G&G

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TUCSON 2014

Every February, exhibitors and buyers from all over the globe descend on Tucson, Arizona, for the annual gem and mineral shows that take place in conference spaces, tents, hotel rooms, and parking lots across the city (figure 1). This year a number of exhibitors noted the lack of Chinese buyers, who are now likely to make their purchases at the Hong Kong show for convenience. For many exhibitors, however, Tucson remains a very important venue in the year's trade show calendar.

For Alexander Wild (Wild & Petsch Lapidaries, Kirschweiler, Germany), the show was a place to write invoices and do "serious selling." While many clients were not shopping for any one particular gem, they were seeking out unique items: fine-quality gems as single pieces, matched pairs, sets, or suites. Exhibitors selling everything from cultured pearls to unheated tanzanite, Australian chrysoprase, and top-quality ruby, sapphire, and emerald echoed the same sentiment: fine goods were strong sellers.

Wild attributed the current shortage of gem rough to the global economic crisis that began in September 2008. The following years, he recalled, were "disastrous" for many in the colored gem trade, as their customers simply stopped buying. The resulting lack of liquidity cascaded down to active mining operations, especially in Africa and Brazil. Miners in those areas were left with no clients for their previously mined goods, and no income with which to purchase equipment or staples such as diesel fuel. Within a short time, Wild said, many operations were saddled with debt and subsequently ceased operations. Mine workers returned to the agricultural sector, which began to rebound in 2009. By then, costs had become so prohibitive that many former operators could no longer afford to return to the mining industry.

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One common refrain among exhibitors was the intense competition for scarce cutting rough, creating a dramatic price increase. Many mentioned stiff competition from Chinese buyers or their agents at the sources. Steve Ulatowski of New Era Gems (Grass Valley, California) told us the price of pink to red tourmaline rough has shot up due to Chinese demand. He cited Nigerian tourmaline rough that was priced at $8,000 per kilogram several years ago; the current asking price for equivalent goods was $200,000 per kilo, with sellers asking for cash on the table.

Many dealers also emphasized the importance of "recirculated" gems or jewelry pieces, remarking on the high quality of pieces in the secondary market. These included fine sapphire, ruby, alexandrite, and cat's-eye chrysoberyl, gems that were otherwise unobtainable. All find a ready market in Asia.

Regardless of these powerful undercurrents, most of the exhibitors who spoke with us expressed satisfaction with their results from Tucson. Although traffic at some shows was down from previous years, exhibitors reported that buyers were serious and business was satisfyingly brisk.

All in all, the Tucson gem and mineral shows are a fascinating cross section of materials, sellers, and buyers that provides a unique window into a singular industry. We eagerly look forward to next year's shows.

G&G appreciates the assistance of the many friends who shared material and information with us this year, with special thanks to the American Gem Trade Association for providing photography studio space during the AGTA show. GIA's Eric Welch, Pedro Padua, Clara Zink, and Andy Lucas contributed to this report.

COLORED STONES AND ORGANIC MATERIALS

Cultured pearl market update. Fran Mastoloni (Mastoloni Pearls, New York City) updated us on the cultured pearl

Figure 1. From the convention center to tented pavilions and hotels to parking lots, Tucson's many gem and mineral shows draw buyers of every stripe hungry for the earth's treasures. Photos by Eric Welch (top left), Stuart Overlin (bottom right), and Duncan Pay (top right and bottom left).

market during the AGTA show. He explained that for the past two years, the emphasis has been on long necklaces, double strands, and mixing different sizes, colors, and types of cultured pearls. These trends have reenergized the market, making pearls "fun to wear again." While weddings and graduations are still occasions for classic akoya-type necklaces and studs, there are now more opportunities to sell innovative blends of color and shape. Typical of this approach is the striking necklace with 15–17 mm Tahitian baroque cultured pearls shown in figure 2 (left). Such a piece might take three years to make and could retail for tens of thousands of dollars.

With production of Tahitian cultured pearls down, Mastoloni has been using smaller off-round, pastel-colored pearls to create distinctive, competitively priced necklaces. These styles offer a "big" look for a relatively low price. The colors, including a subtle silvery gray, are all natural. Mastoloni stressed the importance of luster as a selling point.

South Sea cultured pearl production has been reliable and consistent in quality, but prices have fluctuated. While lower-quality specimens are inexpensive and readily available, high-quality pearls are expensive and difficult to obtain. Due to improvements in culturing processes—including the X-ray inspection of mollusks—baroque-shaped cultured pearls have become increasingly rare. When X-ray operators detect a non-round pearl, Mastoloni noted, they will restart the culturing process. As a result, fewer non-round shapes are available for baroque necklaces (figure 2, center).

Demand for fine cultured pearls from China has outstripped supply, with fine examples of all pearl types show-

Figure 2. Left: This strand of baroque cultured pearls from Tahiti is indicative of current jewelry trends. Center: Due to improved culturing techniques, baroque South Sea cultured pearl necklaces will become increasingly expensive and difficult to find. Right: These naturally golden cultured pearls from the Philippines range from 14 to 17 mm. China's increasing demand for them has pushed up prices and reduced availability elsewhere. Photos by Eric Welch; courtesy of Mastoloni Pearls.

Figure 3. This very fine 12–14 mm multicolor necklace was assembled piece by piece using Australian, Philippine, and Tahitian cultured pearls. Each cultured pearl is matched for size and shape, and all have exceptional luster. Photo by Robert Weldon.

Figure 5. The morganite carving on the left was inspired by the floating watches in the famous Salvador Dali painting "The Persistence of Memory." The geometric carvings on the right look simple when the stone is viewed from the base but produce an array of bright reflections and crystalline brilliance when viewed from above. Photo by Eric Welch; courtesy of Sonja Kreis.

ing surges in price. Golden cultured pearls from the Philippines (figure 2, right) have become increasingly costly and difficult to obtain, Mastoloni noted.

This scarcity of cultured pearls made the necklaces exhibited by Mastoloni all the more remarkable. They included an exceptional strand of multicolor specimens from Australia, the Philippines, and Tahiti (figure 3), as well as a truly remarkable Burmese cultured pearl necklace that was the product of decades of labor (figure 4).

Mastoloni added that the cultured pearl industry has become much more competitive. Dealers require much more breadth of inventory: Simply having akoya or Chinese freshwater material is no longer enough. Customers are more educated and driven to seek out unique, striking pieces of different colors, shapes, or lengths—and want to see new variations and combinations every time they look to make a purchase.

Duncan Pay

Exceptional gem artistry in sunstone, rutilated quartz, and beryl. At the GJX show, Sonja Kreis (Unique Jewelry, Niederworresbach, Germany) displayed exceptional examples of the jeweler's and gem carver's art. Kreis designs the jewelry, and her son Alexander cuts the gems.

Alexander Kreis explained that their family has a tradition of over 500 years of gemstone cutting and jewelry manufacture. He apprenticed as a traditional gem cutter, but elected to find his own path to unlock the beauty of

Figure 4. Fran Mastoloni displays a triple necklace of Burmese cultured pearls (left). From the inner strand out, the strands measure 14.65 × 10.50 mm, 14.80 × 10.30 mm, and 15.30 × 10.50 mm (right). The Mastoloni family collected the pearls from 1965 to 1975 and considers this the finest cultured pearl necklace in existence. Photos by Eric Welch (left) and Robert Weldon (right).

Figure 6. The Oregon sunstones in this fantasy-cut pendant and ring, displaying deep red color and intense stripes of schiller, were cut from the same piece of rough. Photo by Eric Welch; courtesy of Sonja Kreis.

Figure 8. Mary Lou Osmond demonstrates the rich, vibrant color of Marlborough chrysoprase, which is due to high concentrations of nickel. Photo by Eric Welch.

fine gem crystals. His cutting is a spectacular blend of freeform curves and dramatic geometrical cuts. Alexander works with many materials, including tourmalines and beryls (figure 5), but Oregon sunstones (figure 6) and rutilated quartz (figure 7) are among his favorites. The fine Oregon sunstone was on display at their booth. Alexander's father, Stefan Kreis, described their very strict criteria for selecting rough. On a visit to a set of mines in Oregon's Rabbit Basin, they selected 395 grams of rough out of the 50 kg they were shown; one such piece of rough is featured in figure 6.

Duncan Pay

Fine Australian chrysoprase rough and carvings. Mary Lou Osmond (Candala Chrysoprase, Marlborough, Australia) explained the nature and operation of the company's chrysoprase chalcedony mine. Mine access requires flying to the town of Rockhampton, 635 km (394 miles) north of Brisbane, followed by a two-hour drive in a four-wheel-drive vehicle. The site, protected with guard dogs and fences, is adjacent to a Chinese-owned mine, the only other operation in the area.

Highly translucent, deep-color chrysoprase (figure 8) is recovered from veins two to eight inches in thickness. Osmond said the bright green color of material from this deposit is due to high nickel content, reportedly up to 2.35%.

Osmond explained that most material is found after heavy rain, when the extensively mined terrain shifts. Moving water from intense storms might carry automobile-sized rocks over hills and deposit them in neighboring stream beds kilometers away. The downpours expose everything, even material that the miners have been walking over for years. After every rainstorm, it pays to scour the newly exposed ground and look for glints of green, in case there is a larger vein underneath.

