GEM NEWS

JOHN I. KOIVULA, ROBERT C. KAMMERLING, AND EMMANUEL FRITSCH, EDITORS
MARY L. JOHNSON AND DINO G. DEGHIONNO, CONTRIBUTORS

DIAMONDS

Update on Botswana diamond mining. De Beers reported almost 15.9 million carats of diamonds produced here in 1993, down from 17.5 million carats in 1992 because of renegotiated agreements between Botswana and the CSO. Most of this production came from Debswana mines, including Jwaneng (8.5 million carats), Orapa (almost 5.2 million carats), and Letlhakane (nearly 1 million carats). Onshore mining at Mining Area No. 1—Auchas, Elizabeth Bay, and Bogenfels—produced 774,000 carats, with an additional 62,000 carats from contractors and 302,000 carats from De Beers Marine. Debswana production is expected to increase with the current expansion at Jwaneng and possible expansion at Orapa (a feasibility study is in progress). Botswana Diamondfields has been evaluating kimberlite pipes in their Mopipi block by sampling soils. Minerals identified include peridotitic garnets, ilmenite, and chrome diopside. (*Minerals Today,* April 1994, p. 20; and *Mining Journal,* May 27, 1994, p. 385; July 24, 1994, p. 76)

West African diamond mining. In **Ghana,** Consolidated Diamonds plans to double output to 40,000 carats per month at the Akwatia diamond mine. In **Guinea,** Aredor reportedly has suspended all diamond and gold production because of increased security problems; majority shareholder Bridge Oil has transferred its share in Aredor-Guinea S.A. to the government of Guinea. Aredor's production had fallen from 204,000 carats in 1986 to 91,000 carats in 1991. In **Sierra Leone,** 1993 diamond production mainly came from small-scale mining. Government troops have reoccupied the diamond-rich Kono and Eastern Kenema districts, but the mining infrastructure there will have to be rebuilt. Given the falling ore grades and technical problems, it may be more productive for the Sierra Leone government to concentrate on new high-grade kimberlite pipes that have been found in National Diamond Mining Company's Yengema and Tongo lease areas. (*Mining Journal,* April 29, 1994, pp. 314–315; May 13, 1994, p. 351; May 27, 1994, p. 384; June 10, 1994, p. 427)

Diamond mining in Namibia. De Beers reported 302,754 carats from off-shore production (using two ships) in 1993, up from 29,195 carats in 1990. Regional Resources plans to develop an alluvial diamond mine at its Purros claims in Kunene Province, along a former channel of the Hoarusib River. This project is limited by water access, concerns about tourism, and local tribal interests. The Namibian government has invited bids for 46 three-year, exclusive diamond-prospecting licenses along a 1,380-km^2 stretch of the north bank of the Orange River. The alluvial diamond deposits are similar to those at the nearby open-pit mine at Auchas. Because of ecological concerns, no dredging will be allowed in the Orange River itself. (*Mining Journal,* June 10, 1994, pp. 425–426; June 17, 1994, p. 440; August 5, 1994, p. 97; and *De Beers Consolidated Mines 106th Annual Report and De Beers Centenary AG 4th Annual Report,* as of December 31, 1993)

South African diamond mining. De Beers reported production of 9.8 million carats from South African mines in 1993 as follows: nearly 5 million carats from the Venetia mine; over 2.0 million carats from the Finsch mine; almost 1.6 million carats from the Premier mine; and 0.6 million, 0.5 million, and 0.14 million carats, respectively, from the Namaqualand, Kimberley, and Koffiefontein mines. For all these mines, the ore grade has improved slightly from 1992; production seems to be limited by CSO demand.

Regional Resources intends to start pilot open-pit mining at its diamond pipe at Postmasburg in the northern Cape province. Grades are said to be 12 carats per 100 metric tons of ore.

Canadian Overseas has expanded its marine properties along the Namaqualand coast, just south of the estuary of the Olifants River. Diamond recoveries in its new claim 13b average 193 carats (at 0.81 ct per diamond) per metric ton of recovered gravel.

Diamond Field Resources has acquired the Loxton Dal and Frank Smith mines in the Kimberley area. They plan to expand annual processing from the current 204,000 metric tons to 504,000 metric tons of ore. Ore grades were not given, but they run 0.18 ct per metric ton for De Beers mines in the Kimberley region. (*De Beers Consolidated Mines 106th Annual Report and De Beers Centenary AG 4th Annual Report,* as of December 31, 1993; *Mining Journal,* May 13, 1994, p. 349; June 10, 1994, pp. 424–425; *Mining Magazine,* March 1994, p. 178)

Figure 1. It appears that this unusual 0.39-ct heart-shaped natural diamond crystal was formed by selective etching along a surface-reaching crack. Courtesy of Trillion Diamond Co.; photo by Maha DeMaggio.

Update on Australian diamond mining. *Quarterly Notes 94* from the Department of Mineral Resources, New South Wales, Australia, details a new model for diamond formation, which could explain the source for the alluvial diamonds in New South Wales. Because no lamproites or kimberlites have been found in connection with these stones, some Australian geologists think that the diamonds may have formed by rapid subduction of carbon-rich marine sediments and were subsequently brought to the surface by nephelinites or alkali basalts. (*Mining Journal,* March 18, 1994, p. 190)

The Australian Diamond Exploration Venture has begun exploration in the Batten Trough area of the Northern Territory. At least three sources of diamonds are already known in the region: the Excalibur pipe, the Merlin loam anomaly, and the newly discovered Ector pipe. Diamonds from pipes in the Batten area are larger than those from Argyle—17 stones per carat versus 30 per carat for Argyle. (*Mining Journal,* April 29, 1994, p. 309)

The Argyle joint venture is completing a major upgrade of the processing plant and vehicle fleet at the Argyle open pit in the Kimberley region, Western Australia. This upgrade is intended to increase the annual output of diamond ore from the current 6 million tons to 8 million tons. The current ore horizon has a grade of 6 carats per ton, but this grade is expected to decline to 4 carats per ton. In 1993, Argyle produced about 40 million carats (almost seven tons) of diamonds. Only 5% of Argyle's diamond production is gem quality, and less than 0.001% of the total number are "pinks." Drilling has confirmed that diamonds continue to be found in the lamproite pipe to 550 m below the top of the ore body. (*Mining Journal,* March 25, 1994, p. 223)

