GEM N·E·W·S

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DIAMONDS

Diamond presentations at the PDAC conference. Since 1992, new developments in diamond exploration have been presented at the annual conferences of the Prospectors and Developers Association of Canada. Consulting geologist A. J. A. (Bram) Janse, of Perth, Australia, attended the 1999 meeting and sent in the following report. This year the meeting was held in Toronto, on March 14–17. Attendance was high (6,200), despite two bad years for the metals and mining industry as a whole. The mood was cautiously optimistic, and diamonds were one of the most popular subjects. The first diamond mine in Canada, Ekati, began operations in October 1998 (see Winter 1998 Gem News, pp. 290–292); and mining at a second deposit, Diavik, is expected to start in 2002.

This year's conference included one technical session on diamonds, and informal diamond talks in the Investors Exchange forum and an "open forum." Mike Jones of Aber Resources, Toronto, presented a design for barrier dams for the Diavik project at Lac de Gras. Roy Spencer, vice president of Denver-based Archangel Diamond Corporation (ADC), outlined the difficulties of operating in Russia, drawing from ADC's experiences with the Grib kimberlite pipe, discovered in February 1996, where development is now at a standstill. John Auston, president of Vancouver-based Ashton Mining of Canada, gave an update on their recent investigations in the Buffalo Hills kimberlite field in Alberta, Canada (see Summer 1998 Gem News, pp. 134–135), where exploration continues although a commercial diamond deposit has not yet been proved.

Ian McGeorge, of MPH Consulting in Toronto, presented a summary of activities in Botswana: Debswana is developing the Martins Drift kimberlite dike prospect, on the border with South Africa's Northern Province (formerly Transvaal), and has applied for a mining license over the Gope 25 prospect in central Botswana. According to Mr. McGeorge, recent research has indicated that the Orapa kimberlite pipe is not located on the Archean basement of the Kalahari Craton, but actually occurs within the surrounding mobile belt of paleo-Proterozoic age. If substantiated, this would upset previously held concepts on the distribution patterns of economic kimberlites (see, e.g., M. B. Kirkley et al., *Gems & Gemology*, Spring 1991, pp. 2–25; and A. J. A. Janse, *Gems & Gemology*, Winter 1995, pp. 228–255, and Spring 1996, pp. 2–30).

Chris Jennings, president of SouthernEra, Toronto, gave one of the most popular presentations, an update on activities at the Klipspringer project (figure 1), which is located near Potgietersrus in South Africa's Northern Province. SouthernEra has discovered a 20 mile (about 33 km) long dike swarm that contains several near-parallel dikes (colloquially called "fissures"); the main ones are the Leopard and Sugarbird fissures, each of which contains one or more "blows" (small pipes). The company experienced a setback in April 1998, when the heirs to the Marsfontein farm, which is centrally located in the dike swarm and contains the M-1 pipe, sold their titles to De Beers. This dispute has now been resolved (see

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"Happy families," *Mining Journal, London*, June 19, 1998, pp. 469–470); SouthernEra retained 40% of Marsfontein, while it continues to hold 100% of all other relevant farms. Jennings described the recent development of the Sugarbird blow, for which the payback period for capital expenditure was not the two years usually considered adequate, but only *one week*.

In the Investors Exchange forum, John Kaiser of the *Kaiser Bottom-Fishing Report*, spoke on "understanding the diamond exploration cycle." He explained the lesser significance of microdiamonds recovered from small mineral grain-size fractions, as compared to macrodiamonds from bulk and mini-bulk samples, and the need to restrain enthusiasm until results of all samples are released. Ongoing activities worldwide were highlighted in short talks and displays about diamond exploration and mining in Botswana, Brazil, Canada, Finland, Guinea, Lesotho, Namibia (offshore), and South Africa.

Figure 1. This aerial view (looking east) of part of the Klipsinger project shows the Leopard "fissure." The dike is about 1 m wide, and is visible over a distance of approximately 1 km in this photo; drilling has shown it to be 3 km long. The first underground adit at this fissure is visible in the foreground. Photo courtesy of SouthernEra.

Figure 2. Octahedral diamond crystals are featured in this jewelry, which was designed by Andrew Jordan and manufactured by Steve Fong (both of Vancouver, British Columbia, Canada). The 18k gold ring contains a 2.36 ct diamond crystal and two 0.06 ct faceted yellow diamonds. Each diamond crystal in the earrings weighs about 1.25 ct. Courtesy of Betty Sue King; photo by Maha DeMaggio.

A. J. A. (Bram) Janse
Archon Exploration
Carine, Western Australia

Diamond octahedra in jewelry. In their earliest uses in jewelry, diamonds were left in their distinctive natural shapes, such as octahedra. At the Tucson show this year, Betty Sue King of King's Ransom, Sausalito, California, exhibited contemporary jewelry featuring octahedral diamond crystals from Africa (figure 2). These designs illustrated an interesting use of diamonds that are already attractive as natural crystals. Ms. King later reported that she is expanding this line of jewelry to include pieces featuring flat triangular twinned diamond crystals (macles).

Jo Ellen Cole, GIA

First diamonds from the Merlin project, Australia. Ashton Mining has generated several press releases (see, e.g., those dated October 30 and December 17, 1998, and February 18, 1999) concerning its wholly owned Merlin project in the Northern Territory. Merlin yielded the first production of diamonds in mid-February 1999, including more than 720 carats from one day's production at its Excaliber and Sacramore pipes. This sample, which was taken from low-grade ore at the surface of the two pipes, contained "a large selection" of diamonds 1 ct and larger. A second shipment of Sacramore concentrate yielded a 14.76 ct "white" octahedron (figure 3). Although ore grades have not been specified, Ashton forecasts production of 200,000 carats from 500,000 tonnes of ore in the first year (grade 0.4 ct/ton). A commercial-scale trial mining and processing operation is now underway, and will involve taking ore from nine of the 12 pipes on the Merlin property. (For information on the geology of this deposit, see D. C. Lee et al., "The Merlin kimberlites, Northern Territory, Australia," *Proceedings of the Sixth International Kimberlite Conference, Russian Geology and Geophysics*, Vol. 38, No. 1, 1997, pp. 82–96.)

The Merlin diamonds will be sold through Argyle's European sales office in Antwerp, as the production is similar to high-end Argyle material and is "anticipated to appeal to Argyle's established range of customers." Ashton is also mining diamonds at Cuango, in northeastern Angola; more than 61,000 carats from the first three months' production were sold in December to the De Beers Central Selling Organisation (CSO) in Luanda. By agreement, all of the Cuango production will be sold through the CSO.

A review of "GE-processed" diamonds. On March 1, 1999, Lazare Kaplan International Inc. (LKI) sent a press release to the financial press, stating that its new subsidiary, Pegasus Overseas Limited (POL), would be the exclusive agent for selling natural diamonds that had undergone a new process developed by General Electric (GE). According to LKI, the process was permanent and irreversible, and was designed to improve the color, brilliance, and brightness of qualifying diamonds, which they said were a "small fraction of the overall diamond market." Both round and fancy-shaped "processed" diamonds were to be marketed, each with an accompanying grading report from a major laboratory. The release stressed the "all-natural content" of the processed diamonds, and stated that the process did not involve irradiation, laser drilling, surface coating, or fracture filling.