Recovered material is brought back to the mining camp

Figure 7. Left: Alexander Kreis displays one of his unique pieces: a star-shaped rutilated quartz. Right: This superb 442.78 ct faceted Brazilian quartz with rutile inclusions is typical of Kreis's art. According to Kreis, the orientation of the needles is the most important decision in the design of the finished gem. Photos by Eric Welch (left) and Robert Weldon (right); courtesy of Sonja Kreis.

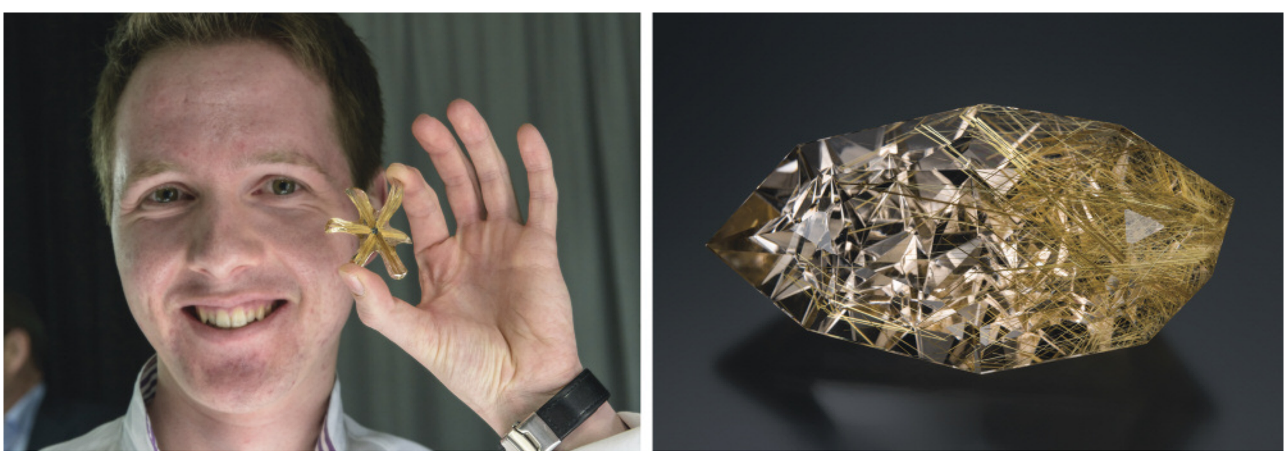


Figure 9. These chrysoprase carvings are from Candala's Queensland mine. Photo by Eric Welch.

Figure 11. This heated 33.16 ct emerald-cut royal blue sapphire is from Sri Lanka. Photo by Robert Weldon; courtesy of B&B Fine Gems.

for washing. Water tanks collect the rainfall, and the miners use high-pressure hoses to wash off the rough chrysoprase, which is then handpicked. The best material, marked "premium," is sent to Sydney for sale, while the remainder is sorted into four grades by color and clarity (A through D). For Tucson, Osmond brought over 80 kg of rough, of which 10 kg was premium quality.

Most buyers gravitated to the top-quality material, all of which was sold, along with over half of the A-grade material. Although buyers bought many carvings (figure 9), to Osmond's surprise they also purchased large quantities of calibrated goods. Many also sought out top-quality rough for cabochon cutting, rather than gem carvings, indicating a growing awareness and demand for the gem.

Candala's client base includes Indian, German, U.S., and Thai buyers. At this year's Tucson show, most of the chrysoprase carvings went to collectors, as well as one television shopping channel.

Duncan Pay

Fine corundum, Paraíba tourmaline, and alexandrite. At the AGTA show, Dave Bindra (B&B Fine Gems, Los Angeles) showed us an exceptionally large fashioned alexandrite reportedly from Sri Lanka (figure 10). According to Bindra, it is very difficult to find fine specimens over 5 ct, although Sri Lanka and Madagascar are known to produce sizeable alexandrite crystals. At over 100 ct, this is certainly one of the largest our team has seen. Bindra speculates that the original crystal may have been over 300 ct.

Also on display was a royal blue emerald-cut Sri Lanka sapphire weighing over 33 ct (figure 11). Bindra noted that supply of fine sapphire, while scarce, is currently stronger than fine ruby. Compared with rubies of equivalent price, fine sapphires offer more size and quality; as a result, prices have risen dramatically over the last two years. This is a function of constricted supply and increasing demand as the Chinese market opens up to premium goods. Only three to five years ago, the strongest demand from Chinese buyers was for mid-range to commercial material. The Chinese are

Figure 10. This remarkable 112.82 ct Sri Lankan alexandrite, seen under incandescent (left) and fluorescent lighting (right), is unusually large. Photos by Robert Weldon; courtesy of B&B Fine Gems.

Figure 12. Fine rubies were scarce and expensive at the 2014 Tucson gem show. According to the dealer, this 9.10 ct Mozambique ruby had only undergone low-temperature heating. Photo by Robert Weldon; courtesy of B&B Fine Gems.

currently consuming the finer items once sought only in Western Europe, the United States, and Japan. As a result, U.S. dealers and consumers have to contend with competition in this market. As Bindra pointed out, this creates "a very interesting dynamic."

Also at the B&B booth was a superb 9 ct Mozambique ruby (figure 12), one of the finest rubies Bindra has seen from this source. He explained that Mozambique's rubies are so popular because they come in large, strongly colored crystals; once cut, they produce clean, attractive gemstones. They are very marketable because consumers readily appreciate their beauty. Bindra told us that Mozambique ruby crystals can be a little flat, which constrains the depth of fashioned stones. It is difficult to find a piece of rough above 4–5 ct with fine color suitable for cutting a clean gemstone; this makes the 9 ct ruby exceptional. A gem of this quality might sell for US$50,000 per carat or more.

By comparison, Burmese rubies are increasingly difficult for domestic dealers to obtain due to the U.S. embargo against Myanmar. Trade is limited to gems that predate the ban and were already in circulation in the United States.

Finally, Bindra showed us what he described as the star of his show: a 14.59 ct Brazilian Paraíba tourmaline, reportedly unheated (figure 13). He was fortunate enough to acquire this stone out of a collection. The previous owner had purchased it years ago when the material first came out, making this another example of recirculation rather than current production. Bindra confirmed the importance of the secondary gem market, which has become critical to dealers because there is so little material coming from deposits. With so much competition at the source—especially when a deposit, such as Paraíba, is reportedly depleted—dealers have no choice but to look in the secondary market.

Duncan Pay

Fossilized drusy shells. Tarun Adlakha (Indus Valley Commerce, New Delhi) exhibited fossilized shells replaced by chalcedony and encrusted with drusy quartz (figure 14). The shells are originally from a rare left-hand coil variety of gastropod that lived between 50 and 100 million years ago, when the Indian subcontinent was submerged under the ocean. Recovered from a hill in the Dhar region of Madhya Pradesh state in central India (figure 15), they were hammered, chiseled, and carefully removed by hand from rock.

According to Adlakha, these shells were called *Dakshinavarti* in ancient Sanskrit. The Hindu, Buddhist, and Tibetan cultures revere the left-hand coil gastropods for their metaphysical powers. Adlakha has trademarked this fossilized material as Spiralite Gemshells for use in jewelry.

Robert Weldon

Gem crystals. At the Pueblo Show, Steve Ulatowski (New Era Gems, Grass Valley, California) told us how the dynamics of his business have shifted from facet-quality rough to crystal specimens, which now make up more than 80% of his turnover by dollar value. In particular, small gem crystals in wire-wrapped jewelry now form a large part of his commerce.

Figure 13. Dave Bindra shows off a superb 14.59 ct oval faceted Brazilian Paraíba tourmaline. Gems of this quality above 1 ct are extremely rare, making this gem exceptional. Photos by Eric Welch (left) and Robert Weldon (right); courtesy of B&B Fine Gems.

Figure 14. A conglomerate of fossilized, drusy quartz-encrusted shells is shown in the host rock, along with several individual pieces that have been prepared for jewelry use. Photo by Robert Weldon/GIA; courtesy of Indus Valley Commerce.

Figure 16. Tiny calcite crystals adhering to the surfaces of this superb tanzanite crystal, along with the brown coloration around its base, are strong indicators that the material has not been heated. The crystal weighs 500.45 ct and measures approximately 8 cm in length. Photo by Eric Welch; courtesy of New Era Gems.

Ten years ago, facet rough made up 90% of New Era's business, while gem crystals were a mere 5%. Facet rough now represents just 10% of his total, because it is nearly unobtainable.

As an example of changing market dynamics, Ulatowski showed us a fine tanzanite crystal (figure 16), which previously would have been more valuable as a mineral specimen. In today's frenzied market, such a crystal might be worth \$45,000 uncut but command \$50,000 as rough for faceting.

Figure 15. These fossilized drusy shells were found in rocks on a hill in central India. Photo courtesy of Tarun Adlakha.

According to Ulatowski, the criteria for a superior gem crystal include luster, color, and the condition of its edges (absence of nicks or chips). Whether or not it has a perfect termination also plays a role. Another consideration is the potential amount of cuttable material. For example, a 109-gram tanzanite crystal might yield 80 grams (400 carats) of cutting material, which would yield on average about 160 carats of fashioned gems.

