature's Geometry has been cutting the material since 1989. Each piece is unique, which Cook said is something the younger generation likes.

Figure 47. Rough rutilated quartz from Bahia, Brazil. Photo by Kevin Schumacher.



Cook said the response to the fair has been "phenomenal." He predicts it will grow in future years, with more vendors and a greater variety of stones.

Ian Bone, manager of Capricorn Gems (Central Queensland, Australia) said the Ethical Gem Fair was created to meet the needs of designers and customers who want a gemstone's mine-to-market story. "There's undoubtedly a generational shift happening," he said. "Customers want to know that the pieces are brought to market in the most responsible manner possible. We see this as the cutting edge of jewelry design and in fact the future of the jewelry industry."

Bone said that because Australia's mining industry already has strong regulations for safety, the environment, energy, and land reclamation, it could serve as an example for other mining communities around the world.

Bone, a Central Queensland native, has built his business around local gemstones: boulder opal, chrysoprase, zircon, and sapphire. He is able to witness the entire process, from mining to cutting to consumer sales. He showed us a selection of chrysoprase from Marlborough, Central Queensland (figure 48). "Marlborough has some of the best chrysoprase in the world," he said. "Chrysoprase is an unusual gem because you can get a whole set of qualities of that stone, from dollars a pound up to dollars a carat."

Bone said Capricorn Gems is breaking down boundaries between sourcing, production, and sales. They share their images, videos, and stories of mining with designers for use in their own marketing. One example is a booklet showcasing the works of designers around the world who

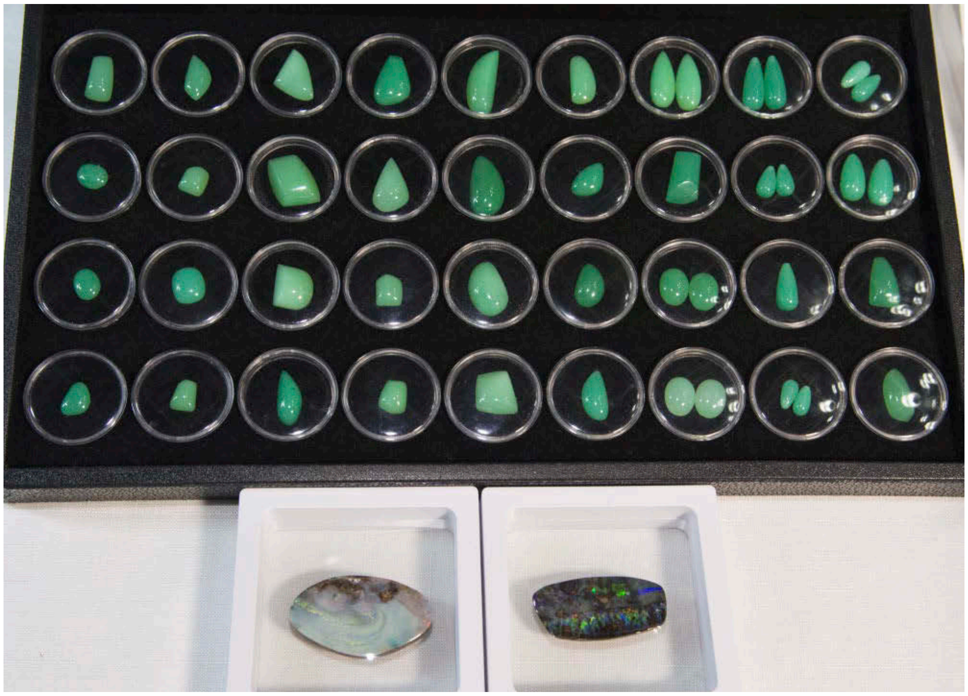


Figure 48. Capricorn Gems' chrysoprase from Marlborough, Central Queensland. Photo by Kevin Schumacher.

use stones from Capricorn Gems. "The client knows that their designer knows and trusts the gem supplier and knows where that material comes from," he said.

Hewan Zewdi, founder of Agere Treasures (Lynnwood, Washington), was born and raised in Ethiopia and moved to Seattle 14 years ago. There she earned her G.G. through GIA Distance Education. When Ethiopian opal (figure 49) was discovered in 2008–2009, people began calling from home to ask if she had a market for them. "That's what I study—that's what I want to do," she told them.

Figure 49. Ethiopian opal from Agere Treasures. Photo by Kevin Schumacher.

At the Denver Gem & Mineral Show, Zewdi's first trade show, she saw Ethiopian opal dealers undervaluing their material and advised them to increase their prices. She also began buying stones from them to sell in her local market in Washington. Her commitment increased when emeralds were discovered in southern Ethiopia. Agere Treasures now offers opal, emerald, amazonite, yellow labradorite, garnet, zircon, tourmaline, and sapphire.

Part of Zewdi's profits go to a new project to train young women in basic gemology and jewelry design. She also donates books on rocks and gems to the Ethiopian Ministry of Mining, and she assists the organization in obtaining gemstone identification at GIA so the stones can be priced accordingly by exporters in Ethiopia.

"Here everybody has the same mission, the same vision," Zewdi said of the Ethical Gem Fair. "To give back and get the material traceably and responsibly, without hurting the environment or the artisanal miner, by creating a fair trade and a fair price."

Buyers at the Ethical Gem Fair were younger people and designers looking for a stone with a story. They want to know about the supply chain for almost every product they use, including jewelry. The show's suppliers offer as much transparency as possible to their customers, often providing supporting information about the stones, such as images from the mines and cutting factories. Everyone involved in the show sees a growing demand for responsibly sourced gemstones.

Articles on two other exhibitors, Perpetuum Jewels and Columbia Gem House, can be found in the Spring 2019 *G&G*.

Wim Vertriest and Erin Hogarth

Figure 50. Split boules of bicolor synthetic sapphire grown by flame fusion. Photo by Jennifer Stone-Sundberg; courtesy of RusGems.

SYNTHETICS AND SIMULANTS

Bicolor synthetic sapphire. At the JOGS show, a wide selection of synthetic gem materials was offered by the Bangkok office of RusGems, a synthetic crystal growth company out of Russia. Olga Tanskaia showed us their extensive color range of synthetic sapphire, spinel, beryl, garnet, and other lab-grown crystals produced using a variety of crystal growth methods. She noted that blue and red synthetic gems are always their best sellers.

As we found with natural sapphire this year, bicolor synthetic sapphire, both rough and cut, was also available and popular (figure 50). This material is grown by flame fusion, and the chromophore component of the powder composition is altered during the growth process at the desired length. Many different color combinations were available, including some with the popular teal blue and purple hues (figure 51, left). The inspiration for applying this method of color zoning to these flame-fusion grown crystals came from historical work on synthetic ruby laser rods where colorless (or "undoped") regions were desired for the ends of the rods (figure 52). A process to grow a single crystal having pure aluminum oxide for a certain length, then adding the desired level of chromium to the growth for the laser rod portion of the length, and then returning to pure aluminum oxide was developed to achieve this.