In a March 19 press release, GIA's president Bill Boyajian called for information from the parties involved in the process. The release further noted that GIA researchers had investigated a small sample of diamonds they believed had undergone the GE process, and that they had noted unusual gemological features in some of the diamonds. No specific information as to the nature of these features was provided, and GIA has yet to release any conclusive evidence that will identify that a diamond has undergone the GE process.

After extensive discussions with GE and LKI, GIA announced the following in a press release dated April 28: LKI will laser-inscribe all GE-processed diamonds on the girdle with the inscription "GE POL" (figure 4). GIA will make the following comment on grading reports for all GE-processed diamonds sent to GIA from POL: " 'GE POL' is present on the girdle. Pegasus Overseas Limited (POL) states that this diamond has been processed to improve its appearance by General Electric (GE)." GIA will move forward with a research project to understand the nature of the process and explore any identifying characteristics of these processed diamonds. It will use its HORIZON laboratory operations and information management system to track and build data on every GE-processed diamond submitted to GIA for grading. Ultimately, GIA intends to publish its findings in *Gems & Gemology*. LKI began selling the GE-processed diamonds—all with "GE POL" inscribed on the girdle—through POL in Antwerp in late May.

During a special June 23 session at the International Gemological Symposium in San Diego, California, Bill Boyajian, GIA Gem Trade Laboratory chief executive officer Tom Yonelunas, GIA Gem Trade Laboratory vice president of identification services Tom Moses, and GIA director of research Jim Shigley provided a "Trade Update" on the GE-processed "Pegasus" diamonds. Although they began by explaining that there was still no "black box" that could identify these diamonds, they did reveal some information based on study of "several hundred" such diamonds that POL had submitted to the laboratory for grading reports. A summary of their findings includes: weight—0.30 to 7 ct, with most in the 1–3 ct range); shapes—most cut in fancy shapes, but some rounds; clarity—IF to I_2, with most IF to SI_1; color—D to light yellow, with most D to H (the majority of all colors are brownish or grayish). The "overwhelming majority" of diamonds were type II's, but some type I's were seen. Mr. Yonelunas, who presented these data, cautioned that the lab had yet to see the "full range" of goods. The best hope to understand this process requires examination of diamonds before and after processing, but these have not yet been available for study.

Dr. Shigley reported that GIA has been conducting its own experiments on treating diamonds using high pressure and high temperature (HPHT) to help develop identification criteria. He noted that one could add or subtract color to diamonds with this technique. Mr. Moses pointed out that HPHT treatment of diamonds has been known in the scientific community since the early

Figure 3. This 14.76 ct diamond octahedron was recovered recently from the Sacramore pipe at the Merlin project in Northern Territory, Australia. Photo courtesy of Ashton Mining.

1970s. Although GE has not provided details of the process being used, many people have expressed their opinion that HPHT is involved (see, e.g., K. Schmetzer, "Behandlung natürlicher Diamanten zur Reduzierung der Gelb- oder Braunsättigung" (Treatment of natural diamonds in order to reduce the yellow or brown color), *Goldschmiede Zeitung*, Vol. 97, No. 5, May 1999, pp. 47–48 [in German]), so it is clearly important to know what the starting features of such treated diamonds are.

Mr. Yonelunas stated the belief that at least a portion of the GE-processed diamonds will be recognizable gemologically. In fact, a parcel of GE-processed diamonds from which the inscriptions had been either partially or completely removed had already been resubmitted to the Gem Trade Laboratory, and the diamonds had been noticed using archived data from the laboratory's HORIZON system. A GIA press release dated July 6 indicated how such diamonds would be handled: The company submitting the diamond will be asked to immediately authorize re-inscription of that diamond. Should the company choose otherwise, GIA would be "obligated to report this to the appropriate authorities, including the Jewelers Vigilance Committee (JVC)."

At the World Federation of Diamond Bourses meeting in Moscow in early July, a resolution was proposed regarding the GE-processed diamonds. As quoted on the Internet in *Rapaport News* (and, at our press time, scheduled to appear in the July 30 issue of the *Rapaport Diamond Report*), the resolution states the following:

1. If a diamond has been treated or processed in order to alter or enhance its color, other than by generally accepted procedures of cutting and polishing, this fact must be disclosed in writing when such a diamond is offered for sale or submitted for certification.
2. The removal of a lasered inscription which identifies a diamond as having been treated or processed as above, shall be considered a deceptive process.
3. Any violation of Articles 1 or 2 above shall be regarded as fraudulent and shall be referred to the applicable Bourse for disciplinary action as the Bourse sees fit.
4. If such a treated or processed diamond is sold without disclosure in breach of the above rule, even in good faith, the buyer shall be entitled to cancel the sale, return the diamond and obtain a refund of the purchase price.

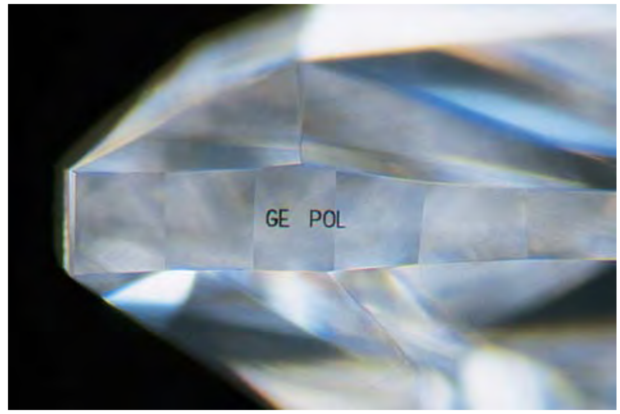


Figure 4. "GE POL" has been inscribed on the girdle of this diamond, which Pegasus Overseas Ltd. stated had been processed by GE. Photomicrograph by Shane McClure; magnified 40×.

COLORED STONES AND ORGANIC MATERIALS

International Colored Gemstone Association Congress. More than 20 countries were represented by 173 participants at ICA's eighth biennial Congress, which was held in Abano Terme, Italy, May 16–19. Dona Dirlam, Director of GIA's Library and Information Center, provided the following report.

The keynote speaker was Rashmikant Durlabhji of India, a founding organizer of ICA, who spoke on the role of colored gemstones in the 21st century. He reminded the audience that ICA is the only organization devoted to colored stones on an international basis, and he pointed out the need to continue to bridge the gaps from miners to cutters to wholesale dealers. He suggested several ideas for promoting jewelry, including the development of a line of jewels for people who wear uniforms. He also encouraged ICA members to be ready to embrace the new paradigm in trading, the Internet.

Professor Jurgen Kleiber-Wurm of the University of Innsbruck, Austria, spoke on the global marketing of colored stones. What is fundamentally new is the speed at which information travels. Also, new markets will be found by focusing on the concept of selling "desire."

An update on the history, mining techniques, and future prospects of the Paraíba tourmaline mines in Brazil was provided by Marcelo Bernardes. He noted that currently there are three groups working the area, but there has been no recent production. Mr. Bernardes estimated that only 7.65 kg of gem-quality Paraíba tourmaline has reached the trade in 17 years of production, making it one of the rarest of the commercial gemstones.