Ulatowski noted that due to demand for cutting rough in late 2013, many crystals were broken for that purpose. Fine, well-formed crystals once commanded a premium over those suitable only for cutting fashioned gems; a fine crystal might be worth twice as much if left as a specimen. Although fine crystals are exceptionally rare, the market for cutting rough is tremendous right now, with worldwide shortage of every type of cutting material—even staples like blue topaz and smoky quartz. He has never seen a rough shortage comparable to this current one. Like other dealers at the shows, Ulatowski believes this represents a combination of less global mining activity, stricter mining regulations in many countries, rising fuel costs, and growing Asian demand.

Still, his U.S. client base is reluctant to pay higher prices for what they perceive as overpriced rough. There is also a growing trend toward better cutting at the source, with governments trying to support their own domestic cutting industries, as this retains more value in country than merely exporting the rough as raw material.

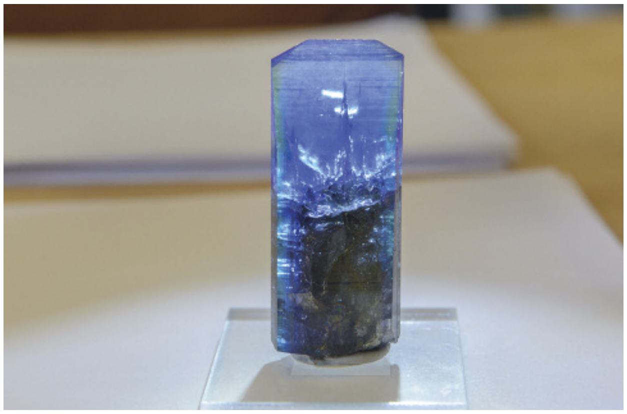


Figure 17. This 335.46 ct crystal contains relatively little cuttable material, but its crystal form and condition are excellent, making it worth five times more as an uncut specimen. The cuttable portion is located near the tip of the crystal, where the rough begins to narrow, so there is not enough depth for a significant faceted stone. Photo by Eric Welch; courtesy of New Era Gems.

Figure 19. Specimen crystals, such as this 87.59 ct natural-color unheated reddish brown zoisite, are currently the mainstay of Steve Ulatowski's business. Photo by Eric Welch; courtesy of New Era Gems.

Ulatowski had a range of unheated tanzanite crystals, which he estimated might make up 20% of total rough tanzanite production. He showed us many examples with blue to green terminations and brown coloration near the base (figure 17). A few blue crystals included calcite matrix, while some had associated pyrite.

Although many in the trade say all blue tanzanites have been heated, Ulatowski explained that it is impossible to heat only part of a crystal. Therefore, any crystal that is brown on the base has not been heated. In many specimens, the brown base is best for cutting, as it is usually the widest part of the crystal.

Demand for what Ulatowski calls "fancy tanzanite" (zoisite) is strong, with top pink colors selling for up to $800 per carat. Unheated natural pinks usually form only in the tip of the crystal, so most stones are small (less than a carat). The most valuable specimens are pure pink, with no purple cast.

For contrast, Ulatowski showed us a heated crystal where the brown coloration had been removed (figure 18), as well as a natural unheated reddish brown sample (figure 19) with no hint of blue. He also had a range of green grossular garnet crystals, a byproduct of Merelani tanzanite mining (figure 20). Also remarkable were bicolor tourma-

Figure 18. This 765.00 ct tanzanite crystal was heated in an oven at approximately 1000°F to remove all brown coloration. After the temperature was raised incrementally over a number of hours, the peak temperature was maintained for one hour before gradual cooling over a period of six to eight hours. Prior to heating, the crystal was completely brown, with no traces of blue. Photo by Eric Welch.

Figure 20. In Merelani, green grossular garnet (tsavorite or "mint" garnet) is a byproduct of tanzanite mining. This unusual 27 ct group of intact euhedral crystals measures approximately 4 cm in length. It is a "floater," meaning there is no visible attachment to any host rock. Photo by Eric Welch; courtesy of New Era Gems.

Figure 21. These bicolor tourmaline crystals are reportedly from the Barra de Salinas mine near Coronel Murta in Minas Gerais, Brazil (left). Each 2–3 cm crystal had a heavily etched, almost skeletal pink core topped by a euhedral or very slightly etched green cap. The terminations (right) may have projected into a layer of clay minerals during formation, protecting them from etching. Photos by Eric Welch; courtesy of New Era Gems.

line crystals (figure 21) with an unusual etched core but intact terminations. These were reportedly from the Barra de Salinas mine in Minas Gerais, Brazil.

In closing, Ulatowski noted that his best sales year at Tucson was 2013, but that 2014 was headed in the same direction.

Duncan Pay

Varieties of rutilated quartz. Rutilated quartz has come into its own as a mainstream gem material, thanks in part to its seemingly infinite variety and one-of-a-kind appeal for jewelry designers. Reddish rutile, owing its color to traces of iron, was exhibited at the AGTA show by Rare Earth Mining Co. (Trumbull, Connecticut). Rare Earth CEO Bill Heher said the material was recovered from Bahia in northern Brazil some decades ago before the mine closed. But due to the rising value of rutilated quartz, the deposit has been reopened and worked in recent years. The distinctiveness of the material, in this case an 85 ct gem (figure 22), lies in its relative transparency and bright reddish color—which can be matched or contrasted in jewelry.

Golden and copper-color rutile is traditionally seen in quartz, and connoisseurs are always on the lookout for a six-rayed star pattern of rutile. Though such stars occur regularly in the rock crystal, they are rarely oriented in such a way to be easily cut into a faceted or cabochon gem. Strong, isolated rutile stars located in the rough must be painstakingly oriented to be visible face-forward, as in the 34.55 ct gem (figure 23) cut by Falk Burger (Hard Works, Tucson). At

Figure 22. This 85 ct quartz crystal contains bright reddish rutile needles. Photo by Robert Weldon; courtesy of Rare Earth Mining Co.

Figure 23. This 34.55 ct quartz has been cut to display the star-shaped needle formation. Photo by Robert Weldon; courtesy of Hard Works.

Figure 24. This 209.06 ct quartz features a rose-shaped cluster of inclusions. Photo by Robert Weldon; courtesy of Hard Works.

Figure 26. This ring's centerpiece is a euhedral 2.76 ct ruby crystal from Winza, Tanzania, flanked by a pair of Canadian rough diamonds. Two green diamonds from Venezuela complete the piece. Photo by Eric Welch; courtesy of Nature's Geometry.

the center of the star, an additional inclusion of hematite is visible.

Burger said that rutile can take unusual forms as well. Minute gray rutile needles in the top of the quartz in figure 24 are clustered in the shape of a rose. The quartz also contains layers of pink and greenish chlorite phantoms. The quartz itself weighs 209.06 ct, and was fashioned by Burger to best exhibit the rutile rose.

Robert Weldon

Innovative optical effects, unique rings with raw crystals. At GJX, Brian and Kendra Cook (Nature's Geometry, Graton, California) showed an innovative series of clear quartz disks they call "wheels of light." These disks are mounted in work-hardened 24K yellow gold for use as pendants or earrings. The center of each disk contains a tube where an insert of colored gem material can be placed. The tube is subsequently sealed with clear quartz. When the disk is viewed face up, the insert's color reflects and suffuses the disk with bright color (figure 25).

For red, Cook uses ruby or even realgar (also known as "ruby sulfur," a very soft arsenic sulfide mineral), and Paraíba tourmaline or haüyne (a brittle sodium calcium sulfate) for rich blues. As the insert is completely enclosed within the quartz, the materials are protected from wear.

Figure 25. "Wheels of light" are innovative quartz disks with sealed inserts of colored gems or minerals, creating multiple reflections to lend color to otherwise transparent rock crystal. Inside these examples are Paraíba tourmaline (left) and realgar (right). Photos by Eric Welch; courtesy of Nature's Geometry.

Figure 27. This ring features cat's-eye spessartine garnet with Paraíba tourmaline shoulder stones in a 24K work-hardened gold mounting. Photo by Eric Welch; courtesy of Nature's Geometry.

Figure 29. Deep orange and cherry red hues are more valued than lighter yellow or orange in these rough Mexican opals without play-of-color. The opals in the back row range from 25 to 107 ct, while the fashioned gems weigh 7.50–31.50 ct. Photo by Eric Welch; courtesy of Opalos & Artesanias Mexicanas.

Cook displayed several intriguing rings with rough crystals, including ruby (figure 26), alexandrite, and diamond, also in work-hardened gold. Another standout featured a cat's-eye spessartine garnet with Paraíba tourmaline cabochons in a similar mounting (figure 27).

Duncan Pay

Mexican opal. Jorge Tamayo Carrillo (Opalos & Artesanias Mexicanas, Magdalena, Mexico) outlined current production of fire opal at his family's mine, located 10 km south of Magdalena in Jalisco, Mexico.

Tamayo said the mine was shut down several years ago. His family took a risk and reopened it, and now they have worked it for more than five years. The material they exhibited at the GJX show represented several years of production.

Figure 28. This rhyolite matrix specimen contains opal-filled cavities displaying play-of-color. Photo by Eric Welch; courtesy of Opalos & Artesanias Mexicanas.

The operation employs about 20 people. The miners look for opal-filled cavities (figure 28) in the rhyolite host rock. Veins last anywhere from two days to a few years on occasion. Explosives are used to break the host rock, and dump trucks move the ore to the surface, where workers break it up further with small hammers to extract the opal.