We took the step-cut bicolor synthetic sapphire in figure 51 back to the GIA lab to determine the trace element chemistry responsible for generating the teal and purple hues. Using laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS), we found that the teal end contained no Be, Mg, Ti, V, Mn, Fe, or Ni but did contain small amounts of Cr and Ga (approximately 4 ppma and 0.5 ppma, respectively) and a substantial amount of Co (approximately 140 ppma). The purple end similarly contained no Be, Mg, V, Mn, Fe, or Ni but did contain small amounts of Ti (0.6 ppma) and Ga (0.4 ppma), with substantial amounts of Co (120 ppma), and Cr (470 ppma). Cobalt is giving this crystal the greenish blue component of its color, and chromium is modifying the hue to purple. We used UV-Vis spectroscopy to detect absorption peaks that could be used with the trace element chemistry to explain the two differently colored regions. We identified chromium peaks at approximately 400 and 560 nm responsible for the red color component in the purple half. We also identified an additional peak in the purple half at around 640 nm, likely due to Co^{3+}. In the teal half, we did not find the Cr^{3+} peaks but did identify Co^{3+} peaks at 640 nm and at around 440 nm, and a peak around 600 nm due to Co^{2+} (K. Schmetzer and A. Peretti, "Characterization of a group of experimental Russian hydrothermal synthetic sapphires," *Journal of Gemmology*, Vol. 27, No. 1, 2000, pp. 1–7).

In inspecting the inclusions at the boundary between the two differently colored portions, we discovered bright

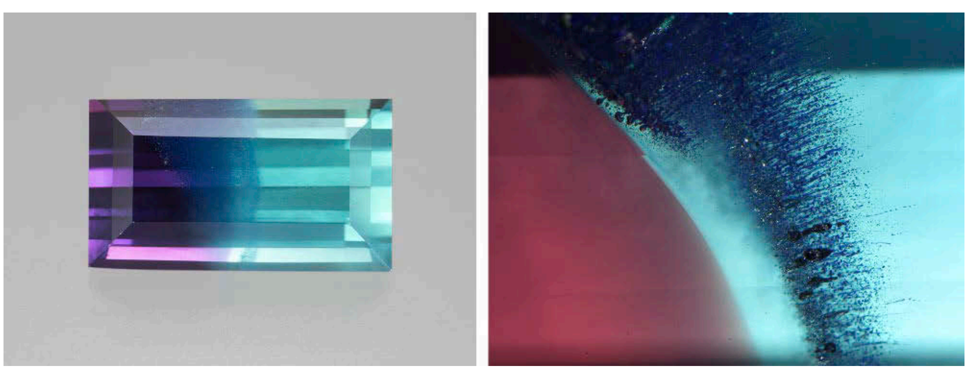


Figure 51. Left: Bicolor 14.83 ct synthetic sapphire showing popular teal blue and purple colors. Photo by Kevin Schumacher; courtesy of RusGems. Right: Wisps of presumably $CoAl_2O_4$ at the boundary of the teal and purple colors in the crystal. Photomicrograph by Nathan Renfro; field of view 7.05 mm.

Figure 52. Synthetic ruby rod grown by the flame-fusion technique showing chromium-free ends. Photo by Jennifer Stone-Sundberg; courtesy of RusGems.

blue wisps of what we believe to be $CoAl_2O_4$ (figure 51, right), a spinel-structure material referred to as "cobalt blue" that is used to impart a blue color to glass, ceramics, and plastics.

The ability to generate just about any hue in sapphire, including color zoning, was readily apparent when looking through the offerings of RusGems. It was fascinating to see evidence of the direct influence of the high-tech laser industry on these synthetic gems.

Jennifer Stone-Sundberg, Ziyin Sun, Nichole Ahline, and Nathan Renfro

ANNOUNCEMENTS

Third annual Gianmaria Buccellati Foundation Award winner. Yi-Hsuan Chiang, a graduate of GIA's Jewelry Design program in Taiwan, received the third annual Gianmaria Buccellati Foundation Award for Excellence in Jewelry Design during the Tucson shows. More than 200 students competed this year, and Chiang was one of 18 finalists from seven GIA campuses. Her winning design, of a necklace depicting a butterfly that has fallen into a spider's web, featured amethyst, diamond, moonstone, conch pearls, coral, black opal, and baroque pearl (figure 53).

Chiang will travel to Italy to meet Rosa Maria Bresciani Buccellati, president of the foundation, and visit its collection.

Larry French of the foundation said, "The designs that were selected as the 18 finalists and exhibited in Tucson beautifully illustrate the passion and dedication of those who created them. It is in honor of Gianmaria Buccellati's name that we will welcome, as our guest, Ms. Chiang to Italy."

Figure 53. Yi-Hsuan Chiang's amethyst, diamond, moonstone, conch pearl, coral, black opal, and baroque pearl necklace design won the third annual Gianmaria Buccellati Foundation Award. Chiang is a graduate of the Jewelry Design program at GIA in Taiwan.

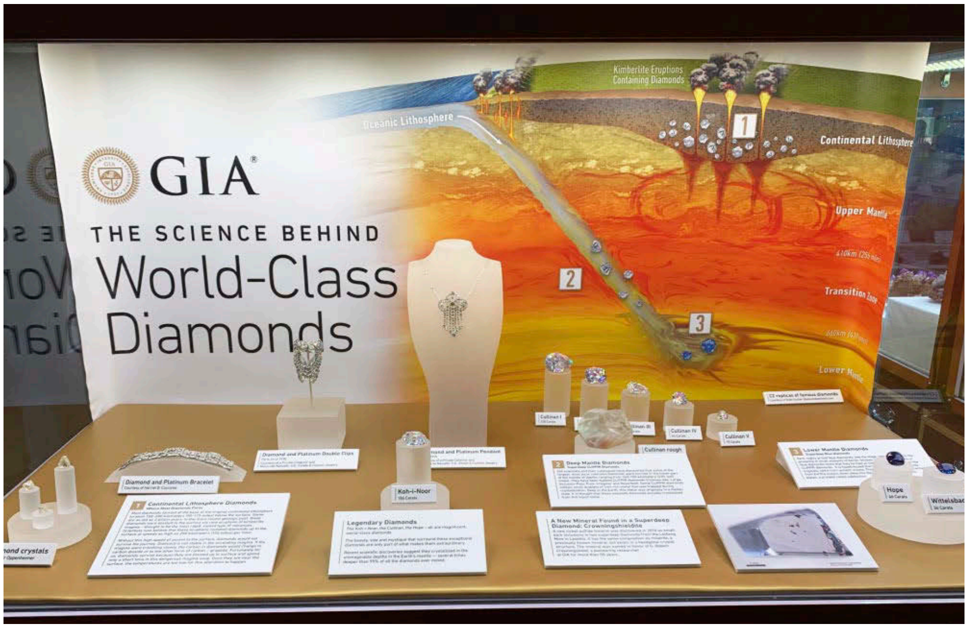


Figure 54. This exhibit highlighted GIA's research into the origin of several of the most famous diamonds. Photo by McKenzie Santimer.

The 2020 Gianmaria Buccellati Foundation Award for Excellence in Jewelry Design competition is underway and open to students in GIA's Jewelry Design courses who meet the eligibility requirements. For more information, visit gia.edu/buccellati-foundation-award-jewelry-design.

