Gems & Gemology

GIA

SPRING 1971

GEMS & GEMOLOGY is the quarterly journal of the Gemological Institute of America, an educational institution originated by jewelers for jewelers. In harmony with its position of maintaining an unbiased and uninfluenced position in the jewelry trade, no advertising is accepted. Any opinions expressed in signed articles are understood to be the views of the authors and not of the publishers. Subscription price $3.50 each four issues.

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IN THIS ISSUE

LABORATORY OF GEMOLOGY & ASSAY OF MATERIALS.

BANCO MUNICIPAL DE LA CIUDAD DE BUENOS AIRES, ARGENTINA

by

DR. JOSE DELLA SALA

The Laboratory of Gemology & Assay of Materials, being a constituent part of the Pledging Department of the Banco Municipal de la Ciudad de Buenos Aires since 1939, is engaged in the determination of species, variety and origin of the many gemological materials, generally set in jewelry, including ornamental stones, ivory, amber, precious metals, etc., delivered to the bank in order to be pledged, sold or investigated. Ours is an autonomous Institution of the Municipalidad de la Ciudad de Buenos Aires, and is the most important organization of its kind in Argentina.

The Laboratory of Gemology consists of three sections:

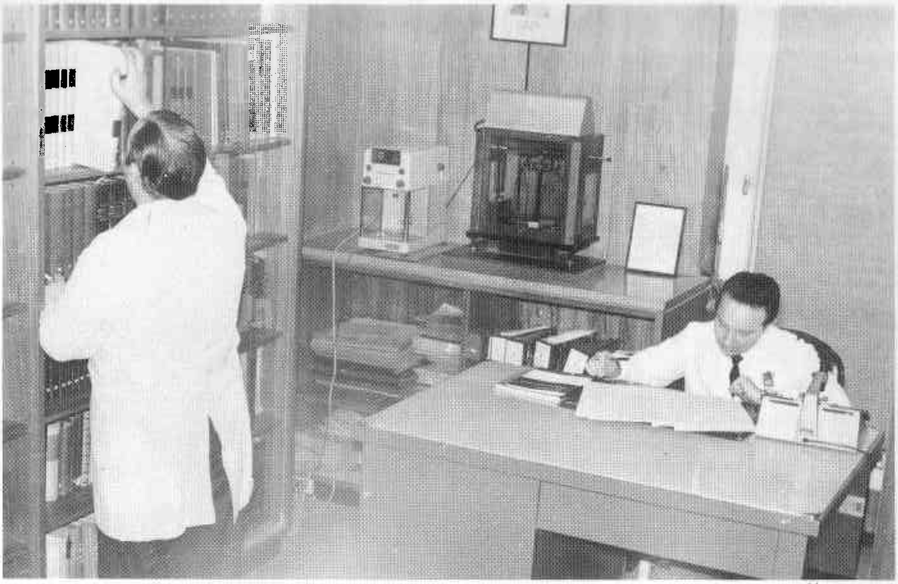
(1) The Laboratory is equipped with modern instruments, including gemological microscopes, refractometers, spectroscopes, polariscopes, dichroscopes, long- and short-wave ultraviolet light, X-ray equipment for the identification of pearls and for analysis of crystal powder by the diffraction method, and X-ray equipment for radiographic and radioscopic study of pictorial pieces, etc.

(2) The Gemological Museum, where an important collection of rough and cut gems of natural and synthetic origin is exhibited.

(3) The Technical Library, continuously kept up-to-date with more than 500 volumes and publications, not only about gemology but also about chemistry, silversmithing, fine arts, etc.

The Laboratory completes a daily average of 150 reports duly signed by specialized university technicians.

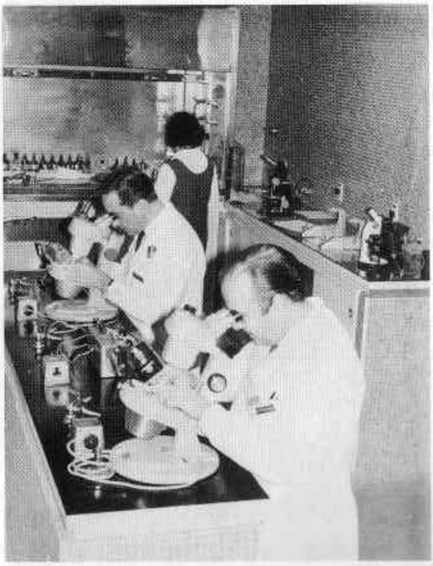
The form in which materials to be identified are presented, generally set in jewelry pieces of great value, makes the identification rather difficult, since some determinations, such as specific



1. View of the Laboratory Library.

gravity and chemical composition, etc. cannot be made. In spite of this, and because of the experience of the technical personnel in charge of analysis, it is possible to furnish a full report on the materials within a short time. Rapidity and surety of information given is a characteristic of

2. Some of the gem collection of the Museum.



3. View of the Laboratory and some instruments.

the work developed in the Laboratory of Gemology and Assay of Materials.

Insurance companies, well-known jewelers, and the public are frequent users of the Laboratory

5. X-ray equipment for the radiographic study of paintings.

4. X-ray equipment for determining the origin of pearls and analysis of crystal powders.

services when they want to be sure of the legitimacy of gems. So, previous payment of a tariff, a certificate stating species, variety and origin of the gem is obtainable.

For development of assigned tasks, the Laboratory counts on the experience of technical personnel, modern instruments and up-to-date information about new natural or synthetic gems, and is in constant contact with the most important gemological centers in the world. The Laboratory has received synthetic emeralds of United States and Austrian origin, strontium titanate, hydrothermal synthetic rubies and other new gemological materials that were identified as to species and origin by previous theoretical knowledge gleaned from publications containing information about the manufacture of these materials.

Developments and Highlights at GIA's Lab in Los Angeles

by

RICHARD T. LIDDICOAT, JR.

Lovely Orange-Red Spinel

We are frequently asked to test magnificent emeralds, rubies, sapphires and diamonds. Often, the colors are lovely. Usually, we have seen comparable colors. Occasionally encountered is a very rare color that appeals to everyone who sees it. Such a stone was in for identification recently that was assumed by the owner to be an orange-red ruby. It seemed fitting that as the 70th birthday approaches of the great gem spectroscopist, Basil W. Anderson of the London Laboratory, the first test performed on this stone employed the spectroscope. We observed the series of lines in the red that Anderson so aptly described as organ-pipe lines; they characterized red spinel.

This was the most delightfully appealing spinel encountered in a long time, and the color was appreciably different from any we had seen. Parhaps the owner, who had sent it in assuming he would receive a report reading "natural ruby,"was disappointed, but we were delighted with the opportunity to see it.