Additional diamond projects in Western Australia include the BHP-Stockdale joint venture at Forrest River, a number of pipes in the Ellendale area, and the Aries kimberlite pipe at Phillips Range, where Triad Minerals is planning to begin bulk sampling. (*Mining Journal,* April 8, 1994, p. 255)

Update on diamond production in the former USSR. For the first time since reaching their agreement with De Beers, Almazy Rossii-Sakha (ARS) sold its entire quota of diamonds in 1993, and $600 million worth of diamonds were sold in the first half of 1994. Profits are expected to be used to upgrade production at the Jubileynaya pipe. (Another pipe, the Udachnaya, produces 8 million carats per year, about 85% of the total Russian production.) However, where these "profits" will come from is not exactly clear. ARS declared a debt of 279 billion rubles at its June 1994 stockholder meeting and has petitioned the Yakutia government to reduce taxes, according to the August 18, 1994, *Diamond Intelligence Briefs.* ARS President Semyon Zelberg said that the company has paid 53.7% of its earnings into local and republic taxes, but tax rates for mineral developers are currently 73%. ARS would like the government to accept the lower rate of taxation, forgiving the rest. Yakutia has agreed only to waive ARS's fines resulting from late payment of taxes.

In an effort to attract private investment, Russian officials have released previously classified details concerning 10 potential mining sites in Russia. These include Karelia, the White Sea shelf, the Kola Peninsula, and the Arkangelsk, Perm, Voronezh, Pakov, and Leningrad regions. Among the companies involved in prospecting are Ashton Mining and De Beers Marine.

In other developments, the Russian Federation is proposing stronger central control over gold mining, while autonomous regions are pushing for legislation that would let them directly control gold and diamonds mined within their borders. The smuggling of diamonds from Russia may become a major problem, negatively affecting the price stability of rough diamonds on the world market. Russian Prime Minister Viktor Chernomyrdin has appointed a committee to combat this problem, and the CSO reduced the level of June, July, and August sights to compensate for "leakage" of Russian diamonds onto the international market. (*Diamond Intelligence Briefs,* August 18, 1994; *Mining Journal,* May 27, 1994, p. 387; July 22, 1994, pp. 57–58)

Unusual diamond crystal. Although nearly all gem-quality diamond crystals are destined to become fashioned gems, an occasional rough crystal is so unusual and attractive that it should not be faceted. Marvin Finker, president of Trillion Diamond, New York, has a fondness for these crystals—and the experience to know when one is special (see Gem News, Summer 1991, p. 118). Once again, he has loaned Gem News editors such a crystal to examine, this one a 0.39-ct heart shape (figure 1).

Preliminary examination of the crystal suggested that its shape might be the result of twinning. With magnification, however, we saw that the lobes of the "heart" were apparently formed by selective etching along a surface-reaching crack that had once existed between them. In a search through the diamond literature, including the *Atlas der Krystallformen* by Victor Goldschmidt (reprinted by the Rochester Academy of Science, Rochester, NY, 1986), we could not find any diamond crystal of similar shape. However, the main portion of the crystal—without the etched groove between the lobes of the "heart"—appeared to be a curved-faced diamond crystal known as a tetrahedroid (Yu. L. Orlov, *Mineralogy of the Diamond*, John Wiley & Sons, New York, 1977, p. 76).

COLORED STONES

"Caymanite" from the Grand Cayman Islands, Caribbean. Gerald Kirkconnell from Kirk Freeport Plaza in the Cayman Islands (British West Indies) sent us samples of, and jewelry made with, a banded rock called "Caymanite" (figure 2). Reportedly dolomite, he said that it is found only in the Cayman Islands, on the eastern end of Grand Cayman and in Cayman Brac. The bands vary in color and in hardness (6 to 7). The darker orangy brown layers are microcrystalline, while the lighter, "cream" color layers are cryptocrystalline. The lighter layers fluoresce orangy yellow to long-wave UV radiation, with a stronger emission to short-wave UV, whereas the darker layers have a much weaker fluorescence or none at all. We recorded an R.I. (measured on one sample by the spot method) of approximately 1.6 and a specific gravity (measured by the hydrostatic method, average of three tests) of 2.63. X-ray diffraction analysis of a scraping from one area produced a pattern that matched the pattern for dolomite.

Figure 2. The cabochons in these rings and the beads in the necklace have been fashioned from a dolomite found in the Cayman Islands that is called "Caymanite." Courtesy of G. Kirkconnell; photo by R. Weldon.

Figure 3. The yellowish green chrysoprase chalcedony from which these beetles were carved was formed in the brown serpentine and iron oxide matrix. Total specimen size is 6.0 x 4.2 x 2.76 cm; each beetle is approximately 15 mm long. Photo by Maha DeMaggio.

Chrysoprase chalcedony matrix carving. Darryl Roder, of the Gembank Group, Hong Kong, recently donated to GIA a carving that consists of two chrysoprase chalcedony beetles on brown matrix (figure 3), fashioned from material found in the Yerilla District in Western Australia. This specimen gave us the opportunity to examine the Yerilla matrix material, which has been described as jasperized ironstone by R. W. Jones ("The Greening of Australia," *Lapidary Journal*, February 1994, pp. 71–79).

The yellowish green color and refractive index (1.54 by the spot method) of the two beetles are typical of Yerilla chrysoprase chalcedony. The legs of the beetles gradually fade into the brown matrix at their extremities. The matrix as a whole is patchy, ranging from a medium

Figure 4. This 0.89-ct faceted demantoid garnet and the rough specimen are from Hermosillo, Sonora, Mexico. Courtesy of Neal Dwire; photo © GIA and Tino Hammid.

brown glassy to waxy material, to a light-brown earthy material with off-white veins. X-ray diffraction analysis of the matrix material revealed quartz (chalcedony or jasper) and a member of the serpentine mineral group, probably antigorite. The brown color is due to amorphous-to-poorly crystalline iron oxides, which are not obvious in the X-ray diffraction pattern.