Production is put aside for six months to a year to minimize the risk to customers that the opals might show crazing due to water loss. At this point, Tamayo estimates, only 5% of the material might craze. Opalos & Artesanias Mexicanas has now been in business for 27 years, and the second-generation company prides itself on full disclosure. Its clientele consists of buyers in the United States, Japan, China, and Germany. All cutting is done in house or by local artisans, as the company aims to support the local community.

Red, pink, orange, yellow, and colorless ("clear" or "white") specimens without play-of-color are polished by hand into freeform shapes or used for faceted stones (figure 29). Fine material with play-of-color is fashioned into cabochons or freeform shapes (figure 30). Lower-end material—essentially rhyolite matrix with gemmy opal portions—is fabricated by hand into cabochons for use in rings, bracelets, and cufflinks.

Duncan Pay

Natural-color tanzanite and yellow sapphire. At the GJX show, Kobe Sevdermish (Advanced Quality, Ramat Gan, Israel) displayed fine unheated tanzanite (figure 31), untreated yellow sapphire, and heated pink zircon.

While it is easier to buy unusual-colored tanzanite rough today, the material still is not available in abundance. Sevdermish informed us that what he calls "fancy-color" tanzanite comes from the same area as the familiar blue to

Figure 30. Top-quality material with play-of-color is cut in cabochon (left) or freeform style (right), which entails far less loss of weight from the original rough. The best material shows striking flashes of color against a colorless, yellow, or orange to red body. Photo by Eric Welch; courtesy of Opalos & Artesanias Mexicanas.

bluish purple tanzanite. The rough pieces he displayed in Tucson had greenish, golden, green blue, pink, and purplish pink colors. The rarest are greens, followed by golden hues. These stones were best sellers for the company in 2013.

According to Sevdermish, the U.S. market is full of "regular" heated tanzanite, and people are looking for something unique. Clients are especially taken with sets where each stone displays a slightly different color. In his opinion, the luster of the unheated stones is significantly better. Sevdermish ensures that no heating is performed on any of the rough he selects. All stones are polished at the company's factory in Bangkok.

After describing a large piece of highly transparent rough that took a week to purchase, Sevdermish showed us the two significant pieces cut from it: a 50.61 ct greenblue oval and a spectacular 19.80 ct greenish blue heart with arresting green and blue green pleochroism cut from the top part of the crystal.

He called our attention to precision-cut unheated yellow sapphires (figure 32) arranged as sets or as precisely cut calibrated shapes, including ovals, pears, and princess cuts. Sevdermish described this corundum as a "true canary color," which is unusual in a natural-color sapphire. He said most of the strong yellow sapphire on the market is either heated or beryllium-treated.

All the rough is carefully selected for color consistency in order to avoid greenish or grayish hues. Sevdermish estimated they select about 5% of the rough production, suitable for cutting into 2–5 mm finished stones, from a small mine in Africa. Material for 0.50 or 1 ct sizes is very rare.

Figure 31. These large, reportedly unheated tanzanites possess fine color. Photos by Eric Welch; courtesy of Advanced Quality.

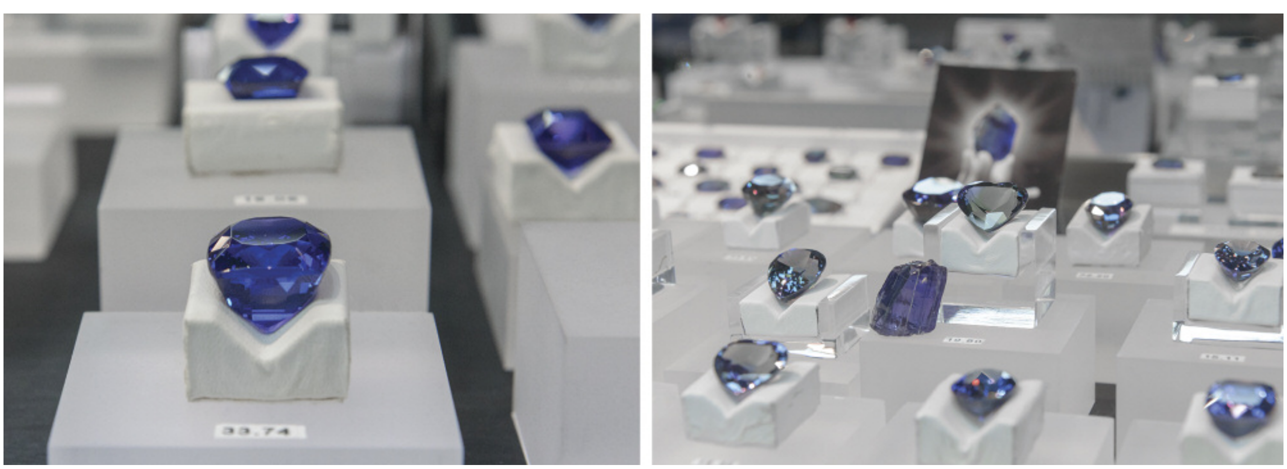


Figure 32. Precision-cut unheated yellow sapphire sold well to buyers looking for yellow diamond substitutes. Photo by Eric Welch; courtesy of Advanced Quality.

Sevdermish said his clients like the material because its clarity, color, and polish give it the look of fancy-color diamond.

Finally, Sevdermish showed us what he described as "fancy vivid" pink zircon from Tanzania (figure 33). The zircon was heat-treated, lightening the original color of the rough to reveal pinks with cinnamon tints. Further heating lightens the color a little more, producing very bright, lively stones. The only downside, Sevdermish remarked, is the name "zircon." Customers tend to confuse the name with "cubic zirconia," which makes them reluctant to purchase the gems until they understand that zircon is a natural stone.

Duncan Pay

Red beryl. At the AGTA show, Ray Zajicek (Equatorian Imports Inc., Dallas) displayed matched red beryls—originally mined from Utah's Wah Wah Mountains—as suites of jewelry and in loose stone form. According to Zajicek, these gems represent newly marketed inventory cut by Colombian cutters in Gibraltar between 1998 and 2000. Each suite contained 25–30 carats of matched red beryls as emerald, marquise, or oval cuts (figure 34).

Zajicek, who began working with red beryl in the 1980s, said the average faceted gem is approximately 0.08 ct. A 0.50 ct sample would be large, and anything above a carat would be exceptionally rare. This made the matched

Figure 33. These heated Tanzanian zircons displayed a range of warm pinkish to yellowish brown colors. Photo by Eric Welch; courtesy of Advanced Quality.

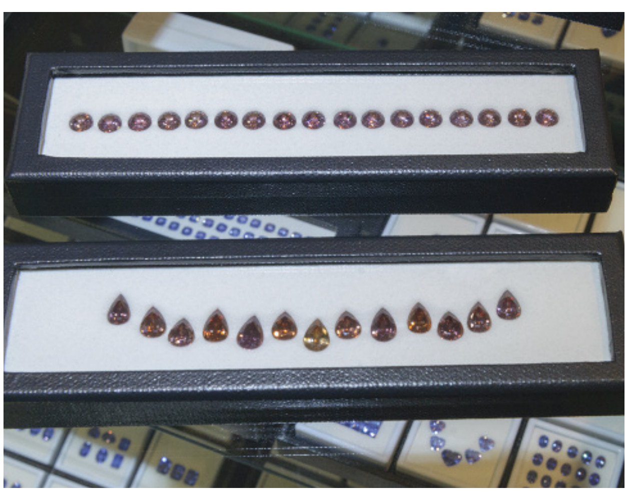


Figure 34. This matched suite contains 27.35 carats of faceted oval red beryls. Photo by Eric Welch; courtesy of Equatorian Imports.

Figure 35. Here, red beryls are mounted with benitoite from California in a pendant (left), and with 28.59 carats of unheated Yogo sapphire from Montana in a spectacular necklace (right). Photos by Eric Welch (left) and Robert Weldon (right); courtesy of Equatorian Imports.

suites at his booth unique and potentially irreplaceable. Like emerald, red beryl has a range of hues and tones, as well as a typically uneven color distribution that makes it a challenge to match.

Zajicek said there is more red beryl in the ground, but the difficulty of mining makes future production cost-prohibitive. Previous operations had to move more than a ton of hard rock to recover a carat of rough. A carat-sized rough stone is not necessarily cuttable; yields are low, averaging between 8% and 15%.

Zajicek described red beryl as a beautiful, uniquely American product that is still relatively unknown. Intriguing combinations included a pendant comprised of red beryl mounted with benitoite (figure 35, left), and a red, white, and blue necklace featuring red beryl, Montana blue sapphires, and colorless diamond (figure 35, right).

If there were more viable red beryl mining locations in Utah, the increased production would boost demand and allow greater promotion. As it stands, few would spend money to promote a gem they probably would not be able to obtain in any quantity.