Fascinating Inclusions

Chuck Fryer, GIA's Laboratory Supervisor, asked me to look at some inclusions in a greenish-blue, oval-cut transparent material. Several were identical and unique in my memory. They seemed to have a reddish center and to have flat diamond-shaped vanes extending from it, reminiscent of a satellite in space after the folded-in vanes had been expanded to their full extent. We had difficulty capturing them on film clearly, but *Figure 1* gives a good idea of their nature. They were accompanied by spherical gas bubbles, typical cobalt lines in the spectroscope, and a 1.73 refractive index, plus strong anomalous double refraction, identifying the material as synthetic spinel. I wish we could account for these unique inclusions in synthetic spinel.

Figure 1.

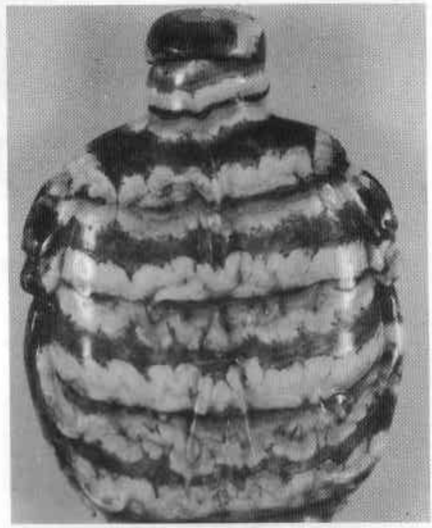


Figure 2.

Elephant- or Mastadon-Tooth Snuff Bottle

We were very interested to receive a snuff bottle for testing that had the typical structure of an elephant or mastadon tooth *(Figure 2)*. The two portions, one presumably mostly dentine and the other the equivalent of conchiolin, showed different R.I.'s, dentine being about 1.56 and the conchiolin about 1.60. This was the first such snuff bottle we had been called upon to test.

Unusual Star Facets

Occasionally, a diamond with a very flat crown will have star facets with an especially acute angle from the plane of the table. Even though the star-facet angle is flattened, seldom is it so flat that a table reflection appears in the star facets. In *Figure 3,* a second table reflection is visible, in addition to the one in the pavilion; it is seen as a ring around an area outside the table in the star facets.

Fluorescent Blue Sapphire

The commonly used quick test used to distinguish natural from synthetic blue sapphire is short-wave ultraviolet light in a darkroom. The synthetic usually shows a yellowish fluorescence; the natural is usually

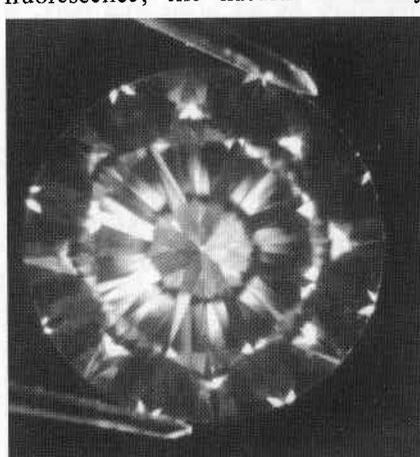


Figure 3.

inert. A natural blue sapphire tested recently showed relatively strong yellowish fluorescence under the short wave ultraviolet light in the zones that were deeply colored. It was rather strongly zoned in a portion of a hexagonal pattern *(Figure 4)*.

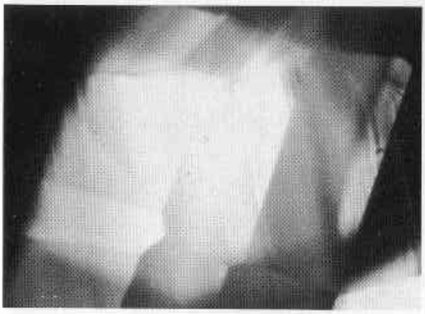


Figure 4.

Unquestionably, the reason for the fluorescence was that the stone was almost completely without the usual iron content, as was shown by the lack of an iron absorption line at 4500Å. Occasional sapphires from Kashmir and Ceylon are without the iron line, but they seldom fluoresce to short-wave ultraviolet. The hexagonal zoning proved natural origin.

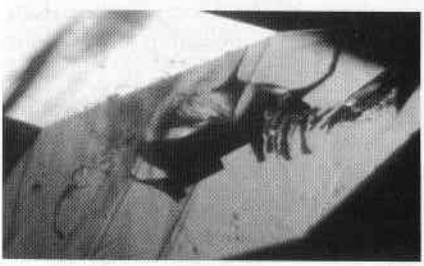


Figure 5.

Two-Phase Inclusions in Colombian Emerald

We expect to see two-phase inclusions in natural emeralds, of course, but it is rare to encounter ones that show such angularity as that in *Figure 5*. There are several right-angled bends on the bottom half of the dark area, which represent the partially gas-filled negative inclusion.

Doctored Synthetic Rubies

Very infrequently, we encounter flame-fusion synthetic rubies that have been altered to give them a more natural appearance. In *Figure 6,* a

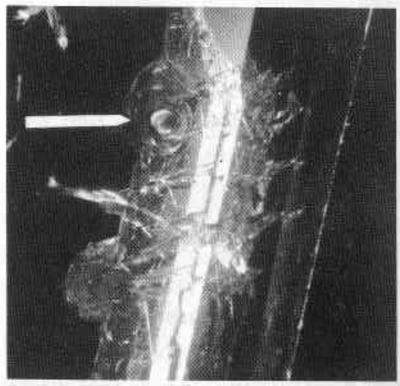


Figure 6.

rather circular area may be seen opposite the arrow, which represents a drilled and reamed depression in the pavilion and that was later filled with plastic. The gray area below it is also plastic filled.

In *Figure 7,* in the gray area, which is below the drilled area, a dark semicircle is seen that outlines the plastic filling of a second depression. It may be seen that a good part of the bottom portion of the pavilion had been filled with a material of a lower R.I., by the fact that the luster on the right-hand side of *Figure 7* is considerably higher than that to the left.

Figure 7.

It is our feeling that this is an example of the alterations that were produced a number of years ago by an American firm that planned to make this a major product. Since the project failed very little of this kind of alteration has been performed to our knowledge. Under casual examination, directed through the top of the stone, such a synthetic has a deceptively natural appearance.

Amber Snuff Bottles

During the past several years, we have been reporting the testing of many snuff bottles and carvings of various descriptions. Recently, we received two bottles from the same source that appeared at first glance to be amber. One was a cloudy, light-yellow amber and the other a rather darker-than-usual amber. Upon checking with ultraviolet light, the cloudy amber looked very natural, whereas the other with the cap off appeared to have been coated. In other words, where the bottle had been ground off at the neck for the stopper, the fluorescence of the outermost ring was considerably less bright than that in the center portion.

