GEM NEWS

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DIAMONDS

Argyle upgrades operation. A second major upgrade will soon be completed at the Argyle mine, according to a statement by the CRA-Ashton Mining joint venture in early 1994. The purpose of the upgrade, which includes installation of a second high-pressure crusher plus additional screening units and conveyors, is to help maintain diamond production over the remaining seven-year life of the open-pit operation. Although the current ore horizon consistently produces 6 ct per ton, the yield is expected to decline eventually to 4 ct per ton.

Production for 1994 is projected to be about 39 million carats. Although only 5% of output is typically gem quality, this 5% generates about 50% of the mine's revenue. The pink diamonds, for which Argyle is so well known, account for less than 0.001% of total production. (*Mining Journal*, March 25, 1994, p. 223)

De Beers's rough diamond sales up. Sales of rough diamonds by De Beers's Central Selling Organisation (CSO) for the first six months of 1994 were US$2,580 million, 1.5% higher than the same period last year and 41.5% higher than the second half of 1993. The CSO reports their sales of rough diamonds from 1984 to 1994 (in millions of US$) as follows:

Year	First half	Second half	Total
1984	US$ 945 m	US$ 668 m	US$1,613 m
1985	837	986	1,823
1986	1,214	1,343	2,557
1987	1,560	1,515	3,075
1988	2,201	1,971	4,172
1989	2,317	1,769	4,086
1990	2,477	1,690	4,167
1991	2,084	1,843	3,927
1992	1,787	1,630	3,417
1993	2,543	1,823	4,366
1994	2,580	—	—

The CSO reduced supplies to the market in the second quarter, following a buildup of stocks in the cutting centers and continued concerns about cutting-center profitability.

Demand for retail jewelry remained weak in Europe and Japan, high in East Asia, and stable in the United States. Any significant improvement in sales of rough diamonds depends on improved Japanese and European markets and on CSO clients being in a position to increase their levels of profitability, said De Beers.

Discussions continue between De Beers and the Russian diamond authorities about future contractual relationships. Although the present contract runs out at the end of 1995, the Russians have made it clear that they support market stability. Both sides have agreed to issue only joint public comments on their negotiations, according to the CSO.

Diamond pipes located outside Canada's "Corridor of Hope." Ashton Mining of Canada's recent discovery of a diamondiferous kimberlite pipe at Cross Lake, in the Northwest Territories, has proved the existence of such pipes outside the northwest/southeast-trending zone aptly named the "Corridor of Hope" by diamond geologist Ed Schiller. This 50-km-wide zone, which extends from Yamba Lake in the north to Artillery Lake in the south, is delineated by a set of parallel diabase dikes that are quite noticeable on regional aeromagnetic maps. Several diamondiferous pipes—including those located in the Lac de Gras area by BHP/Dia Met and DHK/Kennecott—have been found within this zone. The Ashton find, 200 km to the west of the zone, offers great encouragement to other companies who hold claims outside the Corridor of Hope. The pipe was discovered by a combination of till sampling for indicator minerals and aeromagnetic surveys. The claims on which the Cross Lake pipe is located are held by Tenajon Resources and Pure Gold Resources, in a joint venture with Ashton Mining of Canada. (*Northern Miner*, April 4 and May 16, 1994, both on p. 2; courtesy of Bram Janse)

More evidence that Wisconsin diamonds come from Canadian pipes. A significantly diamondiferous kimberlite pipe found in the Hudson Bay–James Bay Lowlands region of northern Ontario, Canada, reaffirms the possibility that the diamonds found in the terminal moraines of southern Wisconsin may have been transported there from the northern Ontario region by glaciers. This idea was first proposed by Hobbs (*Journal of Geology*, Vol. 7, 1899, pp. 375–388) to explain the late-19th-century finds of large (up to 21.25 ct) diamonds by farmers and well diggers in the area.

Discoveries since the late 1970s of at least 20 kimberlite pipes in the Upper Peninsula of Michigan had suggested a closer source for the Wisconsin diamonds. However, detailed investigations have shown that these kimberlites are virtually barren.

The northern Ontario find was made by KWG Resources, of Montreal, Quebec, on the basis of drilling of selected aeromagnetic anomalies. As the new pipe has only been intersected by one drill hole, no firm data are available on the shape or size of the pipe, or the grade or quality of the diamonds. However, one 29-kg section of kimberlite drill core contained six small diamonds (larger than 0.5 mm in two dimensions) and 63 microdiamonds (smaller than 0.5 mm). (*Northern Miner*, May 23 and June 20, 1994, both p. 2; courtesy of Bram Janse)

Update on Ghana production. Shallow alluvial reserves at the Ghana Consolidated Diamond Mines (GCD) operation at Akwatia are reportedly nearing exhaustion; annual output is now barely 200,000 carats (1992 production was 214,155 carats). However, there are substantial deep alluvial deposits in stream gravels of the Birim River Valley, which GCD is actively mining. Diamond production at other small and medium-sized mines in Ghana totalled 479,874 carats in 1992. (*Mining Journal*, November 26, 1993, p. 366; *Mining Magazine*, January 1994, p. 20; *Mining Annual Review* 1993, p. 188)

