



GEM NEWS

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DIAMONDS

Argyle set to expand with mining at home . . . To handle increased production from the AK1 pipe in Western Australia, CRA Ltd. plans to expand ore processing from 6 million to 8 million tons per year over the next two to three years. Their goal is to maintain diamond production for the AK1 pipe and nearby alluvial deposits at 33 to 35 million carats annually during the 20-year life of the pipe, as they reach progressively less-productive depths, with lower-yield ore. (*Diamond Intelligence Briefs*, July 23, 1991)

. . . and cutting in China. Argyle has opened a diamond-cutting and polishing factory in China, approximately 30 km from Beijing, that it will manage as well as co-finance. The factory, which will also provide training, was set up as a joint venture between the governments of Australia and China. The Chinese government hopes to develop diamond processing as a major new industry for the country. (*Mining Journal*, September 6, 1991)

Operations re-established at Elizabeth Bay . . . Namibia's diamond deposit at Elizabeth Bay, discovered in the early 1900s but inactive since the mid-1940s, has been officially re-opened. Operated as an open-cast mine by Consolidated Diamond Mines, the mine is expected to produce about 2.5 million carats of predominantly gem-quality diamonds from 38 million tons of ore over its 10-year life. (*Mining Journal*, August 9, 1991)

. . . amid warnings of large-scale theft. As part of his comments at the opening of the Elizabeth Bay mine, Julian Ogilvie Thompson stated that organized crime syndicates are stealing large values of diamonds each year from Namibia's mines. The theft of diamonds rose sharply in the months preceding Namibia's independence. It is believed that the value of diamonds stolen from the Oranjemund mine may be as high as three times that of the entire production from the new Elizabeth Bay mine. (*Diamond Intelligence Briefs*, August 30, 1991)

New Soviet diamond source. According to recent reports on Radio Moscow, a major new diamond field has been discovered in Buryatskaya, close to the border with

Mongolia, in the eastern Sayany Mountains. Geologists have reportedly identified more than 10 diamond-bearing sites in the region. This discovery, which is scheduled to be exploited commercially, follows 50 years of small-scale prospecting in the area, during which only minor quantities of diamonds were recovered. (*Mining Journal*, August 23, 1991).

Additional diamonds recovered at Fort a la Corne, Saskatchewan, Canada. Additional diamonds were recovered from drill samples taken at the Fort a la Corne property, 80 km east of Prince Albert, according to Uranerz Exploration and Mining, operator of a 50/50 joint venture with Cameco Corp.

Diamonds recovered in 1991 range up to 0.6 ct (5.5 mm in diameter); the larger stones (over 0.5 mm in diameter) appear to be of gem quality. A total of 160 macrodiamonds have been recovered to date from 15 separate kimberlite pipes. The average weight per stone is 0.04 ct, with a maximum projected grade of approximately 10 ct per 100 metric tons in one drillhole. Preliminary cost estimates indicate that a minable deposit would require a much higher grade. Sample recovery is expensive due to the 100-m-thick blanket of overburden that covers the kimberlite pipes.

The exploration results to date are insufficient to determine the economic significance of the Fort a la Corne property. Further exploration and evaluation is warranted since many target areas remain to be tested by drilling. No additional field work is planned for 1991.

Conference on synthetic diamond and diamond-like coatings. In September 1991, Dr. Emmanuel Fritsch of GIA Research attended the Second European Conference on Diamond, Diamond-like and Related Coatings in Nice, France. Titled "Diamond Film 1991," this annual event focuses on the low-pressure synthesis of diamond and related materials. It was well attended this year, with about 350 participants from 28 countries.

One important aspect of the gathering was the large number of presentations on diamond-like carbon (DLC), an amorphous form of carbon noted for its high hardness and great potential for various industrial applications.

For example, DLC-coated sunglasses are currently being marketed in the United States by the firm Diamonex. Soviet scientists exhibited sheets of various plastics—including flexible ones—covered with hard DLC.

The Norton firm reported that it had succeeded in producing thick (approximately 0.3 mm), polycrystalline, optical-quality synthetic diamond films of large dimensions (at least 4 in.—10 cm—square) using plasma jet technology. These films are grayish brown and transparent, unlike previously produced films of this type, which have been black, opaque, and of rather poor quality. This opens the way for the development of fairly inexpensive optical-quality synthetic diamond films.

There were also some definitive findings relating to the origin of the brownish color in DLC produced by chemical vapor deposition techniques. This coloration appears to be intrinsic to the hard variety of this material, the type with potential gemological applications. Therefore, the color of DLC films cannot be improved. However, the brown of CVD-produced polycrystalline synthetic diamond films is due to the concentration of various forms of graphitic carbon between the crystals that form the film. With this knowledge, it may now be possible to control (perhaps eliminate) the brownish coloration of this particular type of film.