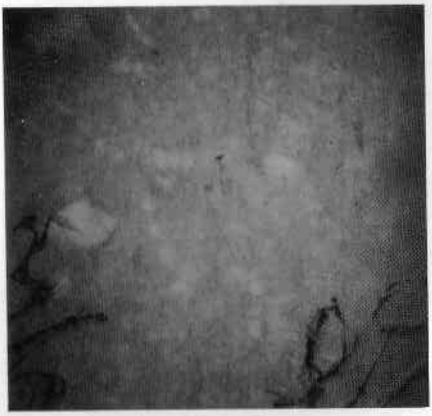


Figure 8.

Both portions tested out correctly for amber, but when a bright light was put under the bottle and it was examined under 10x magnification, a structure such as that seen in *Figure 8* was seen. This is a structure we expect from pressed amber. Although the irregularity of the fluorescence pattern we expect in a pressed piece was not evident, we assumed that this was hidden by the dark coating. We were satisfied that it was a pressed-amber piece. The irregular black lines on the photograph were caused by engraving on the bottle that had been filled with gold.

Some of the interesting, almost agatelike structure, of the cloudy amber is indistinctly shown in *Figure 9.* Under very high magnification, often a myriad of minute bubbles may be seen *(Figure 10).*

Figure 9.

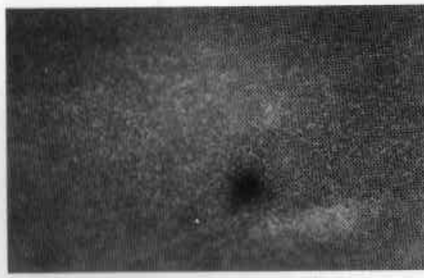


Figure 10.

Synthetic vs. Natural Emeralds

For the past year, we have been inundated with identifications involving the identity of transparent green materials that are obviously either synthetic or natural emeralds. Apparently, this has been occasioned by the growing number of reports of the difficulty of distinguishing between the two. Since the stories have appeared that both Gilson and Linde have been producing synthetics within the property ranges of natural emeralds, and with a small percentage of the Gilson output no longer showing fluorescence to ultraviolet, many jewelers seem to need reassurance on their identifications.

An additional cause has been the popularity of Trapiche natural emeralds, which have a cloudy appearance quite unlike that of most other natural emeralds. These may be new in the experience even of those who have been examining emeralds for a lifetime. Trapiche emeralds, which are from Colombia, apparently have been found both at the Chivor and Muzo Mines. They are distinguished by a cloudy appearance and by properties rather higher than the usual natural material. For example, the high R.I. will usually go to 1.59 or above; this is a characteristic that has not yet been seen in synthetic emeralds of any kind. The inclusions in Trapiche emeralds, which have been discussed many times in *Gems & Gemology,* were very prominent in an example tested recently in the Los Angeles Laboratory *(Figure 11).* This was a slightly-more-transparent-than-usual stone.

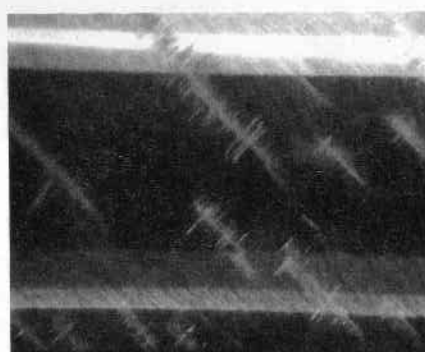


Figure 11.

Tomb Jade?

A jade dealer, who frequently has very fine carved-jade objects tested, sent us a greenish-white carved piece with a typical brownish orange rind seen in some nephrite. The rind had seemingly been used very effectively in the carving to highlight the message of the carving. The dealer suspected that the color of the rind was the result of artificial coloration.

In checking out his assumption, we found that he was correct, and that a relatively thin coating of undetermined nature had been painted on some of the greenish-white surfaces to give the attractive bicolored effect. The coating was very thin and flaked away under the point of a pin. Since he only wanted conformation that the material was coated and did not want it damaged, we were unable to determine the nature of the coating.

Gigantism in One Amazing Trio

One day we were called upon to identify three huge gemstones. A sapphire cabochon *(Figure 12)* was the largest; it weighed nearly 2½ pounds (approximately 5600 carats). There was also a ruby cabochon of the typical Mysore type that weighed about 1795 carats *(Figure 13)*, and a faceted green beryl of close to 1180 carats *(Figure 14)*. The stones had dimensions of 4 3/8 x 3 7/8 x 2 1/4", 3 1/8 x 2 1/2 x 1 1/2", and 2 7/8 x 2 1/4 x 1 15/16", respectively.

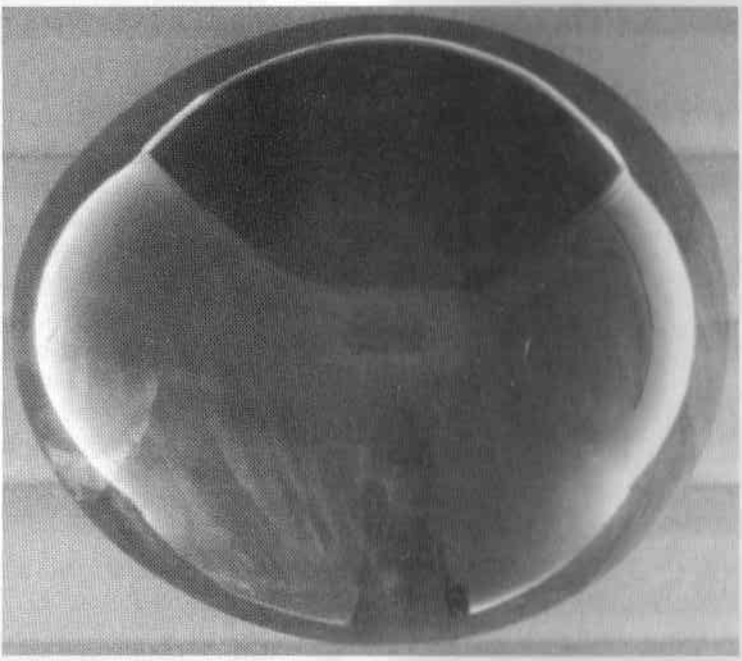


Figure 12.