GIA Museum's Tucson exhibit receives two awards. The GIA Museum received two awards for its exhibit at the 2020 Tucson Gem and Mineral Show. "The Science Behind World-Class Diamonds" (figure 54) won Best Museum Exhibit from the Tucson Gem & Mineral Society and Best Institutional Educational Award from the Friends of Mineralogy. The exhibit demonstrated how famous diamonds such as the Hope and the Cullinan originated in extreme depths of the earth's lower mantle. The showcase featured extraordinary diamond jewelry and diamond replicas.

More than 30 cases were displayed by renowned museums including the Smithsonian Institution, LA County Museum of Natural History, and the Royal Ontario Museum. This is the second time GIA has won the award for Best Museum Exhibit, having won previously in 2016.

Robert Weldon receives Bonanno Award. Longtime *Gems & Gemology* author and photographer Robert Weldon (figure 55) has received the Accredited Gemologists Association's 2020 Antonio C. Bonanno Award for Excellence in Gemology. The award was presented during AGA's annual gala in Tucson on February 5.

During his more than 30-year career, Weldon has contributed scores of publications, serving as colored gemstone editor at *JCK* and senior writer at *Professional Jeweler*. His photography has appeared on more than 30 *G&G* covers, and he has written numerous feature articles for the journal. He coauthored, with Dona Dirlam, *Splendour & Science of Pearls* (2013). Since 2017, Weldon has been director of GIA's Richard T. Liddicoat Gemological Library and Information Center. In recent years he has also been closely involved in providing gemological training to independent African miners.

Figure 55. G&G *contributor Robert Weldon received the 2020 Bonanno Award for Excellence in Gemology.*

REGULAR FEATURES

COLORED STONES AND ORGANIC MATERIALS

DNA barcoding and next-generation sequencing (NGS) of freshwater pearls. Research efforts on the deoxyribonucleic acid (DNA) species identification of biogenic materials, in particular pearls, have been the focus of some gemological laboratories, including GIA's, for several years (J.B. Meyer et al., "DNA fingerprinting of pearls to determine their origins," *PLOS ONE*, Vol. 8, No. 10, 2013, e75606; K. Saruwatari et al., "DNA techniques applied to the identification of *Pinctada fucata* pearls from Uwajima, Ehime Prefecture, Japan," Spring 2018 *G&G*, pp. 40–50; K. Scarratt, *CIBJO Special Pearl Report*, 2019). Here we report on the findings of a study on the DNA analysis of cultured and natural freshwater pearls originating from both North America and China using the next-generation sequencing (NGS) technique, in collaboration with the Canadian Centre for DNA Barcoding at the University of Guelph.

A total of 22 freshwater pearl samples were subjected to DNA barcode analysis (figure 56). Nine American freshwater natural pearls (sample numbers 1, 2, 8, 12, 13, 15, 16, 17, and 18) and four American freshwater cultured pearls (sample numbers 3, 4, 9, and 10) from Gina Latendresse (American Pearl Company, Inc., Nashville, Tennessee), and nine Chinese freshwater cultured pearls (sample numbers 5, 6, 7, 11, 14, 19, 20, 21, and 22) from the GIA research collection were analyzed. The samples were either drilled with a hand drill using sterile techniques or crushed with a mortar and pestle using liquid nitrogen to obtain powder for analysis. Previously published DNA extraction protocols for pearls were modified to include newly designed primers for polymerase chain reaction (PCR) amplification and NGS. Only high-quality reads assigned to correct Ion Xpress MID (molecular identifier) tags were used in NGS data analysis. Negative PCR and negative extraction controls did not produce any valid sequencing data. Blast algorithms were utilized to match resulting operational taxonomic units to a reference library database for mitochondrial cytochrome c oxidase subunit I; results were imaged using MEGAN software. DNA sequences recovered from the unknown pearl samples were compared against the species sequence reference library in the Barcode of Life Data System, accessible at http://www.boldsystems.org, and compared against the National Center for Biotechnology Information database (https://www.ncbi.nlm.nih.gov).

DNA fragments from eight of the twenty-two samples were successfully recovered and identified. DNA-based species identification was highly consistent with the reported origin of the pearls (table 1). Results on the analyses of the 14 remaining samples were not successful, and no valid yield was recovered. This can be attributed to many factors, including insufficient DNA content due to limited sample size, or the elimination of trace DNA during the various routine pearl treatments known to be applied. While challenges remain on the extraction of DNA fragments from pearls, the results indicate that this technique can provide positive matches on individual pearls and prove which mollusk species they originated from, thus aiding in the identification of some challenging pearls or confirming mollusk origins in cases where greater detail may justify the time and expense of such analyses.

Figure 56. Twenty-two pearls of various kinds and species from various freshwater sources were used for the blind DNA study. Photo by Sood Oil (Judy) Chia.

TABLE 1. Successful DNA barcoding results of eight freshwater pearl samples, with their reported origins.

Sample no.	Reported origin	DNA barcoding result
3	American freshwater cultured pearl (*Megalonaias nervosa*—Washboard)	*Megalonaias nervosa*
4	American freshwater cultured pearl (*Megalonaias nervosa*—Washboard)	*Megalonaias nervosa*
8	American freshwater natural pearl (*Potamilus alatus*—Pink Heelsplitter)	*Potamilus alatus/purpuratus*
9	American freshwater cultured pearl (*Megalonaias nervosa*—Washboard)	*Megalonaias nervosa*
10	American freshwater cultured pearl (*Megalonaias nervosa*—Washboard)	*Megalonaias nervosa*
15	American freshwater natural pearl (unknown)	*Megalonaias nervosa*
19	Chinese freshwater cultured pearl (*Hyriopsis* species)	*Hyriopsis cumingii/schlegelii*
22	Chinese freshwater cultured pearl (*Hyriopsis* species)	*Hyriopsis cumingii/schlegelii*

This joint research was previously presented at the 7th International Barcode of Life Conference (*Genome*, Vol. 60, No. 11, pp. 1003–1004). GIA will continue to investigate this field of research, which is proving to be a highly valuable supplementary technique in the gemological examination of pearls.

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Sunstone plagioclase feldspar from Ethiopia. Ethiopia, traditionally known for opal, has become an important source for emerald and sapphire. After these significant discoveries, a new type of Cu-bearing sunstone feldspar, first shown in 2015 to Tewodros Sintayehu (Orbit Ethiopia Plc.), was discovered in the Afar region (L. Kiefert et al., "Sunstone labradorite-bytownite from Ethiopia," *Journal of Gemmology*, Vol. 36, No. 8, 2019, pp. 694–695). This material made its way to the jewelry market last year in Tucson.