New diamond cuts. New York-based Maico Diamond recently unveiled their new trademarked "Dream" cuts (figure 1). These new cuts represent modifications of the standard fancy-shape brilliant cuts—the oval, marquise, and pear—to take advantage of relatively flat rough. Note that the standard octagonal table outline has been "squared off" to make the table area appear larger. The Dream marquise also has two elongated star facets toward the points that add to the impression of an enlarged table area. The facet arrangements on the pavilion sides received slight modifications as well. The majority of the pavilion facets that traditionally meet at the keel-line have been shortened and opened up at the girdle, thus giving the impression of a finer subdivision of the pavilion area. The bow-tie effect appears to have been slightly diminished and moved away from the table area into the crown facets. The advantage of all these modifications would appear to be greater weight retention from the rough. Visually, the diamonds appear larger than their actual weight.

Historical diamond photographs. Many gemologists frequent local-area gem and mineral shows, swap meets, and even "yard sales," looking for interesting gems and old pieces of jewelry. Recently, GIA instructor Yianni Melas made an unexpected find of another sort while looking through some old twin-image photographs used in the once-popular stereoscopic viewers. Among the images were photos relating to early diamond mining in



Figure 1. Visually these "Dream cuts" (0.50–0.54 ct) appear larger than their actual weights. Photo © GIA and Tino Hammid.

South Africa, including ones of Groot Schuur, the country home of Cecil Rhodes at Cape Town; the workers' compound at Kimberley; and a mining scene at Kimberley (figure 2). According to a librarian at the University of California in Riverside, the facility that has archived all the images of the now-defunct Keystone View Company, the photographs from South Africa were taken in approximately 1899–1900.

COLORED STONES

Colombia reports record emerald exports. Colombia's Mineralco announced that emerald exports had reached their highest level ever in February 1991, with sales totaling \$16.7 million for the one-month period. Total reported emerald sales for 1990 came to \$116.7 million, with Japan accounting for \$91.6 million and the U.S., \$16 million. (*Mining Magazine*, July 1991)

Large South Sea pearl. William A. Weidinger, a goldsmith and jewelry designer from Columbus, Ohio, reports having seen an unusual South Sea pearl on a trip to Thailand this past May. The gray pearl, seen at Naga Noi Island off the coast from Phuket, Thailand, was egg shaped, approximately 42 mm long, and had a high luster. Of particular interest, the pearl appeared to be an "enhydro," that is, to contain a liquid, probably water, in a pocket of air. The liquid was readily apparent when the pearl was shaken.

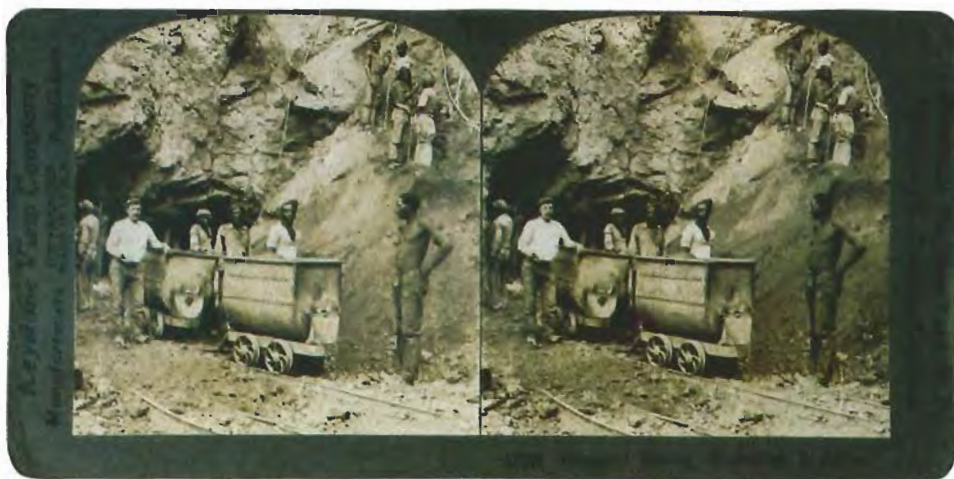


Figure 2. This twin-image "slide" for a stereoscopic viewer illustrates a turn-of-the-century mining scene at Kimberley, South Africa.

Myanmar to authorize Thai buyers. The Myanmar (formerly Burma) government has agreed to allow AGD Gem Dealer Co. of Thailand to open an office in Yangon (Rangoon). AGD, a buying company established by 72 members of the Thai Gem and Jewelry Traders Association, will purchase rough and fashioned gems from private mining companies in Myanmar as well as from stocks held by the state's Myanmar Gems Enterprise. (*Jewellery News Asia*, July 1991)

Postage stamp commemorates large Burmese ruby. Earlier this year the government of Myanmar issued a special commemorative postage stamp (figure 3), both in honor of the 1991 Gems, Jade, and Pearl Emporium and to celebrate an exceptionally large ruby crystal mined in the historic Mogok region.

According to a report that appeared in the August 21, 1990, issue of *The Working Peoples' Daily*, an English-language journal published in Yangon (Rangoon), the crystal weighs 496.5 ct, measures 43 × 37 × 44 mm, and has a "crimson rose" color. As a special Emporium guest of the government's gem exploration, recovery, and marketing division—Myanmar Gems Enterprise (MGE)—the GIA Gem Trade Laboratory's Robert Kane was allowed to examine this exceptional crystal. He reports that it was typical of the fine color for which Burmese rubies are renowned. It was reportedly recovered in the Mogok region in 1990, and was part of the 30,728 carats of illegally mined rubies confiscated by members of the government's Defence Services Intelligence Office on August 18 of that year; this particular stone was confiscated "from abroad." Originally dubbed the "Nawata ruby," the crystal was subsequently renamed the "SLORC ruby," after the acronym for State Law and Order Restoration Council, the ruling government body.