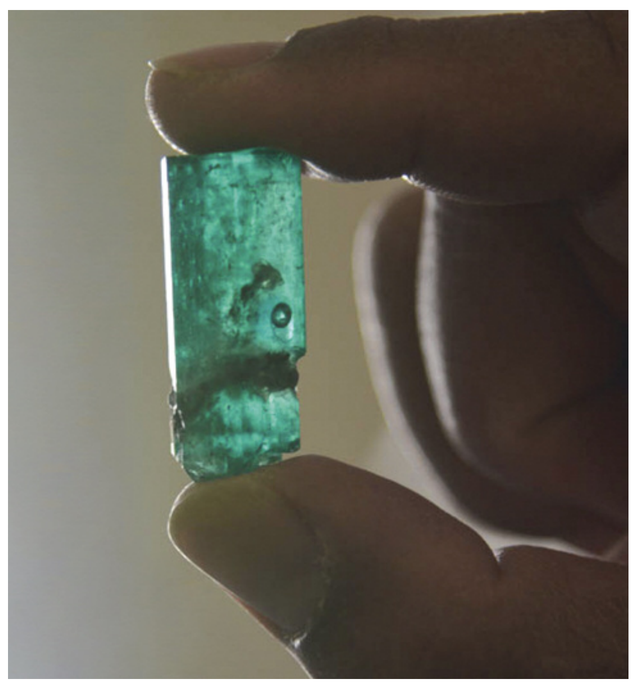
Duncan Pay

OTHER NOTABLE FINDS

More of the interesting and unusual. Among the other fascinating materials seen in Tucson were a Colombian emerald crystal with an eye-visible multi-phase inclusion (figure 36), a large nugget of turquoise (figure 37), some interesting quartz from Namibia (figure 38), and large colorful slices of liddicoatite tourmaline (figure 39).

Stone and fossil photography. At the Tucson Gem and Mineral Show, Mike Woodward (San Clemente, California) showcased a collection of stone and fossil photos (figure 40). With their variety of arresting forms, the images resemble abstract paintings or landscapes. Among the featured materials were Australian and Peruvian opal, banded agate, and ammonite. Woodward, a graphic designer by

Figure 36. This emerald crystal, reportedly from Muzo, Colombia, is approximately 35 mm long and contains an eye-visible multi-phase inclusion. The gas bubble within the inclusion moves a few millimeters as the crystal is tilted. Photo by Duncan Pay; courtesy of William Johnson, Natural Formations.



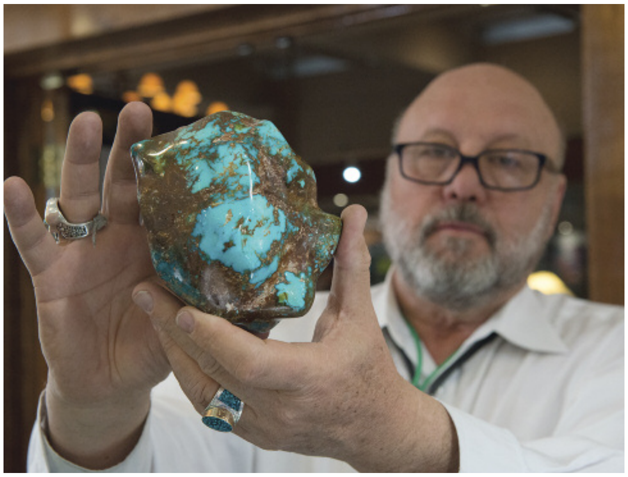


Figure 37. This spectacular 7,043 ct turquoise nugget was recovered from the Lavender Pit mine of Arizona in 1934. Lavender Pit was adjacent to the much larger Bisbee copper mine. Much of the turquoise from Arizona's mines was reputedly smuggled out by copper miners, and thus referred to as "lunch bucket" turquoise. Photo by Eric Welch, courtesy of Studio GL.

trade, has collected stones since the age of five, and has photographed them for 12 years. The images are captured with a 4 × 5 camera, using a polarized macro lens and a high-resolution digital camera back. They are enlarged as single panels, or triptychs, and available in a variety of formats, including canvas, aluminum prints, and traditional photographic prints.

Stuart Overlin

Figure 38. These curious examples of "crazy quartz" are reportedly from basalt cavities in the Gobobos Mountains of Namibia. These well-formed colorless quartz crystals are capped by smaller amethyst-colored tips in a "reverse scepter" formation. The crystal cluster is approximately 6 cm wide. Photo by Eric Welch; courtesy of Stefan Reif, Reif Collection.

Figure 39. These slices of liddicoatite tourmaline display colorful growth zoning. The largest slice measures approximately 30 cm. Photo by Duncan Pay; courtesy of Frederic Gautier, Little Big Stone.

Figure 40. This enlarged image of a Peruvian opal showcases the dramatic forms captured by Mike Woodward. Courtesy of Mike Woodward Photography.

REGULAR FEATURES

COLORED STONES AND ORGANIC MATERIALS

Gem-quality Cr-rich kyanite from India. In 2009, one of the contributors had the opportunity to see small lots of greenish blue to bluish green Cr-rich kyanite in Jaipur, reportedly mined from the eastern Indian state of Odisha (formerly Orissa). Most of the cabochons and faceted gems, ranging in size up to 25 ct, were highly included. In 2013, this Cr-rich kyanite from Odisha was again available in Jaipur, this time with very few or no eye-visible inclusions (figure 41). Although a few specimens contained numerous black inclusions, most of the stones lacked these features and had a more desirable uniform greenish blue to bluish green color, making them suitable for jewelry mounting.

Standard gemological properties were measured for one cabochon and two faceted samples (0.99–6.17 ct). The cabochon was chosen for its striking black eye-visible inclusions. The three samples showed an RI of 1.714–1.730 (spot RI of 1.73 for the cabochon) with birefringence of 0.016 and a biaxial positive optic sign, and a hydrostatic SG of 3.68–3.70. Moderate to strong trichroism was observed, with pleochroic colors of greenish blue, bluish green, and pale green. Under a desk-model spectroscope, all three displayed fine lines in the red region with absorption bands in the yellow-orange and blue regions. The samples appeared strong red under the Chelsea filter and were inert to both long- and short-wave UV. These properties were consistent with those reported for kyanite.

Examined under the microscope, the black inclusions in the cabochon appeared to be clusters of black grains with striated surfaces and metallic luster (figure 42); some appeared iridescent in reflected light, while others displayed frosted surfaces. Raman and SEM analysis identified these black grains as ilmenite. In addition, numerous colorless sub-rounded crystals of quartz, feldspar, and zircon were observed; the latter usually occurred in clusters, with stress cracks around them (figure 43). These samples also displayed cleavage planes in two directions and fine fissures, a characteristic usually seen in kyanites.

UV-Vis-NIR spectroscopy in the 300–800 nm region (figure 44) showed broad absorption bands between 500 and 700 nm, with a slight shift in the center position from about 585 nm (green direction) to 610 nm (blue direction). Also present were distinct peaks at approximately 370, 380, 417, 432, 446, 690, and 708 nm. The latter two peaks

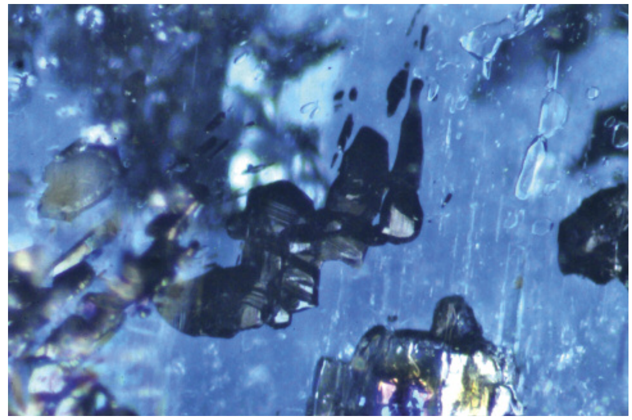
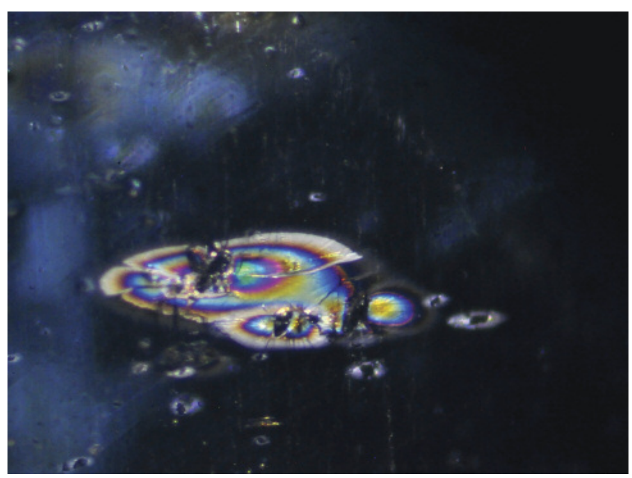


Figure 42. These kyanites display striking black metallic crystals of ilmenite; note the striated surface and the few colorless crystals of quartz. Photomicrograph by Gagan Choudhary; magnified 64×.

Figure 41. These gem-quality kyanites (0.99–6.17 ct) were reportedly mined in the eastern Indian state of Odisha. Photo by Gagan Choudhary.

Figure 43. Clusters of zircon crystals associated with stress cracks were another common feature in these kyanites. Photomicrograph by Gagan Choudhary; magnified 80×.