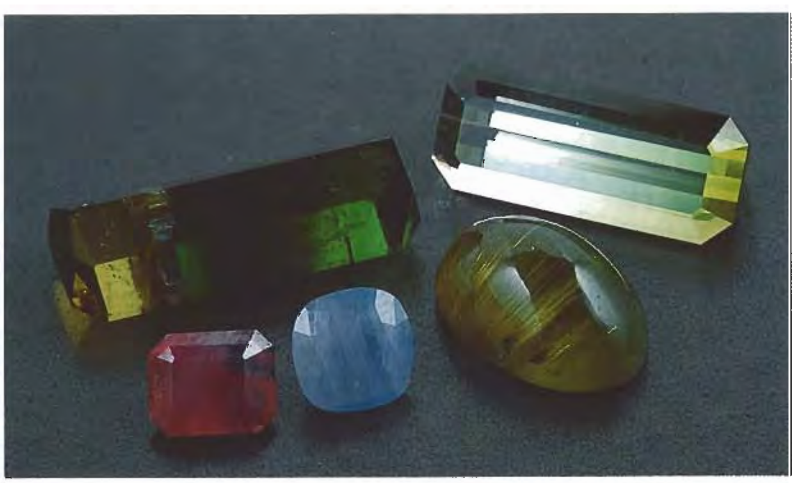
Demantoid garnet from Mexico. The Fall 1987 and Summer 1988 Gem News sections reported on the unusual iridescent andradite garnets being recovered in the state of Sonora, Mexico. Earlier this year, Neal Dwire of Rainbow Garnet, Tucson, Arizona, informed one of the editors (JIK) that he was mining the material from a locality near the city of Hermosillo in Sonora.

Mr. Dwire subsequently loaned the editors several specimens, both rough and cut, for examination. We examined in detail a yellowish green cluster of euhedral crystals ($23.83 \times 15.57 \times 7.75$ mm) and a transparent, 0.89-ct round brilliant that was cut from similar-appearing material (figure 4).

The color of these two andradites would classify them as the demantoid variety. On the basis of energy-dispersive X-ray fluorescence (EDXRF) analysis performed by Sam Muhlmeister of GIA Research, we concluded that the faceted stone was a very pure andradite, with no chromium and only a small trace of manganese. UV-visible absorption spectroscopy proved that the color is due to the presence of Fe^{3+} alone. In a presentation at Tucson this past February, GIA researchers, collaborating with Dr. George Rossman of the California Institute of Technology, had noted that some demantoid garnets from Russia do not show any chromium absorption either and also lack the iron-titanium charge transfer that gives Italian andradites ("topazolites") their yellower color.

Mr. Dwire informed us that the amount of both the transparent green and the iridescent varieties of andradite from this mining area appears to be limited.

Figure 5. These gems were recently acquired in Nepal. From the top, clockwise from left: 7.82-ct bicolored tourmaline from Manang; 5.63-ct bicolored and 4.71-ct cat's-eye tourmaline from the Hyakule mine; a blue sapphire from Gauri Shankar and a ruby from Ganesh Himal, approximately 2 ct each. Courtesy of Mark H. Smith; photo by Maha DeMaggio.



News from Nepal. In the Fall 1993 Gem News section, Gemologist Mark H. Smith of Bangkok provided information on the availability of various gem materials in Nepal. On his recent return from another buying trip to that country, he reported that gem-quality yellow to slightly greenish yellow tourmalines—from a deposit just east of the town of Manang, northeast of Annapuma, in the Marsyangdi River valley—continue to be readily available. The largest crystal he saw measured 15×2.5 cm; it was yellow with a thin layer of black to dark green on the single flat termination; he saw faceted yellow tourmalines as large as 149 ct. Dark green gems were being cut from the terminations, as were some green to yellowish green bicolors (figure 5). According to Mr. Smith, tourmalines of a dark green color similar to that seen on the terminations of these predominantly yellow stones are being recovered from deposits in the mountains north of Gorka, between Pokhara and Kathmandu.

A few gems were also available from the Hyakule mine on the Arun River, in eastern Nepal, which is the most famous gem locality in the country. Mr. Smith reported that the tourmalines said to be from the Hyakule mine were light green, orangy pink, or bicolored; some showed chatoyancy when cut *en cabochon* (again, see figure 5).

A few rubies and blue sapphires were also seen (figure 5). The rubies, reportedly from Ganesh Himal, were translucent and contained distinct blue color zones. The sapphires, reportedly from Gauri Shankar (a mountain on the Nepal-Tibet border, northeast of Kathmandu), were

*Figure 6. In general, the properties of these four horse conch (*Pleuroploca gigantea*) "pearls" were similar to those of such "pearls" from other conchs. The large brown specimen at the top right is 27.47 mm on its longest dimension. Photo by Robert Weldon.*

barrel-shaped opaque-to-translucent crystals that produced light grayish blue fashioned gems. Mr. Smith saw aquamarine, danburite, and hambergite as well.

Horse conch "pearls." Ever since we described the properties of conch "pearls" from *Strombus gigas* in the Winter 1987 issue of *Gems & Gemology*, we have been aware of the existence of similar-appearing "pearls" from the horse conch (*Pleuroploca gigantea*) but have not been able to obtain good examples for comparison. Susan Hendrickson from Seattle, Washington, and Stefan Hemmerle, from Hemmerle Juweliere in Munich, Germany, recently loaned us some typical and some spectacular examples of this very rare gem (figure 6). These "pearls" (placed in quotation marks here to indicate that they are nonnacreous) were said by reputable fishermen to come from the horse conch. Their exact geographic origin was not disclosed.

Mr. Hemmerle let us examine a 111.76-ct dark brown, football-shaped horse conch "pearl," 27.47 mm in its longest dimension. Ms. Hendrickson loaned us two typical brown specimens, as well as an exceptional 22.01-ct medium orange, round "pearl." On all examples, we measured (by the spot method) an R.I. of about 1.65, consistent with what we reported for conch "pearls," with a typical although weak "carbonate blink." Specific gravity (measured by the hydrostatic method) was 2.77 on the largest sample, and 2.85 on the round one. On the surfaces of all of the "pearls," we observed some small patches of lighter color, as well as a different flame structure from that reported for *Strombus gigas* "pearls." Many small "bursts" of fibrous, reflecting crystals, forming minute depressions where they reach the surface (figure 7), are relatively evenly distributed. They are flame-like in appearance, but smaller than those in *Strombus.* They show a whitish sheen in one orientation, and appear almost transparent when the "pearl" is rotated 180°. The UV fluorescence is weak and spotty, with a stronger response to short-wave than long-wave UV. The fluorescence color is yellow to orange, with lighter brown spots and small, hairline "fractures" seen on the surface fluorescing brightest.

X-radiography of the largest specimen revealed a concentric structure typical of natural pearls. EDXRF spectroscopy of the two largest "pearls" demonstrated the presence of calcium as a major component (as expected), with a strontium impurity (common in natural and cultured pearls).