Russia offers rough for sale . . . In mid-March, Komdragmet, the Committee on Precious Metals and Gems of the Russian Federation, put up for sale approximately 114,000 carats of rough. This is part of an "open tender" that Russia is permitted to hold under the terms of its marketing agreement with De Beers. Per-carat estimates suggest that the overall value of the goods is in the US$10–11 million range. Although this amount is significantly larger than past such auctions—which were typically in the $500,000–$2 million range—the increase is seen merely as a "catching-up" exercise and is still within the amounts permitted under the De Beers agreement. In November 1993, authority to conduct these independent sales in Russia was transferred from Almazjuvelirexport, then a part of the mining group Almazy Rossii-Sakha, to Komdragmet, which controls the Russian stockpile. (*Diamantaire*, No. 21, April 1994)

. . . and develops diamond-cutting equipment. To double the output of its domestic polishing industry by late 1995, the Russian government has directed several machinery manufacturers to speed development of diamond-fashioning equipment. Newly available equipment includes a bruting lathe that permits two diamonds of equal weight and diameter to be bruted without the use of diamond tools. This product of Precision Machine Works, St. Petersburg, has reportedly been tested successfully at the Kristall polishing factory. In late 1993, SKTB Kristall, of Smolensk, introduced a work station that includes five sawing units with automatic heads and consoles to control the heads. (*Diamant*, No. 371, January–February 1994, p. 28)

Figure 1. This 0.42-ct near-colorless synthetic diamond crystal was produced in Russia by means of a belt apparatus. Courtesy of Chatham Created Gems; photo by Shane F. McClure.

Production plant upgrade for Zimbabwe. The recovery plant at the River Ranch diamond mine in Zimbabwe will be upgraded with the goal of increasing annual production from 130,000 carats to more than 300,000 carats. Proven reserves should allow for continuous operation of the mine for at least 15 more years. (*Mining Journal*, February 18, 1994, p. 121)

Near-colorless Russian synthetic diamond examined. This past May, GIA Research examined a 0.42-ct near-colorless synthetic diamond crystal from Russia (figure 1). It was grown using a "belt" apparatus, not the split-sphere (or "BARS") technology the Russians use to produce their yellow synthetic diamonds, according to Tom Chatham, Chatham Created Gems, San Francisco, California, who loaned the crystal to GIA. (For more on Russian synthetic yellow diamonds, see the article by Shigley et al., *Gems & Gemology*, Winter 1993, pp. 228–247.)

The features most useful in identifying this near-colorless cuboctahedral crystal as synthetic are its large metallic inclusions and yellow fluorescence to short-wave ultraviolet radiation only.

The metallic inclusions appear predominantly brown when viewed in reflected light. They were sufficiently large and numerous that the crystal adhered to a simple magnet. Energy-dispersive X-ray fluorescence chemical analysis confirmed that the inclusions contained iron. No graining, and only very weak anomalous birefringence ("strain"), was noted.

The crystal did not fluoresce to long-wave U.V., and it only fluoresced weak yellow to short-wave U.V. The fluorescence appeared evenly distributed. When the short-wave U.V. lamp was turned off, the crystal phosphoresced yellow for 30 to 45 seconds.

These and other features observed were consistent with those of other near-colorless synthetic diamonds examined by GIA Research. The crystal was slightly electrically conductive, with the degree of conductivity varying considerably depending on which pair of crystal faces was tested. No absorption bands were seen with a handheld spectroscope. The absorption spectrum recorded at liquid-nitrogen temperature with the spectrophotometer revealed no absorption in the visible range. The mid-infrared spectrum identified this synthetic diamond as type IIa. GIA researchers could not record an infrared spectrum that had features associated with type-IIb diamond to confirm the measurements of electrical conductivity, presumably because the metallic inclusions interfered with recording a spectrum in the direction in which the type-IIb character would most likely be seen.

COLORED STONES

Amber marketed with photomicrography. As noted in the Spring 1994 Gem News, amber was well represented at the February 1994 Tucson shows. In that item, we mentioned one Russian dealer who provided customers with small note cards describing the type of insect in each of his specimens. Another amber dealer at Tucson—Dan McAuley of the Berkeley Amber Group, a firm based in California—took this marketing/educational approach one step further by providing each buyer with a photomicrograph of the actual inclusion in the specimen. Working with Mr. McAuley was Pat Craig, who identified and then photographed the inclusions. Mr. Craig, who has been studying amber for more than 20 years, produced the photomicrographs using a video camera and a digital thermal printer. The end result was an "instant" color photomicrograph with good resolution (see, e.g., figure 2). Although magnification in most of the photographs ranged from 1:1 to about 20×, theoretically it is limited only by the microscope used. The system also included a standard Sony color monitor, so visitors to the booth could easily watch Mr. Craig work.

Packages being offered at the show included the piece of amber, the photo of its inclusion, and a certificate giving the inclusion's identity. The advantage of such a package for retailers is that the picture can be displayed with the specimen, permitting prospective customers to "examine" inclusions without a microscope or hand lens—and the corresponding help of a salesperson.

Mr. Craig noted that a standard video-cassette recorder could be added to the system to save images and print them at a later date.

Basel Fair Highlights. For the second year in a row, *Gems & Gemology* and other GIA representatives attended the European Watch, Clock and Jewellery Fair, held in Basel, Switzerland, from April 13 to 21. Although our representatives were veterans of numerous trade shows and more than 20 years of Tucson shows, they found the 1994 Basel Fair to be a superb experience for the gem enthusiast.