These enormous gemstones were all

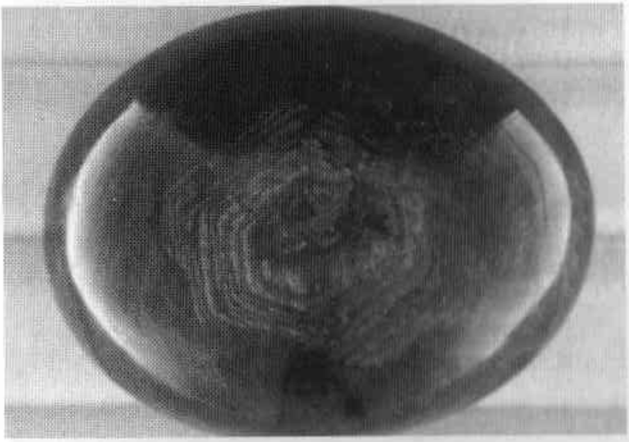


Figure 13.

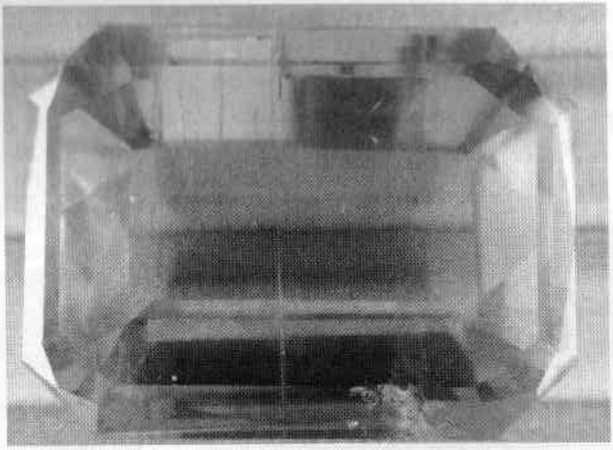


Figure 14.

brought in by the same person.

A short time later, we had a carved opal object, much of it fairly attractive. It was 4 x 5" and was photographed at ½ actual size *Figure 15).*

Odd Glasses

In the past few weeks, we have been asked to test several specimens of one unusual type of glass and one of a second kind. In each case, under magnification we could see evidence of a crystalline structure, usually in the form of dendritic growths extending throughout the material. As a result, we scraped a small amount from the girdle area and used X-ray diffraction to identify the dendritic material.

The kind of which we have seen several examples proved to be fluorite

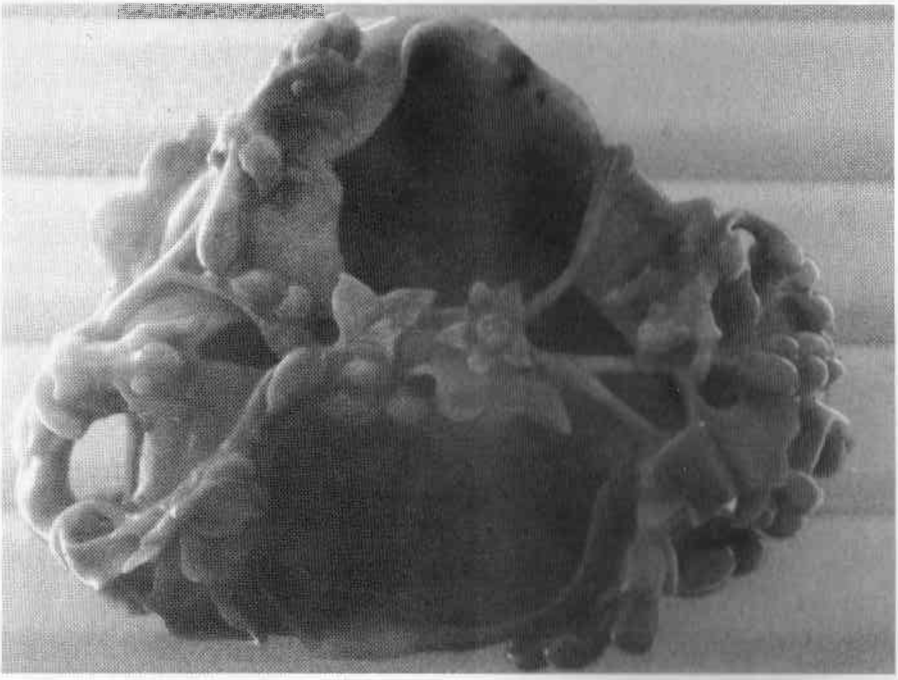


Figure 15.

and the other, wollastonite. The material that contained fluorite had overall properties that were quite different from those of fluorite; it was considerably higher in R.I. than fluorite and much lower in S.G. The overall properties of the wollastonite glass were much lower in both R.I. and S.G. than wollastonite. In each of the materials tested, we could see gas bubbles clearly, which led to the glass determination, but the dendritic crystal pattern was disquieting.

Despite the X-ray diffraction patterns in both situations, we were satisfied that the material was an unusual form of glass, possibly a slag. The glass that gave a wollastonite diffraction pattern had an index of approximately 1.51, an S.G. of about 2.50, and gas bubbles. It showed strong X-ray fluorescence, which is a characteristic of wollastonite, but wollastonite would have indices of near 1.620 to 1.634 and an S.G. of 2.9.

Star Doublets

Several years ago, Robert Crowningshield, GIA's New York Laboratory Director, used a section of blue star sapphire as the base of a star doublet. Using a colorless cabochon on top of a small section of blue-star base, he made a very effective star imitation to which he jokingly referred as a "Crowningstar."

Recently, we saw a pair of very similar star doublets that had been sold to a jeweler. In this case, the doublet was made up of a black star sapphire base cemented to a padparadsha, synthetic sapphire crown. The star was very clear in one of the two examples and considerably less distinct in the other *(Figures 16 and 17)*. The structure of the base section of natural black sapphire is shown clearly in *Figure 18,* which was taken

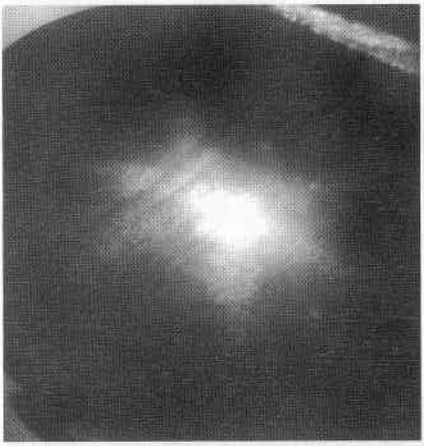


Figure 16.

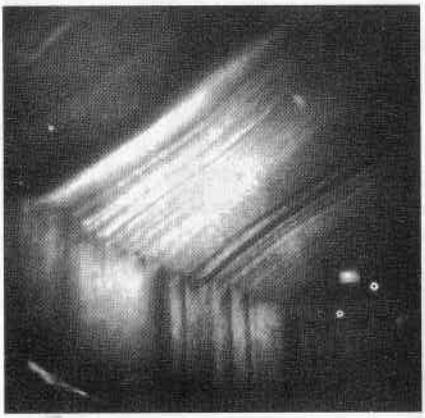


Figure 18.

with base lighting through the two portions of the doublet. Another photograph was taken to show the construction of the doublet. This was taken from the side and shows the clear synthetic sapphire crown and the fairly thick base of natural star sapphire *(Figure 19)*.