To fully characterize this new production, GIA obtained 48 Ethiopian sunstones for scientific examination. Among them, 44 rough stones (figure 57, left) were borrowed from Stephen Challener (Angry Turtle Jewelry), who acquired them from an Ethiopian gem dealer in Tucson in February 2019. Another four rough stones (figure 57, right) were purchased by author YK from Amde Zewdalem (Ethiopian Opal and Minerals) and Benyam Mengistu, who facilitates mining and exporting samples from Ethiopia, at the Tokyo International Mineral Association show in June 2019. Prior to this discovery, the only verified occurrences of Cu-bearing feldspar were from Lake and Harney Counties in Oregon (e.g., the Dust Devil and Ponderosa mines). However, more than a decade ago there was a controversy about Cu-bearing feldspar on the market purportedly from Asia or Africa with an undetermined color origin, presumably Cu-diffused (G.R. Rossman, "The Chinese red feldspar controversy: Chronology of research through July 2009," Spring 2011 *G&G*, pp. 16–30; A. Abduriyim et al., "Research on gem feldspar from the Shigatse region of Tibet," Summer 2011 *G&G*, pp. 167–180). Gemological testing and advanced analytical methods helped distinguish this new Ethiopian material from the Oregon material and the controversial feldspar of questionable color origin mentioned above in order to ensure GIA's accurate reporting of the natural origin of Cu-bearing feldspar.

Two polished rough Ethiopian samples gave RI readings of $n_\alpha = 1.562$ and $n_\gamma = 1.571$ and birefringence of 0.009. Optic

Figure 57. Left: Forty-four Ethiopian rough sunstones exhibiting different colors and clarities. The largest stone weighs 54.41 ct. Right: Four Ethiopian rough sunstones ranging from 9.92 to 35.42 ct. All 48 rough stones were identified as labradorite by LA-ICP-MS, except for one spot as bytownite. Photos by Diego Sanchez (left) and Shunsuke Nagai (right).

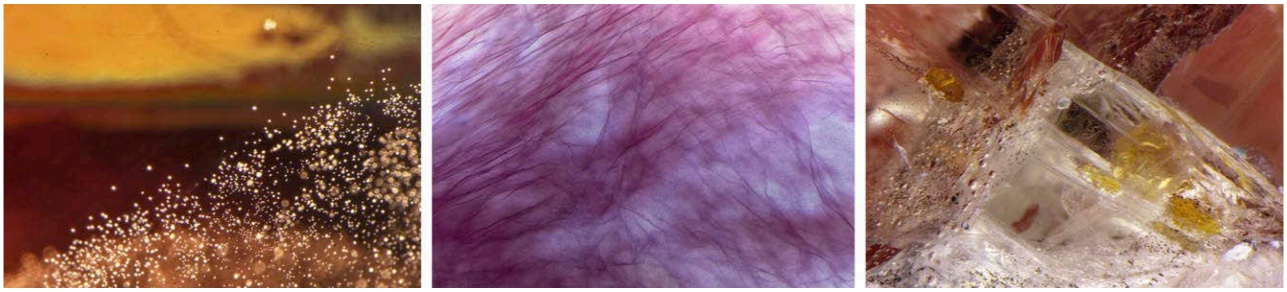

Figure 58. Left: Clouds of copper platelets were observed in numerous Ethiopian sunstones. Field of view 3.13 mm. Center: Dense networks of reddish wispy dislocations were seen in some Ethiopian sunstones, along with a slightly greenish blue bodycolor. Field of view 2.72 mm. Right: Yellowish crystals of what are likely fayalite were seen in one Ethiopian feldspar. These inclusions have also been documented in Oregon sunstone. Field of view 2.82 mm. Photomicrographs by Nathan Renfro.

signs were biaxial positive. Hydrostatic SG measurements were 2.70 and 2.72. These RI and SG ranges overlapped with Oregon sunstone (RI—n_α = 1.560–1.570, n_γ = 1.568–1.579; birefringence—0.006–0.012; SG—2.70–2.72) but were significantly higher than other Cu-bearing feldspars with undetermined natural or treated color origin (n_α = 1.551–1.559, n_γ = 1.559–1.566; birefringence—0.004–0.010; SG—2.68–2.69). A total of 18 Ethiopian sunstones were tested under a desktop UV lamp. Eleven showed very weak orange fluorescence, while seven were inert under long-wave UV. All showed very weak red fluorescence under short-wave UV. Under magnification, many showed dense clouds of reflec-

TABLE 1. Generalized trace element profiles of sunstone feldspar in parts per million weight (ppmw) and mol.% end members.

Ponderosa mine: Natural Oregon sunstone							
	Key trace element chemistry				Mol.% end members[a]		
	Mg	Cu	Ga	Sr	Ab	An	Or
Range	879–1110	3.78–179	12.0–14.0	437–485	28.1–32.4	67.3–71.6	0.27–0.37
Average	1050	58.2	12.8	452	29.9	69.8	0.29
Median	1060	27.1	12.7	450	29.8	69.9	0.29
Dust Devil mine: Natural Oregon sunstone							
	Key trace element chemistry				Mol.% end members[a]		
	Mg	Cu	Ga	Sr	Ab	An	Or
Range	810–1090	0.74–104	12.0–20.1	449–671	27.7–35.7	63.5–72.0	0.28–0.82
Average	920	25.0	16.4	580	32.2	67.2	0.62
Median	903	17.5	17.1	593	32.5	66.8	0.68
Natural Ethiopian sunstone							
	Key trace element chemistry				Mol.% end members[a]		
	Mg	Cu	Ga	Sr	Ab	An	Or
Range	261–686	0.51–115	16.5–25.3	283–781	29.7–39.4	60.1–69.9	0.37–1.42
Average	421	15.5	19.4	367	34.2	65.3	0.59
Median	411	7.54	19.2	328	34.4	65.0	0.49
Cu-bearing feldspar with undetermined color origin							
	Key trace element chemistry				Mol.% end members[a]		
	Mg	Cu	Ga	Sr	Ab	An	Or
Range	315–492	405–653	16.3–18.8	1120–1210	46.3–50.8	46.3–51.3	2.36–3.05
Average	423	499	17.6	1160	48.7	48.7	2.60
Median	420	481	17.7	1160	48.7	48.8	2.57

[a]Abbreviations: Ab = albite, An = anorthite, Or = orthoclase
Detection limits: 0.45–2.08 ppmw Na, 0.011–0.11 ppmw Mg, 0.26–0.59 ppmw K, 5.27–22.2 ppmw Ca, 0.014–0.050 ppmw Cu, 0.007–0.45 ppmw Ga, 0.002–0.008 ppmw Sr

