GEM NEWS

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DIAMONDS

Botswana expands into diamond manufacturing. Through Debswana, the joint diamond-mining venture of De Beers and the government of Botswana, a cutting industry is being developed in that southern African nation. The Teemane Manufacturing Company has more than 100 trainees at its newly established school in Serowe. This is the first cutting and polishing venture in the country. (*Diamond Intelligence Briefs*, October 10, 1991, p. 815)

Large Chinese diamond. The Wafangdian Diamond Mine in northeast China, one of the latest to go on-line in that country, recently produced a 60.6-ct stone. The crystal, named Fenggu Number 1, is one of several stones larger than 10 ct. recovered from this locality. (*Diamond Intelligence Briefs*, July 11, 1991, p. 784)

Diamond center planned for China. A new diamond "town," to be located in the Pudong area of Shanghai, China, is being planned for completion in 1995. More than 30 foreign firms are currently negotiating to participate in diamond trading and construction of diamond-processing plants. The project is supervised by the Shanghai Arts and Crafts Import and Export Company. (*Rapaport Diamond Report*, January 11, 1991, p. 8)

Data suggest strong, changing U.S. diamond market. Despite the sluggish economy and the Gulf War, U.S. demand for diamonds remained strong during the first six months of 1991. This assessment is based on monthly statistics from the U.S. Bureau of Mines as analyzed by Lloyd Jaffe, Chairman of the American Diamond Industry Association (ADIA).

Overseas shipments of cut goods by caratage rose substantially—15.7%—compared to the first half of 1990, although in terms of dollar value this was a decrease of about 0.1%. U.S. exports to top trading partners in Belgium, Hong Kong, Japan, Israel, and Switzerland continued to be strong, but the overall average per-carat price of loose fashioned stones exported fell 13.7% to $1,366. By comparison, imports of loose fashioned diamonds in the first half of 1991 increased in terms of both dollar value and weight compared to the same period last year: up 4.5% to $1.65 billion and up 9.4% to 3.13 million carats.

The data also suggest that many U.S. diamond merchants are shifting their inventories to accommodate market changes brought about by lower levels of disposable income. For example, the average per-carat price of loose cut stones from India, a major source of smaller, less expensive goods, dropped 14% to $263; and the average per-carat price of goods from Israel, a key source of middle-range diamonds, dropped to $791.

Diamond factory to open in Dubai. What reportedly will be the first diamond factory in the Middle East outside Israel is currently being set up in Dubai, one of the United Arab Emirates. Equipment obtained in Antwerp has already been installed and, initially, 40 workers will be employed. Citi Diamond Co. will produce finished stones for export in the 0.05–0.50 ct range. (*Diamond International*, September/October 1991, p. 26)

G.E. synthesizes large carbon-13 diamonds. In October 1991, the General Electric Research and Development Center in Schenectady, New York, announced the synthesis of the first large, gem-quality diamonds composed almost entirely—99%—of the isotope carbon-13. By comparison, natural diamonds are composed almost entirely of the lighter isotope carbon-12. Carbon exists in nature as these two stable isotopes; but the natural abundance of carbon-13 is only 1%.

The essentially colorless carbon-13 synthetic diamonds, in crystals up to 3 ct, were produced by a two-step process that involves both chemical vapor deposition and high-pressure technology. This is the same technique G.E. used in 1990 to produce the first gem-quality synthetic diamonds enriched with 99.9% carbon-12. In 1970, G.E. scientists produced their first carbon-13-enriched gem-quality diamond using high-pressure technology. Its purity level, however, was only 91% carbon-13, short of the desired goal.

High-resolution X-ray measurements, performed by Ford Motor Company scientists in Dearborn, Michigan, revealed that these new synthetic diamonds contain more atoms per cubic centimeter at room temperature than any other solid known to exist on earth. Experiments carried out by Ford researchers showed that, as the carbon-13 concentration is increased, the interatomic distance decreases slightly, resulting in a corresponding increase in atomic density. This is an important discovery (and one expected on theoretical grounds), as some scientists speculate that carbon-13 diamonds may be harder than natural diamonds. G.E. scientists will be making comparative measurements to test this concept.

One unexpected discovery made by the Ford researchers was the exceptional perfection of the crystal structure of G.E. synthetic diamonds of all compositions, approaching that of silicon semiconductor crystals. Because improved crystal quality translates into improved electronic properties, the Ford discovery may stimulate development of new diamond-based electronic devices.