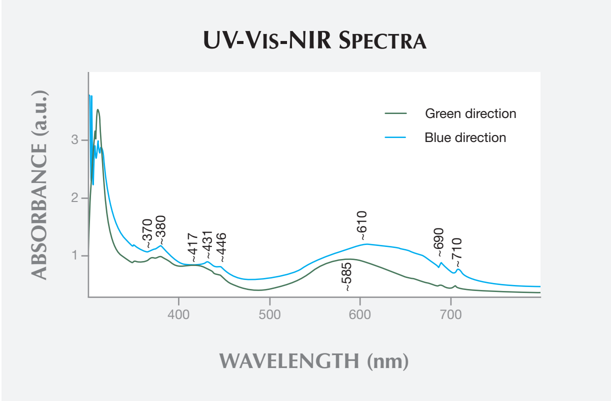


Figure 44. The UV-Vis-NIR spectrum in the 300–800 nm region showed broad absorption band between 500 and 700 nm (assigned to Fe^{2+}-Ti^{4+} charge transfer), along with twin peaks at approximately 690 and 708 nm (associated with Cr^{3+}). In addition, numerous Fe^{3+}-related peaks were present in the 350–470 nm region.

are associated with Cr^{3+} and the rest to Fe^{3+}. The broad absorption band is attributed to the Fe^{2+}-Ti^{4+} charge transfer (see G. Bosshart et al., "Blue colour-changing kyanite from East Africa," *Journal of Gemmology*, Vol. 18, No. 3, pp. 205–212).

Gem-quality kyanite is already known from Nepal, Brazil, Kenya, Tanzania, and Madagascar (the latter material being Cr-rich as well). Now India can be added to this list, with attractive greenish blue to bluish green colors. The production and supply of this kyanite are still unknown.

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Indian ruby mining. The Karur-Kangayam and Hole-Narsipur belts, in the southern Indian states of Tamil Nadu and Karnataka, respectively, are famous throughout the subcontinent for their gemstones, including sapphire, moonstone, iolite, aquamarine, garnet, sunstone and corundum. The city of Karur itself is well known for rubies. Ruby is also found in Subramaniam (also known as Red Hills), near Madikeri in Karnataka. Channapatna (figure 45, top left), roughly 280 km (117 miles) from Madikeri, is famous for its star rubies. In all of these locations, mining is performed using primitive methods.

Good-quality transparent rubies come from the Karur region, though color varies along this gemstone belt. The mines situated in Karur are located on barren land along the roadside; the nearby towns of Kangayam and Paramatti also have ruby mines.

Madikeri is a remote hill station covered by lush green forests, located in the Western Ghats of India. The ruby found here is lighter, translucent to transparent, and of

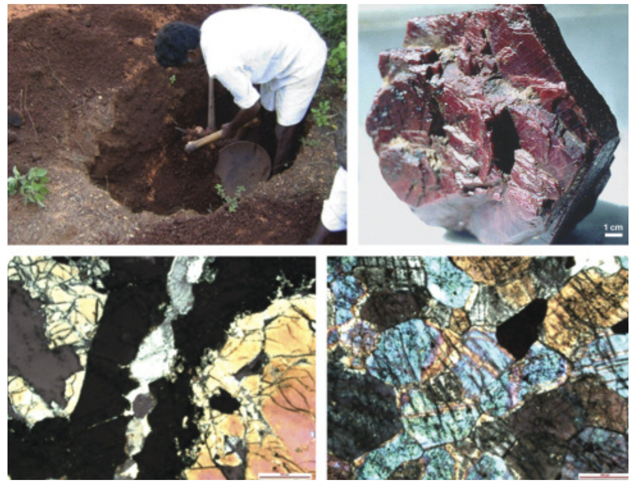

Figure 45. Top left: Rubies are mined in a mango orchard in Channapatna, India. Top right: This 15 kg rough ruby is from Subramaniam, in the Indian state of Karnataka. Photos by Pooja Shirole. Bottom left: This thin section of ruby is surrounded by an isotropic reaction rim. Bottom right: A corundum granulite showing ruby with blue and pink interference colors. Photomicrographs by Pooja Shirole; crossed polarizers, magnified 4×.

good quality. A ruby-bearing granulite, commonly called ruby rock, is used for making artifacts such as wands and crystal balls.

In the town of Subramaniam, close to Madikeri, large hexagonal pillars of ruby are mined; deposits are also located in the nearby villages. The stones are mainly hexagonal but come in many sizes and shapes. They have a maroon color, and some show 16 mm dot inclusions of hematite. These rubies range from 20 to 100 mm across the pinacoidal face, with the length across the prism faces varying from 10 to 50 mm. Their weight ranged from 10 g to 2 kg, though specimens are as large as 15 kg, as in the top right image in figure 45.

In the Bangalore district of Karnataka, opaque maroon star ruby is found in the village of Channapatna and other nearby villages. It is extracted from red and yellow soils in mango and coconut orchards, rather than from traditional mines.

Granulite, the host rock of the Karur rubies, is somewhat similar to the host rock of Mozambique rubies (see Winter 2012 GNI, pp. 309–311). Both contain hornblende, biotite, and plagioclase. In certain areas such as Sengal and Kiranur, rubies are found in association with gem-quality iolite (cordierite). The ruby in Pamakondampalayam is found with a reaction rim of spinel, sapphirine, and cordierite (figure 45, bottom left), while the Madikeri rubies are associated with plagioclase, augite, garnet, sillimanite, and sphene in corundum granulites (figure 45, bottom right). Madikeri ruby also occurs in corundum-fuchsite-mica schists, which have a mineral assemblage of fuchsite mica, quartz, corundum, and rutile.

In summary, good-quality transparent ruby comes from host rocks in Karur; tabular hexagonal crystals ranging from transparent to translucent are mined from corundum granulites in Madikeri; and opaque star-ruby is found in the mango and coconut orchard soils of Channapantna.

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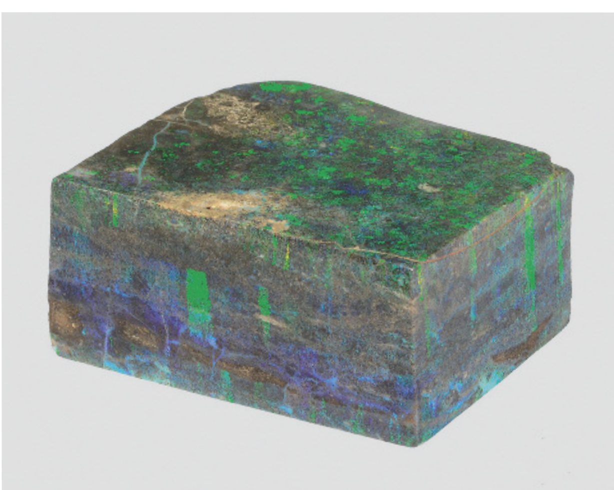
Large oolitic opal block. Longtime opal dealer Tibor Shelley (Opals by GMT, Adelaide, Australia) recently brought a large 1.43 kg block of opal (figure 46) to GIA's Carlsbad laboratory for examination. Mr. Shelley said he purchased it from a miner at the Andamooka opal fields in Australia more than 40 years ago. Since then, it has remained in his private collection. The RI measured on the polished face of this sawn and partially polished block was 1.45, consistent with opal.

Upon initial observation, the semi-translucent to opaque opal appeared similar to typical matrix-type opal from Andamooka that is routinely treated black. Microscopic examination, however, revealed an interesting and unique texture rarely seen in Andamooka opal. The stone was composed of numerous dark spherical inclusions, known as "ooids," with precious opal filling in the pore spaces between the spheres (figure 47). This type of opal has been previously reported (see Summer 1982 Lab Notes, p. 104; Winter 1984 Lab Notes, p. 229; and Spring 1986 Lab Notes, p. 50), but this example is especially rare due to its large size. Although an example of treated black oolitic opal has also been previously reported (Spring 1983 Lab Notes, p. 46), microscopic examination revealed that the overall gray bodycolor of this extremely large opal was due to the high density of dark ooids scattered throughout the block. There were also some light brown patches that appeared to be a sandstone type of matrix, as well as numerous veins and pockets of precious opal that did not contain ooids.

Figure 46. This exceptionally large 1.43 kg block of opal, which measures 12.8 × 10.1 × 5.8 cm, is rare not only for its size but also its oolitic texture. Photo by Robison McMurtry; courtesy of Tibor Shelley/Opals by GMT.



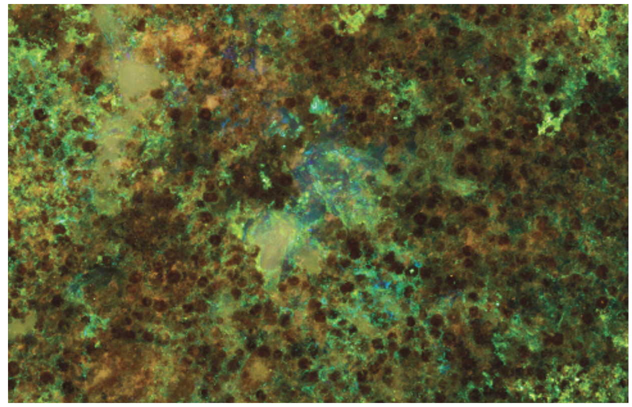


Figure 47. Numerous brown spheres scattered throughout precious opal were seen in this very large block of oolitic opal from Andamooka, Australia. Photomicrograph by Nathan Renfro, courtesy of Tibor Shelley/Opals by GMT; field of view 17 mm.

This unusual piece of natural-color oolitic opal is the largest of its type that GIA has examined to date.

Nathan Renfro
GIA, Carlsbad

Natural pipi pearls from Tahiti. Recently, the Laboratoire Français de Gemmologie (LFG) received a parcel of nearly 100 pearls submitted as natural pearls from *Pinctada maculata*. The owner (Bruno Arrighi, Croissy Pacific) specified that he had personally collected the parcel in French Polynesia during the past year (figure 48).