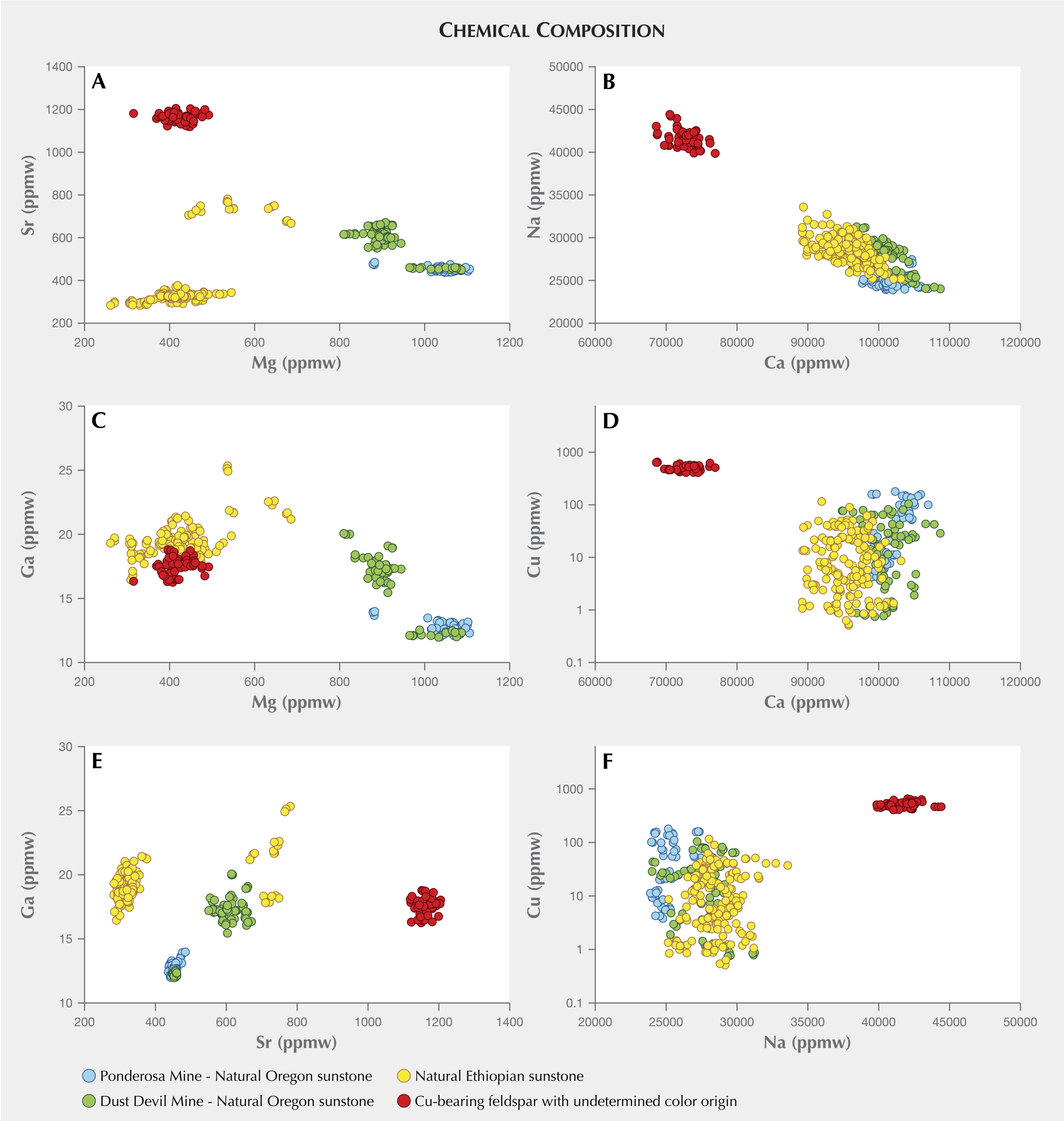

Figure 59. Chemical comparison of Oregon and Ethiopian sunstone and Cu-bearing feldspar with undetermined color origin. Mg (A and C) is the key trace element that separates Ethiopian from Oregon sunstone. The unknown Cu-bearing feldspar has a much higher Cu and Sr concentration than other natural untreated sunstones (A, D, E, and F). For major elements, Ethiopian sunstone overlaps with Oregon sunstone, with a slight lower Ca concentration (B and D). The unknown Cu-bearing feldspar contains more Na and less Ca than other natural untreated sunstones (B, D, and F).

tive copper platelets, much like those observed in material from Oregon (figure 58, left). Some stones also showed an interesting wispy network of reddish dislocation stringers with a greenish blue bodycolor in transmitted light (figure 58, center). Another example revealed several yellow crystals of what appeared to be fayalite, an inclusion also observed in Oregon sunstone (figure 58, right).

Laser ablation–inductively coupled plasma–mass spectrometry (LA-ICP-MS) was used to measure the chemistry of all 48 Ethiopian sunstones, 26 Dust Devil sunstones, 19