Small-scale sapphire mining continues in Thailand. Although much attention has been paid to the large,

mechanized mining operations developing around Bo Phloi in western Thailand, much mining activity in this country is still carried out by traditional hand methods. On his trip to Southeast Asia in early 1991, GIA-GTL's Robert Kane also had the opportunity to visit some of these traditional sapphire mines. One typical small-scale operation, approximately 6 km (10 mi.) outside Chanthaburi, consisted of a single round, vertical shaft 1

Figure 3. This postage stamp from Myanmar (Burma) features an exceptionally large ruby crystal mined recently in the Mogok region.



Figure 4. A "handful" of sapphire rough is recovered in a good week of working this small mine near Chanthaburi, Thailand. Photo by Robert E. Kane.



m in diameter and 4 m deep (figure 4). In place of a ladder, the miner simply dug footholes into the walls of the shaft. He then tunneled laterally when he encountered the sapphire-bearing gravels. The buckets of soil brought to the surface were washed in artificial pools and hand sorted in rattan baskets. The miner indicated that in a good week he could recover a "handful" of green, blue, and dark brown sapphire rough.

Tanzanian spinel. In the Spring 1990 Gem News section, we mentioned spinels from the Umba Valley of Tanzania and showed three representative pieces of rough. This year at the February Tucson Show, a number of dealers were selling faceted stones from this locality. Some of the more attractive spinels ranged from a medium pink reminiscent of pink sapphire to a light purplish pink that strongly resembled fine kunzite. In general, these Tanzanian stones display more saturated colors in lighter tones than what we are accustomed to seeing in Sri Lankan spinels.

In some of these stones, we noted a soft, "velvety" look and reduced transparency similar to that for which sapphires from Kashmir are famous (figure 5). We believe this effect is due to the presence of submicroscopic mineral inclusions. Other gemological properties are consistent with those reported in the literature for spinels of similar color from other localities.

Update from Tanzania. Dr. Allen M. Bassett, currently working as chief geologist and gemologist for the Swiss company Tofco in northern Tanzania, has provided the editors with an update on activity at the Longido ruby deposit. The mine, which had been abandoned at the time it was nationalized in 1971, is now being worked by

Tofco in a joint venture with Tanzania Gemstone Industries, a government parastatal.

When the mine was closed some 20 years ago, it had reached what is described as the "4th level." Since operations were renewed, miners have reached down to the 7th level, 270 ft. (approximately 83 m) below the surface. Plans call for the mine eventually to extend to the 10th level. At different levels, different types of rock

Figure 5. This 4.28-ct spinel from Tanzania has a pleasing "velvety" look that is probably caused by minute inclusions. Photo by Maha Smith.





Figure 6. These 21.78-ct (left) and 33.13-ct (right) tourmalines are reportedly from Paraíba, Brazil; they are unusually large for this locality. Photo by Robert Weldon.

have been encountered. In addition to the chrome zoisite and ruby for which the deposit is well known—tons of cabochon-grade material but only a few carats of facetable material are being recovered—other potential gem materials include feldspar, apatite, and actinolite.

Tanzania invites tenders for mineral rights. The Tanzanian Ministry for Water, Energy and Minerals has invited urgent tenders for companies to apply for mineral rights to the Merelani area of Arusha, where tanzanite is mined. To be considered, a company must have experience in the mining, processing, and marketing of gem materials and indicate the prospecting methods, equipment, and drilling techniques to be used. Applicants must also provide a detailed work program and indicate their proposed minimum financial commitment to exploration and development as well as their security arrangements for the protection of the mine. Successful applicants will be awarded mineral rights for 200 m × 300 m blocks, nine of which are available, and will be

required to post a bond. (*Mining Journal*, September 6, 1991)

Large Paraíba tourmalines. The majority of the distinctively colored tourmalines from Paraíba we have observed have been relatively small. Recently, however, we had the opportunity to examine two exceptionally large stones that are reportedly from this source: a 33.13-ct green and a 21.78-ct bluish green, both rectangular cushion cuts (figure 6).

EDXRF analysis by GIA Research revealed the presence of copper in both stones. This supports their purported origin as Paraíba, which to date is the only locality known to produce tourmalines colored by copper (see the Fall 1989 *Gems & Gemology*, p. 204).

Tourmaline with unusual "color change." Gem dealer Don Clary loaned GIA Research an interesting matched pair of "golden" yellow tourmalines from East Africa (Tanzania or Kenya). These two "opposed bar" cut stones, 2.48 and 2.56 ct, exhibit a most unusual color phenomenon: When examined under either incandescent or fluorescent lighting, they appear slightly brownish yellow (figure 7, left). However, when viewed under a combination of incandescent *and* fluorescent lighting, the stones become distinctly more greenish yellow (figure 7, right). To our knowledge, this type of color behavior has not been reported previously in the literature.