Notable round black cultured pearl. A 19-mm undrilled black cultured pearl (see figure 8) recovered from this year's harvest in the Marutea lagoon is the largest such cultured pearl ever examined by the GIA Gem Trade Laboratory staff in New York.

Marutea is one of the French Polynesian islands in the Gambier archipelago, which lies more than a thousand miles southeast of Tahiti. According to Mr. Salvador Assael, of Assael International, because of the specific environment and conditions (especially the abundant food supply) found in this lagoon, the *Pinctada margaritifera* in which the pearls are cultivated grow to 23–24 cm, significantly larger than those grown in most other atolls in the area (typically no more than 20–21 cm). The larger mollusk can produce larger pearls, although it is very rare to encounter round black pearls over 18 mm in diameter.

This cultured pearl exhibited the typical dull orange-

Figure 7. Details of the flame structure are clearly visible on the largest horse conch "pearl" shown in figure 6. Photomicrograph by John I. Koivula; magnified 30×.

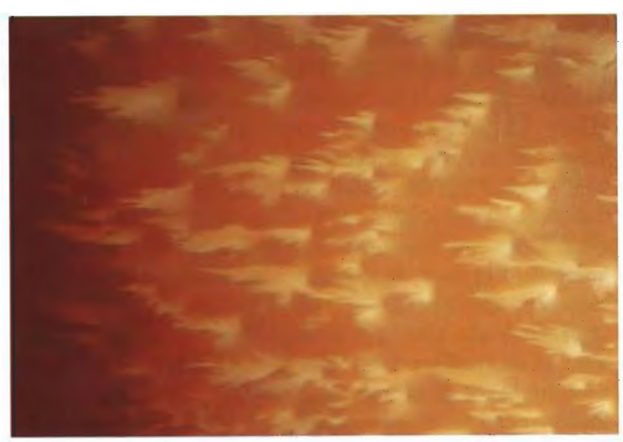


Figure 8. The 19-mm cultured black pearl that has been placed as the centerpiece of this graduated necklace layout was recovered from this year's harvest. A matched pair of 17-mm black cultured pearls flank the center position of the necklace. Courtesy of Assael International; photo by Nicholas DelRe.

brown reaction to long-wave UV radiation that corroborated its natural color.

Peridot from Pakistan. This decade has already seen two new sources—Ethiopia and Vietnam—added to the list of countries producing peridot (for more on these two localities, see respectively the Spring and Fall 1993 Gem News sections). In fall 1994, Bill Larson of Pala International, Fallbrook, California, brought to the editors' attention yet another new source of peridot: Pakistan. Subsequent communications with Laura Thompson, president of Shades of the Earth, Phoenix, Arizona, the firm marketing the material, provided the following information.

The locality, at an elevation of about 4,500 m (15,000 feet) above sea level, is in the far west of the Himalaya Mountains, not far from the Indus River. From the closest community, Basham Village, the deposit is reached by a seven-hour horse ride and two-day hike.

According to Mrs. Thompson, small crystals were first found in mid-1992, although good facet-grade material was only discovered in mid-1994, when actual mining began. The area is worked at any given time by anywhere from 200 to 2,000 villagers who hike in from as far away as 80 to 112 km (50–70 miles). There is no overall organization to this mining activity; Mrs. Thompson's firm purchases material from the various groups and individuals working the area. Because of the severe climate at the deposit's elevation, the area can only be mined from approximately late June to early October. Total production as of October 1994 was approximately 100 kg, the vast majority of which was only suitable for tumbling and/or cutting *en cabochon*. Only about 3 kg of facet-grade rough has been reported to date. However, because of the large size of the crystals, faceted stones are primarily in the 10- to 20-ct range, and stones as large as 100 ct will undoubtedly be cut in the future.

To date, the editors have examined only a few crystals (see figure 9). Gemological information will be provided as soon as we have had an opportunity to test faceted stones.

Yukon rhodonite. Rhodonite, one of the better-known ornamental gem materials, typically occurs in coarsely mottled patterns of varying shades of pink. Also common to this material are black "spots" and veins of manganese oxide. At Tucson this year, we saw some especially attractive material that had been fashioned into matching tablets (see, e.g., figure 10). The mottling in this material was unusually fine, somewhat reminiscent of jadeite; there were no dark inclusions. According to one dealer, the material came from in the Yukon region of Canada.

"Samotsvetov" Colored Stones Museum in Moscow. In August 1994, one of the Gem News editors (RCK) visited the Federal Museum of Colored Stones, "Samotsvetov," in Moscow. This small but impressive facility, operated under the direction of the Russian State Committee "Roskomnedra," is housed on the ground floor of a combined commercial and residential building in the center of the city.

The front section of the museum features an extensive display of fine-quality mineral specimens from virtually all regions of the former Soviet Union, with speci-

Figure 9. These peridot crystals, the largest of which is 45.3 mm × 24.3 mm × 34.5 mm, were recovered from a new locality in Pakistan, high in the Himalaya Mountains. Courtesy of Pala International; photo by Shane F. McClure.

mens grouped by geographic area. In addition to more traditional items, this section contains samples of fossilized mammoth ivory. The next section of the museum is a narrow corridor, along one side of which are pedestals with statuettes of traditional scenes from Russia or one of the other republics—for example, a Georgian peasant in native dress, and two women in a bath, drinking tea from a samovar (figure 11). All of these are constructed from various ornamental gem materials mined in Russia and the republics. There is also an exceptional writing table fashioned from wood and malachite.

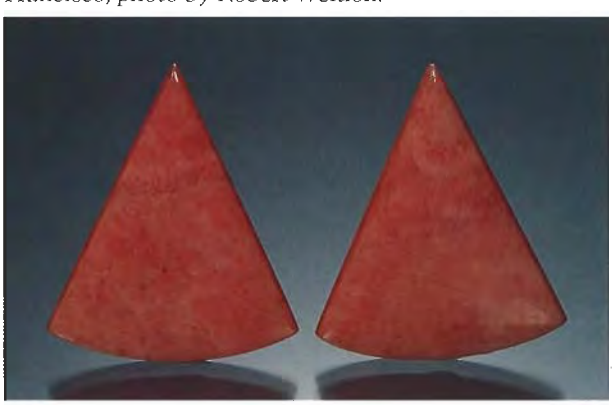
The last section of the museum contains a series of wall cases, each of which contains examples of a single ornamental gem material, for example, charoite, lapis lazuli, nephrite, and rhodonite. One case is devoted to synthetic and imitation gem materials produced in Russia, including various colors of YAG, CZ, and hydrothermal synthetic quartz. A carved wooden map of the former Soviet Union graces one of the walls in this section and is inlaid with rough specimens placed to show their localities.