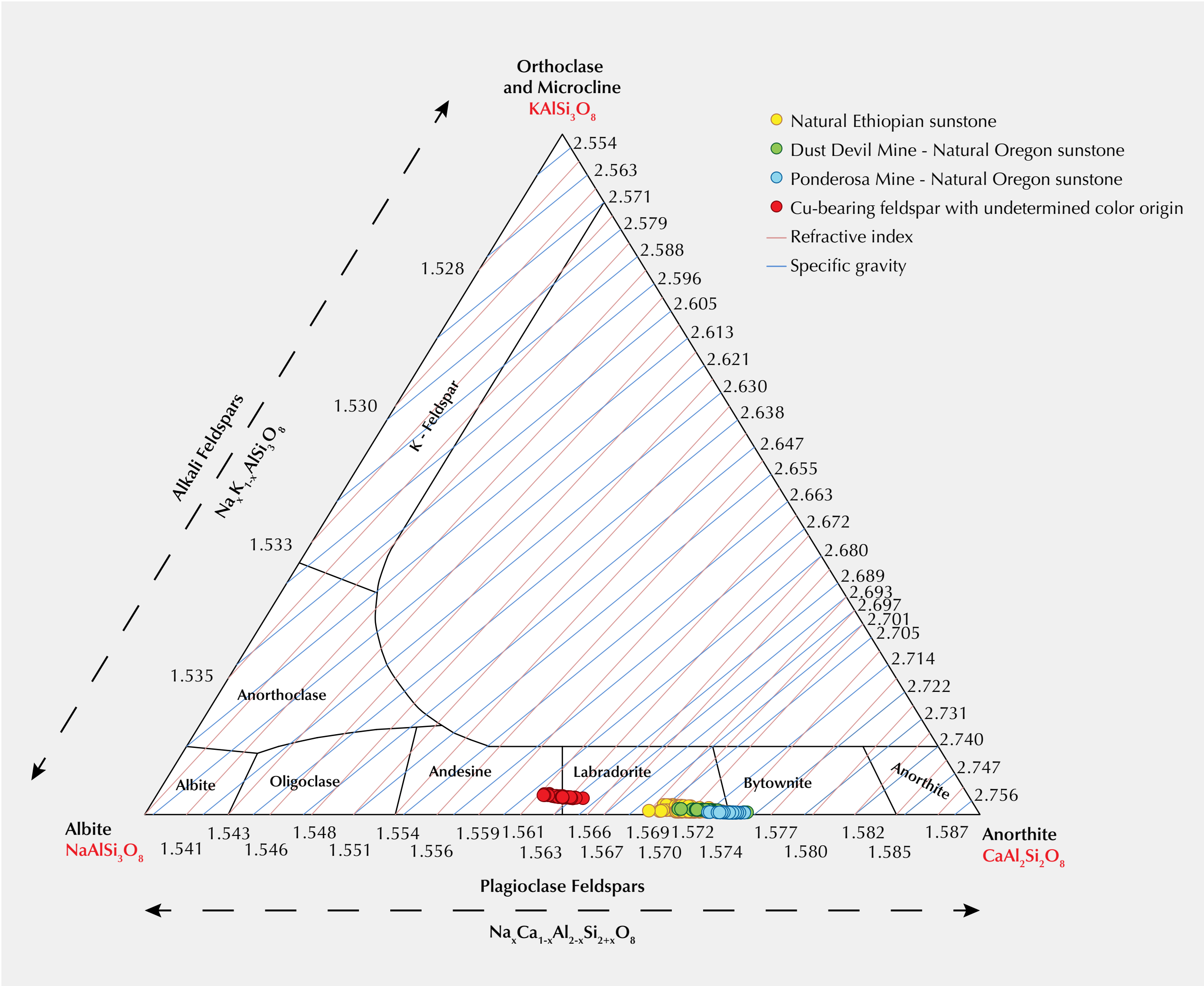

*Figure 60. Illustration of solid solution in the feldspars, modified after Deer et al. (*Rock-Forming Minerals, Volume 4: Framework Silicates*, 1963). The nomenclature of the plagioclase series and the alkali feldspars is also shown. All 48 Ethiopian rough stones (yellow dots) were classified as labradorite except one bytownite. Forty-five Oregon sunstones (blue and green dots) were classified as labradorite-bytownite. Twenty Cu-bearing feldspars with undetermined color origin (red dots) were classified as andesine-labradorite. Ethiopian sunstones are less calcic than Oregon sunstones. Variation of refractive indices n_γ and specific gravity with composition of feldspars were plotted in the ternary plot as pink and blue straight lines, respectively. Note: n_γ = gamma, the highest RI of a biaxial crystal, light vibrating parallel to the Z optical direction.*

Ponderosa sunstones, and 20 Cu-bearing feldspars with undetermined color origin. NIST 610 and USGS GSD-1G and GSE-1G glasses were used as external standards. ^{29}Si was used as an internal standard. Ponderosa and Dust Devil sunstones yielded an end member composition of $Ab_{28–32}An_{67–72}Or_{0.3–0.4}$ and $Ab_{28–36}An_{64–72}Or_{0.3–0.8}$, respectively (table 1). They are classified as labradorite-bytownite using an albite-anorthite-orthoclase (Ab-An-Or) ternary diagram (figures 59B and 60, blue and green dots). Ethiopian sunstones yielded an end member composition of $Ab_{30–39}An_{60–70}Or_{0.4–1.4}$, which is generally similar but less calcic than Oregon sunstones (table 1). All analyses of Ethiopian material indicated classification as labradorite except one spot that gave bytownite (figure 59B and figure 60, yellow dots). The Cu-bearing feldspar with undetermined color origin yielded an end member composition of $Ab_{46–51}An_{46–51}Or_{2–3}$ (table 1). They were classified as andesine-labradorite, distinct from the Oregon and Ethiopian material (figure 59B and figure 60, red dots). In addition to the differences with major elements Na, Ca, and K, the analyses revealed that the trace elements Mg, Cu, Ga, and Sr were the four best discriminators providing clear separations among Oregon and Ethiopian sunstone and Cu-bearing feldspar with undetermined color origin. All Ethiopian sunstone had a lower Mg concentration (261–686 ppmw, table 1) than Oregon sunstone (>810 ppmw, table 1) (figure 59A). The Cu-bearing feldspar with undetermined color origin had a higher Cu (>405 ppmw) and Sr (>1120 ppmw) concentration than Oregon and Ethiopian sunstone (figure 59, A, D, E, and F). Interestingly, Ponderosa samples (figure 59, C and E) had a lower Ga concentration (<14.0 ppmw) than the Ethiopian sunstone and Cu-bearing feldspar with undetermined color origin. A group of Dust Devil stones with higher Mg, Ga, and Sr concentrations were separated from all other sources in figures 59A and 59C, further differentiating them from Ponderosa stones.

Copper-bearing sunstones from different sources are visually indistinguishable from one another. Gemological properties are usually sufficient to separate Ethiopian and Oregon sunstones from these Cu-bearing feldspars with undetermined color origin. However, accurate major and trace element chemical analysis obtained by methods such as LA-ICP-MS, XRF (Ga and Sr were first identified as reliable discriminators for separating Ethiopian from Oregon sunstones using XRF by author GRR before this work), or electron microprobe is critical to separating Ethiopian, Oregon, and Cu-bearing feldspar with undetermined color origin.

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SYNTHETICS AND SIMULANTS

Dyed chalcedony imitation of chrysocolla-in-chalcedony. Chrysocolla-in-chalcedony, also known as gem silica or blue chalcedony in Taiwan, is the most valuable chalcedony variety on the Taiwanese market. The beautiful greenish blue color is derived from micro-inclusions of chrysocolla, which can be identified by observation of a peak at 3619 cm^{-1} in the Raman spectrum. This peak can be assigned to OH groups in chrysocolla. Therefore, the color origin for this material is fundamentally rooted in the presence of Cu^{2+} ions in the structure of the chrysocolla inclusions. In the past few years, a large number of dyed chalcedony imitations have appeared in Taiwan's market. The blue color of chalcedony dyed by copper salts, and that of natural specimens containing chrysocolla, is caused by Cu^{2+} ions.

Recently, a parcel of loose chalcedonies was sent to the Taiwan Union Lab of Gem Research (TULAB) for identification. These stones were submitted as natural blue chalcedony, but Raman spectroscopy later confirmed them as chalcedony without the characteristic peaks of chrysocolla (figure 61).

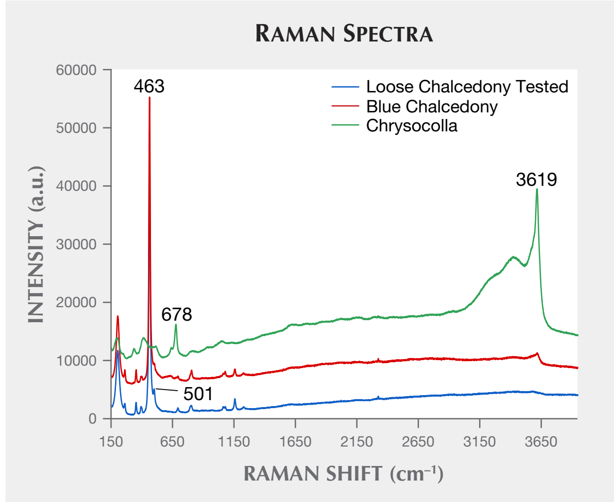
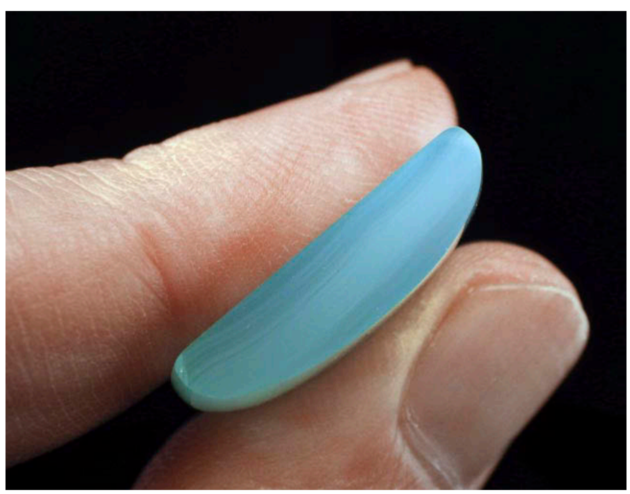


Figure 61. The Raman spectrum of the loose chalcedony compared to that of chrysocolla and blue chalcedony reveals a mineral composition of quartz (463 cm^{-1}) and moganite (501 cm^{-1}) but a lack of chrysocolla inclusions (3619 cm^{-1}).