Guinea's Aredor produces another large diamond. A 192.9-ct gem-quality diamond was recovered from the Aredor alluvial diamond mine in May 1991. It is being sold through IDC Diamond Holdings in Antwerp. This reportedly is the fifth gem-quality stone of 100 ct or larger that has been recovered from this mine since 1986. (*Mining Journal*, July 26, 1991, p. 67)

Indonesian production on line. Indonesian Diamond Corp. reports that production at its southeastern Kalimantan holdings began in October 1991. In the first 17 days of operation, 476.6 ct of diamonds were recovered from the treatment of 4,740 m^3 of gravel. The current project area has a proven reserve of 2.9 million m^3, with an average 0.102 ct of diamond per cubic meter. There is a further indicated resource of 15.3 million m^3 and an inferred 29.4 million m^3 in an adjacent area. When two processing plants are fully operational, IDC will be able to process 54,000 m^3 of gravel per month for a recovery of about 5,400 ct of diamonds. (*Mining Journal*, November 8, 1991, p. 355)

"Nickel thermometer" for diamond exploration. Chrome-pyrope garnet is widely used in diamond exploration as an indicator mineral. Quantitative evaluation of potential diamond sources has involved searching for low-calcium, high-chromium (G10) harzburgitic garnets. Unfortunately, this method has drawbacks: Some diamondiferous pipes, such as at Argyle, contain few of these garnets, while other pipes rich in them are barren of diamonds.

Higher-calcium chrome pyropes (G9 garnets) have largely been ignored, although they are typically more abundant in heavy mineral concentrates from both kimberlites and lamproites and provide considerable information on diamond potential. The CSIRO Division of the Exploration Geoscience Diamond Project has developed a simple technique to evaluate the diamond potential of kimberlites and lamproites that uses proton-microprobe (PIXE) trace-element analysis of a relatively small number of G9 garnet grains. The nickel content, which is very sensitive to temperature of formation, is used with a conversion factor to estimate depth of formation. This knowledge, in turn, makes it possible to determine which garnets should co-exist with diamonds. The technique appears to be a more reliable indicator of potential diamond grade than the presence or absence of G10 chrome pyropes. (*Mining Journal*, March 22, 1991)

Figure 1. These new "Royal" cuts (0.70 ct to 2.32 ct), are modified brilliant cuts with outlines that resemble the traditional pear, oval, and marquise. Photo © Tino Hammid.

New "Royal" diamond cuts. Raphaeli-Stschik, an Israel-based firm that specializes in fancy shapes, recently unveiled their new Royal Line diamond cuts. The three trademarked cuts—the Duchess, the Baroness, and the Empress—were reportedly designed to take advantage of relatively flat rough. According to Gershon Stschik, who co-developed the cuts with Chumi Raphaeli, certain rough led them to design diamonds that were significantly wider at the top than either traditional fancy shapes or rounds. Stschik says the stones are "top heavy" in comparison to traditional fancy shapes, which makes the new cuts appear 50% larger than traditional fancies of the same carat weight.

Recently, GIA received a few samples of these new cuts for inspection from the U.S. distributor, Suberi Bros., New York. The Duchess cut, a modification of the marquise, is an elongated, hexagon-shaped brilliant; the Empress cut is a seven-sided modified pear brilliant; and the Baroness cut is an octagonal brilliant that resembles an oval (figure 1). All three cuts have traditional crown and pavilion facet arrangements.

COLORED STONES

Hairy insect in amber... Dr. George O. Poinar, Jr., insect paleontologist at the University of California at Berkeley, recently described an unusual fossil insect found in amber from the Dominican Republic. The insect (figure 2) possesses what is perhaps one of the most unique offense-defense systems nature has yet to devise. Sometimes called a "hairy bug," it is scientifically classified in the family Reduvidae, subfamily Holoptilinae, of which it is the only known fossil member in the New World. Its defense system consists of the stout, brittle hairs that protect the limbs from attack by ants. The offensive "weaponry" consists of a gland on the ventral side of the abdomen that releases a secretion that both attracts ants and tranquilizes them so they can be devoured.

Czechoslovakian conference yields valuable information. In September 1991, Karin N. Hurwit of the GIA Gem Trade Laboratory, Santa Monica, attended Intergem, a gemological conference hosted by the Geological Survey of Prague in conjunction with the Czechoslovak Academy of Sciences and "Granát," a Czechoslovakian commercial enterprise. Ms. Hurwit provided the following information from exchanges with various researchers at the gathering.

Figure 2. This unusual 4.7-mm long "hairy bug" is encased in amber that was found in the Dominican Republic. Photo by Dr. George O. Poinar, Jr.

Figure 3. This fine 3 mm × 1.4 mm ruby crystal in matrix is from a recently discovered deposit in the South Ural Mountains of Russia. Photo © GIA and Tino Hammid.

Dr. A. Kissin, from the Ural branch of the Academy of Science, Ekaterinburg, Russia, released information on a recently discovered ruby deposit in the "Kootchinskoye" ore mine complex, located in the South Ural Mountains north of Magnitogorsk. Although rubies were first found in this area in 1979, not until late August 1991 did geologists locate the important new find that promises to produce high-quality stones. Dr. Kissin indicated that the host rock is a magnesium-calcite marble, which is believed to provide the best environment for the growth of fine-quality ruby crystals. Dr. Kissin generously donated a few samples to GIA for examination, including a fine tabular ruby crystal in matrix (figure 3) and several carats of extremely small loose crystals, also of exceptionally fine color.