Buyers from all over the world (fair organizers reported total attendance of 83,000) explored the four large buildings in which diamonds, colored stones, jewelry in a variety of metals and bold designs, watches, and machinery were displayed by more than 2,133 exhibitors from 24 countries. Among the many high-quality gem materials offered were large numbers of cabochon-cut as well as faceted emeralds, rubies, and sapphires; significant quantities of Paraíba tourmaline; several large (5-ct plus) alexandrites; numerous important Polynesian cultured pearls from Tahiti; as well as fine large carvings and carvings set in jewelry. Of particular interest were the new Design Hall and Prestige Room. The latter—set up in a warm, sophisticated environment on the bottom floor of Building 2—featured gem-set jewelry by some of the finest jewelers in the world, including Carrera y Carrera, Damiani, Henry Dunay, Hammerman, Nova Stylings, and La Nouvelle Bague. One of the most unusual colored-stone pieces on display was a rhodochrosite brooch by Henry Dunay (figure 3).

The 1995 Basel Fair will be held April 26–May 3.

Figure 2. This photomicrograph of an approximately 3-mm-long Tertiary pseudoscorpion in Dominican amber was taken by video camera and "instantly" printed by a digital thermal printer. Photo by Pat Craig.

Figure 3. The 1994 Basel Fair showcased many fine, as well as unusual, colored gems. This unique brooch features a 115.13-ct rhodochrosite "rosette" set in 18k gold with 2.80 ct of diamonds. Courtesy of Henry Dunay Inc., New York.

Fluorite from California. Some green fluorite of very high clarity has been found at the Felix fluorite mine, a deposit in the hills above Azusa in Los Angeles County, California, that has been known for many decades. In October 1993, mineral collector Robert Housley led a group to a pocket that he had discovered. One member of the group, Tish Hunter, picked up some broken pieces of fluorite rough after the others had finished collecting mineral specimens. She later asked Michael Gray, of Coast-to-Coast Rare Stones, Missoula, Montana, to facet one. The result was a 30.67-ct round modified brilliant (figure 4) that was subsequently donated to the San Bernardino County Museum.

Mr. Gray estimated that a few hundred carats of fluorite came from the pocket; some has entered the trade. Although southern California is known for its important gem deposits, including tourmaline, spessartine garnet, and the original occurrence of kunzite, the densely populated Los Angeles basin is not usually thought of as a source of gem material.

Gem artistry knows no boundaries. Although gem carvings and pieces inlaid with gem materials have been valued as art objects for thousands of years, "conceptual gemologist" John Nels Hatleberg, of New York City, has extended the concept of gem artistry to new arenas. Best known for his success at fashioning replicas of famous diamonds (including the Hope, the Portuguese, and the Guinea Star) by taking silicon molds from the actual diamonds and casting them in a custom-formulated resin, Mr. Hatleberg has also developed a unique line of jewelry known as "Gold Body Gems"—temporary tattoos fashioned of 23k gold that are modelled after famous diamonds.

Last year, he completed a unique "painting" fashioned of gems and minerals. The large-scale (14.5 × 16 cm; 36 × 40 inches) picture, titled "Woo," uses pearl, tourmaline, and chiastolite placed on a pyrite mirror set in a frame of quartz crystals cast in gold leaf (figure 5). Note that the "corn cobs" are made of natural corn cob with Chinese freshwater pearls strung on gold wire. He is currently working on a number of other projects that mix gems with other natural materials, such as a delicate nest of blond hair in which egg-shaped South Seas pearls have been laid.

Green gems from Australia. Chrysoprase chalcedony, an attractive gem in its own right, is often used as a jade simulant. The misnomer "Queensland jade," for example, describes chrysoprase chalcedony from an important deposit discovered in 1965 near Marlborough Creek (see Webster's *Gems*, 4th. ed., 1983, p. 220). We saw considerable quantities of this gem material at the February Tucson shows. Particularly interesting were fine, intense yellowish green cabochons in calibrated sizes ranging from 6 × 4 mm to 28 × 20 mm (see, e.g., figure 6) and strands of well-matched beads from 3 to 11 mm in diameter. Offered by Po Yuen Gems Company of Hong Kong, this chrysoprase reportedly came from their mine in

Figure 4. This 30.67-ct fluorite was faceted from material recovered from the Felix fluorite mine in Los Angeles County, California. Photo by Shane F. McClure.

Figure 5. This gem "painting" (14.5 × 16 cm) was fashioned by gem artist John Nels Hatleberg from pearls, tourmaline, and chiastolite—with other natural materials—placed on a pyrite "mirror" and set into a frame of gold-cast quartz crystals. Photo by Durston Saylor.

Queensland. Similar rough and fashioned Queensland chrysoprase—including carvings with Oriental motifs—was offered by Kajar-USA of Montclair, California.

A second major chrysoprase-producing area represented at Tucson is the Yerilla District in Western Australia. As of November 1993, annual production from a mine operated by the Gembank Group was projected to be 100 tons (see the article by R. W. Jones, *Lapidary Journal*, February 1994, pp. 71–79).

Another green ornamental gem from Australia was offered at Tucson under the trade name "Allura" (again, see figure 6). Vendor Martin Rosser, of Munich, Germany, reported that this gem material is actually the mineral gaspeite, a nickel, magnesium, and iron carbonate [$(Ni,Mg,Fe)CO_3$], which comes from a site in Western Australia about 300 km southeast of Perth.