With the owner's consent, we cut one cabochon and polished the cross section displaying a blue mantle zoning from surface to center parallel to its profile (figure 62). The sample was analyzed with EDXRF, and concentration mapping on the cross section confirmed that copper was concentrated on the surface and decreased toward the interior, which is strong evidence for dyeing with copper salts (figure 63).

Twenty pieces of chalcedony dyed with copper salts were further analyzed with EDXRF and compared to results from twenty pieces of natural blue chalcedony. EDXRF re-

Figure 62. A blue mantle zoning on the cross section of the loose chalcedony is due to the bath of copper dye. Photo by Shu-Hong Lin.



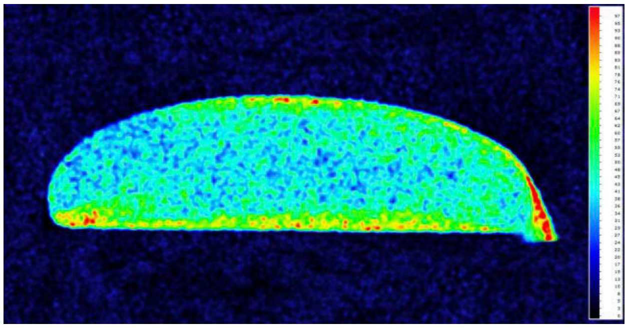


Figure 63. The concentration mapping for copper on the cross section of dyed chalcedony, which shows higher copper concentration in the periphery and lower in the interior; the different colors on the right represent the degree of relative concentration for copper from high to low.

sults indicated that the Si/Cu ratio of chalcedony dyed with copper salts was much higher than that of natural blue chalcedony (400–600 and 4–50, respectively). The content of Cu was relatively low in dyed chalcedonies tested.

There are many types of dye used for the color enhancement of chalcedony. Although a series of tests like those used above provide a comprehensive comparison between natural blue chalcedony and the dyed chalcedony analyzed in this research, it requires further verification whether these methods can be applied to other dyed chalcedonies.

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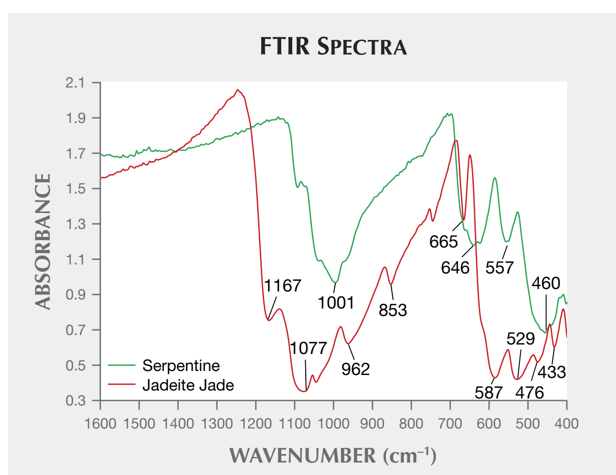
Jadeite jade and serpentine doublet. The Lai Tai-An Gem Lab in Taipei recently received a carving presented as jadeite jade. The rectangular, uneven green piece, carved on one side but almost plain on the back and sides, weighed approximately 171.01 ct and measured approximately 50.4 × 39.9 × 7.4 mm (figure 64). Standard gemological testing revealed a spot RI of 1.66 on an area of the carved side, but surprisingly the smoother surfaces failed to yield clear readings. Microscopic observation revealed a coating in the areas where the failed RI attempts were made.

Subsequent infrared analysis proved the carved side was jadeite jade owing to the relevant absorption valleys observed at 1167, 1077, 962, 853, 665, 587, 529, 476, and 433 cm^{-1}. However, the four sides and base revealed valleys at 1001, 646, 557, and 460 cm^{-1}, characteristic of serpentine despite the surface coating observed (figure 65).

Figure 64. This "jadeite jade" carving submitted for identification proved to be a jadeite jade and serpentine doublet. Photo by Lai Tai-An Gem Lab.

The client granted us permission to remove the coating in order to analyze the item in more detail. After removal of the coating, the four sides and base showed a lighter saturation of green color separated by a visible horizontal line (figure 66, B and D). Before coating removal, the layering was not as obvious (figure 66, A and C). Magnification confirmed that the object was composed of two different materials. Standard gemological testing of the lighter colored material yielded RIs of 1.56, consistent with those expected

Figure 65. FTIR analysis revealed absorption valleys at 1167, 1077, 962, 853, 665, 587, 529, 476, and 433 cm^{-1} in the jadeite jade portion (red spectrum) and valleys at 1001, 646, 557, and 460 cm^{-1} in the serpentine portion (green spectrum).



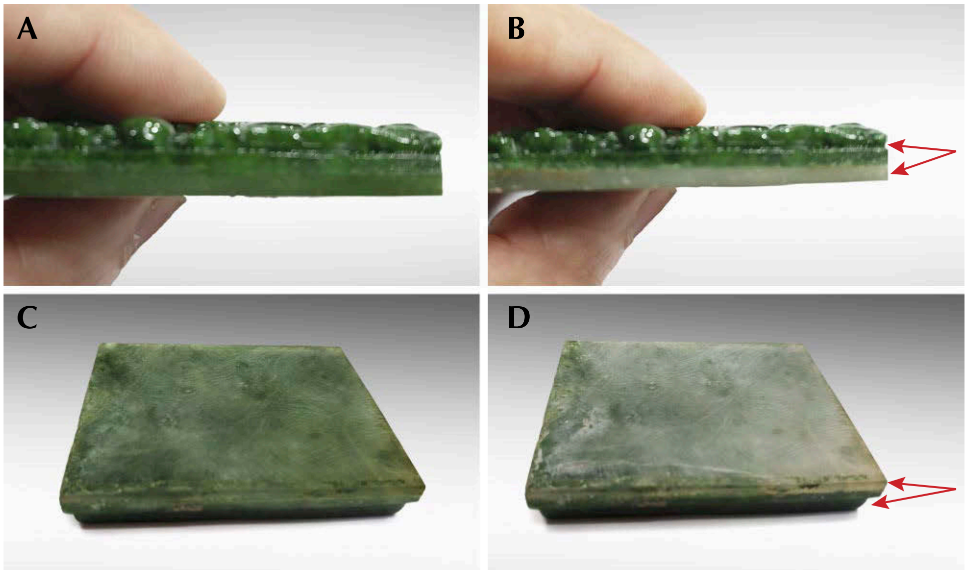


Figure 66. Removal of the coating from the four sides and base exposed a clear boundary between the two materials (B and D). Prior to the coating's removal (A and C), there were no indications the item was a doublet. Photos by Lai Tai-An Gem Lab.

for serpentine and supported by the FTIR and Raman analyses. Jadeite jade and serpentine can have a very similar appearance. The identification of this particular piece proved relatively straightforward, but if it were mounted in a closed-back setting with only the carved face visible, a costly identification error could easily result.