Pinctada maculata is a bivalve mollusk (figure 49) found in the Pacific Ocean, particularly near French Polynesia and the Cook Islands, that may produce rare "poe pipi" (better known as "pipi") pearls. There were several unsuccessful attempts in the 1950s to produce cultured pipi specimens. Today, all such pearls are considered natural.

Different techniques are used to find the pearls. In one method, divers pick the largest shells of *Pinctada maculata*, then leave the shells on the beach in buckets full of salt water to putrefy. Three days later, the shells are selected and only the valves with blisters are kept. Deep in the bucket, one may occasionally find a few natural pearls. *Kakaro* (in the Paumotuan language) is considered the oldest technique

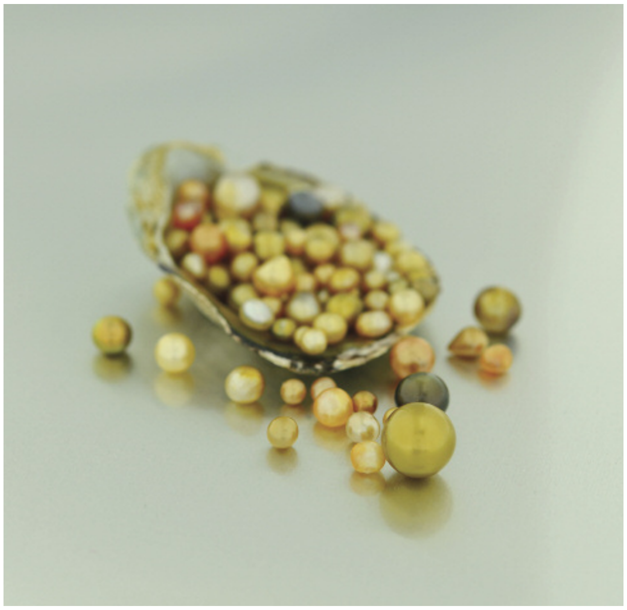


Figure 48. This parcel of rare natural pipi pearls was collected from French Polynesia. Note the exceptional golden pearl in the front with a diameter of 9.6 mm, believed to be the largest recorded pipi pearl. Courtesy of Bruno Arrighi/Croissy Pacific. Photo by Olivier Segura.

for obtaining pipi pearls. During the dive, the largest shells are opened directly underwater to locate pearls.

Most pipi pearls range from orange to cream, gray, and white, but the typical and most sought-after color is a deep golden color. The size of the pearls generally ranges from 1 to 4 mm. The pearl in the forefront of figure 49 has one of the best golden colors possible. It is an exceptionally large specimen measuring 9.6 mm in diameter, which the contributors believe to be the largest size documented for a pipi pearl.

Microradiography reveals internal structures typical for natural pearls: onion-like stacking of aragonite layers possibly containing a calcitic core. Although Raman scattering, UV-visible reflectance, or UV luminescence spectrometry have helped identify the mollusk species in some cases, preliminary results with *Pinctada maculata* are still not conclusive. Hence, it is not possible to identify with certainty the exact mollusk from which these pearls came.

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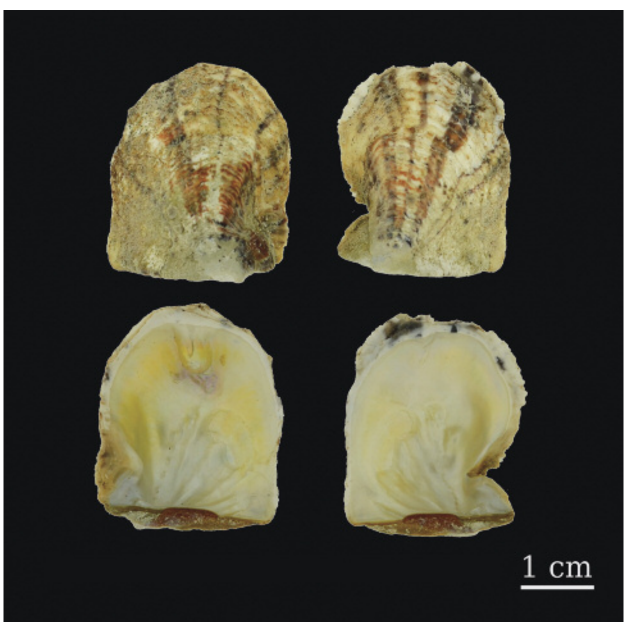
Emmanuel Fritsch

Djamel Touati
Swan AG, Zurich

Figure 49. The two valves of a typical Pinctada maculata shell specimen (interior and exterior view). Photo by Olivier Segura.



TREATMENTS

Polymer-impregnated aventurine quartz, a new imitation of "ice jade." The market for jadeite jade is sizable, especially in the Far East. The variety and quantity of jadeite imitations is vast, a source of concern for the trade and consumers alike. A client recently submitted a polymer-impregnated aventurine quartz bangle to the Lai Tai-An Gem Lab in Taipei under the mistaken impression that it was jadeite jade.

The 212.90 ct bangle measured approximately 68 × 13 mm and exhibited a light green color, with a pleasant semi-transparent appearance that resembled a type of jadeite

Figure 50. This light green semi-transparent bangle was made from polymer-impregnated aventurine quartz, a new imitation of "ice jade." Photo courtesy of Lai Tai-An Gem Lab.

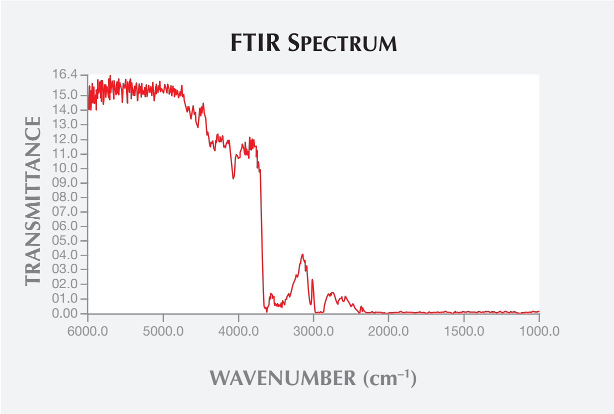


Figure 51. FTIR testing of the bangle revealed polymer impregnation at the 3000–3100 cm^{-1} absorption in the mid-infrared region.

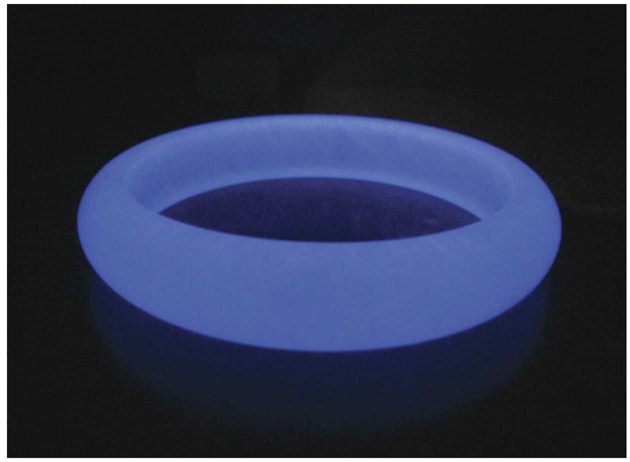


Figure 52. Notably, the bangle had a very strong blue reaction to long-wave UV light. Photo courtesy of Lai Tai-An Gem Lab.

often referred to as "ice jade" (figure 50). Standard gemological testing gave a spot RI of 1.54 and an SG of approximately 2.66, and we observed inclusions of fuchsite mica, properties all consistent with aventurine quartz. More advanced methods, namely FTIR and Raman spectroscopy, were also applied. The FTIR spectrum (figure 51) revealed the polymer treatment of the piece. The long-wave UV light reaction was a very strong blue (figure 52), which appeared to confirm the treatment. Natural aventurine normally has an inert to weak reaction to long-wave UV light; by contrast, polymers generally show a moderate to very strong blue reaction. The acid-damaged surface structure observed with a microscope also corresponded with the treatment procedures used on jadeite.

In our experience, polymer-impregnated aventurine quartz is rarely encountered in the jewelry market. Still, its resemblance to "ice jade" shows that buyers should be fully aware of the potential risk of misidentifying such material.

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Tenebrescent irradiated scapolite. Sixteen near-colorless scapolite rough crystal fragments, provided by Dudley Blauwet (Dudley Blauwet Gems, Louisville, Colorado) were recently examined in the Carlsbad laboratory. All of the samples were reportedly from the Pitawak mine in the Sar-e-Sang region of Afghanistan's Badakhshan province. The material was transparent and near colorless, with transparent crystal and fluid inclusions, and some brownish epigenetic staining in cracks.

Half of the crystals had reportedly undergone radiation treatment. The identification of both the natural and irradiated groups as scapolite was confirmed with Raman spectroscopy. Both sets of crystals appeared the same under normal lighting conditions (figure 53, left). When exposed to long-wave ultraviolet (LWUV) light, both the natural and artificially irradiated scapolite showed a strong yellow fluorescence, which was slightly less intense in the irradiated

Figure 53. The scapolite pieces on the left side of these photos were irradiated, while the right group of scapolite fragments were not. The photo on the left shows the scapolite before exposure to UV radiation. In the center photo, the scapolite has been exposed to LWUV for 10 minutes. The photo on the right shows the samples after 30 seconds of exposure to SWUV. Scale is in 1 mm increments. Photos by Nathan Renfro.