The museum also operates a foreign trade company, Exportsamotzvety, which markets mineral specimens and objects fashioned from ornamental gem materials.

Figure 11. This scene of two women in a bath, drinking tea from a samovar, is constructed of ornamental gem materials mined in the former Soviet Union. It is one of the many exceptional items on display in the "Samotsvetov" museum, Moscow. Photo by Robert C. Kammerling.

"Trapiche" purple-pink sapphire. Yianni Melas, of D. Swarowski and Co., Wattens, Austria, loaned us a very unusual, 3.38-ct sapphire crystal. This slightly rounded section of a tapered hexagonal prism shows inclusions preferentially located in planes running from the center of the stone to the edges of the prism faces—an appearance reminiscent of trapiche emerald. According to Mr. Melas, this is one of two such crystals he found in a parcel of sapphires from Vietnam. The gemological properties of this specimen are typical of corundum. The crystal fluoresced weak to moderate red to long-wave UV radiation, with a weaker reaction to short-wave UV. The small chromium content is evidenced by fluorescent chromium lines at about 670 nm—as well as a weak, sharp line at about 460 nm—in the spectroscope.

Figure 10. The Yukon region of Canada is the reported source of this finely textured rhodonite, total weight 21.89 ct. Courtesy of Judith Whitehead, San Francisco; photo by Robert Weldon.



With magnification, we saw numerous needle-like inclusions that were all perpendicular to the prism faces when viewed along the optic axis. When viewed from the prism faces, they were no longer parallel, but rather within 20° of perpendicular to the optic axis. As mentioned earlier, they are preferentially located in or close to planes running from the center of the crystal to the prism edges. The exact nature of these inclusions is difficult to establish. They appear to be hollow. Some of those reaching the surface actually contain rust-color iron compounds. Others are fully included in the crystal, and therefore could not be the result of etching. X-ray diffraction analysis attempted on several such inclusions revealed only the typical pattern for corundum.

Gem-inlaid shell jewelry. A revival of gemstone-inset shell jewelry was seen at the AGTA Tucson show this past February. The use of shell was popularized in the 1950s and early 1960s by the Duke of Verdura, a well-known Italian jeweler who decorated scallop shells, usually with rims of diamonds and insets of gold set with various types of cabochons (see, e.g., *Gems & Gemology*, Spring 1987, p. 14).

Sunil Tholia, of Universal Point, New York, selects gastropod shells from the Indo-Pacific region. He then adorns them with gemstones for use as cuff links, earrings and pins (figure 12). The obvious challenge of this process is drilling and insetting the shells without damaging them. Recently, a suite of these was sold at Christie's East in New York.

Figure 12. These gem-inlaid shells (largest, 6 × 2 cm) are used in producing such jewelry items as cuff links, earrings, and pins. Photo by Nicholas DelRe.

Tourmaline with atypical R.I. readings. Most gemologists consider the refractometer one of their most useful instruments. It enables the determination of several optical properties of a gem, including R.I., birefringence, optic character, and optic sign. In some instances, the information obtained on the refractometer may be so specific to a gem material (e.g., "the red flag effect" seen with a garnet-and-glass doublet) that it almost allows for identification with no further instrument tests.

Recently, Prof. A. A. Levinson of the University of Calgary, Alberta, Canada, showed the editors an 8.79-ct modified emerald-cut tourmaline that one of his students had encountered as a test stone. Not only did the stone show readings typical of tourmaline on the refractometer, but the stone's table facet displayed additional distinct shadow edges that appeared to "float" above (i.e., at numerical values higher than) the stone's true R.I. values (figure 13).

This unusual set of refractometer readings on tourmaline has been encountered by the editors in the past on rare occasions. Known as the "Kerez effect" or "satellite readings," they are believed to result from the stone having been subjected to overheating and/or thermal shock during polishing. Experiments have shown that the additional readings can be removed by careful repolishing of the stone. In our experience, such anomalous readings have only been encountered on very dark green tourmalines, as was the case with this specimen.

Gem production in the U.S. The total value of U.S. gem production in 1993 was $51.1 million for natural gems and $19.5 million for synthetic gems. The most important natural gem material in terms of value was freshwater pearls, which accounted for approximately $25 million in production from Tennessee. (Note, however, that shell inserts exported for cultured pearl production were even more important economically—$53 million for 1993, more than the *total* value for natural stones.) Natural-gem production from other states includes: $10.1 million for California (tourmaline, etc.); $4.5 million for Arizona (turquoise, peridot, petrified wood); $1.7 million for Oregon (labradorite sunstone, opal); $1.6 million for South Dakota (rose quartz); $1.4 million for Arkansas (quartz); $1.4 million for Utah; and $1.3 million for North Carolina, primarily from "fee-for-dig" areas. Montana also produced over $1 million in gemstones in 1993, mainly sapphires.

The production of synthetic gems—primarily synthetic emeralds, rubies, alexandrites, and sapphires, with imitation turquoise included in the figure as well—was concentrated in California. (*Mineral Industry Surveys, U.S. Bureau of Mines,* Annual Advance Supplement, June 1994)

Green cat's-eye zoisite. As noted in the article "Gem-Quality Green Zoisite" (N. Barot and E. Boehm, *Gems & Gemology,* Spring 1992), parallel growth tubes are a relatively common inclusion in both the green and blue-to-purple varieties of this gem species. If present in sufficient quantity and properly oriented in cutting, these inclusions will produce chatoyancy.

Recently, Mark H. Smith showed us a 6.83-ct oval cabochon of this material that displays a very distinct cat's-eye effect (figure 14). It struck us that in terms of both body color and the presence of large, eye-visible, tubular inclusions, the stone was very similar in appearance to some cat's-eye tourmalines. Furthermore, R.I. determinations on cabochons lacking flat polished bases are restricted to spot readings, and a careless spot reading on a green cat's-eye zoisite (about 1.69) could be misread as the 1.64 reading on a tourmaline. A similar situation exists with bright green cat's-eye diopsides, which typically give spot R.I. readings of about 1.68. Gemologists must keep in mind that zoisite, in addition to tourmaline and diopside, can occur as dark green cat's-eyes with a spot R.I. reading in the 1.6s.