Mehul Durlabhji, the ICA ambassador to India, gave an update on the commercial ruby localities in India's Orissa and Madhya Pradesh states, on rhodolite garnet mining in Orissa, and on tanzanite mining in Tanzania. In particular, he noted that decreased production combined with steady demand have resulted in sharp price increases for tanzanite. He concluded by suggesting that future mining for colored stones will require more sophisticated techniques and equipment.

Particularly memorable this year was the unveiling of a silver, gold, and platinum sculpture by Ninni Verga called "The Gate of the 2000 Gems" (figure 5). Decorated with 2,000 diamonds and colored gems, the sculpture was presented to the Israeli Ambassador to Italy, Yehuda Millo, by outgoing ICA president Paolo Valentini, as a symbol of peace and hope for the next millennium. After touring countries throughout the world to promote ICA, colored gemstones, and peace, it will be presented to the City of Jerusalem.

A proposal has been submitted to hold the next ICA

Figure 5. The "Gate of the 2000 Gems," an artistic replica of the Lion's Gate of the old city of Jerusalem, symbolizes the crossing from the second to the third millennium. Designed by Ninni Verga, it is made of gold, silver, and platinum and set with 2,000 colored gems weighing 253.13 ct. The sculpture, which stands 36 cm tall, has a 49 × 37 cm base. Photo courtesy of ICA.

Congress in 2001 in Sydney, Australia. The final location will be decided later this year.

Dona Mary Dirlam, GIA

Andradite (including demantoid) from Canada. At the 1999 Tucson show, Brad Wilson, of the Kingston, Ontario, office of Coast-to-Coast Rare Stones, showed *G&G* senior editor Brendan Laurs a 5.8-mm-diameter (0.78 ct) round brilliant andradite garnet that was reportedly from Black Lake, Quebec. Because the color was in the yellow-to-green range, and possibly achieved the green hue necessary to be called demantoid, Mr. Laurs requested the loan of two additional pieces so that their colors could be observed under more controlled conditions. These samples (figure 6) were examined with daylight-equivalent fluorescent lighting in a MacBeth "Judge II" viewing environment. Using Munsell color chips as comparators (see, e.g., J. M. King et al., "Color grading of colored diamonds in the GIA Gem Trade Laboratory," *Gems & Gemology*, Vol. 30, No. 4, 1994, pp. 220–242), we found that one was yellowish green (green enough to be demantoid), but the other was greenish yellow and so not demantoid.

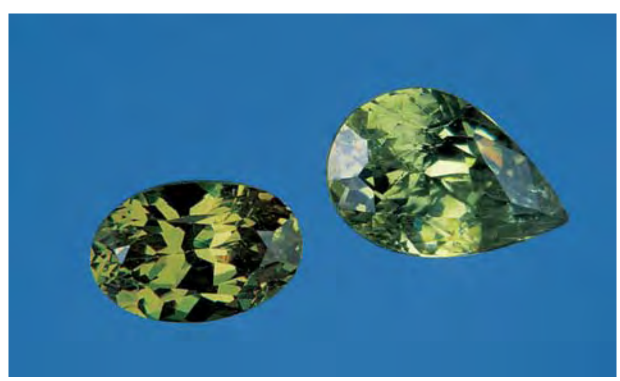
Limited quantities of this andradite were found in 1995 and April 1998 in an asbestos mine at Black Lake, Quebec; this locality was described in the 1940s (J. D. H. Donnay and C. Faessler, "Trisoctahedral garnet from the Black Lake region, Quebec," *University of Toronto Studies, Geological Series*, No. 46, 1941, pp. 19–24). Although most of the stones cut thus far are smaller than 0.5 ct, larger ones have been faceted (e.g., 1.08, 1.38, and 2.74 ct). The properties of this material were reported in a recent article (B. S. Wilson and W. Wight, "Gem andradite garnet from Black Lake, Quebec," *Canadian Gemmologist*, March 1999, pp. 18–19) and include: R.I. of 1.880; S.G. of 3.83–3.94; no "horsetail" inclusions; and low chromium content (less than 0.01 wt.% Cr_2O_3), based on microprobe analysis of a sample for which the color was not specified.

Trapiche cat's-eye emeralds. Most gemologists and jewelers are familiar with trapiche emeralds and their six-spoke, wagon-wheel appearance. What is less well known, however, is that the pie-shaped sections in some of these emeralds may lend themselves to the fashioning of chatoyant gems.

Chatoyancy in emeralds is typically the result of light reflection from fine parallel growth tubes elongated in the c-axis direction. Less commonly, the chatoyancy results from the accidental parallel to subparallel bunching of fibrous mineral inclusions such as amphiboles. Instead of being aligned parallel to the c-axis, as are growth tubes, the fine "bunching" structure that produces chatoyancy in trapiche emeralds is oriented at 90° to the c-axis. This results in cat's-eye cabochons with the optic axis direction oriented through the dome (i.e., perpendicular to the girdle), rather than through the long side, as would be the case in a cat's-eye created by reflection from growth tubes.

Although fine-scale structure has been recognized as a characteristic of trapiche emeralds for many years (see, e.g., K. Nassau and K. A. Jackson, "Trapiche emeralds from Chivor and Muzo, Colombia," *American Mineralogist*, Vol. 55, 1970, pp. 416–427; Spring 1981 Gem Trade Lab Notes, pp. 43–44), the Gem News editors could find no mention of chatoyancy in such gems. At the 1999 Tucson show, however, Michael Gray of Coast-to-Coast Rare Stones, Missoula, Montana, showed

Figure 6. The 0.39 ct pear shaped andradite garnet from Black Lake, Quebec, Canada, is yellowish green, and therefore the variety demantoid; the 0.34 ct oval from the same locality is greenish yellow, and should be referred to simply as andradite. Courtesy of Brad Wilson; photo by Maha DeMaggio.



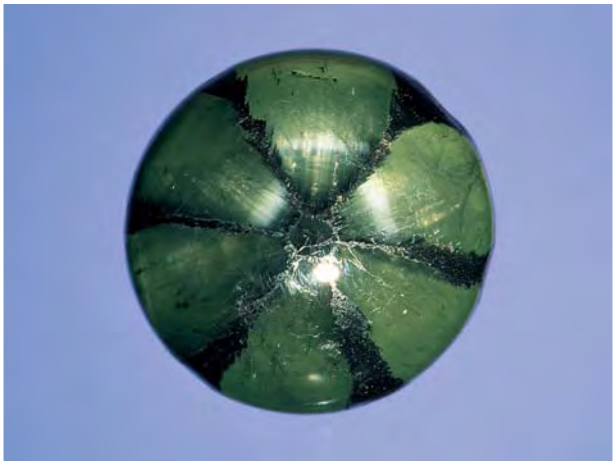


Figure 7. Bright, chatoyant bands are visible near the apexes of several wedge-shaped sections of this 18.37 ct (16.28–15.88 × 9.82 mm) trapiche emerald cabochon. Courtesy of Coast-to-Coast Rare Stones; photo by Maha DeMaggio.