Microprobe analysis identified the stones as dravite tourmalines with approximately 9.9 wt.% MgO. Titanium is the major impurity, with minor amounts of vanadium and iron, and traces of manganese and chromium. The optical absorption spectrum shows a broad absorption feature centered at about 450 nm and a much less intense broad band at about 630 nm. This type of spectrum is typical of dravite and is attributed to $\text{Fe}^{2+} \rightarrow \text{Ti}^{4+}$ charge transfer and V^{3+} , respectively.

The luminescence of the stones was found to be

Figure 7. These two dravite tourmalines appear slightly brownish yellow when seen under incandescent (or fluorescent) lighting (left), but they become distinctly greenish yellow when illuminated simultaneously with incandescent and fluorescent lighting (right). Courtesy of Don Clary; photos by Robert Weldon.



somewhat unusual in that they were inert to long-wave ultraviolet radiation but fluoresced a moderate chalky yellow to short-wave U.V.

Tourmaline/andalusite: A pleochroism caveat. Gemologists learn to take full advantage of their most sensitive gemological equipment, their eyes. Visual observation — noting features with the unaided eye — thus becomes a first critical test. This includes such characteristics as transparency, color, color distribution, dispersion, brilliance, surface condition, and eye-visible inclusions.

Another important feature to note with colored stones is any eye-visible pleochroism. This can be very useful in identifying a number of gems such as tanzanite and iolite. It can also help separate tourmaline and andalusite, two stones with overlapping R.I.'s. Students are taught that, in general, the two pleochroic colors seen in tourmaline are different tones of the basic body color, and stones are usually cut to show the more desirable color through the table. Andalusite, as normally oriented in cutting, displays two distinct pleochroic colors through the table (figure 8, right).



Figure 8. Note the similarity in pleochroism between the oval 1.13-ct dravite tourmaline on the left and the round 1.48-ct andalusite on the right. Photo by Robert Weldon.

Becoming overly reliant on such gemological generalities can cause problems, as we were reminded recently when examining some dravite tourmalines from Sri Lanka. The pleochroic colors of these stones typically are significantly different in hue, and both can be seen through the table of a faceted stone (figure 8, left) — in a manner similar to the pleochroism in andalusite.

Purple and “chrome” green vesuvianites from Quebec. Vesuvianite, also known by gemologists as idocrase, is most often seen as a massive ornamental stone resembling jade. Less commonly, transparent single-crystal material is seen. Reports (see, e.g., *Mineralogical Re-*

cord, September/October 1991, p. 386) indicate that significant quantities of purple and green vesuvianite crystals have been recovered recently from the Jeffrey mine, in the province of Quebec, Canada, although most of the material is not gem quality.

Recently, GIA's Dr. Emmanuel Fritsch had a chance to study some faceted vesuvianites of these unusual colors, which were loaned by Guy Langelier of Montreal. The stones had been recovered from the Jeffrey mine between 1988 and mid-1990. The lot consisted of three purple, two saturated green, and two bicolored (light green and light pink) stones (see figure 9 for representative samples).

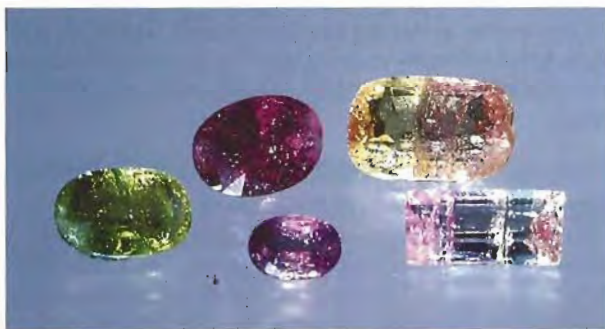


Figure 9. These unusual-colored vesuvianites, ranging from 0.48 to 2.79 ct, were recovered recently from the Jeffrey mine, Quebec, Canada. Courtesy of Guy Langelier; photo by Maha Smith.

EDXRF and U.V.-visible absorption spectroscopy were used to determine the cause of color in the green and purple stones. The purple stones were found to be colored by Mn^{3+} , apparently in a distorted octahedral site, which would account for their fairly pronounced pleochroism. The vivid green stones were determined to be colored by Cr^{3+} , also presumably in an octahedral site. Small amounts of nickel were also discovered in both the green and bicolored stones, but the data were insufficient to determine whether Ni^{2+} contributes to the coloration of these gems.

Unusual red zoisite. Dr. Allen Bassett has provided us with a brief note on an unusual zoisite, a 38.8-gram piece of dark-toned material that was brought to the Tanswit laboratory in Arusha, Tanzania. The specimen had one crystal face measuring approximately $4 \times 2.5 \times 2.5$ cm, and was nearly clean, exhibiting some unidentified black specks and shallow surface-reaching fractures. The stone appeared to be too dark to facet into a gem. The owner, however, disagreed and proceeded to grind and polish its surfaces, which only served to destroy the specimen value of the piece.