New Synthetics

A short time ago we received a synthetic material new to our Laboratories: another yttrium

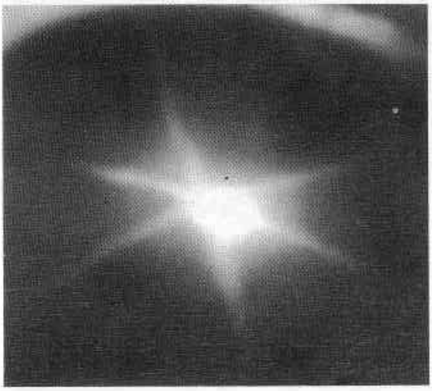


Figure 17.

Figure 19.

aluminate with a structure different from that of YAG. YAG has a formula of $Y_3Al_5O_{12}$; this could also be expressed as $3Y_2O_3{:}5Al_2O_3$. A second yttrium aluminate with the formula $YAlO_3$, or, expressed in a different way, $Y_2O_3:Al_2O_3$, is an orthorhombic form of yttrium aluminate. It has indices of approximately 1.938-1.955, and its hardness by the Knoop indentor test is identical with that of YAG at 1800. It has an S.G. of 5.35, compared to the 4.55 or 4.56 for YAG.

This is another of the materials that have been doped with various oxides to produce laser materials for industry. The specimens we received had colors that we would describe as pink, orangy pink, and light bluish violet.

All specimens showed very strong rare-earth absorption spectra. The strongest is shown in *Figure 20,* perhaps the most spectacular spectrum we have ever seen.

Powdering a small portion of one of the specimens for X-ray diffraction-powder photography, we obtained the pattern shown in *Figure 21*. The little information we have indicates that there is no present intention to put this material on the market as a gem substitute. Even so, it may be encountered in cut form in laboratories around the world in the next year or two. Since its properties do not fit those of any known natural material, it seemed incumbent upon us to report the properties either provided by the manufacturer or observed in this Laboratory. Anyone with X-ray powder-photography equipment who would like to have a report on the line positions and intensities may write to GIA for the essential figures.

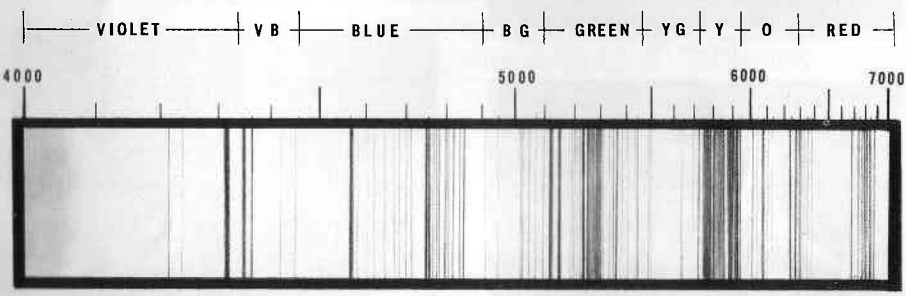


Figure 20.

Figure 21.

Tourmaline Collection

We had a unique opportunity to examine a magnificent collection of the exceptionally wide variety of colors in which gem tourmaline occurs. The color range was as wide as that of any collection we have ever encountered in gem-quality tourmaline.

We did take the opportunity to test

by accurate hydrostatic means the S.G. of the specimens. They were as expected: within the range for magnesium tourmaline. With these large specimens, we could expect a high degree of accuracy. With one exception, all of those tested had S.G.'s of 3.04 to 3.05; the other was 3.02.

Acknowledgements

We with to express our sincere appreciation for the following gifts:

To **Ocala Jewelers Inc.**, Ocala, Florida, for a calcite crystal aggregate specimen for our collection.

To **Ed Swoboda**, for a fine zoisite crystal from Tanzania, to be used in our collection and for student use.

To **Jay Spilo**, student, Spilo Art & Jewel, Joffa, Israel, for a bicolored red and green marquise diamond. The marquise generally is yellowish green, but in the center area, a rich medium-red color is visible. It is not the usual garnet-red color of so-called red diamonds.

To **Carroll Chatham**, San Francisco, California, for three fine flux grown ruby clusters for use in our display case.

To Graduate Gemologist **Ben Gordon**, for yet another selection of stones including jade, shell cameos, and many other gem materials.

To **S/Sgt. Ronald V. Hay**, student, for a parcel of rough black star sapphires.

To **George Brooks**, Santa Barbara, California, for three beautiful boulder opal cabochons, and several pieces of rough boulder opal.

To **Paul A. Marriott**, student, for a slab of nephrite jade.

To **K. Jackson.** Coolangattee, Australia, for a rutile cabochon. We seldom see rutile cut en cabochon.

To **Steller's Jewelers**, Milwaukee, Wisconsin, for a large selection of doublets and assorted stones, including tourmaline, chalcedony and turquois, which always are welcome for student study purposes.

To **Edgar F. Borgatta, Ph.D.**, student, Gempro Distributors, Rupert, Vermont, for his very generous donation of over 500 jadeite cabochons to be used in our gem identification class. This is a most welcome gift.

To **John Fuhrbach**, student, Jonz Inc., Amarillo, Texas, for a number of pieces of apatite rough.

To **Louis J. Bernard, Jr.**, C.G., Bernard & Grunning, New Orleans, Louisiana, for a very fine selection of stones including natural and synthetic corundum, demantoid garnet, aquamarine, turquois and pearls for our gem identification classes and display collection. We were sorry to learn of the death of his father, Louis J. Bernard, Sr., a long time friend and Gemologist.

Developments and Highlights at GIA's Lab in New York

by

ROBERT CROWNINGSHIELD

Opal Nomenclature

In the last issue of *Gems & Gemology,* it was mentioned in this column that we had been informed that only black opal from Lightning Ridge may be called *black opal.* I failed to state that this was one man's opinion, and that we knew of no regulation or even local Australian custom that has so decreed. In fact, until the rather vehement claim was made, we would have considered the stones under discussion to be simply black opal. To be sure, they were clear opal overlying dark ironstone matrix and could be likened to stones from Lightning Ridge, in which clear opal overlies black or dark-gray potch. Since the last issue, we have written to the Australian Gemmological Association for more information about any possible regulations. Meanwhile, we have had several interesting responses to the Lab column.