Figure 8. Both of these free-form double cabochons, which were cut from a single trapiche emerald crystal, show chatoyancy. These 2.05 and 2.15 ct samples measure 10.79 × 7.78 × 3.32 and 10.98 × 8.01 × 3.33 mm, respectively. Courtesy of Collectors; photo by Maha DeMaggio.

us an 18.37 ct trapiche emerald cabochon (figure 7) that had a chatoyant band in each of the six wedge-shaped sections, near the apex of the cabochon, when viewed with a penlight. Magnification revealed a fibrous-looking structure that was oriented perpendicular to the c-axis. From this observation, it seemed logical that individual emerald cat's-eyes could be cut from the trapiche crystal if the fibrous structure was fine enough, and if the rough was properly oriented during cutting.

As a coincidence to this earlier observation, Roxanne Kremer of Collectors in Rosemead, California, subsequently loaned GIA two cat's-eye emerald cabochons (2.05 and 2.15 ct) that reportedly had been cut from trapiche rough from the Muzo mine (figure 8). Examination with magnification showed that the structure of these two cabochons was identical to that of the much larger, complete trapiche emerald cabochon we had examined previously. The internal structure became even more apparent when the cabochons were examined with polarized light (figure 9). It was also apparent that the fibers did not extend radially from the core (i.e., like the spokes on a bicycle wheel); instead, they maintained a parallel orientation within each trapiche section. Opaque black fringe-like extensions protruding from the spokes also pointed in the same direction as the fibrous structure in the emerald sections.

Natural pearls from the northern Cook Islands. In October 1998, GIA Extension Education manager Eddie Buscher visited the Cook Islands and met with Ben Bergman of Bergman & Sons (on Rarotonga, the capital island), who provided the following information about natural pearls from Penrhyn Island, in the northern Cook Islands.

According to Mr. Bergman, commercial farming of South Sea black (cultured) pearls was established in the Cook Islands 27 years ago. Before then, the enormous lagoon at Penrhyn was noted for the small natural pearls found there, which continue to be harvested today. Penrhyn is located 650 miles (about 1,045 km) north of Rarotonga; its lagoon, which is about 50 miles (80 km) in circumference, is the home of the species *Pinctada maculata*, also known as the "Polynesian Pipi Shell." This mollusk, which averages 4 cm in diameter, occasionally produces natural pearls (figure 10). *P. maculata* mollusks cluster underwater, from near the surface to about 2 m deep, on massive coral heads that occur randomly throughout the lagoon. The natural pearls are harvested year-round, mostly by local women who use small outboard-powered boats to reach the pearl beds. Some divers employ a unique technique to determine selection of the shell: They actually look into the naturally gaping shells to see if there is a pearl inside. This approach requires considerable finesse, as the mollusk will close if it

Figure 9. When the two cabochons in figure 8 were viewed in the optic axis direction with cross-polarized light, the parallel fibrous structure that causes the chatoyancy was readily apparent. Notice how the fringed edges of the black spokes taper in the same direction as the fibrous structure. Photomicrograph by John I. Koivula.

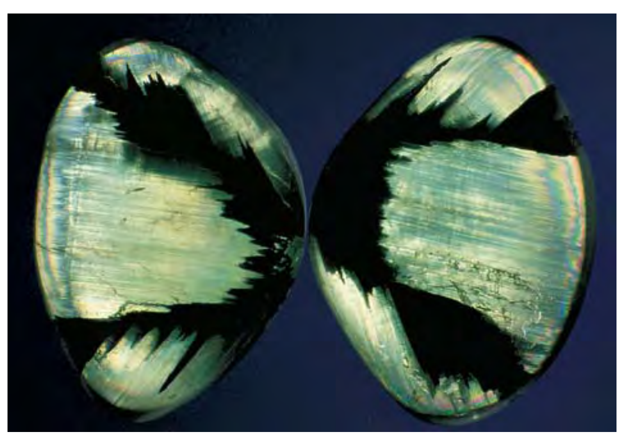


Figure 10. These natural pearls (4.5–5.0 mm) and polished shells (2.5–3.8 cm) are typical of Pinctada maculata, *a small mollusk native to Penrhyn Lagoon in the Cook Islands. Pearls courtesy of Bergman & Sons, and shells courtesy of the Beachcomber, Rarotonga; photo by Maha DeMaggio.*

detects the presence of the diver. In the last decade, Penrhyn has been affected by some unusually low tides (attributed to El Niño), which have left portions of the pearl beds exposed on the surface. The resulting mortality of the mollusks has restricted the availability of these pearls.

According to Mr. Bergman, the pearls produced by *P. maculata* average 4–5 mm in diameter. Although the color can vary considerably, the pearls are predominantly a "soft golden hue." Rarely, pearls are found that could be considered "deep gold," green, "copper," black, gray, pink to orange, or white. Common shapes include baroque, semi-baroque, button, and occasionally round. Blister pearls are referred to locally as "puku." The population of *P. maculata* is insufficient to justify commercial exploitation, and local law forbids foreigners from harvesting them. As a consequence, no official production statistics have been kept. These natural pearls are usually sold to local buyers for use in jewelry manufacturing.

Mr. Bergman noted that Penrhyn and the neighboring island Manihiki also have a large population of "wild" *P. margaritifera* mollusks (about 5 million currently), which have been harvested for the last 100 years. Local legend alludes to fabulous collections of natural pearls from the *P. margaritifera*. Although Mr. Bergman was not able to confirm this, he has seen some notable natural pearls from this mollusk, including a pair of "silver white" egg-shaped pearls about 10 mm in diameter (both said to have come from the same shell) and a single drop-shaped "silver white" pearl that measured 10.2 mm.

Eddie Buscher, GIA

Twelve-rayed star sapphire from Madagascar. Star sapphires from northern Madagascar are frequently fashioned from crystals with colorless transparent cores that are surrounded by milky white to intense blue growth sectors, as described by D. Schwarz and J. Kanis ("Madagaskar: Korund aus Nord und Süd," *extraLapis*, No. 15, 1998, pp. 60–63). In general, the six-rayed star sapphires are cut to remove this colorless core, or to place it at the rim of the cabochon. The latter was the case for a 71.18 ct 12-rayed star sapphire (figure 11) that was recently examined by contributing editor Karl Schmetzer. The stone was reportedly recovered from Antsirañana Province in northern Madagascar, a large region from which blue and yellow sapphires—including six-rayed star sapphires—have been recovered since about 1997 (see, e.g., Summer 1998 Gem News, pp. 140–141).

The flat back of this cabochon revealed that the original crystal had indeed grown around a colorless transparent core (some of which remained on one edge of the cabochon). This core was surrounded by three milky white growth sectors, which were found to be hexagonal dipyramids—probably ω $\{14\ 14\ \overline{28}\ 3\}$. Between two of these milky white growth sectors were narrower, transparent, intense blue rhombohedral *r* $\{10\overline{1}1\}$ growth zones. These forms are consistent with those of sapphire seen from northern Madagascar in recent years; as such, they provided additional evidence that the stone was natural.

The 12-rayed star actually consisted of two six-rayed stars with the same axis on which the rays were offset at

Figure 11. This 12-rayed star sapphire is from Antsirañana Province, in northern Madagascar; the 71.18 ct cabochon measures 26.2 ×18.9 mm. Photo by Maha DeMaggio.