We recorded the following gemological properties on a 3.15-ct cabochon of "Allura": diaphaneity—opaque; R.I.—1.62 to over-the-limits (noted with a "birefringence blink"); inert to both long- and short-wave U.V. radiation; no reaction to the Chelsea color filter (i.e., it appeared green); S.G.—3.51. These properties are consistent with those reported in the mineralogical literature for gaspeite, although the S.G. is somewhat lower than the reported 3.71. This may be partly explained by the matrix in the test sample, a predominantly brown veining. The lower S.G. value may also be due to the presence of some magnesite (S.G. 3.0–3.1), since gaspeite forms a solid-solution series with both that magnesium carbonate ($MgCO_3$) and the iron carbonate siderite ($FeCO_3$).

Myanmar liberalizes gem trading. For the first time in three decades, Myanmar (Burma) will let foreigners purchase privately owned gems, jade, and jewelry year-round with few restrictions, according to a May 2 press release from Myanmar VES Joint Venture Company, Yangon. Any Myanmar citizen or company can sell for export. All such export transactions must be made through one of six Gem Trade Centers: Yangon, Mandalay, Taunggyi (Shan State), Tachileik (on the border across from Mae Sai, Thailand), Muse (on the Chinese border), or Kaw Thaung (on the southern border with Thailand).

All sales are to be made in U.S. dollars or other approved foreign currencies. Each sale is subject to a 15% tax: 5% is a commission paid to the Myanma Gems Enterprise (MGE); the remaining 10% consolidates all income, commercial, and other taxes that might otherwise be applicable.

Under the new provisions, any business registered with the MGE may sell finished jewelry up to US$30,000 as long as MGE-supplied sales receipts are used. Sales of rough and fashioned jade and other gems up to $30,000 must be made under MGE supervision at one of the Gem Trade Centers, where MGE will issue the receipt. Sales of $30,000 or more are permitted as long as they are referred to the MGE headquarters in Yangon, which will issue the receipt. These receipts are the only documents accepted or required by the Myanmar Customs Department to allow purchasers to export gems or jewelry.

Figure 6. The cabochon on the left (2.65 ct, 8 × 10 mm) is chrysoprase chalcedony from Queensland, Australia; the other (3.15 ct, 8.22 × 10.13 mm) is gaspeite, a nickel ferrous carbonate mined in Western Australia. Photo by Maha DeMaggio.

The new regulations will be in effect for a one-year trial period, after which they will be reviewed. The Ministry of Mines is optimistic that the program will markedly promote free trade and discourage illegal gem trading. More than 200 firms registered with the MGE in the first two weeks of the program's implementation.

Freshwater pearls from Bangladesh. One pleasure of attending the Tucson shows is seeing gem materials from countries not usually considered gem producers. This year, we noticed a parcel of seven very attractive seed pearls, labeled "from Bangladesh," at a booth specializing in South Asian gems.

The pearls (figure 7) were oval to button shaped and ranged up to 3.8 mm in longest dimension. Body colors were white to pink, and all exhibited a very strong pink overtone. The luster was exceptional, being almost metallic. X-radiography and X-ray fluorescence together confirmed that they are natural freshwater pearls. All were purchased in Bombay, India, according to a representative of the vendor Ruedisili, of Sylvania, Ohio.

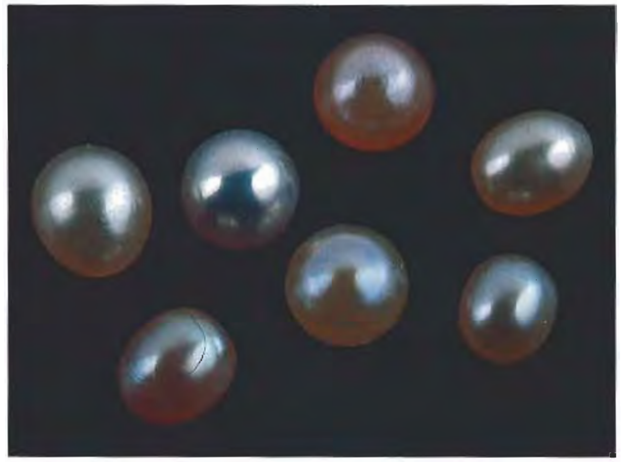


Figure 7. These natural freshwater pearls, ranging up to 3.8 mm in longest dimension, reportedly came from Bangladesh. Photo by Maha DeMaggio.

Tiger's-eye quartz production record in South Africa. South Africa set a new record for tiger's-eye quartz production in 1992, the most recent year for which complete figures are available. At 620.8 tons, this was an increase of 22% over the previous year. Demand for this gem material is primarily from the Far East, Europe, and the United States; demand for material with a strong yellow to red color component comes mainly from the first two areas. (*Diamond News and S.A. Jeweller*, No. 11, November 1993, p. 21)

Cat's-eye sillimanite from Orissa, India. In both the Summer and Winter 1993 Gem News sections, we reported on cat's-eye sillimanite from the state of Orissa, India. This gem material, sometimes called cat's-eye fibrolite because of its fibrous structure, was one of the more readily available phenomenal gems at the 1994 Tucson shows. When cut *en cabochon*, these gems invariably exhibit very distinct, sharp chatoyant bands that are noticeable with even weak overhead lighting. Body colors that ranged from near-colorless to gray, with white chatoyant bands, were most common at Tucson; these stones often had high transparency. Also seen were medium to very dark brown stones with light yellow-brown cat's-eyes. A representative of Orissa Gems reported that brown sillimanites with pink chatoyant bands would soon be in the trade.