We are particularly indebted to Mr. George Brooks, jeweler in Santa Barbara, California, not only for his authoritative discussion of the subject, but for samples of both white and black boulder opal. With long experience in visiting the Australian mines, dealing in opal and cutting for the wholesale trade, he stated that the black boulder opal (so called to distinguish it from Lightning Ridge material) had some advantages over the latter. He stated that it does not crack, or craze, as some Lightning Ridge material does, and the color of the finest stones holds up well under all lighting conditions: daylight, fluorescent and incandescent. We can only agree with him that some of the stones are magnificent, and such boulder opal seems to be tne only material currently available to help relieve the black-opal shortage. *Figure 1* illustrates both rough and cut ironstone boulder opal, for which we are indeed grateful to Mr. Brooks, who stated that they came from a mine in central Queensland.

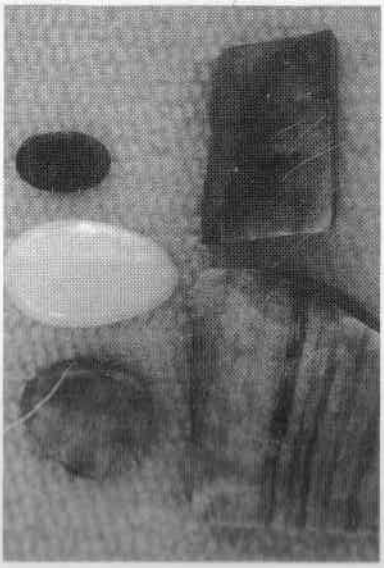


Figure 1.

Figure 2.

Treated Corundum

Figure 2 is a PhotoScope picture of two artificially colored cut stones fashioned from highly fractured grayish-pink corundum. We have had several occasions to identify this stained material. In one case, the stones were sold as rubies, but one stone became almost totally gray during the manufacture of a piece of jewelry. The identification was made easy by the fact that under long-wave ultraviolet the dye appeared orange in color and could be seen penetrating the cracks. The fluorescence and color reminds one of fluorescein dyes used in industry.

Russian Diamond

Although Russia is certainly one of the most important producers of gem diamond, and we have probably graded and examined many of them, it is almost impossible to obtain incontestible proof of the origin of either rough or cut Russian stones. There have been attempts to characterize the material: Is it good color? Is it more brittle than other diamond? Are the grained stones we have been seeing lately possibly from that source? Is it true that they do not stand rapid temperature changes? Are there any fancy colors coming from that country?

We have been unable to obtain positive answers, although there are several known dealers in Russian-cut stones both in this country and Europe. Also, we have conflicting reports as to the quality of the cutting being done in Russia.

We were happy to examine a large, slightly distorted, fine-color octahedron that the bearer said he was "99%" sure was of Russian origin. The stone showed considerable red

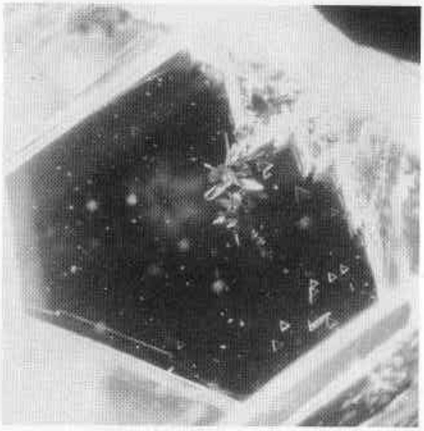


Figure 3.

interference under the polariscope, particularly at the extremities of the large inclusions. In Figure 3, one can see at the left of the inclusions a ghostly flowerlike pattern made up of microscopic white pinpoints. The strain pattern was so distinct that we have recorded it on color film, with the hope of recording any changes when the stone is cut.

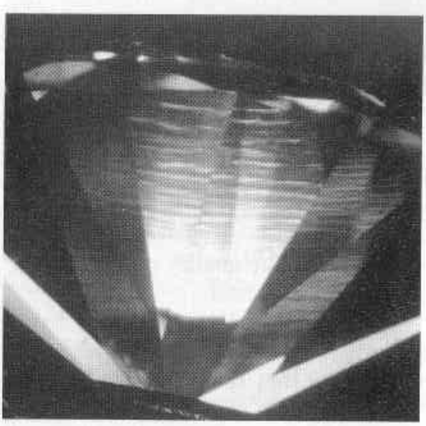


Figure 4.

Graining in Diamond

Appropos of the above discussion of graining in diamonds, *Figure 4* illustrates pronounced graining in a round brilliant-cut diamond, which in certain directions appears like curved striae in synthetic corundum.

Crazed Diamond Surface

Figure 5 is a PhotoScope picture of what appears to be a crazed surface on the pavilion of an emerald-cut diamond. We were unable to determine if the effect was caused by an error in orientation of the rough, or

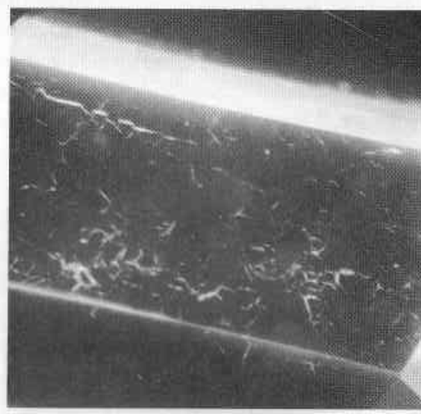


Figure 5.

if the cracks were inherent fractures and cleavages of an alluvial stone. Again, we wondered if the stone could have met with some accident, such as rapid temperature change.

New Diamond Design

Attempts to minimize the bowtie effect in the middle of marquise and pear-shape diamonds are continually being made. We have encountered very fine stones that had been recut with new central angles and had been greatly improved. *Figure 6* shows another attempt at this worthy end. The middle pavilion facets have been split so that light does not reflect or leak through the entire area at one time. We judged the design to be quite effective.

Figure 6.

Unusual Doublet

A most unusual identification is shown in *Figure 7.* It is a rather crudely made cluster ring consisting of diamond-topped doublets with zircon backs. The usual difficulty in making diamond adhere to other crystalline materials was evident, since one stone had lost its pavilion.

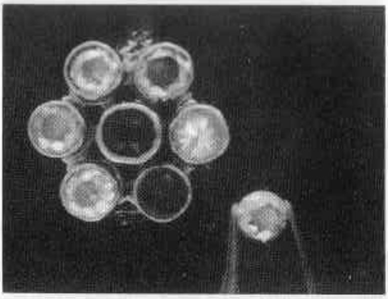


Figure 7.

Old-European Cut

Figure 8 shows the almost classic reflections of the culet of an old-European brilliant at the tips of the bezel facets. Typically, too, one can see the effects of wear on the very thin girdle.