30°. The arms of the most prominent star were oriented perpendicular to the hexagonal dipyramids. (This is the usual orientation of six-rayed star cabochons from northern Madagascar.) The rays of the other star were oriented parallel to the hexagonal dipyramids, between the arms of the first star. The cause of the double star—that is, the identity of the elongated mineral inclusions in two orientations within this stone—has not yet been determined.

KS

Blue, pink, and purple sapphires from Ilakaka, Madagascar. . . . Tom Cushman of Allerton Cushman and Co., Sun Valley, Idaho, recently showed us several sapphires from new production at Ilakaka, in southern Madagascar. According to Mr. Cushman, 30 kg of gem rough were legally exported in November–December 1998; however, the miners probably recovered a great deal more than that, and the rate of production is increasing. He considers several kilograms per week a reasonable estimate, with the majority of the sapphires in pink-to-purple colors. The stones (all alluvial) are being mined principally in two areas (one near the town of Ilakaka) that are about 100 km apart; recently, however, stones also have been recovered from the region between these two areas. Pieces as large as several grams have been found.

The sapphires generally are heat treated after export, and untreated fashioned stones are comparatively rare. Mr. Cushman reports that more than 90% of the Madagascar sapphires he is marketing have been heat treated.

Figure 12. These sapphires came from Ilakaka in southern Madagascar. The long blue oval (bottom right) showed evidence of heat treatment. Courtesy of Tom Cushman; photo by Maha DeMaggio.

We examined five faceted stones (figure 12), ranging from blue to purple to pink. All but the 1.54 ct stone, a modified octagonal brilliant, were oval mixed cuts. The gemological properties are given in table 1. Four of the stones contained tiny birefringent transparent crystals,

TABLE 1. Properties of five sapphires from Ilakaka, Madagascar.

Properties	Orangy pink	Purplish pink	Pinkish purple	Blue	Blue[a]
Weight (ct)	1.99	1.54	2.12	1.72	2.03
Pleochroism	Purple pink Orange pink	Purplish pink Orangy pink	Purple Orange	Violet-blue Blue	Violetish blue Greenish blue
Color filter reaction	Reddish orange	Reddish orange	Red	Weak pink	None
Specific gravity	4.00	3.99	4.00	3.99	3.98
Refractive indices	1.760–1.768	1.760–1.768	1.761–1.769	1.760–1.768	1.761–1.769
UV fluorescence					
Long-wave	Moderate to strong orange	Moderate red-orange	Moderate red-orange	Very weak red	Inert
Short-wave	Very weak orange	Very weak orange	Very weak orange	Inert	Chalky, uneven, mod. yellowish green
Visible luminescence	None	None	None	Weak red	None
Absorption spectrum	Chromium lines (ruby spectrum)	Weak ruby spectrum	Ruby spectrum + 450 Fe line	Very weak ruby spectrum + 450 Fe band	Weak 450 Fe band
Inclusions	Stringers and clusters of tiny transparent near-colorless birefingent crystals, tension cracks around crystals	Tiny individual transparent near-colorless birefringent crystals, tension cracks, partially healed fractures	Tiny transparent near-colorless birefringent crystals, stress haloes, lamellar twinning, residues in surface cavities	Tiny transparent near-colorless birefringent crystals, irregular silk, lamellar twinning, "fingerprints"	Melted crystals, discoid fractures, cloud, "fingerprints"

[a] *Internal features showed evidence of heat treatment.*

Figure 13. This lot of mixed gem rough was recovered from alluvial deposits in the Ilakaka region of Madagascar. The largest pieces measure about 1 cm. Photo courtesy of Henry Hänni.

possibly zircon. Although we were told that two of these samples had been heat treated, only the 2.03 ct blue oval mixed cut showed evidence of this, in the form of melted crystals surrounded by discoid fractures.

. . . and other gems from near Ilakaka. Blue, pink, and purple sapphires are not the only gem materials being found in the Ilakaka area. Contributing editor Henry Hänni examined a 1 kg parcel of gem rough obtained by Werner Spaltenstein of Chanthaburi, Thailand, from the Ilakaka district. The 150-km-long alluvial deposit begins about 50 km beyond the city of Tulear (Toliara) on the southwest coast of Madagascar, along the road to Antananarivo; the village of Ilakaka is currently at the center of the excavations.

The colorful mix of slightly to distinctly rounded pebbles (figure 13) was analyzed with Raman spectroscopy at the SSEF Swiss Gemmological Institute in January 1999. The following gem minerals were identified: blue, pink-to-purple, and brown sapphire; blue, violet, and purple spinel; yellow-to-brown grossular garnets, including orange hessonite; pyralspite garnets, including almandine, rhodolite, violet-blue and "malaia"-type garnets; colorless-to-yellow, greenish yellow, or brownish yellow chrysoberyl, with some cat's-eye material and some alexandrite; colorless, light yellow, and light blue topaz; brown and red tourmaline; andalusite; yellow, brown, and green zircon; grayish blue platy kyanite; and citrine and amethyst, as well as colorless quartz. The parcel was also found to contain one light green pebble of manufactured glass.

It is interesting to note that these gem pebbles were very similar in species and shape to the rough in the parcel from Puchapucha, in the Tunduru area of southern Tanzania, that Dr. Hänni described in the Summer 1995 Gem News section (pp. 133–134). These similarities suggest that the gems may have been derived from a geologically similar source that existed while Madagascar was still attached to the African continent (see, e.g., C. B. Dissanayake and R. Chandrajith, "Sri Lanka–Madagascar Gondwana linkage: Evidence for a Pan-African mineral belt," *Journal of Geology*, Vol. 107, 1999, pp. 223–235, which includes a map showing a possible reconstruction of East Africa, Madagascar, and Sri Lanka). *HAH*

Tanzanite fluorescence: a seldom-noted property. Bill Vance, a Graduate Gemologist and gem dealer from Waldport, Oregon, recently showed the Gem News editors a transparent, 3.46 ct pear-shaped mixed-cut tanzanite that fluoresced to long-wave UV radiation. Since UV fluorescence has not been reported previously for tanzanite (see, e.g., pp. 387–388 of R. Webster's *Gems*, 5th ed., Butterworth-Heinemann, 1994: "There is no noticeable luminescence under ultra-violet light"), we examined the stone in more detail.

The tanzanite was slightly purplish blue face-up, and

Figure 14. Miners emerge from a tunnel at the Merelani mining area in northeast Tanzania. Photo by Angelique Crown.

showed rather typical pleochroism in shades of reddish purple, brownish yellow, and grayish to greenish blue. The refractive indices were 1.691, 1.693, and 1.701, with a birefringence of 0.010 and a biaxial positive optic character; a partial interference figure could also be resolved through the pavilion of the stone. The specific gravity, determined hydrostatically, averaged 3.36 over three measurements. No absorption spectrum was seen through either a diffraction-grating or a prism spectroscope. With magnification, we saw several small scratches and surface abrasions, and a single small, iridescent cleavage extending from the girdle.