Figure 13. Atypical "satellite readings" can be seen on the refractometer scale when the table facet of an unusual 8.79-ct tourmaline is tested. Photo by Maha DeMaggio.

Figure 14. Care should be taken not to mistake cat's-eye zoisite (like this 6.83-ct specimen) for other chatoyant green stones with R.I.'s in the 1.6s. Courtesy of Mark H. Smith; photo by Maha DeMaggio.

ENHANCEMENTS

Coated jadeite. A new treatment that involves coating jadeite with varnish to improve its color or appearance has been cited for some time (see, e.g., *Jewellery News Asia,* November 1990, pp. 1 and 90). However, we did not have a chance to examine such material until, on a recent visit to Taiwan, one of the editors (EF) was shown this peculiar form of treated jadeite by Ten S.-T. Wu, of IGI, Kaohsiung, and Peter Chiu, of Delight Jewelry, Taipei.

Mr. Ten showed us a large (117.99 ct, 24 mm in diameter) jadeite bead of grayish purple color that was coated with a layer of mottled green varnish. From a distance, it was a very convincing imitation of good-quality jade. On closer examination, however, it was evident that part of the coating had spalled off, showing the true color of the material. At 1.52 (spot reading), the R.I. was too low for jadeite; presumably, it was the R.I. of the coating. The specific gravity, 3.29, was slightly below normal for jadeite. The strong chalky blue fluorescence to long-wave UV radiation, with a weak reaction to short-wave UV, was also probably from the coating; the fluorescence of natural jadeite is normally spotty and yellowish white. The coating melted on contact when touched with a hot point.

Mr. Chiu loaned us a jadeite pipe that was similarly coated on its outside (but not inside) surface. In several areas, the coating had chipped away (figure 15). The R.I. was 1.54 on the coated areas and 1.66 (as expected for jadeite) on the uncoated areas. A moderate line at 437 nm in the handheld spectroscope further supported the identification of the bulk of the pipe as jadeite. Comparison by EDXRF of the chemistry of the pipe material with that of some well-documented jadeite samples confirmed the identification. Microscopic examination of the chipped areas in reflected light revealed that there were actually two layers of coating. The innermost layer is mottled green—apparently applied for color enhancement—whereas the outermost (top) layer seems to be colorless or of a uniform very light yellow color, probably a protective varnish (figure 15, inset). This double layering is actually more distinct in ultraviolet radiation, where both coatings fluoresce yellow-green with different intensities. The underlying jadeite is inert.

Infrared spectrometry showed a strong absorption around 2900 cm^{-1}, which is absent from the spectrum of natural jadeite. This absorption, similar to that recorded in some bleached and polymer-impregnated "B" jade, is typical of the presence of an organic polymer; it confirms that there is an organic coating on the jadeite piece. If one does not carefully examine such material, reference to the infrared spectrum alone might lead to the erroneous conclusion that this sample is actually "B" jade.

SYNTHETICS AND SIMULANTS

Synthetic phenakite from Russia. Graduate Gemologist Bill Vance, of Rough Times, San Diego, California, recently acquired a collection of 10 transparent blue-green crystals and crystal fragments of synthetic phenakite, a beryllium silicate, which were produced in Russia by the flux growth technique. He subsequently loaned one of these crystals (5.27 ct; 10.83 × 7.77 × 7.58 mm) to us for gemological examination. Because of its blocky shape, size, and transparency, it could provide a faceted stone of perhaps 2 ct or more. The optical and

Figure 15. Note where the coating has been chipped away from the surface of this approximately 8-cm-long jadeite pipe. As shown on the inset, there are actually two layers of coating, one with color and one presumably a protective varnish. Pipe courtesy of Peter Chiu; photo by Maha DeMaggio. Inset photomicrograph by John I. Koivula; magnified 30×.

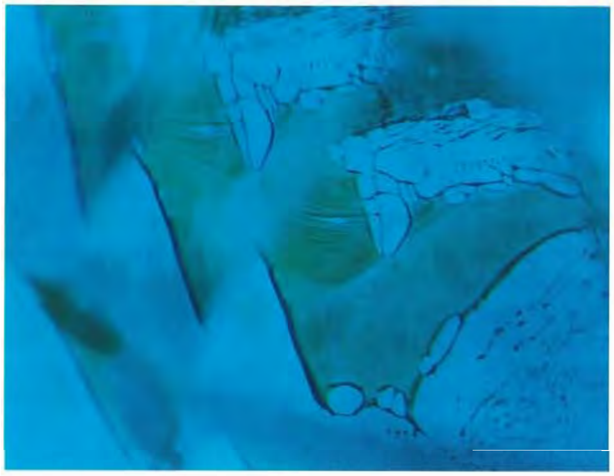


Figure 16. Primary flux inclusions form phantom structures in this synthetic phenakite manufactured in Russia. Photomicrograph by John I. Koivula; magnified 25×.

physical properties of the crystal matched those of phenakite. The dichroism observed through a calcite dichroscope was very distinct in a dark blue-green and a light bluish green. Aside from the distinctive color, which has not been observed in nature for the mineral phenakite, flux inclusions provided the most obvious clue to its synthetic origin. Magnification revealed fine networks and planar zones of primary flux inclusions that had apparently been trapped along growth steps and planes, forming phantom structures within their host (figure 16). These flux inclusions seemed to range from colorless (relative to body color of the phenakite itself) for very fine structures, to an obvious greenish brown in thicker areas. All 10 of these crystals will be faceted, and the largest—12.50 ct—is expected to yield a 5–6 ct stone.

New production facility inaugurated in Siberia. On August 3, 1994, a new synthetic-gemstone production facility was formally opened in Novosibirsk, Siberia. The new building, adjacent to the United Institute of Geology, Geophysics & Mineralogy (UIGGM), Siberian Branch of the Russian Academy of Sciences, is owned and operated by the firm Tairus, a joint venture between UIGGM and Pinky Trading Co., of Bangkok, Thailand. UIGGM brings to the joint venture personnel with expertise in crystal growth and related fields, as well as ongoing research in developing potential new products with jewelry applications. Pinky Trading, in turn, brings to bear its experience in the fashioning and marketing of gem materials, both natural and synthetic.