Dr. Vladimir Balitsky, of the Laboratory for Mineral Synthesis at the Institute of Experimental Mineralogy, Moscow, discussed and displayed synthetic malachite. Although the Fall 1987 issue of *Gems & Gemology* contains a detailed article on this material (of which Dr. Balitsky was the senior author), GIA staff members had not yet had an opportunity to examine this gem-quality synthetic first-hand. However, Ms. Hurwit was able to purchase a large specimen for GIA's collection. This material is being studied and any new information will be reported at a later date.

In a discussion with scientists from the St. Petersburg State University, Ms. Hurwit learned that synthetic opal is being produced commercially in Russia. GIA is arranging to obtain samples of this material for investigation, the results of which will be published in an upcoming issue of *Gems & Gemology*.

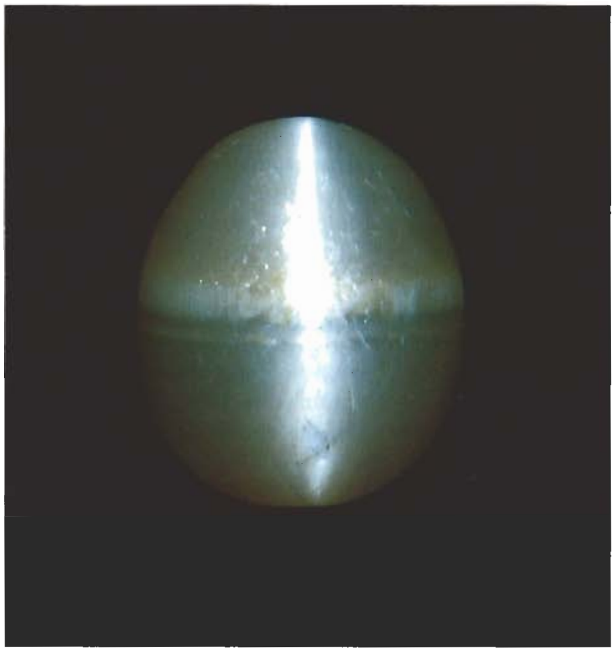

Figure 4. This 3.65-ct chrysoberyl (9.69 × 8.14 × 4.54 mm) exhibits a chatoyant band along its longer dimension, crossed at right angles by a growth band. Courtesy of Edward J. Gübelin; photo by Maha Smith.

Novel chrysoberyl "cross" cat's-eye. Dr. Edward J. Gübelin shared with the Gem News editors a most unusual chrysoberyl in his collection (figure 4). The yellowish grayish green oval cabochon exhibits a typical bright chatoyant band down its longer dimension. This is crossed at a right angle by another band. The second band, however, is not produced by reflection and scattering of light off parallel acicular inclusions. Rather, it is a distinct growth band that has a noticeably different color from that of the remainder of the stone.

Attractive Tanzanian diopside. The transparent, faceted diopside most often seen in the trade is the "chrome" variety from Russia. This material typically exhibits a highly saturated, dark green body color that would most likely be confused visually with the bright green tourmaline from East Africa that is marketed as "chrome tourmaline."

The 1.18-ct diopside in figure 5, however, was cut from rough reported mined in the Lelatema Hills of northern Tanzania. The stone is lighter in tone and has a stronger yellow component to its color than what we expect to see in transparent diopside. It reminded us of some green grossular garnet from Tanzania or fine-quality peridot from Burma, although we have seen somewhat similar-appearing diopside from China (see the Summer 1989 Gem News column entry "Colored stone update from China," pp. 111–112).

Gemological testing confirmed the identity as diopside, with R.I., birefringence, and S.G. within the ranges reported in the literature for this gem species. Examination with a dichroscope revealed weak pleochroism of brownish green and bluish green. The stone fluoresced a weak reddish orange to long-wave U.V., and a strong, slightly chalky yellow-green to short-wave U.V. No distinct absorption features were noted with a desk-model prism spectroscope. Magnification revealed graphite plates and fluid inclusions in a plane parallel to a cleavage direction.

Fine emerald/green beryl from Nigeria. Mike Ridding of the firm Silverhorn, in Santa Barbara, California, brought to our attention an important find of large emerald and green beryl crystals from the area of Jos, Central Plateau State, Nigeria, that was made in December 1990. We examined a number of these crystals, which display well-formed crystal faces (figure 6). Most of the material reportedly went to Idar-Oberstein, where faceted stones as large as 20 ct have been cut.