The gray body-color material seemed almost visually identical to some of the fiber-optic chatoyant glass marketed under such names as "Catseyte," "Cathaystone," and "Fiber Eye" (see figure 8). The two materials also share the ability to "project" type down the length of their fibers when placed over type on a book or other publication (as does the fibrous mineral ulexite; see the Summer 1991 Gem News, p. 123, for more on this effect in fiber-optic glass). When examined down the length of its fibers, however, the fiber-optic glass revealed the hexagonal packing of its optical fibers; no similar effect was seen in the cat's-eye sillimanite. With magnification, we saw some fibers in the sillimanite at one or two different orientations to the main acicular crystals; we have not seen this in any chatoyant glass. Also, the chatoyant glass is opaque when examined perpendicular to the fibers; the sillimanite ranges from almost transparent to translucent.

At Tucson, we also saw a few cat's-eye sillimanites from Sri Lanka, which has produced this gem material in small quantities over the years; these stones are typically

Figure 8. Glass or sillimanite? A 1.78-ct cat's-eye sillimanite from the relatively new source of Orissa is on the left. The other, 1.72-ct cabochon is chatoyant fiber-optic glass. Photo by Shane F. McClure.

Figure 9. This 2.02-ct tanzanite (6.92 × 7.09 × 6.44 mm) is a most unusual example of a faceted gem with a reflecting "pinwheel" inclusion. Courtesy of Kaufman Enterprises; photo by Shane F. McClure.

gray and nearly opaque. Before the Indian material appeared on the market, chatoyant sillimanite was considered fairly rare. This is no longer the case.

"Wagon wheel" tanzanite. Both gemologically and aesthetically, some of the most interesting inclusions are those that are positioned in fashioning so as to become integral components of the gemstone's faceup appearance. Among the most familiar examples of this are the acicular inclusions that produce asterism and chatoyancy. Another interesting, if less common, use of acicular inclusions is in the fashioning of "wagon wheel" gemstones, where a single needle-like inclusion is positioned so that it runs from the culet to the center of the table facet. The result is a symmetric pattern of spoke-like reflections, reminiscent of a wagon wheel. Most such gems seen by the editors have been fashioned from rock crystal quartz containing a tourmaline or rutile needle (see, e.g., Gem News, Summer 1986, p. 115).

This spring, the editors saw a very unusual example of this "phenomenon": a 2.02-ct tanzanite that the cutter, Mark A. Kaufman of San Diego, California, calls a "pinwheel" (figure 9). The editors did not have the opportunity to conclusively identify the reflector inclusion, which was very dark with a somewhat granular appearance. It may actually be a growth tube that has filled epigenetically with foreign mineral matter.

Bicolored topaz. Some gem materials, such as tourmaline, frequently occur as color-zoned crystals that can be cut to show the different zones in a fashioned stone. Other gems, including topaz, rarely display such pronounced color zoning (for an exception, see Lab Notes, Summer 1987, p. 110).

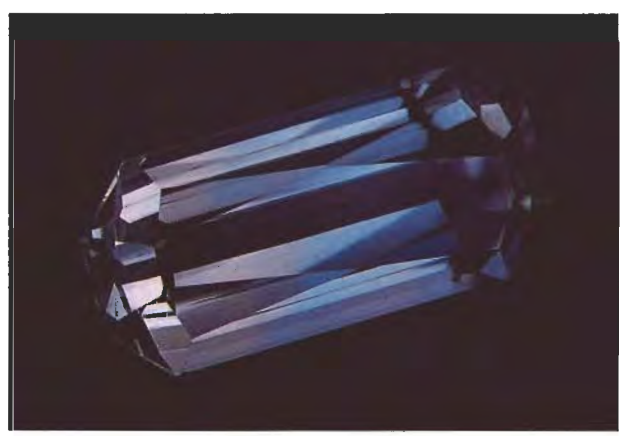
Mark Herschede, of Turmali & Herschede, Sanibel, Florida, reports that rough suitable for cutting intentionally color-zoned topaz (figure 10) is now coming from several locations in western Russia and the Ukraine (the latter producing the finest quality). Mr. Herschede has seen crystals (with small areas of cutting quality) as large as 8 kg, with one faceted stone exceeding 1,000 ct. He maintains, though, that total annual production from all localities is only 30 to 50 kg and that less than 10% of the total production is "facet grade."

The crystals are predominantly lighter shades of blue and pink (see, e.g., figure 11). Some particolored crystals show alternating color zones, such as: blue, pink, blue, brownish pink, and blue.

"Zebra" stones from Australia. At Tucson this year, the editors came across two distinctly different ornamental gem materials that were being offered as "zebra" stones because of their banding. Both are of Australian origin.

"Zebra marble" (figure 12, left) is aptly named for its irregular black-and-white banding. A spot R.I. reading taken on a 547.77-ct sphere gave values of approximately 1.51 to 1.67 with a "birefringence blink." These R.I. values are in the ranges of calcite and dolomite, both carbonates. When exposed to long-wave U.V. radiation, the white areas fluoresced a strong, chalky white and phosphoresced a weak green-white; with short-wave U.V., the reactions were the same colors although the fluorescence was weaker and the phosphorescence stronger. The black areas were inert to both wavelengths. X-ray diffraction analyses of both the black and the white areas

Figure 10. The rough from which this 11.32-ct bicolored topaz (18.69 × 8.66 × 7.35 mm) was fashioned reportedly came from western Russia or the Ukraine. Courtesy of Turmali & Herschede; photo by Maha DeMaggio.



produced patterns matching a standard for dolomite. We concluded that the material is a dolomitic marble.