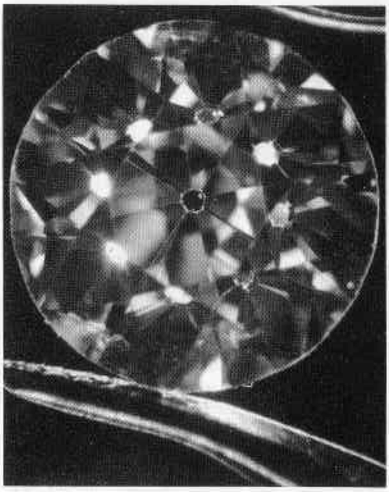


Figure 8.

Black Diamond

To the unaided eye, treated and natural-color black diamonds seem indistinguishable. *Figure 9* depicts a 10-carat stone with only occasional areas of whitish fractures visible. If it were a treated stone, there would be greenish glints along the fractures and the stone would be truly opaque. *Figure 10* shows that it is really an

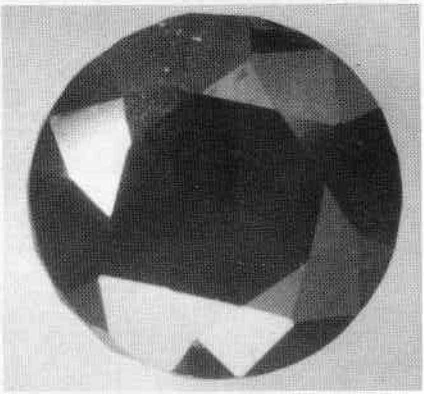


Figure 9.

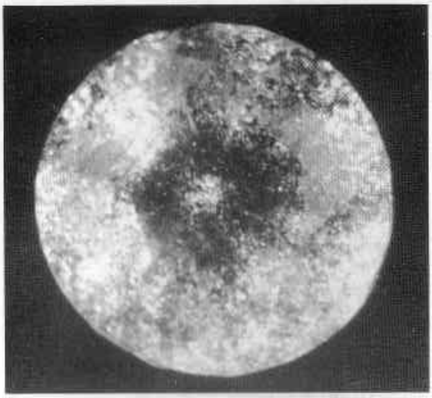


Figure 10.

intensely flawed natural stone. Transmitted light of the Gemolite provided the answer.

Acknowledgements

We wish to express our appreciation for the following gifts:

To **Stanley Gross**, Philadelphia jeweler, for a 14.32-carat, dark-blue, emerald-cut tourmaline, which makes a handsome addition to our collection.

To **Murray Darvik**, GIA student, I. Morgenstein, Inc., New York City, for four cut YAG's.

To **Dr. Howard M. Dess**, of National Lead Co., for several well-cut examples of strontium titanate.

To **Tina Singer**, of M. & L. Singer, New York City, for a fine selection of synthetic rubies and sapphires.

To **James Drilling**, New York gem dealer, for several dozen synthetic sapphires and spinels for class use.

Guillermo Russek from Chihuahua, Mexico, gave us some examples of what to us was a new kind of opal from his state. It was a soft powder-blue common opal with areas of play of color in some stones. Others lacked the play of color but had an attractive, if somewhat subdued, color. He had a large selection of cut stones, and was in this country to obtain the reaction of the trade.

From **Mr. E. E. Parrott**, gem man and lapidary of Vancouver, Washington, we received a nice example of green sphalerite that he had cut on an experimental wax lap. This stone is notoriously difficult to cut, and the orientation of the rough to avoid cleavage spalling is imperative. Obtaining a good polish, which he did, is not easy.

GIA's JEWELRY DESIGN PROGRAM

by

IRENE BUSER
Jewelry Design Instructor

We have noticed a rapidly growing interest by retailers in Jewelry Design. They express the feeling that it is becoming a more necessary and essential part of the retail jewelry store, and that today's clientele are seeking exclusive creations in jewelry; they are demanding personalized service. Retailers report that they are increasing sales and developing a standard of prestige by expanding their business to include the art of rendering designs. Customers seem quite receptive to the individual attention they receive from the jeweler who can provide these artistic and creative expressions of an item for an article of jewelry, designed especially for them.

Jewelers realize that fashion and fad play an important role in the designing of jewelry, but are reaching out to learn the techniques and procedures to create a long-lived adornment which will convey and carry the elements of design that constitute "fine quality jewelry." Customers cherish a personalized item of jewelry; thus, the jeweler is seeking the knowledge to be able to produce professional renderings in depth, dimension and color, using their own innate ability to create.

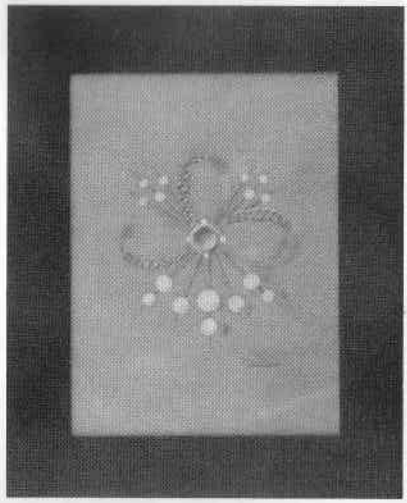


Figure 1: Bowknot pin, containing baguette and brilliant-cut diamonds with pearls. Note how the stones appear to curve with the metal and bows.

GIA's recently revised Jewelry Design course is structured to provide the retail jeweler with the opportunity to learn simple techniques of sketching, rendering, painting, shading, perspective; the full comprehensive outlook of developing fine quality designs in jewelry.

In this course, a student need not have drawing ability in order to learn the skills of rendering professional jewelry designs. With the simple basic

Figure 2: Pendant. Design taken from a wig, as seen from back. Yellow-gold pendant with two pearls (upper left, lower right), and pieces of coral and turquois used as accents.

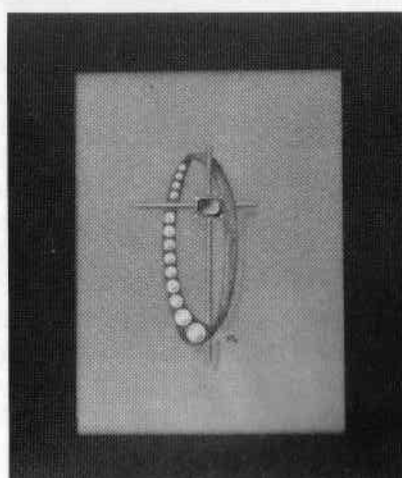
techniques taught, any jeweler having only an average ability to work with his hands, plus a willingness to experiment using his imagination and an attitude of patience, will amaze himself by what he can accomplish. Jewelers taking the course appreciate the value in learning the practical factors in design; beauty, wearability and durability of an item; how to create an item that will "speak out" about the wearer; what types of design and color best compliment the client; the characteristic features of a customer to enhance as well as those to minimize; and what to observe when working at the counter with a prospective client.