The primary focus of the new facility is the production of hydrothermal synthetic emeralds, Tairus's most important product. These—as well as smaller quantities of hydrothermal synthetic ruby—are produced in a large room with rows of metal containment "safes" (figure 17), each of which contains a hydrothermal autoclave housed in a raised concrete block. Control and monitoring equipment is located in an adjacent room. The new building also has facilities for the preparation of the seed-crystal wafers used to nucleate crystal growth; for growing synthetic emeralds and other synthetic beryls—at this stage on an experimental basis only—these seeds are currently being fashioned from natural golden beryl from the Ukraine. All of the equipment, including the autoclaves, control mechanisms, and even the saws for producing the seed plates, have been designed and manufactured by UIGGM.

Another building in the compound houses equipment used to produce synthetic oxide materials by a modified floating-zone technique known as horizontal growth. When one of the editors (RCK) visited the facility in early August, synthetic ruby and YAG in a variety of colors were being produced. Other products that have been grown by Tairus using this technique include synthetic alexandrite and a nonphenomenal green chrysoberyl.

INSTRUMENTATION

Russian equipment for diamond sorting and identification. On a visit to Moscow recently, one of the editors (RCK) visited the offices of Ginalmazzoloto, the State Central Research and Designing Institute of Precious Metals and Diamonds. In addition to carrying out research that focuses primarily on the properties of diamonds, the organization designs and manufactures equipment for use in the gem industry.

Most of the equipment produced is for sorting and processing rough diamonds. These include the AФ-2, an instrument for analyzing the shape of rough and determining the parameters for fashioning round brilliants; the 9CA Diamond Analyser-Selector, for analyzing degree of strain; the ACФγ-2 Diamond Selector, for automatically sorting diamonds based on nitrogen content; the 6CA Diamond Selector, for separating gem-quality from industrial-grade diamonds on the basis of color and transparency; and other automated equipment for sorting diamonds by weight, dimensions, color, and transparency.

The firm also designs and produces instruments for gem identification, including a diamond (thermal) probe for separating diamond from its simulants, a refractometer, a prism-type spectroscope, and a Chelsea-type filter. These and other items are available separately or may be purchased as components of a portable laboratory.

MISCELLANEOUS

Sinkankas book honored. *Gemology: An Annotated Bibliography* (Scarecrow Press, Metuchen, NJ), by *Gems & Gemology* Associate Editor Dr. John Sinkankas, received the coveted Geoscience Information Society (GIS)/Mary B. Ansari Best Reference Work Award for 1994. The award, given since 1988, was presented October 25 in Seattle, Washington. Marie Dvorzak, chairperson of the award committee, called the book a "wonderful contribution to the earth science literature . . . a valuable bibliographic resource for many years." (See *Gems & Gemology*, Winter 1993, p. 297, for Richard T. Liddicoat's review of *Gemology*.)

ANNOUNCEMENTS

Buccellati masterworks to be displayed. Fourteen masterworks from the private collection of Gianmaria Buccellati will be displayed at the Natural History Museum of Los Angeles County from November 5, 1994, to January 8, 1995. Based in Milan, Italy, the Buccellati company is best known for pieces designed in Italian Renaissance and French Rococo styles (see, e.g., the rock crystal chalice—which will be in the Los Angeles exhibit—on the cover of the Summer 1994 *Gems & Gemology*). The exhibit, the first stop of a world tour, will also include distinctive jewelry pieces created by the Buccellati company over the past 100 years, as well as tools, design drawings, and photographs that show their jewelry-making and goldsmithing techniques.

Dates set for February 1995 Tucson shows. The American Gem Trade Association (AGTA) GemFair will run from February 1 to 6 at the Tucson Convention Center. After that show leaves, the Tucson Gem & Mineral Society will take over the Convention Center for its show from February 9 to 12. At the Holiday Inn City Center from February 4–11 will be the Gem & Lapidary Dealers Association (GLDA) show. Other show venues include the: Pueblo Inn, Rodeway Inn, Howard Johnson Midtown, Discovery Inn, Desert Inn, Scottish Rite Temple, Day's Inn Convention Center and Congress Street Expo, Windmill at Phillip's Plaza, Best Western Executive Inn, La Quinta Inn, Holiday Inn Holidome, and Tucson Exposition Center. Times and dates of shows vary at each location. Consult the show guide, available at the different venues, for further information.

Education at the Tucson AGTA GemFair. The AGTA GemFair will feature a comprehensive gem-education program. Pre-show seminars—training your staff to sell colored stones, creating promotions and special events around colored gemstone jewelry, and the jeweler's quality advantage—will be offered on January 31, 1995. Other AGTA seminars, from February 2–5, include: sessions on jewelry business opportunities of the North America Free Trade Agreement, gemstone enhancements, and specific gemstones (for example, ruby and sapphire, tourmaline, emerald, and opal); and panel discussions about North American gem cutters and designing with color. For more information, contact Nancy Donaho of AGTA at (800) 972-1162 or (214) 742-4367.

In addition, GIA will offer technical training sessions, beginning with a diamond grading class, January 29–February 7. Also available will be seminars on topics such as detection of filled diamonds and treated rubies, sapphires, and emeralds; identifying challenging synthetics; advanced diamond clarity grading; and a gem identification challenge. For further information on GIA classes in Tucson, call (800) 421-7250, extension 292.

Figure 17. Each of the metal containment safes in the new Tairus joint-venture facility in Novosibirsk, Siberia, contains a hydrothermal autoclave. Most of the production is synthetic emerald, but there are also smaller quantities of synthetic ruby. Photo by Robert C. Kammerling.

***Gems & Gemology* invites you to visit us in Tucson.** *Gems & Gemology* Editor Alice Keller and Assistant Editor Irv Dierdorff will be staffing the *Gems & Gemology* booth in the galleria section (middle floor) of the Tucson Convention Center for the duration of the AGTA show, February 1–6. Drop by to ask questions, share information (and unusual stones), or just say hello. Many back issues will be available.

More GIA Tucson show news. Also in the galleria section of the Tucson Convention Center during the AGTA show with booths of their own will be the GIA: Bookstore, Alumni Association, Education, Advanced Retail Managements Systems, and GEM Instruments Corporation. The bookstore, GIA Education, and GEM Instruments also will have booths in the lobby at the GLDA show.