With strong fiber-optic illumination, the optic axis direction of the stone transmitted pure red, showing no hint of either orange or purple secondary hues; under ordinary incident light, the stone appeared black when viewed in this direction. One of the two other axial directions appeared medium greenish blue under intense illumination and almost black in weaker incident light, while the third, perpendicular direction transmitted a deep, pure purple with red flashes from the dichroic ends of the piece. Thin edges in the blue direction appeared to be almost pure yellow tinged with green. Dr. Bassett volunteered that, had the stone been lighter in tone, it would have been a unique gem.

When examined through a dichroscope, the red direction was seen to be composed of pure red and yellow-orange components; in the blue direction, the pleochroic colors were greenish blue and yellow-orange; and in the purple direction, they were red and greenish blue.

ENHANCEMENTS

Faceted gems coated with diamond-like carbon. A number of reports have appeared in the trade press relating to gemstones supposedly coated with synthetic diamond. To our knowledge, however, the only documented faceted gemstones so treated to date are the three diamonds that were experimentally coated with blue type IIb synthetic diamond, as reported in the Summer 1991 Gem News section. All other reports refer instead to coating with diamond-like carbon (DLC). The two materials are quite different. Specifically, DLC is amorphous and brownish in color, has a refractive index around 2.00,

a hardness between that of diamond and corundum, and often contains hydrogen as a major constituent. The thin films described in the Summer 1991 issue are truly synthetic diamond: They are monocrystalline, bluish gray in color, have an R.I. of 2.4, and a hardness of 10. These particular synthetic diamond thin films do not contain hydrogen.

At the International Gemological Symposium held in Los Angeles this past June, Dr. Fritsch reported on the experimental coating of faceted gemstones with diamond-like carbon (DLC). The treatment was carried out so that both the identifying characteristics of the coating as well as its impact on various durability aspects of the stones could be determined.

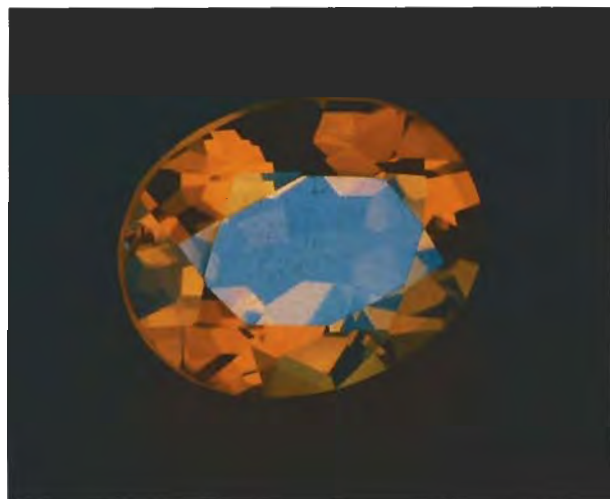
The deposition of DLC films on faceted stones was performed at the University of Nantes, France, by Prof. Yves Catherine, Prof. Jean-Louis Mansot, and Mr. Pierre Fumey. They covered the top portions of faceted beryls (aquamarine and emerald), amethyst, citrine, tourmaline, garnet, and strontium titanate with a thin film of diamond-like carbon approximately 0.08 micron thick, using a specially designed plasma reactor.

All DLC films did adhere to their gem substrates and could not be scratched with a corundum (Mohs 9) hardness point. When placed in a gem tumbler along with uncoated gems of the same species and varieties, the DLC-coated gemstones showed greater resistance to wear than their uncoated counterparts. Detection of the presence of the coatings is straightforward. Because of its high refractive index, the coating imparts an adamantine luster to the treated stones. This is particularly evident on stones of lower refractive index, such as citrine (figure 10). On lighter-toned stones, the brownish color of the film is evident. In addition, as the adherence is less than ideal, the film tends to wear at facet junctions, a feature that can be easily seen with magnification and surface-reflected light.

Montana sapphire heat treatment. For the past few years, Marc Bielenberg of Hamilton, Montana, has been mining the Dry Cottonwood Creek sapphire deposit in that state. The sapphire-bearing zone, at the valley bottom, is approximately 3,000 ft. (900+ m) long. Exploration has shown that the area contains deposits of gold as well as sapphires. Mr. Bielenberg reports that the recovery of sapphires seems to be good, particularly in sizes over one carat, although many of the crystals recovered to date are very pale.

To enhance the color of these pale crystals, Mr. Bielenberg has been working with Dale E. Siegford of Missoula, Montana, a specialist in the heat treatment of Montana sapphires. To date, the results have been excellent, as illustrated by the pale blue and yellow rough Dry Cottonwood Creek sapphires shown before heat treatment in figure 11 top and after heat treatment in figure 11 bottom. The blue crystals show the greatest improvement.

Figure 10. Note the unusually high luster of this 2.32-ct citrine, which has been coated with a thin film of diamond-like carbon. Courtesy of J.-L. Mansot and Pierre Fumey; photo by Robert Weldon.