New production of demantoid garnets from Russia. Bill Larson, of Pala Properties International in Fallbrook, California, reports that demantoid garnets apparently are again being mined in the Ural Mountains of Russia. At the Munich gem fair last fall, Mr. Larson obtained more than 100 grams of rough material that reportedly had been recovered recently from the same region of the Urals where the historic deposits were mined. The best of the

Figure 5. A mine in the Lelatema Hills of northern Tanzania was the source of this 1.18-ct diopside. Photo by Maha Smith.

Figure 6. These emerald/green beryl crystals (standing—55 mm long, 200 ct; lying—75 mm long, 100 ct) were mined in Nigeria in late 1990. Photo by Maha Smith.

Figure 7. Demantoid garnets are again being mined in Russia. This 0.31-ct demantoid represents some of the finer recent material seen. Photo © GIA and Tino Hammid.

material appears to be the deep rich green for which Russian demantoid garnets are noted (figure 7). Less than 10% of the parcel he obtained fit this category, however; most of the material was a lighter green.

Tanzanian yellow grossular garnets. Although best known for its hessonite and tsavorite varieties, grossular garnet occurs in a wide range of colors. Recently, private collector Don Clary submitted to GIA's Research Department three stones from Tanzania for investigation. The largest of the three stones, a 3.17-ct barion cut (figure 8) was studied in detail in an attempt to understand the origin of its unusual color. EDXRF spectroscopy detected the presence of titanium, manganese, and iron. U.V.-visible absorption spectroscopy revealed absorption increasing toward the ultraviolet, with three sharp lines at approximately 407, 418, and 428 nm, and a doublet at about 370 nm. These sharp bands are typical of Mn^{2+} in the distorted cubic site in garnets. We concluded, therefore, that the yellow color of these Tanzanian grossularite garnets is primarily due to manganese (Mn^{2+}), with no significant contribution from iron.

Large tsavorite garnet from Tanzania. The Summer 1990 *Gems & Gemology* contained a report titled "Well-Formed Tsavorite Gem Crystals from Tanzania" that focused on high-clarity material recovered from the Karo pit of the tanzanite mining belt. The largest faceted stone mentioned (and illustrated) in that report was 14.84 ct.

Figure 8. The color of this 3.17-ct grossular garnet from Tanzania is primarily due to manganese. Photo by Robert Weldon.

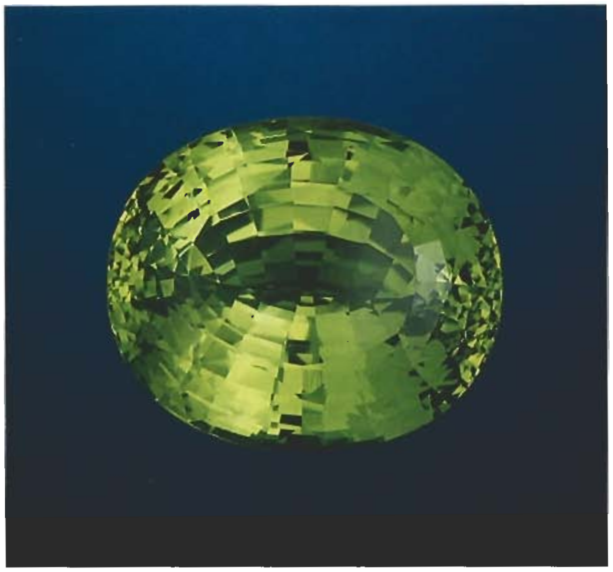

Figure 9. At 23.56 ct, this tsavorite from the tanzanite deposits at Merelani, Tanzania, is exceptionally large for this gem variety. Courtesy of Dr. Horst Krupp; photo by Shane McClure.

Recently, the GIA Gem Trade Laboratory's Robert Kane, senior author of the article, brought to our attention an even larger faceted stone from this deposit. The 23.56-ct oval mixed cut (figure 9) is exceptionally clean: Microscopic examination revealed only weak graining and three acicular inclusions. It was reportedly cut from a well-formed crystal similar to those described in the article.

"Recycled" ivory. Increased awareness of, and concern for, endangered species over the past several years has resulted in a number of moves to ban trade in such organic gem materials as tortoise shell and elephant ivory. This has resulted in a search for acceptable substitutes. A number of replacements for elephant ivory have been promoted, from "fossilized" ivory–mastodon and mammoth tusks–to "vegetable" ivory, particularly tagua nuts. Laboratory-made substitutes have also been promoted, including various plastics and one reportedly effective composite material from Japan.

At a recent gem and mineral show, one of the editors came across a novel scheme to market natural elephant ivory while assuring prospective buyers that it did not come from recently killed elephants. Sold as "recycled" ivory for use in small engravings and plaques, the pieces in question were actually the thin ivory veneer removed from old piano keys!

More on Peruvian opal. The Summer 1991 Gem News column included a brief entry on an attractive blue opal that reportedly originates in the Andes Mountains of Peru. Subsequently, the editors obtained additional information from Eugene Mueller, president of The Gem Shop, a Cedarburg, Wisconsin, firm that markets this material.