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MISCELLANEOUS

Television documentary series: "Beautiful Gem Stories." The unique allure of jewelry and the excitement of the global gem industry are captured in the Japanese documentary series "Beautiful Gem Stories." The program is broadcast on BS-TBS channel, a subsidiary of Tokyo Broadcasting System, and hosted by longtime *G&G* contributor and editorial board member Dr. Ahmadjan Abduriyim (Tokyo Gem Science, LLC and GSTV Gemological Laboratory). Hour-long episodes examine the growth of gemstones deep under the earth's surface and the mining methods to recover them, as well as the characteristics, craftsmanship, and cultural significance that make them special.

Since 2016, Dr. Abduriyim has filmed on location at important gem deposits in Madagascar, Mozambique (figure 67), Tanzania, Namibia, Sri Lanka (figure 68), Myanmar, Thailand, Vietnam, Brazil, Colombia, and other countries. He has also gone to natural and cultured pearl localities in Bahrain, the United Arab Emirates, Vietnam, and Japan, as well as global manufacturing centers, museums, and trade shows.

Figure 67. Dr. Ahmadjan Abduriyim hosts an episode of "Beautiful Gem Stories," filmed on location at the Montepuez ruby mine in northern Mozambique. Photo by Tomoaki Miyake.

Figure 68. In this episode, Dr. Abduriyim reports from the Bogawatalawa sapphire deposit in Sri Lanka. Photo by Tomoaki Miyake.

After monthly episodes from 2016 to 2018, four new episodes are broadcast per year now. With more than one million regular viewers, "Beautiful Gem Stories" has been warmly received.

"The financial crisis that hit the Japanese economy in 2008 took a heavy toll on consumer interest in jewelry," said Dr. Abduriyim. "But I am very grateful to contribute to restoring the jewelry industry in Japan and throughout the world with an enlightening look at gemstones."

ANNOUNCEMENTS

Dutrowite: New mineral species of tourmaline. A newly discovered mineral species of the tourmaline group has been named in honor of Dr. Barbara Dutrow (figure 69, left). Dutrowite (figure 69, right) was discovered in the Apuan Alps of Tuscany, Italy, and has been recognized by the International Mineralogical Association. The Austrian, Italian, and Swedish researchers who discovered the mineral named it in recognition of Dr. Dutrow's teaching and research contributions, particularly on tourmaline and its formation. She is the Gerald Cire and Lena Grand Williams Alumni Professor in the Department of Geology and Geophysics at Louisiana State University in Baton Rouge. In 2007, she was a coauthor of the 23rd edition of *Manual of Mineral Science*, a standard reference textbook for the study of minerals. Since 2016, Dr. Dutrow has served on the GIA Board of Governors.

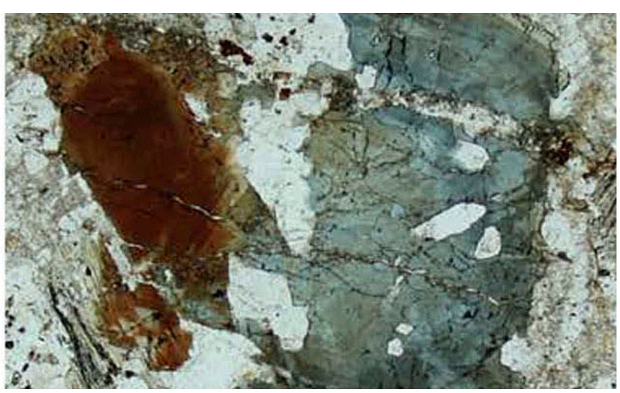

Figure 69. Left: Professor Barbara Dutrow has been honored with the naming of the new mineral dutrowite. Photo by Kevin Schumacher. Right: Sample of dutrowite (brown) and dravite (blue) tourmalines in meta-rhyolite from Italy. Courtesy of Cristian Biagioni.

***G&G* launches Facebook group.** On February 5, 2020, *Gems & Gemology* launched a Facebook group dedicated to gemology and research published in the journal. The group has attracted jewelry professionals, researchers, students, and those with a general interest in gemology who want to share and expand their knowledge. With several dozen posts (figure 70), the *G&G* Facebook group has become a dedicated forum for the discussion of inclusions, treatments, field gemology and gemstone mining, and identification of laboratory-grown or cultured gemstones, including identification challenge quizzes. Some of the most popular posts to date have featured stunning photomicrographs of gersdorffite inclusions in quartz, diamonds with octahedral stellate cloud inclusions, mysterious sapphires from the Andes Mountains in South America, and the use of Google Earth for research in field gemology. The enthusiastic base of more than 7,000 members hails from all parts of the globe. To join, visit www.facebook.com/groups/giagemsgemology.

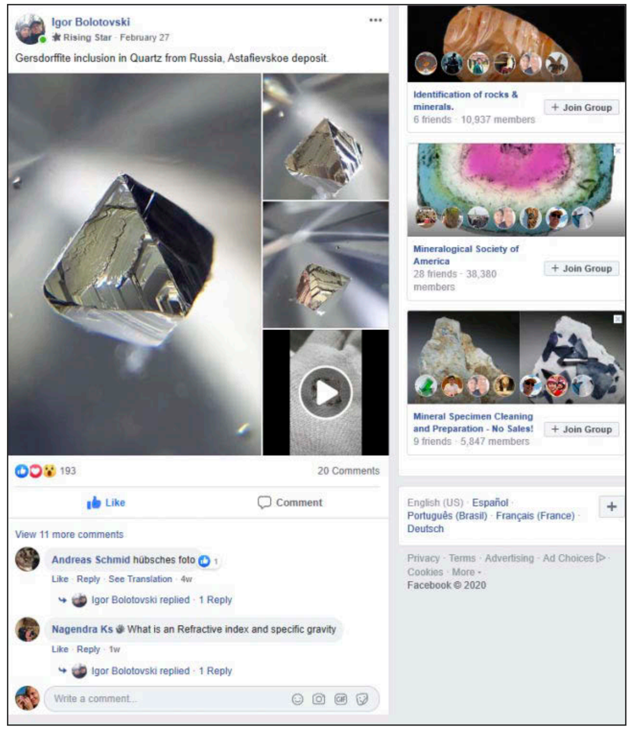

Figure 70. The G&G *Facebook group is a new community for all gem and jewelry enthusiasts.*

ERRATUM

In the Winter 2019 article "Geographic Origin Determination of Emerald," the figure 9 caption gave the source of the faceted emerald as Zarajet, Afghanistan. The correct location is Zarakhil, Afghanistan. We thank Ahmad Khaled for this correction.