The stone showed no reaction to short-wave UV radiation, but it did fluoresce a weak yet definite slightly chalky bluish green to long-wave UV. Three other faceted tanzanites—ranging in tone from very light to very dark purplish blue—were used as comparison stones; all three were inert, and their presence in the ultraviolet testing box made the reaction of the 3.46 ct stone all the more obvious. Since UV fluorescence has apparently not been recognized in tanzanite until now, we do not know if this particular stone represents an anomaly or, because the reaction is weak, if similar fluorescence may have been overlooked in the past. Regardless, this example shows the importance of using "darkroom" conditions when testing gems for their potential reaction to UV radiation.

Tanzanite mining update. GIA instructor Angelique Crown visited the Merelani mining area in northeast Tanzania in late April 1999 (figure 14) and provided the following update. Blocks A, B, and D were being actively mined. Although no activity was noted at Block C (the largest mining area), this Block was acquired in February 1999 by a Tanzanian/South African joint venture from Graphtan International, which had been mining graphite there. African Gem Mining Resources (AFGEM) purchased the Block through its subsidiary, Mererani Mining Ltd. According to Michael Nunn, chief executive officer of AFGEM, 5% of the equity of the mining company will be placed into the Merelani Development Trust, which will be operated for the benefit of the community of Merelani. This company, which is investing $10 million in the project in the short term, is now conducting a comprehensive feasibility study and plans to begin production by the second quarter of 2000.

Meanwhile, the American Gem Trade Association (AGTA) relief program has raised approximately $35,000 to help the tanzanite miners recover from the April 1998 mine disaster (see Summer 1998 Gem News, p. 145), and a shelter for the miners is being built. During the author's visit, Philip Zahm, chairman of the AGTA project, was at the mining site with three professional paramedic and rescue training experts (Jeff Schneider, Larry Bingham, and Rod Shimamoto) from the former Samaritan Training Center based in Vacaville, California. At least 15 miners completed three days of emergency medical and rescue training. Assistance has also been provided to the Arusha Fire Brigade, the emergency responder.

Angelique Crown, GIA

Figure 15. These stones (approximately 0.50–2.52 ct) are representative of the color range we observed in faceted tsavorites from the new deposit in southern Tanzania. Photo by Maha DeMaggio.

A new source for tsavorite. Dr. Horst Krupp, technical director of Wahuwa Mining Ltd. of Tanzania, recently informed us of a major new primary deposit for tsavorite garnet in southern Tanzania that may radically change the availability of fine–color material. The new locality is about 15 km from the town of Ruangwa in Lindi Province. Word of this new discovery has spread quickly, and miners are flocking to the area. According to Dr. Krupp, mining at Tunduru, about 150 km west of this new deposit, has virtually ceased as a result.

Dr. Krupp told us that the tsavorite is found as cracked masses in pods that may reach as large as 8 kg. The masses yield approximately 10%–15% gem-quality rough, most of which will cut small stones. Dr. Krupp showed us approximately one kilo of gem tsavorite rough and about 40 faceted stones (some of which are shown in figure 15), which were among the largest tsavorites cut to date (most larger than 1 ct, the largest being 3.65 ct). All were a medium dark green with very little or no yellow component, and many were equal in quality to the finest material on the market. According to Dr. Krupp, the new locality is producing this quality of tsavorite by the kilo, with the overall color of the rough being very consistent.

The gemological characteristics of these stones are virtually identical to those of material from other localities in Tanzania. The R.I. is very consistent at 1.74, there were no distinct lines in the spectroscope, and none of the samples fluoresced to UV radiation. Even the inclusions were the same as those in tsavorites from the older deposits, consisting of "sugary"-appearing fingerprints, curved or angled needles or growth tubes, and—identified on the basis of morphology—platy crystals of opaque black graphite and transparent dark brown mica, probably biotite. We also noted some unusual graining in one of the stones. This consisted of fine parallel curved lines that veered off in several directions (figure 16) and was

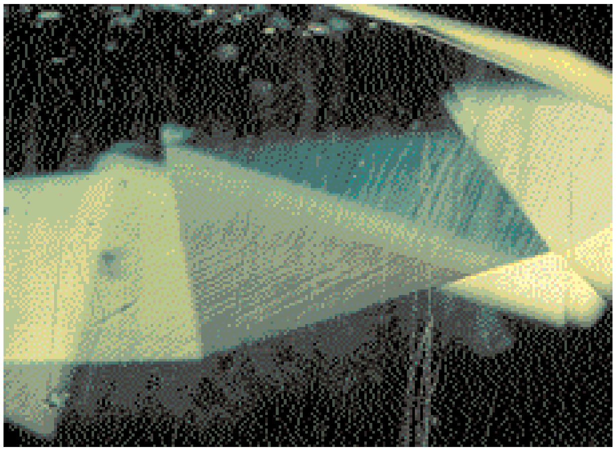


Figure 16. This unusual curved parallel graining, which was observed in one of the faceted tsavorites from the new Tanzanian deposit, is reminiscent of flow lines seen in some types of glass. Photomicrograph by Shane F. McClure; magnified 20×.

reminiscent of the swirled striae that are seen in glass. Indeed, if the stone had not had natural inclusions we would have been suspicious of its origin.

We obtained qualitative chemical analyses of three of the tsavorites using EDXRF spectrometry. The chemistry of these samples was consistent with tsavorite from other localities, with the main chromophore being vanadium. Traces of chromium may have been present, but those peaks would be concealed by overlap with the vanadium spectral peaks.

This deposit appears to be located within the same geologic belt (the Mozambique belt) as the well-known tsavorite mines at Komolo, Tanzania. However, it is almost 800 km to the south, and much of the region between has yet to be thoroughly explored. *SFM*

SYNTHETICS AND SIMULANTS

Synthetic beryl showing zoned pleochroism. Russian laboratories have been growing hydrothermal synthetic beryl in a variety of colors for more than a decade (see, e.g., Winter 1988 Gem News, pp. 252–253; and articles by J. I. Koivula et al. [pp. 32–39] and K. Schmetzer [pp. 40–43] in the Spring 1996 *Gems & Gemology*). Although most of the Russian hydrothermal synthetic beryl is green (i.e., synthetic emerald), colored by chromium, more "exotic" colors also are produced. These include: rich "turquoise" blue, colored by copper; intense pink, colored by manganese; orangy red, resulting from a trace of cobalt; and purple, colored by traces of chromium and manganese in combination. Recently, the Gem News editors received for examination an interesting hydrothermal synthetic beryl crystal with a coloration not previously encountered.

The crystal, grown on a colorless seed plate as is typical for such material, measured 45.7 × 10.5 × 9.3 mm and weighed 42.50 ct. Thomas Hunn of Thomas Hunn Co. in Grand Junction, Colorado, purchased it from the Fersman Mineralogical Museum (Moscow) as a "purple hydrothermal (synthetic) beryl." The crystal was obviously bi-colored when examined through the side in a direction parallel to the plane of the seed plate: The outer rim was dark purplish blue, and the center sections next to the seed plate were intense purplish pink (figure 17, left). When the crystal was examined in a direction perpendicular to the seed plate, or in the optic-axis direction, the mixture of these two hues resulted in an overall purplish color.