According to Mr. Mueller, the blue opal, as well as a pink variety, is recovered from a copper mining area called Acari, located near the city of Arequipa, Peru. Some 200 to 400 kg of opal is produced each month during the six months of the year when mining takes place. The material, which occurs in seams ranging from 1 to 5 cm thick, is currently mined using simple hand methods.

Less than 10% of the total production is of the blue variety, which ranges from transparent to a "milky" translucency, and varies from a light blue-gray through blue-green to a saturated greenish blue similar to that associated with fine chrysocolla. The pink material varies from translucent to almost opaque, in hues ranging from a light brownish pink through a purer pink; some exhibits a color reminiscent of rhodochrosite. The pink material (figure 10) is reportedly the tougher of the two color types. Gemological testing revealed properties consistent with

Figure 10. This 15.54-ct opal cabochon comes from the Acari copper mining area near Arequipa, Peru. Photo by Maha Smith.

opal for both types. Both blue and pink materials commonly contain dendritic inclusions; prior to the discovery of these colored varieties, colorless dendritic opal mined in this area had reached the U.S. market.

Antique portrait ring. An unusual late-19th-century portrait ring, recently auctioned at Sotheby's in Beverly Hills, California, was brought to our attention by Carol Elkins, a graduate gemologist and assistant vice-president of jewelry for Sotheby's. The yellow gold and platinum ring, highlighted by small rose- and single-cut diamonds, contains as its center stone an oval flat-topped tablet of very slightly yellowish white translucent chalcedony that measures approximately 22 × 16 mm. The chalcedony is an interesting type of "cameo" stone in that there is an excellent brown-colored portrait of George Washington printed on, or stained into, its surface (figure 11). Microscopic examination revealed that the portrait does in fact penetrate the surface by a fraction of a millimeter. The fine detail of the portrait, along with the noted penetration into the stone, suggest that the image was produced by means of a photographic process. In such a process, the porous chalcedony was probably first chemically treated with a light-sensitive substance and then exposed, much as one would print using photographic printing paper. This is the first such example of photoprinting on a gem material that we have encountered. However, we recall seeing a light-sensitive aerosol spray that could be used to turn various surfaces into photographic printing "paper."

Figure 11. This antique chalcedony ring is decorated with what appears to be a photoportrait of George Washington. Photo courtesy of Sotheby's, Beverly Hills, CA.

More synthetics sold as natural ruby in Vietnam. We recently were shown the five pieces of rough and one preform illustrated in figure 12, which were reportedly purchased in Vietnam as natural ruby. All six stones showed the spectrum typical of both natural and synthetic ruby when examined with a handheld type of spectroscope. The smallest piece of rough was easily identified as natural on the basis of its inclusions (which are described in detail in the article "Rubies and Fancy Sapphires from Vietnam," by Robert E. Kane et al., in the Fall 1991 issue of *Gems & Gemology*). Microscopic examination of the preform readily revealed the presence of curved striae and gas bubbles typical of Verneuil synthetics. Because of the irregular surfaces and reduced transparency of the "crystals," X-ray fluorescence analysis was used in conjunction with microscopy to test the remaining four pieces of rough. All proved to be synthetic; curved striae were seen in two of the four pieces. Curved striae are generally quite difficult to discern in "rough" synthetic rubies.

It appears that the pieces of synthetic rough had been intentionally worked, perhaps cobbed as well as tumbled, to look like natural rough. Such fraudulent practices have been seen in localities all over the world, and we have examined several examples of faceted synthetic rubies that were purchased in Vietnam as natural stones. These are the first examples of synthetic ruby "rough" that we have examined at GIA.

Update from Sri Lanka. Gordon Bleck, a dealer who resides in Sri Lanka much of the year, has once again provided us with an update on gemstone production in that country. He informs us that, overall, gem mining is hampered by terrorist activity, particularly in remote jungle areas such as that around Okampitya. Ratnapura, however, remains relatively safe. Following are some of the recent developments and unusual gem materials Mr. Bleck brought to our attention.

Rubies have been found near Hambatota, which represents a new locality for this gem. Stones rarely reach one carat in weight, but are of an unusually good quality, with a deeper color than is usually associated with rubies from Sri Lanka.

Deep pink fancy sapphires were recently found in the Matara district, along the southern coast. Fashioned gems are rarely more than 2 ct. To date, production has been limited.

In our experience, star spinels from Sri Lanka have tended to be almost opaque and of a very dark, low-saturation purple color. According to Mr. Bleck, in 1991 star spinels of a saturated red color and a high degree of transparency were found in the Ratnapura district (figure 13).

Clean, light yellow danburite crystals have been recovered from the Nirialla River, approximately 10 km from Ratnapura, near the towns of Palawela and Nirialla. The large specimen from which the 11.52-ct pear shape shown in figure 14 was cut was found in the river bed, whereas smaller fragments come from the river bank. This newer danburite tends to be less included than earlier productions.