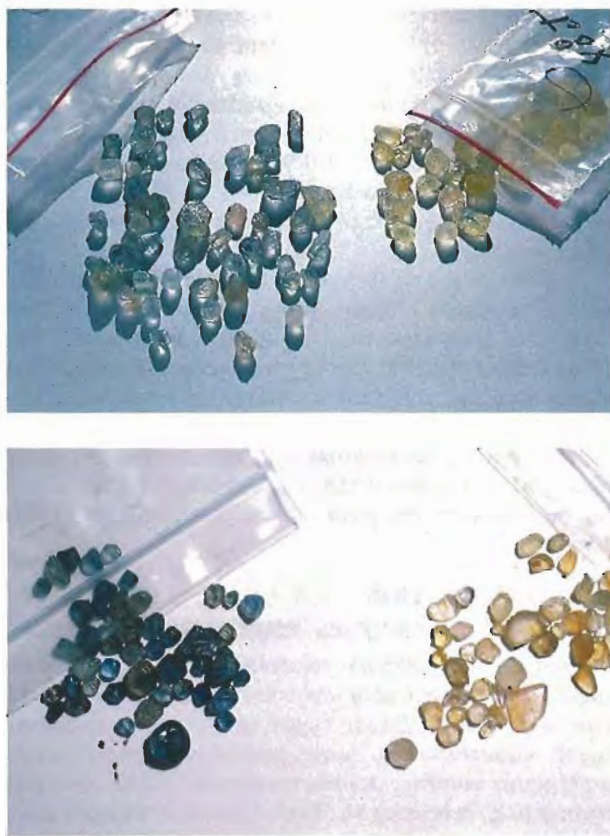


Figure 11. The improvement in color brought about by heat treating sapphires from Dry Cottonwood Creek, Montana, is readily apparent in these photographs showing typical material before (top) and after (bottom) enhancement. Photos by Maha Smith.

More experimentation with blue diffusion-treated sapphires . . . The Summer 1990 issue of *Gems & Gemology* carried a comprehensive article on diffusion-treated sapphires. Among the materials examined were stones marketed by the firm Gem Source of Las Vegas, Nevada, and Bangkok, Thailand. At that time, Jeffery Bergman of Gem Source stated that he used Sri Lankan sapphires as starting material.

Recently, Mr. Bergman shared information relating to experimental diffusion treatment of sapphires from another locality: Montana. He also donated eight of these stones, ranging from 0.53 to 1.18 ct, to GIA for study. According to Mr. Bergman, approximately 50% of the Montana sapphires they have diffusion treated to produce a blue color have also developed unwanted yellowish orange zones.

Examination of the eight sample stones with magnification readily revealed the yellowish orange zones described by Mr. Bergman; also noted in some of the stones were disk-like areas of dark blue surrounding

dark crystalline inclusions (figure 12). We believe that the yellowish orange areas are related to zoned growth and reflect a higher iron impurity content, while the disk-like dark blue areas are caused by internal diffusion, a cannibalization of both iron and titanium from possibly iron-rich rutile and/or ilmenite inclusions. Both of these unanticipated color areas no doubt result from the high temperatures used in the diffusion-treatment process.

. . . and red stones too. The Spring 1991 Gem News column mentioned research being conducted by Gem Source to produce red diffusion-treated stones. That entry pointed out one problem being encountered: the simultaneous development of a blue color component, believed to be due to the presence of the appropriate chromophores in the starting gem material.

More recent communication with Mr. Bergman has shed additional light on the issue. He states that the development of the unwanted blue component might also be due to contaminants in the treatment oven, as the same ovens used to carry out this experimentation are used in the commercial production of the blue diffusion-treated stones. Mr. Bergman also indicated that adequate penetration of the desired red-producing chromophore has not been achieved to date, possibly due to insufficiently high temperatures. Repolishing has resulted in the removal of over 90% of the diffused color layer.

Mr. Bergman loaned us two of these experimental treated stones for examination, oval mixed cuts weighing 1.37 and 1.49 ct. The smaller stone had a predominantly violet face-up appearance with some areas that were more red-purple. Face-up, the larger stone seemed to be heavily color zoned, with two quadrants appearing a patchy medium red-purple and the other two appearing a dark purple, approaching black.

Figure 12. It is likely that both the large yellowish orange color zone and the smaller disk-like blue zones in this blue diffusion-treated sapphire from Montana resulted from the high temperatures used in the diffusion-treatment process. Photo by John I. Koivula.

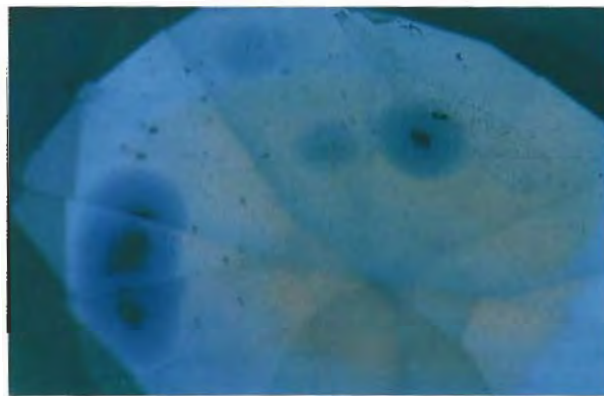




Figure 13. Diffused transmitted illumination reveals that what little diffusion-produced color remained after repolishing this experimentally treated sapphire was concentrated along facet junctions. Photo by John I. Koivula.