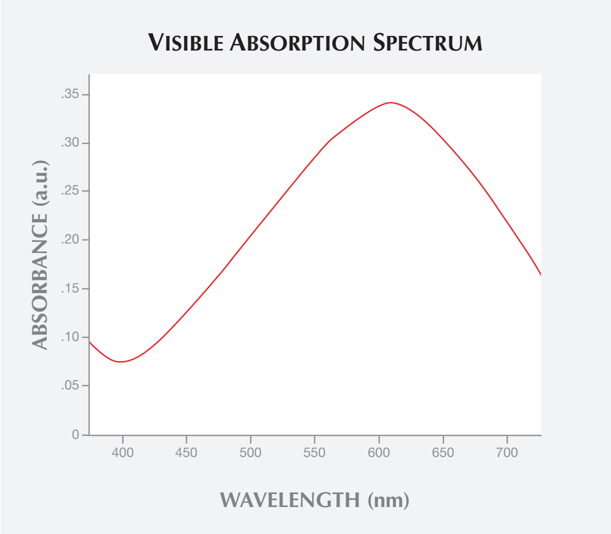

Figure 54. The visible absorption spectrum of the blue color-causing tenebrescent defect showed a broad absorption band centered around 610 nm. The transmission window in the blue region is consistent with the observed blue color.

scapolite. Under short-wave UV light (SWUV) a similar intensity trend was observed, with both the natural and artificially irradiated scapolite fluorescing a weak to moderate yellow. However, the most notable difference was in the intensity of the tenebrescent effect exhibited in both sets of stones, which occurs after exposure to both LWUV and SWUV light sources.

Tenebrescence is the phenomenon that occurs when a mineral changes color after exposure to UV light. The color change is temporary, and can be reversed when the material is exposed to incandescent light. Tenebrescence in natural scapolite has been documented (Fall 2005 GNI, pp. 269–271). In the case of these 16 scapolite samples, tenebrescence was observed as a moderately saturated blue color in a previously near-colorless stone. Based on the submitted materials tested, it appeared that artificially irradiating scapolite created a much stronger tenebrescent effect when the material was subsequently exposed to UV light. The material displayed tenebrescence when subjected to LWUV, but the intensity was generally greater after exposure to SWUV (figure 53, center and right). After exposure to SWUV, the visible absorption spectrum of the blue color-causing defect was measured. The resulting visible spectrum confirmed that the blue color was induced in the scapolite (figure 54).

Irradiation of colorless scapolite appears to have a very limited effect on the material. After performing various gemological tests, the only significant difference we observed was the strength of the tenebrescence, which may serve as a clue that the scapolite was previously irradiated. The appearance of the material was otherwise not improved in any noticeable way.

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Figure 55. This 4.27 ct sapphire was filled with orangy yellow lead glass throughout the stone. Photo by Gagan Choudhary; courtesy of Dheeraj Gupta.

Yellow sapphire filled with lead glass. This contributor has previously reported glass-filled, color-changing red and blue corundum (Spring 2008 GNI, pp. 88–89). After recent reports of green sapphire filled with lead glass (Fall 2013 Lab Notes, p. 176) and sapphires with cobalt-colored lead glass (e.g., T. Leelawatanasuk et al., "Cobalt-doped glass-filled sapphire; an update," *Australian Gemmologist*, Vol. 25, No. 1, 2013, pp. 14–20), an orangy yellow sapphire filled with lead glass was presented to us by Dheeraj Gupta (Gem & Jewellery Sales Promotion Council, New Delhi).

The 4.27 ct sapphire (figure 55) was hazy throughout, with a roiled effect reminiscent of hessonite, but standard gemological properties and microscopic analysis identified the specimen as natural corundum. It gave an RI of 1.762–1.770; a hydrostatic SG of 4.03; an absorption band at around 450 nm, along with fine lines in the red end under the desk-model spectroscope; and reddish orange fluorescence in long- and short-wave UV. The sapphire showed stronger fluorescence under long-wave UV. Microscopic examination revealed numerous low-relief cracks throughout the stone with a distinct flash effect. Also visible were trapped, flattened gas bubbles, as seen in figure 56, and whitish cloudy patches; these are typically associated with filled stones. Also present were milky zones consisting of fine discs (usually rutile) and negative crystals associated with liquid films. Under diffused lighting, the glass-filled fractures appeared orangy yellow against the pale yellow bodycolor of the stone (again, see figure 56). As a result, the face-up color also appeared orangy yellow. The color of the filler glass was similar to that observed in glass-filled rubies. The lead content of the glass was further confirmed by EDXRF analysis, while the presence of iron (the cause of the sapphire's yellow color) was confirmed by an Fe-related

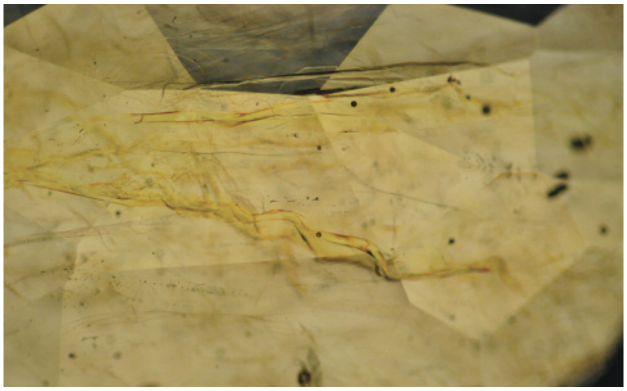

Figure 56. This 4.27 ct sapphire was filled with orangy yellow lead glass throughout the stone. Photo by Gagan Choudhary; courtesy of Dheeraj Gupta.

450 nm band in the UV-visible spectrum.

Since this was first example of lead-glass-filled yellow sapphire examined by this contributor, its market penetration is still unknown. With its transparency and color, this material qualifies as an inexpensive substitute for yellow sapphire, provided there is complete disclosure.

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CONFERENCE REPORTS

Geo-Literary Society meeting. The Geo-Literary Society held its annual meeting on Feb. 14 at the Tucson Convention Center. The event, which drew attendees from the Tucson Gem and Mineral Shows, featured presentations by Scott Sucher and Al Gilbertson in a session titled "The Evolution of Diamond Cutting."

Sucher, president of The Stonecutter in Albuquerque, New Mexico, has created replicas of famous diamonds for more than 30 years. Gilbertson, a research associate at GIA in Carlsbad, California, has authored numerous articles on diamond cut and grading, as well as the 2007 book *American Cut: The First 100 Years*.

Sucher opened the session by chronicling the early history of diamond use, global trade patterns, and advances in cutting techniques and styles. Using computer models, he compared the brilliance and fire of several early diamond cuts.

Gilbertson picked up the story with the discovery of Brazilian diamond deposits around 1725, which ushered in a period of glittery excess among European elites. David Jeffries, whose 1750 treatise described the use of a handheld "prover" to measure cutting angles, coined the term "round brilliant" for a cut that contained 58 facets.

The discovery of massive diamond deposits in South Africa in 1867 changed the course of the industry, making these treasures available to a mass market. By 1870, there were 10,000 cutters in Europe. These artisans followed the shape of the original crystal and kept as much of the original weight as possible.

But the emphasis on weight retention was beginning to unravel thanks to Henry Morse, who set up a cutting shop in Boston around 1860. Morse, who once said, "Shopping for diamonds by the carat is like buying a racehorse by the pound," emphasized the cut of a stone and the brilliance that resulted. He invented a gauge to measure crown and pavilion angles, and devised his own set of best proportions. He also helped develop mechanical bruting, which increased the production of round-cut diamonds.

With turn-of-the-century improvements such as the circular saw, which made it easy to cut two diamonds from a rough crystal, the stage was set for the modern round brilliant. In 1919, Belgian engineer Marcel Tolkowsky published a landmark book, titled *Diamond Design*, in which he asserted that the best-cut stones feature a 53% table, 59% total depth, and a knife-edged girdle. With some modifications to Tolkowsky's proportions—an extended lower half, a larger table, and a closed-up culet—the round brilliant as we know it was established by 1950.

As Gilbertson pointed out, the breakthroughs in diamond cut planning and evaluation were just beginning. The Firescope viewer, developed in 1986, allowed the user to see a "Hearts and Arrows" pattern in a diamond cut to these "ideal" proportions. The Sarin scanner, introduced six years later, offered rapid, accurate proportion measurement, which led to the various cut grading services available today. Among other recent advances are inclusion-mapping software and high-speed laser cutting.

Following the presentation, Sucher invited the audience to view his faceted replicas of Cullinans I and II, the Koh-i-Noor, the Hope, and several other historical diamonds.

"Scott Sucher transported us to the early days of diamond cutting as we learned the first sources and tools," said Dona Dirlam, the Geo-Literary Society's secretary and the host of the session. "We saw how cutting styles evolved with improvements in the tools and an increase in the diamond supply. With each development, we saw this fascinating transformation through visual models.

"Al Gilbertson told us the largely unknown story of Henry Morse and chronicled the birth of the modern round brilliant," Dirlam added. "As Al and Scott pointed out, today's computer-optimized diamond cutting seems light-years removed from the earliest techniques."

Stuart Overlin