Among the rarities found this past year were two crystals of translucent yellowish green andradite, the larger about 2 cm across, which show a typical combination of dodecahedral and trapezohedral shape. This past year also saw the production of larger quantities of color-change spinels, sapphires, and garnets.

Mr. Bleck also encountered considerably more facetable kornerupine this past year. An outstanding example is the 17.01-ct brownish green stone from central Sri Lanka shown in figure 14. The color is unusually light in tone for a stone of this size. Cat's-eye kornerupines, which were once fairly easy to obtain in Sri Lanka, have become quite scarce. Figure 14 also shows an unusually large—5.00 ct—blue sillimanite, from Ambalapitya.

Figure 12. All six of these stones were purchased in Vietnam as natural ruby. On the basis of gemological testing and, in some cases, X-ray fluorescence analysis, the 11.44-ct preform and four of the pieces of rough (3.93–15.17 ct) were identified as Verneuil synthetic rubies; the smallest piece of rough (bottom, 3.79 ct) proved to be natural ruby. Photo by Shane McClure.

Sunstone/iolite mixture. Herb Walters of Craftstones in Ramona, California, gave us some tumble-polished samples of an intergrowth of sunstone oligoclase feldspar and iolite to examine. According to Mr. Walters, the material originated in India, from which he regularly receives large quantities of both sunstone and iolite. Rarely, however, do they encounter intergrowths like the one shown in figure 15. When these intergrowths do occur, the iolite portion is usually of the "bloodshot" type, that is, containing "hematite" inclusions.

Figure 13. This 1.12-ct red star spinel from the Ratnapura district of Sri Lanka is unusual for both its color and its high degree of transparency. Photo by Robert Weldon.

Figure 14. Recent production in Sri Lanka includes the 11.52-ct pear-shaped yellow danburite, 17.01-ct brownish green kornerupine, and 5.00-ct blue sillimanite shown here. Courtesy of Gordon Bleck; photo by Robert Weldon.

Update on Tanzanite mining. Abe Suleman of Tuckman Mines & Minerals Ltd. recently provided the Gem News editors with a detailed update of mining activity in the Merelani mineralization zone of Tanzania.

This zone, which is more than 5 km long, runs in a northeast-southwest direction. It contains four main blocks, designated A, B, C, and D, which cover old mining areas. The government has awarded mining rights to these large blocks to firms with technical expertise and financial resources in order to have mechanized, large-scale, controlled mining in the area.

Block A, at the southwest end of the deposit, measures 540 m × 850 m (1,755 × 2,770 ft.) and has been awarded to Kilimanjaro Mines. Although there are no official reports of mining activity, it is known that exploratory tunneling has begun.

Block B, measuring 845 × 1,150 m (2,750 × 3,760 ft.), includes the famous "Opec" pits (former location of the "De Souza Pit") and is the site where the green zoisite is found. It is now held by Building Utilities Ltd. Rehabilitation of some of the old pits in this block has been completed and a few are again being mined.

Block C, measuring 1,150 × 2,075 m (3,760 × 6,750 ft.), is run by Tangraph, a joint venture between Samax, Tanzania Gemstone Industries Ltd. (a parastatal body), and Africa Gems. Under their agreement, Samax takes the graphite, T.G.I. takes the gemstones, and Africa Gems handles the marketing of the gems. Apart from a few exploratory trenches, no mining activity has officially been reported.

Block D, measuring 875 × 1,460 m (2,850 × 4,750 ft.), is where the major activity is taking place. Formerly awarded to Arema Enterprise Ltd., it has since been given to the Arusha Region Miners' Association (an association of small-scale miners and prospectors) by a special order from Tanzania's Minister of Home Affairs. The block was immediately divided into small areas that were distributed among the members. This amounts to a return to small-scale individual mining: going down by rope into unventilated pits 30 to over 60 m in depth, working by the light of small kerosene wicker lamps, and bringing up the "muck" in cowhide buckets. Mr. Suleman estimates that there are roughly 350 pits being worked by some 4,000 miners, all chasing the same two or three productive mineralized zones. According to an unwritten but strictly honored law, whoever first hits the zone has the right to mine that portion of it. Thus, there ensues an underground race in which everyone is trying to dig deeper and farther than the others.

The government also marked out several small blocks southwest and northeast of blocks A and D, respectively, and has already invited offers to mine these. Reportedly, in the near future, Tanzanian firms and individuals will be allowed to peg claims to mine tanzanite on a small scale.

Although all production is supposed to pass through Arema and be sold only to authorized dealers, it has been difficult to monitor production. It is widely known in gemstone circles in Tanzania that inventories in neighboring countries are building up again.