BACK ISSUES OF

GEMS & GEMOLOGY

Limited quantities of these issues are still available

Spring 1987
"Modern" Jewelry: Retro to Abstract
Infrared Spectroscopy in Gem Identification
A Study of the General Electric Synthetic Jadeite
Iridescent Orthoamphibole from Greenland

Summer 1987
Gemstone Durability: Design to Display
Wessels Mine Sugilite
Three Notable Fancy-Color Diamonds
The Separation of Natural from Synthetic Emeralds by Infrared Spectroscopy
The Rutilated Topaz Misnomer

Fall 1987
An Update on Color in Gems. Part I
The Lennix Synthetic Emerald
Kyocera Corp. Products that Show Play-of-Color
Man-Made Jewelry Malachite
Inamori Synthetic Cat's-Eye Alexandrite

Winter 1987
The De Beers Gem-Quality Synthetic Diamonds
Queen Conch "Pearls"
The Seven Types of Yellow Sapphire and Their Stability to Light

Summer 1988
The Diamond Deposits of Kalimantan, Borneo
An Update on Color in Gems. Part 3
Pastel Pyropes
Three-Phase Inclusions in Sapphires from Sri Lanka

Fall 1988
An Economic Review of Diamonds
The Sapphires of Penglai, Hainan Island, China
Iridescent Orthoamphibole from Wyoming
Detection of Treatment in Two Green Diamonds

Winter 1988
Gemstone Irradiation and Radioactivity
Amethyst from Brazil
Opal from Opal Butte, Oregon
Kyocera's Synthetic Star Ruby

Spring 1989
The Sinkankas Library
The Gujar Killi Emerald Deposit
Beryl Gem Nodules from the Bananal Mine
"Opalite:" Plastic Imitation Opal

Summer 1989
Filled Diamonds
Synthetic Diamond Thin Films
Grading the Hope Diamond
Diamonds with Color-Zoned Pavilions

Fall 1989
Polynesian Black Pearls
The Capoeirana Emerald Deposit
Brazil-Twinned Synthetic Quartz
Thermal Alteration of Inclusions in Rutilated Topaz
Chicken-Blood Stone from China

Winter 1989
Emerald and Gold Treasures of the Atocha
Zircon from the Harts Range, Australia
Blue Pectolite
Reflectance Infrared Spectroscopy in Gemology
Mildly Radioactive Rhinestones and Synthetic Spinel-and-Glass Triplets

Spring 1990
Gem Localities of the 1980s
Gemstone Enhancement and Its Detection
Synthetic Gem Materials of the 1980s
New Technologies of the 80s: Their Impact in Gemology

Winter 1990
The Dresden Green Diamond
Identification of Kashmir Sapphires
A Suite of Black Diamond Jewelry
Emeraldolite

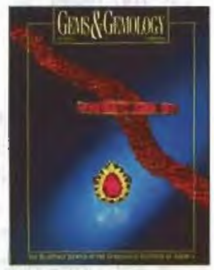

Spring 1991

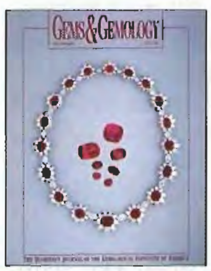

Spring 1992


Spring 1993


Summer 1991


Summer 1992


Summer 1993


Fall 1991


Fall 1992


Fall 1993


Winter 1991


Winter 1992


Winter 1993

Complete your back issues of Gems & Gemology NOW!

Single Issues*	$ 9.50 ea. U.S.	$ 13.00 ea. elsewhere
*Complete Volumes:** 1986, 1987, 1989, 1991, 1992, 1993	$ 34.00 ea. vol. U.S.	$ 44.00 ea. vol. elsewhere
Three-year set	$ 95.00 U.S.	$120.00 elsewhere
Five-year set	$150.00 U.S.	$190.00 elsewhere

*10% discount for GIA Annual Fund donors at the Booster's Circle level and above.

TO ORDER: Call toll free (800) 421-7250, ext. 394 or (310) 829-2991, ext. 394
FAX (310) 453-4478 OR WRITE: Attn: G&G Subscriptions
GIA, 1660 Stewart Street, Santa Monica, CA 90404

Spring 1991
Age, Origin, and Emplacement of Diamonds
Emeralds of Panjshir Valley, Afghanistan

Summer 1991
Fracture Filling of Emeralds: Opticon and "Oils"
Emeralds from the Ural Mountains, USSR
Treated Andamooka Matrix Opal

Fall 1991
Rubies and Fancy Sapphires from Vietnam
New Rubies from Morogoro, Tanzania
Bohemian Garnet—Today

Winter 1991
Marine Mining of Diamonds off Southern Africa
Sunstone Labradorite from the Ponderosa Mine, Oregon
Nontraditional Gemstone Cutting
Nontransparent "CZ" from Russia

Spring 1992
Gem-Quality Green Zoisite
Kilbourne Hole Peridot
Fluid Inclusion Study of Querétaro Opal
Natural-Color Nonconductive Gray-to-Blue Diamonds
Peridot as an Interplanetary Gemstone

Summer 1992
Gem Wealth of Tanzania
Gamma-Ray Spectroscopy to Measure Radioactivity
Dyed Natural Corundum as a Ruby Imitation
An Update on Sumitomo Synthetic Diamonds

Fall 1992
Ruby and Sapphire Mining in Mogok
Bleached and Polymer-Impregnated Jadeite
Radiation-Induced Yellow-Green Color in Grossular Garnet

Winter 1992
Determining the Gold Content of Jewelry Metals
Diamond Sources and Production
Sapphires from Changle, China

Spring 1993
Queensland Boulder Opal
Update on Diffusion-Treated Corundum: Red and Other Colors
A New Gem Beryl Locality: Luumäki, Finland
De Beers Near Colorless-to-Blue Experimental Gem-Quality Synthetic Diamonds

Summer 1993
Flux-Grown Synthetic Red and Blue Spinels from Russia
Emeralds and Green Beryls of Upper Egypt
Reactor-Irradiated Green Topaz

Fall 1993
Jewels of the Edwardians
A Prospectors' Guide Map to the Gem Deposits of Sri Lanka
Two Treated-Color Synthetic Red Diamonds Seen in the Trade
Two Near-Colorless General Electric Type IIa Synthetic Diamond Crystals

Winter 1993
The Gemological Properties of Russian Gem-Quality Synthetic Yellow Diamonds
Heat Treating the Sapphires of Rock Creek, Montana
Garnets from Altay, China

Some issues from the 1984, 1985, and 1986 volume years are also available. Please call the Subscriptions Office for details.

ORDER NOW!