The source rock was probably a gray or dark-colored stromatolite ooze (formed from algal reefs) that has been recrystallized. If its origins are similar to that of "zebra dolomite" from Leadville, Colorado, the white bands formed when dolomite dissolved and re-precipitated from formation water (e.g., groundwater) during cave-forming events in the massive dolomite (Horton, 1989, Geological Society of America, *Abstracts with Programs*, Vol. 21, No. 5, p. 95). Although attractive, the material is probably not the best choice for a durable jewelry stone because of its 3.5–4 Mohs hardness. However, material cut as hearts was being offered for use as pendants.

The second ornamental gem material, offered as "zebra rock," consists of alternating parallel layers that are medium-dark reddish brown and tan (figure 12, right). It was described first by Trainer in 1931 (*American Mineralogist*, Vol. 16, No. 5, pp. 221–225) and more recently by Bracewell (*Australian Gemmologist*, Vol. 17, No. 11, 1991, pp. 454–456). This "zebra rock" is from an Upper Proterozoic or Precambrian deposit in the East Kimberley region of Western Australia. It is reported to be a fine-grained siliceous argillite, which is a clay- or mud-containing sedimentary rock that has reacted with silica-rich fluids to form a harder material; Trainer (1931) confirmed quartz and chlorite as visible components.

A triangular tablet of "zebra rock" gave a spot R.I. value of 1.525, although this value could be attributed to a colorless lacquer surface coating (Bracewell, 1991). Such a coating is detectable by an acrid odor produced when it is touched by a thermal reaction tester ("hot point") and by the presence of minute gas bubbles noted with magnification. Microscopic examination also revealed a texture consistent with fine-grained silt subjected to later cementation. The darker bands are colored by the presence of hematite. These bands, however, do not correspond to the original bedding planes of the siltstone, and there are secondary concentrations of brownish material in the widest tan areas. Although we do not know the cause of color banding in this material, the type of zoning is typical of material that has been colored by rhythmic chemical precipitation, a phenomenon that causes repeated circular features—known as *Liesegang rings*—within fluid-saturated rocks (see, e.g., R.A. Ball, *Australian Gemmologist*, Vol. 12, No. 3, 1974, pp. 89–91).

Figure 12. Although both are promoted as "zebra" rocks, the 547.77-ct sphere is a dolomitic marble and the 28.79-ct triangular tablet is a fine-grained siliceous argillite. Photo by Maha DeMaggio.

Figure 11. This 1,644-ct parti-colored topaz is the termination from an 8-kg crystal. Courtesy of Turmali & Herschede; photo by Maha DeMaggio.

ENHANCEMENTS

New emerald treatment/polishing systems from Israel. The Spring 1993 Gem News section (pp. 62–63) described LubriGem, a system produced in Israel that was being commercially promoted for the fracture filling of emeralds. The report mentioned that the system was available in two sizes, one that permitted treatment of several "cups" of stones at a time and a second, smaller unit, that accommodated a single cup. Zvi Domb, developer and manufacturer of LubriGem, has advised us that his company is now offering a mid-size unit, which has a capacity of 400 stones (as compared to 50 and 1,000, respectively, for the small and large units offered originally). All of the units have been designed so that they can be used with a vacuum pump, to remove air and moisture from fractures before they are filled under pressure.

Another Israeli manufacturer, Colgem-Zamrot of Ramat Gan, is now also offering fracture-filling equipment. Two new electrically powered items are for filling fractures in emeralds and other colored stones. The larger unit, called the VPO ("Vacuum and Pressure Oiling System"), reportedly can treat "thousands" of stones in a

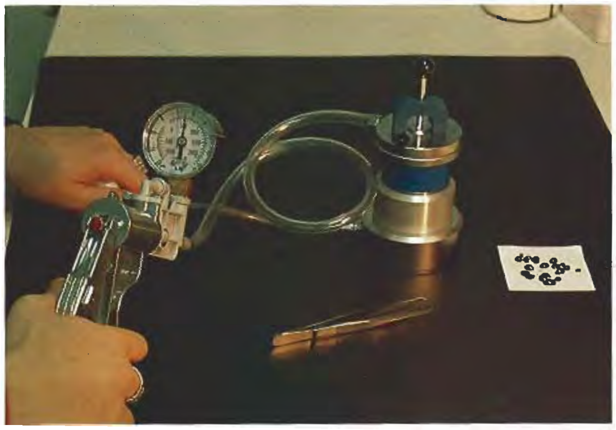


Figure 13. The "Mini Oiler" uses a hand-operated vacuum pump, first to remove air and moisture from fractures and then to carry out fracture filling under pressure. Photo courtesy of Colgem-Zamrot.

few hours with any of a wide range of filling substances, including natural and synthetic oils and resins. It basically consists of two chambers. In one chamber, the stones are first warmed in a vacuum—as above, to remove air and moisture from the fractures. In the second, the filling substance is warmed to reduce viscosity before it is transferred to the chamber that has the prepared stones. To help the filler penetrate the stones, the first chamber can be pressurized up to eight atmospheres.