Bicolored tourmaline with unusual color effect. Tourmaline may exhibit two basic types of color zoning. In one, color varies from the center of the crystal to the periphery, as in watermelon tourmaline. In the other type, color varies

Figure 15. This 40-mm-long tumble-polished pebble consists of an unusual intergrowth of sunstone feldspar and iolite. Photo by Maha Smith.

Figure 16. This 6.10-ct bicolored tourmaline appears orange in areas where reflections of its pink and yellow color components overlap. Photo by Maha Smith.

down the length of the crystal. The latter type is typically step cut to display zones of colors along the length of the faceted stone.

The step cut is also typically used with amethyst-citrine, the bicolored variety of quartz. Occasionally, however, we see a bicolored quartz gem fashioned in a brilliant cut. The finest of these exhibit distinct zones of amethyst and citrine color, and they may display a distinctive "peach" color that results from a blending of the two color components through internal reflection. We recently examined a tourmaline (figure 16) that reminded us of the brilliant-cut amethyst-citrines just described. The stone, brought to our attention by gemologist William Pinch of Pittsford, New York, was mined in Minas Gerais, Brazil. The 6.10-ct oval modified brilliant is bicolored, with both pink and yellow. Where reflections of the two colors overlap, the stone appears orange.

SYNTHETICS AND SIMULANTS

New laser crystals with gem potential. Apparently, firms that grow crystals for technical applications now routinely sell their scraps to recyclers and faceters. As such materials may find their way into the jewelry industry, it is prudent to keep up with developments in crystal synthesis. In January 1991, GIA's Emmanuel Fritsch attended the Lasers '91 exhibit in Los Angeles. Following are some of the developments and materials covered at the event. Many companies with exhibits at the show were marketing crystals grown in China, which must now be considered an important source of synthetic crystals.

Synoptic, a division of Litton, Airtron, grows a number of crystals by the Czochralski pulling technique. These include chromium-doped synthetic alexandrite and two materials with an orangy pink color reminiscent of "padparadscha" sapphire: an erbium-doped YAG and an erbium-doped yttrium lithium fluoride (YLF). The firm also produces three materials with a saturated "emerald" green color: YAG doped with a combination of chromium, thulium, and holmium; chromium-doped lithium calcium fluoride (LiCaF or "licaf"); and chromium- and neodymium-doped gallium scandium gadolinium garnet (Cr,Nd:GSGG). Synoptic's parent company owns Diamonair, a firm that produces cubic zirconia jewelry.

Novel synthetic star sapphire. From a gemological viewpoint, some of the most interesting gem materials are those that display optical effects referred to collectively as "phenomena." We are especially intrigued by uncommon chatoyant and asteriated gems, a number of which have been reported in the Gem News section. Recently, one of the editors purchased an unusual laboratory-grown gem: a synthetic star sapphire with an incomplete star.

Figure 17. The "hole" in the center of this 2.68-ct synthetic star sapphire makes this a most unusual phenomenal stone. Photo by Maha Smith.

Unlike most asteriated synthetics, which display well-defined rays intersecting at the apex of the cabochon, this gem has a "hole" in its star. While the rays extending up from the girdle edge are relatively sharp, they stop abruptly about one-quarter of the way from the top of the dome (figure 17). The unasteriated core area also appears to be somewhat more transparent than the remainder of the stone, which, in general, is considerably more transparent than most synthetic star sapphires and star rubies we have examined. Magnification revealed that the area of greater transparency is totally devoid of the minute spherical gas bubbles that are usually found throughout asteriated flame-fusion synthetics.

The Gem Trade Lab Notes section of the Summer 1982 *Gems & Gemology* pictures a similar effect in a synthetic star ruby, which had been cut from a section near the bottom of the boule. The nonasteriated portion of that stone was believed to represent part of the nonasteriated seed crystal used to initiate growth of the boule. This explanation might also account for the similar effect noted here.

ENHANCEMENTS

More on Opticon as a fracture filler. Although the article in the Summer 1991 *Gems & Gemology* on fracture filling focused on emerald ("Fracture Filling of Emeralds: Opticon and Traditional 'Oils'"), reference was also made to its relative effectiveness in treating other materials. One stone treated, an amethyst, showed significant improvement in appearance after filling with Opticon. Among the features noted in filled breaks within this stone were blue dispersive colors.

Since that report was published, the editors have treated more than 30 additional faceted quartz gems—rock crystal, amethyst, citrine, and smoky quartz—with Opticon to document its effectiveness further and study identifying features.

In all cases, filled areas had very low relief and could not be detected without magnification. When the stones were examined with a microscope and darkfield illumination, the most prevalent feature was the presence of violetish blue dispersive flashes from the filled breaks (figure 18). On the basis of this investigation, the editors believe that this is the most reliable characteristic for the identification of Opticon-filled fractures in quartz gems.

Figure 18. Violetish blue dispersive flashes, as shown here in an amethyst, are believed to be the most characteristic feature of Opticon-filled fractures in quartz gems. Photomicrograph by John I. Koivula.