When viewed with the spectroscope, the crystal showed a sharp line at 678 nm, weaker lines at 648 and 630 nm, general absorption in the yellow-green to orange region from approximately 540 to 580 nm, and a band in the blue region between 433 and 434 nm. The spectrum did not change as the orientation of the specimen was changed, provided the beam did not pass through the seed plate. The R.I. values obtained on a relatively flat and smooth crystal face were 1.576–1.582 (typical for beryl), yielding a birefringence of 0.006. The crystal was inert to both long- and short-wave UV radiation. Since

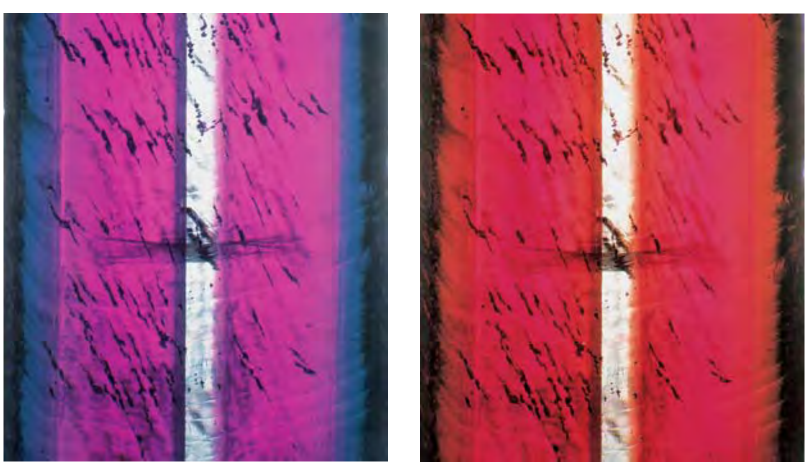


Figure 17. This 9.3-mm-wide crystal of hydrothermal synthetic beryl shows distinct color zoning, with a dark purplish blue rim and a purplish pink central area (left); these are the colors normally seen when observing the crystal. The colorless layer in the middle is the seed plate; the dark horizontal cracks are due to strain. A 90° rotation of the analyzer (right) produces a dramatic shift in the pleochroic colors, resulting in a reddish orange rim and an orangy red center. Photomicrographs by John I. Koivula.

the crystal had metal wires embedded at both ends, no attempt was made to obtain the specific gravity.

When we viewed the sample with a microscope, we saw numerous two-phase fluid inclusions. Most of these were conical- to needle-shaped growth tubes that extend in the c-axis direction. There were a few partially healed fingerprint-type fluid inclusions, particularly around the suspension wires at either end of the crystal. The pleochroism related to the color zones—perhaps the most striking aspect of this crystal—was also most evident with magnification. We observed the sample through the microscope using only the analyzing plate (that is, not the polarizer as well). The colors in each zone shifted dramatically as the plate was rotated through 90°: from dark purplish blue to reddish orange in the rim, and from purplish pink to orangy red in the center section (figure 17).

GIA Gem Trade Laboratory research associate Sam Muhlmeister obtained qualitative chemistry on the crystal using a Tracor Spectrace 5000 EDXRF system. He analyzed two separate surfaces, one parallel and the other perpendicular to the seed plate (i.e., in directions that maximized information from the bulk and the rim of the sample). The major elements detected were aluminum and silicon (light elements such as beryllium cannot be detected using this instrumentation). Phosphorus appeared to be present in minor amounts, and traces of calcium, chromium, copper, gallium, iron, manganese, nickel, sulfur, and zinc were also noted. The dark purplish blue rim contained more chromium and copper than the purplish pink central area. The exact cause of color in the crystal was not determined, but it is logical to speculate that the purplish pink central zone is colored primarily by manganese, as are natural morganite and red beryl, and additional chromium and copper are responsible for the coloration in the rim.

Polymer-impregnated synthetic fire opal from Kyocera. At the 1998 Basel Fair, the Kyocera Corp. of Kyoto, Japan, was offering a new product: "synthetic fire opal." Kyocera had already test marketed several colors of polymer-impregnated synthetic opal (see, e.g., Summer 1995 Gem News, pp. 137–139), including orangy pink, reddish orange, and orangy yellow. However, the product presented in Basel looked somewhat different from these in that it showed green and orange play-of-color against a bright orange bodycolor, similar in appearance to some Mexican fire opal.

A 24.55 ct block of this bright orange synthetic opal (figure 18) was recently studied by contributing editor Emmanuel Fritsch. The columnar structure typical of synthetic opal was clearly visible, with the cells elongated perpendicular to the top and bottom surfaces of the sample. The overall appearance was reminiscent of the atypical Gilson synthetic opal described in the Summer 1985 Gem Trade Lab Notes (pp. 110–111). The R.I. of the block was about 1.46; the S.G. (estimated by volumetric means) was about 1.8, which is low for natural gem-quality opal. The sample fluoresced strong yellow-orange to long-wave UV radiation and very strong orangy yellow to short-wave UV; the orange appearance of this luminescence might be influenced by the sample's bodycolor. The luminescence was evenly distributed (whereas some natural opals have uneven luminescence) and was not followed by phosphorescence (many natural and some synthetic opals, including fire opals, do phosphoresce).

With magnification, many small fractures perpendicular to the top and bottom surfaces were visible; these extended about 1 mm into the block. The resulting small brownish patches (figure 19) on the top and bottom sur-

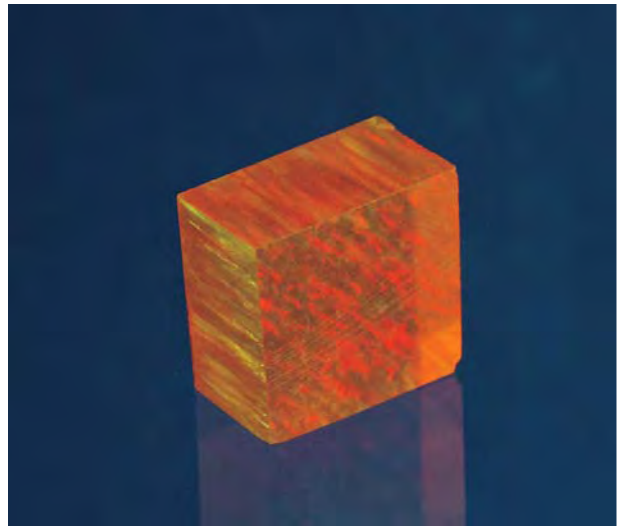


Figure 18. This 24.55 ct block of Kyocera polymer-impregnated synthetic fire opal, introduced at the April 1998 Basel Fair, has properties that are significantly different from those of natural fire opal. The block measures about 16.5 mm in maximum dimension. Photo by A. Cossard.

Figure 19. A typical "chicken wire" structure was seen within some brown patches on the surface of the synthetic opal shown in figure 18. Photomicrograph by E. Fritsch; magnified 60×.