Magnification revealed that the dark areas of the larger stone corresponded to areas of the pavilion that were dark red-purple and badly sintered; apparently they had not been repolished after treatment. Diffused transmitted light revealed that the repolished facets on both stones had little remaining surface-diffused color, most of which was found along facet junctions (figure 13).

Interestingly, the surface-diffused color of both stones had less of a blue component than their face-up color. Magnification, however, revealed blue color bands within the stones that no doubt were responsible for the stronger blue component of the face-up appearance. These blue bands were most likely caused by internal color diffusion around stringers of iron-titanium inclusions. The fact that the externally diffused color was red-purple rather than a purer red also gives some credence to the theory of surface contamination from the oven.

SYNTHETICS AND SIMULANTS

Porous Gilson synthetic opal. Hydrophane is a porous natural opal that reveals its play-of-color after it absorbs water or another liquid. Recently, the editors had the opportunity to examine a porous synthetic opal that also improved in appearance after being placed in water. The material, described as Gilson white porous synthetic opal, was provided to GIA by Louis Lo of Sunning Gems Co., Hong Kong. This material currently is not marketed commercially.

The 6-mm round cabochon had a white translucent body color and a moderate, predominantly orange play-of-color in small, angular patches. The play-of-color was weaker than what is typical of Gilson synthetic opal. The appearance began to change immediately when the cabochon was immersed in water, increasing in transpar-

ency first from the periphery and then proceeding inward (figure 14). The complete transformation, observed with magnification using direct transmitted light, took approximately 35 minutes. We also observed bubbles rising from the surface, probably air driven out of the voids between the silica as these were filled with water. As the water was absorbed, the distinctive "chicken wire" structure of the synthetic opal also became more apparent.

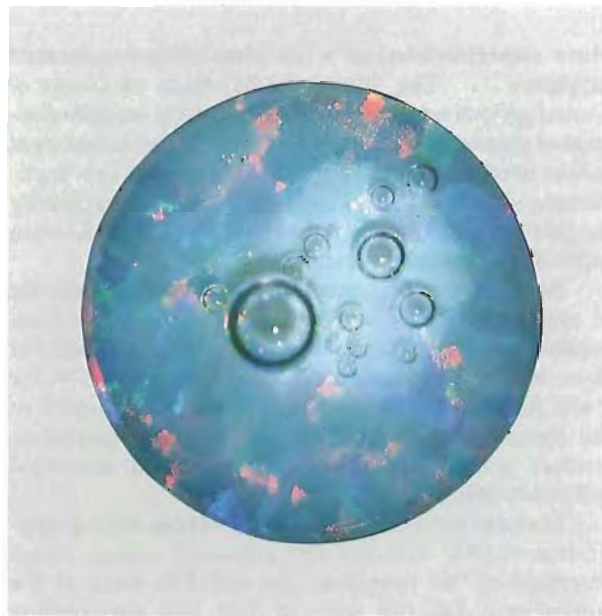
When removed from the water, the hydrated cabochon appeared slightly more transparent and less "white" in body color than before it was immersed. The play-of-color was also more pronounced. We dehydrated the stone in the well of a binocular microscope, using the heat of the incandescent bulb. This returned the synthetic opal to its original appearance. As one final observation, we noted that the cabochon sticks to the tongue, as does the porous, smoke-treated opal from Mexico.

INSTRUMENTATION

AND NEW TECHNIQUES

Distinguishing diffusion treatment from surface coating. Diffusion treatment and colored surface coating are two distinctly different types of gemstone enhancement. Unfortunately, some confusion exists because ambiguous wording is sometimes used to describe the former (e.g., reference to "heat diffused coating of blue

Figure 14. The peripheral areas of this 6-mm porous Gilson synthetic opal have absorbed water while the lighter central area has not. Note also the air bubbles escaping from the surface. Photo by William Videto.



sapphire" in ICA Early Warning Laboratory Alert No. 45). Such confusion may be compounded by the fact that there can be superficial similarities between the two treatments, such as uneven facet-to-facet coloration and a dark color outlining some facet junctions.

In diffusion treatment, high temperatures are used to literally "cook" chromophores into the gem's crystal lattice. The mechanism that produces the blue color in, for example, blue diffusion-treated sapphires, is the same as that which produces blue in natural untreated (as well as heat-treated and synthetic) blue sapphires. Because it is the same mechanism, the pleochroism of blue diffusion-treated sapphires is essentially the same as that of natural or synthetic blue sapphires of comparable hue and depth of color.

Colored surface coatings, on the other hand, are just that: substances that are applied over the surface of the gem rather than incorporated into its structure. Those colored surface coatings we have examined to date—including Aqua Aura treated quartz and topaz (see the Fall 1990 Gem News section)—are isotropic substances, which have no effect on the stone's pleochroism.

In our experience, the presence or absence of pleochroism is a useful test to separate diffusion treatment from surface coating in anisotropic materials.

New setting method challenges diamond testers. Gemologists are well aware of the limitations that mountings can impose in gem identification. For example, specific gravity cannot be determined on mounted stones, prongs and other metalwork may obscure diagnostic inclusions, and modified lighting techniques may be required when attempting examination with a spectroscope.