The other unit, called the Mini Oiler (figure 13), has a single electrically heated chamber. A hand-operated pump creates the vacuum in which the stones are first heated in a small basket at the top of the sealed chamber. They are held there by an ingenious magnet system while the filler is warmed below. Releasing the magnet causes the stone-filled basket to drop into the heated filler. The pump can then be used to pressurize the chamber. Additional filler chambers are available for both systems to permit rapid substitution of different types of fillers.

The third unit, a Rotary Cleaning Machine, has been designed for one specific application: cleaning and buffing stones after fracture filling. Using a circular motion, the machine first cleans the stones for about 30 seconds with soft cloths. The cloths are then replaced with a chamois for a 30-second buffing. The system reportedly can clean "thousands" of stones per hour.

SYNTHETICS AND SIMULANTS

New emerald imitation. D. Swarowski & Co., from Wattens, Tirol, Austria, provided us with a new material—"Swarogreen"—that they designed to imitate emerald. We tested seven small (0.08–0.42 ct) faceted samples (figure 14) and one large (223-ct) parallel-windows sample made to our specifications.

We determined an R.I. range of 1.608–1.612 for this green, isotropic material (Swarowski had reported 1.605–1.615). All of the faceted samples sank in 3.05-S.G. liquid and floated in 2.67 liquid, which is consistent with the 2.88–2.94 range reported by the manufacturer. Our samples of "Swarogreen" fluoresced a weak green to short-wave ultraviolet radiation and a weak-to-faint yellowish green to greenish yellow to long-wave U.V. With the handheld spectroscope, we noted a strong, broad doublet at about 442 and 448 nm; a triplet of increasing intensity at 466, 472, and 483 nm; and a moderate, broad band centered at about 590 nm. There was no color-filter reaction (i.e., the material appeared green). The faceted samples were all inclusion-free, although we saw some bubbles in the larger sample. We were later told by a company representative that faceted stones containing bubbles are discarded at the factory. Swarowski product literature reports the dispersion at about 0.030, and a Mohs hardness of approximately 6.5.

EDXRF analysis at GIA Research confirmed Swarowski reports that the material is a calcium-aluminum silicate. We also detected praseodymium (Pr) and copper (Cu). X-ray diffraction analysis demonstrated that the material is amorphous. U.V.-visible absorption spectrophotometry confirmed the peaks noted above, and also showed a broad, strong absorption extending from the near-infrared into the visible range to approximately 570 nm. The green color is due to the transmission window formed by the Pr^{3+} (with the 442 to 483 nm peaks) and the Cu^{2+} absorptions starting at about 570 nm.

We concluded that "Swarogreen" is a glass with a relatively high R.I.; it is also significantly harder than most commercial glasses (which have an average Mohs hardness of about 5.5). The higher-than-usual R.I. is due to the presence of both calcium and aluminum.

Although this material is an attractive emerald simulant, it is easily separated from natural emerald because almost all of the gemological properties are different.

Kimberley expands product line. New York–based Kimberley Created Emeralds, which has an exclusive

Figure 14. These faceted examples of "Swarogreen," a new glass imitation of emerald, range from 0.08 to 0.42 ct. Photo by Maha DeMaggio.

Figure 15. These 1.15-mm synthetic spinel triplets are representative of some of the tiny synthetics and simulants now being fashioned with robotic cutting. Photo by John I. Koivula.

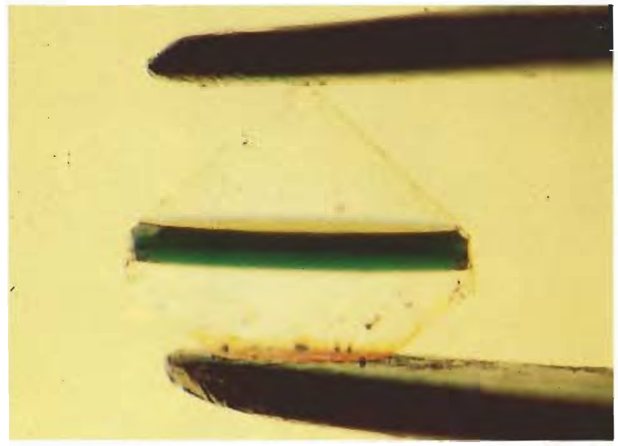


Figure 16. As seen parallel to the girdle when immersed in methylene iodide, the central color layer of this 2-mm-diameter synthetic spinel triplet represents an unusually large proportion of the stone. Photomicrograph by John I. Koivula.

agreement to market Australian-produced Biron hydrothermal synthetic emerald in North America, has expanded its product line to include Czochralski-pulled synthetic rubies and blue sapphires. Pulled synthetic alexandrite will also be available soon, according to Kimberley president Leonard Kramer. All these new pulled synthetics are produced in the United States.

Minute "machine-cut" synthetics. Robotic cutting is used to fashion various natural colored stones rapidly and uniformly. This technology is also used to fashion synthetics and simulants. At the 1994 Tucson shows, Golay Buchel had colorless cubic zirconia, flame-fusion synthetic rubies, and synthetic sapphires. All had been robotically cut at the firm's Swiss facilities in calibrated sizes ranging from 1 to 6 mm in diameter. Stones larger than 6 mm are cut by hand, according to Johnny Wong of the firm's California subsidiary.