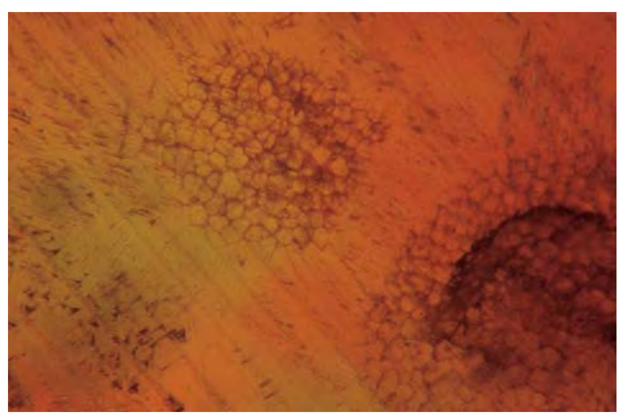


Figure 20. These citrine, tourmaline, and amethyst gemstones (39.46 ct, 6.46 ct, and 4.24 ct, respectively) were fashioned by Guy Couture as Butterfly cuts. Courtesy of Yves Morrier; photo by Maha DeMaggio.

faces showed the "chicken wire" structure that is typical for synthetic opal.

Mid-infrared absorption spectroscopy revealed absorption maxima at about 5950, 5875, 5815, 5800, 5625 (with a shoulder at 5125), 4371, and 4675 cm^{-1}. The sample was opaque at lower wavenumbers due to bulk absorption. These features are reminiscent of those seen in Kyocera's previous generation of colored impregnated synthetic opals—indicating the presence of polymers—but the differences in band positions suggest that a different polymer is being used for this material. A significant concentration of low-S.G. organic materials could account for the low specific gravity value.

Although this synthetic opal appears to be somewhat different from Kyocera's previous material, it still can be readily identified by standard gemological properties (i.e., columnar texture, "chicken wire" pattern, UV luminescence, and low S.G.). *EF*

MISCELLANEOUS

A new cut for colored stones. Gemologist Yves Morrier of Les Gemmologistes Associés OCYM Inc., Montreal, Quebec, Canada has provided the following information about a new cut for colored stones. The "Butterfly" cut features 43 facets (figure 20). Gems fashioned so far with this cut have ranged from 0.27 to 44 ct (with some calibrated goods) and include the quartz varieties amethyst and citrine, tanzanite, rhodolite and almandine garnets, fire opal, topaz, tourmaline, scapolite, and cubic zirconia. Mr. Morrier examined more than one hundred samples that revealed fairly consistent proportions, including an average length-to-width ratio of 1.38:1; an average total depth of 62%; an average crown height-to-pavilion depth ratio of 1:3; and "excellent balance" for all profile views.

The Butterfly cut was created by jewelry designer Guy Couture of Beauport, Quebec, Canada, after two years of experimentation; it debuted in August last year at Expo Prestige 98 (the annual jewelry show of the Quebec Jewellers Corp.). Mr. Couture holds U.S. and Canadian patents on this cut, and a French patent is pending. He plans to produce "butterflies" from ruby, sapphire, and emerald in 1999, and from diamond for the new millennium.

Yves Morrier
Les Gemmologistes Associés OCYM
Montreal, Quebec, Canada

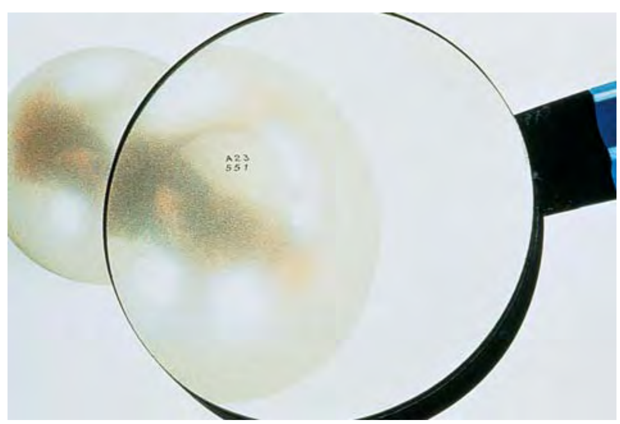
Pearl Branding: "Utopia" cultured pearls. One of the latest entries in the branding of gem materials is the "Utopia pearl." According to Claudio Pagani, international promotion manager for the South Sea Pearl Consortium, each cultured pearl that is branded and marketed as a "Utopia pearl" has not been either treated or polished, and is considered the finest-quality white South Sea cultured pearl. In the patented system, a minute (1 mm × 1 mm) alphanumeric code (figure 21) is placed on each pearl by a gold vaporization method. Although a special sealant is laid over the code for protection, the customer can still remove the code without damaging the nacre. All "Utopia pearls" are accompanied by a certificate that includes a digital photo as well as the dimensions, weight, and form. To date, Mr. Pagani reports, approximately 10,000 cultured pearls in virtually all sizes have been branded "Utopia pearls."

Noted U.S. designer Henry Dunay of New York is creating a special jewelry collection of rings, pendants, earrings, and bracelets fashioned from "Utopia pearls." This collection will be introduced nationwide at the Neiman Marcus department stores this fall.

ANNOUNCEMENTS

Hong Kong Jewellery & Watch Fair '99. This show will be held from September 23 to 27 at the Hong Kong Convention and Exhibition Centre (HKCEC). Specialized

Figure 21. Magnification reveals the alphanumeric code that has been placed on this "Utopia pearl" by a gold vaporization method. Courtesy of Henry Dunay.



pavilions highlighting new jewelry designs, fine designs, antique and estate jewelry, equipment and packaging products, and design competitions will be featured. Two major pearl auctions, by Paspaley and Robert Wan, will also be held at the HKCEC just before the fair. There will also be professional seminars and workshops. For details, contact Miller Freeman Asia Ltd. at 852-2827-6211 (phone) or 852-2564-5496 (fax), or visit http://www.jewellery-net-asia.com/fair9jw.htm.

***Cartier* at the Field Museum.** The exhibition *Cartier: 1900–1939* will be held at the Field Museum in Chicago from October 2, 1999 to January 16, 2000. Over 200 works will be displayed, including jewelry, clocks, watches, and ornamental accessories. Client order books, idea sketches, and original plaster casts of jewels will provide a behind-the-scenes look into Cartier's creative process during this innovative period. For more information, call the Field Museum at 312-922-9410, or visit the Web site http://www.fmnh.org/exhibits/spec_exhibits.htm.

Gem Conference 99. The 10th annual Canadian Gemmological Association conference will take place October 23–24 at the University of Toronto. Lectures and workshops will cover inclusions, synthetic moissanite, jewelry design and manufacturing, and appraisals. For more information, contact Mary Ellis at 416-785-0962 (phone) or 416-785-9043 (fax).

Jewellery Arabia 99. The 8th Jewellery Arabia exhibition will take place November 9–13, 1999 at the Bahrain International Exhibition Centre. The event is intended to serve jewelry manufacturers, importers, wholesalers, and retailers throughout the Middle East. Visitors will be admitted on the basis of a business card or invitation. For further information, contact the event organizers (based in London) at 44 171-862-2041 (phone), 44 171-862-2049 (fax), or via e-mail at jewellery@montnet.com.

CORRECTIONS:

1. *On page 19 of the Schmetzer and Peretti article "Some Diagnostic Features of Russian Hydrothermal Synthetic Rubies and Sapphires," published in the Spring 1999 issue, the photographer of the main photo in figure 3 was Maha DeMaggio.*

2. *In the Spring 1999 Gem News entry "Cat's-eye andradite from San Benito County, California," the large cat's-eye andradite in figure 4 (p. 48) and the two orangy andradites in figure 5 (p. 49) were courtesy of Rick Kennedy.*