Recently, Robert Crowningshield, of the GIA Gem Trade Laboratory, brought to our attention a problem with using thermal conductivity meters ("diamond testers") on very small diamonds set by an ingenious new method. The setting method, introduced by Claar Brothers, of New York, holds full-cut diamonds of about 0.01 ct by embedding them up to approximately one-half the crown area in a transparent, colorless, carbon-based polymer (figure 15). The setting method has been dubbed Carbolokd, with the set pieces called Carbolokd Diamond Jewelry.

Because the setting style has such a novel appearance, it would not be unexpected for some jewelers to suspect the identity of the set stones. And the first line of defense for most would probably be a diamond tester. Unfortunately, all such instruments have a lower size limitation on the stones they can effectively test; with many instruments, this lower limit is around 0.02 ct.

Some instruments, such as those produced by Presidium Diamond, include a small metal block with wells for testing small, loose stones down to 0.02 ct.; diamonds even this small generally read accurately as "diamond" when so tested unmounted or when they are set in traditional metal settings. Recent examination of



Figure 15. The diamonds in this pendant are mounted in a transparent colorless carbon-based polymer. The X-radiograph clearly shows the distinctive X-ray transparency of the diamonds. Pendant courtesy of Claar Brothers; photo by Nick DelRe. X-radiograph by Robert Crowningshield.

such small diamonds set in Carbolokd Jewelry, however, shows that they give readings short of the "diamond" indication (although considerably higher than the readings characteristically given by CZ).

It is important that gemologists keep this in mind when attempting to use diamond testers on stones set with this new style, and they should depend more on examination with magnification to help correctly identify the stones. Two important features are characteristic inclusions and the precision of cutting on even very small diamonds (virtually impossible with simulants this size). In addition, since the Carbolokd Diamond Jewelry employs many stones in each piece, a certain percentage of them will undoubtedly fluoresce blue to long-wave U.V. radiation, the most typical reaction of diamond; CZ, the most common simulant these days, tends to fluoresce a uniform orange. Another method that can be used, albeit not available to most jewelers, is X-ray transparency. The X-radiograph of the pendant in the inset in figure 15 clearly shows the diamonds' distinctively high degree of X-ray transparency.

Jewelry imaging/teleconferencing system introduced. A high-resolution color imaging and teleconferencing sys-



Figure 16. This computer-generated image of a gem-set watch was produced on an imaging system developed by Card 'N' Tag Systems.

tem that allows jewelers to store and transmit photographic images of gemstones and jewelry pieces (figure 16) has been developed by Card 'N' Tag Systems of Benicia, California.

The company reports that their system, designed for use in promotions, special orders, electronic catalogs, inventories, customer profiles, repairs and appraisals, uses image compression to solve the problem of color graphic file storage and transmission. Normal color graphics files require more than one megabyte of computer memory, impractical for teleconferencing or most other personal computer applications. The imaging system compresses images by more than 95%, allowing the transmission of full-screen jewelry images in under one minute. The software may be combined with other

programs, and images may be combined with text for a point-of-purchase display.

Tweezer improvement. After reading the *Gems & Gemology* article on diamond grit-impregnated tweezers (Summer 1990), Standwood S. Schmidt, a physician from Eureka, California, sent the Gem News editors a sample of 3M Microfoam Surgical Tape to examine. Dr. Schmidt uses this soft tape to "coat" the working surfaces of ordinary tweezers, thereby improving their gripping capacity while eliminating any danger of damaging even very small stones. The tape, which has one adhesive side (the other is soft and pliable), is easy to apply to the tweezers. The excess is simply trimmed away with a pair of scissors or a sharp knife blade.

ANNOUNCEMENTS

The Tucson Gem and Mineral Show will be held February 12-16, 1992, at the Tucson Convention Center. The featured mineral for the show is pyromorphite. For more information, contact the Tucson Gem and Mineral Society, P.O. Box 42543, Tucson, AZ 85733. Note that this year in Tucson a PGA Golf Tournament will be held February 10-16. Early room reservations are encouraged.

The American Gem Trade Association Gem Fair will be held in Tucson February 8-13 at the Convention Center. AGTA will announce the winners of the Spectrum Awards (a jewelry contest aimed at the effective use of colored stones) at that time. For information, contact AGTA at the World Trade Center #181, P.O. Box 581043, Dallas, TX 75258; (214) 742-4367.

The Gemological Institute of America will present various lectures and seminars in Tucson, February 8-13 at the Convention Center. For information, call (800)

421-7250 or (310) 829-2991, ext. 227, or write the GIA Registrar, P.O. Box 2110, Santa Monica, CA 90407.

American Craft Association joins fight against design knock-offs. The newly formed American Craft Association has joined The Design Coalition in its fight to pass legislation to discourage copying of original and distinctive U.S. designs. The proposed bill, H.R. 1790, would give copyright-like protection to original, distinctive, and discretionary designs of useful articles. Its goals are to help preserve the creative integrity of original work of designers and help protect their livelihood.

The American Craft Association is a Washington, D.C.-based trade association representing the American Craft Council's 26,000 members. The Design Coalition is composed of more than 40 manufacturers, trade associations, labor unions, and designers working to strengthen U.S. design protection.