What we found most interesting is that, to fill out their line of colored stones and provide an emerald simulant, the firm also commercially produces green synthetic spinel triplets (figure 15) in sizes as small as 1 mm in diameter. In such tiny sizes, the central color layer is proportionately a much higher percentage of the entire stone than it is in larger triplets (figure 16).

All of these small stones can present quite an identification challenge to gemologists, especially if set in jewelry.

Faceted synthetic opal. Because most opal with white, gray, or black body color is translucent to opaque, it is typically fashioned as cabochons. Similarly, the synthetic counterparts of white and black opal are almost always fashioned as cabochons.

Some of the more transparent types of natural opal, however, may be faceted. These include the orange to red fire opals, colorless crystal opal, and some of the slightly less transparent milky-appearing material. This year at Tucson, one firm had faceted synthetic material—10 × 5 mm marquises and "roll-top" cuts in 8 × 6 and 10 × 8 mm sizes (see, e.g., figure 17). This Gilson synthetic opal was semitransparent and near-colorless, that is, with a slightly milky body color. It exhibited a full range of hues in its play-of-color, with green usually predominating.

When examined face-up, most pieces displayed a "streaky" pattern to the play-of-color, something we have noted in the past with synthetic opal cabochons that have been fashioned with their bases oriented at right angles or at a very oblique angle to the direction of sedimentation of their silica spheres. Because of the orientation in fashioning, the diagnostic "chicken-wire" structural patterns were seen when the stones were examined through their sides rather than face-up; this is typically the case with synthetic opal cabochons cut to display a "harlequin" pattern to their play-of-color.

Bright yellow "pulled" synthetic sapphires. A number of Czochralski-pulled synthetic gem materials have been in the trade for some years. These include synthetic alexandrite and yttrium aluminum garnet (YAG) in various colors, as well as synthetic ruby and blue, green, and pink synthetic sapphires. At Tucson this year, Manning International, of New York, offered what appears to be a new color of Czochralski-produced synthetic sapphire—a highly saturated, slightly greenish yellow (figure 18). Although the color was unlike that of most natural or flame-fusion synthetic yellow sapphires (which usually have a secondary orange-to-brown component), it resembled that of some golden beryls.

EDXRF analysis of two specimens revealed the presence of nickel, but no other chromophores in significant amounts. Although nickel has long been used to produce yellow in flame-fusion synthetic sapphires, these typically also contained other elements. For example, chromium and/or iron moderate the "nickel yellow" to a more natural-appearing tint (see, e.g. "Naturally-Coloured and Treated Yellow and Orange-Brown Sapphires," by

Figure 17. Like some natural crystal opal and other transparent-to-translucent types, these Gilson synthetic opals (0.70–1.96 ct) have been faceted rather than cut en cabochon. *Courtesy of Manning International, New York; photo by Robert Weldon.*

Figure 18. Nickel is the primary coloring agent in these three synthetic sapphires (1.66, 2.91, and 1.66 ct) produced by the Czochralski-pulling method. Courtesy of Manning International; photo by Maha DeMaggio.

Schmetzer et al., *Journal of Gemmology*, Vol. 18, No. 7, 1983, pp. 607–622). In fact, with the desk-model spectroscope, we did resolve a faint 690-nm emission ("fluorescent") line—which commonly denotes the presence of chromium in flame-fusion synthetics—in three samples tested gemologically. All three also fluoresced a faint orange to short-wave U.V. radiation; one of the three had a similar reaction to long-wave U.V.

Magnification revealed a few pinpoint inclusions, possibly gas bubbles, in one of the three specimens. Using immersion, brightfield illumination, and a blue contrast filter, we saw curved growth features in all three stones. In one sample, these consisted of curved yellow color banding, like that noted in some flame-fusion yellow synthetic sapphires. Each of the other two pieces appeared evenly colored except for one curved colorless band. With the possible exception of this band and the atypical color, there were no features that would clearly distinguish this product from flame-fusion synthetic yellow sapphires.

ANNOUNCEMENTS

"Cutting Edge" winners start tour. Winning entries in the 1994 Cutting Edge Gemstone Competition debuted at the June JCK Show in Las Vegas, starting a year-long tour of North American museums, trade shows and retail stores. The 47 winners were chosen from 290 entries in 24 categories.

The gemstone-fashioning competition now includes two divisions. Division 1, the International Gemstone Showcase, is open to natural gemstones fashioned in any country by any cutter, even if the identity of the cutter is not known (collectors and dealers, as well as cutters, can submit entries). Division 2, the North American Gem Design Competition, is limited to natural gemstones cut in North America by professional lapidary artists.

Winners were chosen April 17 at the Dallas headquarters of the American Gem Trade Association (AGTA), which created the competition in 1991. Sites where the winning entries can be viewed include the New Mexico Museum of Natural History, Albuquerque, October 19–31; the William Weinmann Mineral Museum, Cartersville, Georgia, November 7–22; and the AGTA GemFair in Tucson, Arizona, February 1–6, 1995 (winners will be honored there at an awards reception on February 1, 1995).

Rare colored diamonds displayed. "Exceedingly rare" is how Joel Bartsch, curator of gems and minerals for the Houston Museum of Natural Science, describes a collection of 162 colored diamonds on display at that museum through December 31. Only one or two diamonds in 10,000 can be considered fancy color, according to the museum in Houston, Texas. Billed as the Butterfly Collection, the diamonds are on loan from Aurora Gems and weigh up to 3 ct.