Figure 19. This bale-set emerald crystal has large, cavernous areas that have been "oiled." Photo by Maha Smith.

Filled cavernous emerald crystal. Although substances such as cedarwood oil, Canada balsam, and Opticon are most commonly used to fill fractures in emeralds, occasionally we see them used to fill other openings such as hollow growth tubes and internal cavities with surface-reaching fractures.

Recently, Ron Ringsrud of Constellation Gems, Los Angeles, brought to our attention an unusual bale-set Colombian emerald crystal that had very extensive filled areas. In fact, when we first looked at the stone (figure 19) we thought it might be an assembled specimen, similar to that described in the Summer 1989 Gem News column. Gas bubbles were prominent below the surface in a number of fluid-filled areas extending around the circumference of the crystal. These bubbles could be made to move, showing that they were contained in a fairly fluid substance.

A careful microscopic examination of the crystal revealed its true nature: It is a cavernous crystal, with a solid central core that is almost completely surrounded by hollow, cavernous areas running parallel to the c-axis. The perimeter of the crystal consists only of a thin "shell" of emerald. The filler has an "oily" odor, indicating that the crystal had been treated with one of the more "traditional" filling substances.

Filled synthetic emerald in parcel from Swat. Above, we reported on another incidence of flame-fusion synthetic rubies being encountered in parcels of natural stones from Vietnam. A recent laboratory alert—No. 48, dated November 5, 1991—from the International Colored Gemstone Association (ICA) reports on another variation on this deceptive theme.

The report was submitted by Shyamala Fernandes of the Gem Testing Laboratory of the Gem & Jewellery Export Promotion Council, Jaipur, India. It describes two synthetic emerald cabochons that were discovered in a parcel of stones reportedly from Swat, Pakistan. It was found that one of the two synthetics had been fracture-filled. Dendritic patterns were noted in the filled fractures, which fluoresced a strong yellow to long-wave U.V. radiation.

Deceptive color coating of sapphires in Sri Lanka. Gordon Bleck has also informed the Gem News editors that the demand for yellow sapphires in Sri Lanka has led to widespread heat treatment of appropriate rough. It has also resulted in greater quantities of synthetic yellow sapphire in the local market.

In addition, there has been a resurrection of some "old tricks": surface color coating of rough stones with organic compounds. One method used to mimic the appearance of good-color "golden" sapphire is to boil pale yellow sapphires in water with small branches or the inside bark of a local tree. Sometimes wax is added to the solution to provide a thin outer coating. One method that buyers use to test for this treatment is to immerse the suspect stone in nitric acid, thereby removing any coating present. If wax was used in the mixture, the coating will not be removed unless the acid is first heated.

Pink sapphire rough is also being imitated with a similar coating technique. Pale or colorless crystals are put in the treater's mouth, along with a local berry that is chewed. After a sufficient color coating has been achieved, the treater smokes a cigarette to coat the stone with tobacco residue, which reportedly improves the durability of the color coating.

More on Paraíba tourmaline simulants. With the continued demand for the distinctively colored tourmalines from Paraíba, Brazil, it is not surprising that simulants continue to show up in the marketplace. In the Summer 1990 Gem News column, we mentioned one natural gem that has been marketed as Paraíba material: bluish green to greenish blue apatite from Madagascar.

In September 1991, the ICA released Laboratory Alert No. 47, submitted by Dr. Hermann Bank and Dr. Ulrich Henn of the German Foundation for Gemstone Research (DSEF), which documents a number of these imitators. They, too, mention apatite, and further mention that this material has been found in parcels of rough Paraíba tourmaline. Other Paraíba imitators noted include irradiated topaz that has not been annealed subsequent to irradiation, beryl triplets that consist of two pieces of beryl joined with a bright blue cement, and doublets fabricated from a tourmaline crown and a glass pavilion (figure 20). The last assemblage might be missed without careful microscopic examination, as a refractive index reading taken on the crown would yield R.I. and birefringence values consistent with those of Paraíba tourmaline. Since the publication of the ICA Alert, Dr. Henn has informed the editors that he has seen blue cat's-eye apatites offered as tourmaline cat's-eyes from Paraíba.

Figure 20. A tourmaline crown and a glass pavilion were used to fabricate this assembled imitation of Paraíba tourmaline. Photo courtesy of Dr. Ulrich Henn.

ANNOUNCEMENTS

The Gemmological Association of Australia, in conjunction with the Gemmological Association of Hong Kong, will present a scientific program "Bringing Australian Gemstones to South East Asia" on June 6, 1992, at the Park Hotel, Hong Kong. The event, the GAA's 46th Annual Federal Conference, follows the World Gems and Jewellery Fair being held in that city May 31–June 3. For more information or to register, contact The Gemmological Association of Australia, Federal Chairman, Post Office Box 381, Everton Park, Queensland 4053, Australia.