Jewelers have been enthusiastic about the results obtained from GIA's one-week classes in Jewelry Design which are conducted in the Los Angeles and New York offices, as well as in major cities throughout the United States. In addition, the response to the recently rewritten 34 lesson correspondence course encompassing a comprehensive program in design has been excellent.

New Six-Week Residence Program

In August of 1970, a new six-week residence program was developed in Los Angeles to satisfy a growing demand from jewelers who sought a more extensive resident study in design. Students come to Los Angeles for an exceptionally comprehensive program. All of the jewelry design techniques are mastered under the

Figure 3: Brooch. Idea taken from race track. Pearls represent cars running down the backstretch with white-gold crossbars representing the finish line, as well as adding interest and purpose to the design.



constant supervision of an instructor.

The response toward this newly developed class has proven most gratifying, with students expressing the confidence that their retail business will be expanded with this new talent in promoting their personal creations of fine-quality jewelry design.

Upon successful completion of either the correspondence or full resident program a Jewelry Design Diploma is awarded.

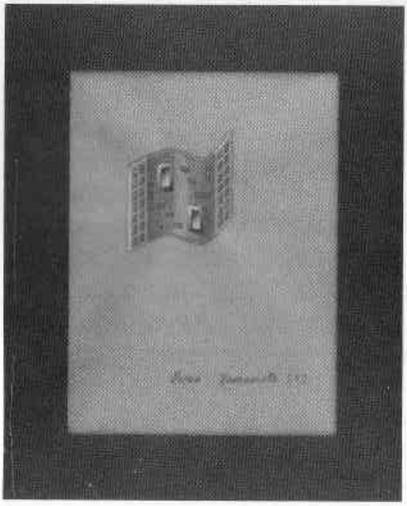


Figure 4: Brooch. This idea was taken from an open door with floor-to-ceiling windows on either side. Diamonds and piecework have been added as accents.

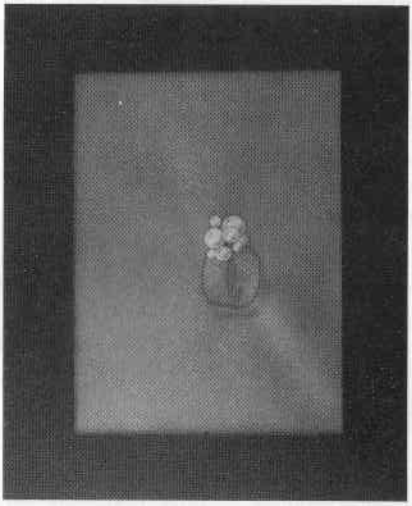


Figure 5: Ladies' "bubble" ring. A simple yellow-gold band with various-size pearls mounted to give the appearance of bubbles lying on the band.

Gemological Digests

WORLD'S LARGEST MANUFACTURED DIAMOND PRODUCED BY UTAH SCIENTISTS

(Ed. note: The development reported in the following digest may prove more important in industrial diamond technology than the original synthesis of diamond grit. Polycrystalline synthetic diamond – a synthetic carbonado – that can be shaped to suit the task as well as having a much longer useful life, is a truly revolutionary discovery.)

The largest known manufactured diamond in the world – a 20-carat cylinder larger than a toothpaste cap – has been produced by a team of Utah scientists after years of intensive research in a secluded laboratory here.

Dr. H. Tracy Hall, who in 1954 became the first man to accomplish a confirmed synthesis of diamond, unveiled the unpolished gray-black stone at his tree-cloistered Megadiamond Corporation laboratory on the outskirts of Provo last fall.

Hall, president of Megadiamond and Distinguished Professor at nearby Brigham Young University, said the process breakthrough that made possible creation of the material called *Megadiamond* (trademark), is more significant than his initial discovery of how to make diamond. "It is the harbinger," Hall said, "of an exciting new era in industrial-diamond technology."

The soft-spoken scientist said Megadiamond of 100 carats is within the firm's capability, and that commercial production "can begin immediately."

Dr. Harvey Fletcher, former director of the Bell Research Laboratory, called the achievement one of "far-reaching significance," and Governor Calvin L. Rampton issued the following statement:

"The creation of a multicarat diamond by man is, without question, a technological breakthrough of the highest order. We are justly proud that this event has been achieved in Utah – proud of our Utah industry and proud of the extraordinary talent that chooses Utah as a place for man, for industry, for movement forward. Utah salutes Dr. Tracy Hall and Megadiamond Corporation."

Elaborating on the achievement, Hall explained that the 20-carat stone is the result of a first-of-its-kind process for bonding diamond particles into large, usable polycrystalline diamonds.

"The closest thing in nature to Megadiamond is carbonado, a polycrystalline diamond mined chiefly in Brazil," Hall said. "Carbonado is extremely tough, but because of its many-crystalled structure it is not easily shaped. You can't cleave it accurately – you have to grind it to the shape you want. Since only diamond will cut diamond, this is an expensive process – analogous to cutting a board with a wooden saw."

"On the other hand," Hall continued, "Megadiamond is comparable to carbonado in toughness but can be formed directly in virtually any desired shape: wedges, points, flat plates, pierced parts, rollers, spirals. This formability feature eliminates the time-consuming grinding process and opens up limitless possibilities, particularly in view of the fact that industrial-diamond use is increasing 10% a year, twice the annual industrial growth rate."

Hall predicted that wherever industry needs large-sized diamonds for wear or abrasive applications or for high resistance to deformation, "Megadiamond will be part of the action."

Some immediate applications the firm sees for Megadiamond are wire-drawing dies, drills, chisels, thread guides, saws, blades, specialized machining tools, and grinding wheels and grinding-wheel dressers. (*Figure 1* shows a 20- and a 16-carat grinding-wheel dresser. *Figure 2* shows, from left to right, a 1-carat mounted dresser, a 12-carat dresser with a central hole, a 3.30-carat cabochon mounted in a man's ring, and, front center, a 1.50-carat faceted Megadiamond.)

"But we're looking at a good many other intriguing possibilities down the road a bit," Hall said.

Dr. Bill J. Pope, who collaborated with Hall on the project with Dr. M. Duane Horton, said that Megadiamond has far greater strength than existing industrial-diamond materials, which are held together with plastic or metal-bonding agents. "That's another reason we're confident we're going to have real impact on the country's $100 million-plus annual diamond-tool industry," Pope said.

Pope, Megadiamond's Executive Vice President and former Chairman

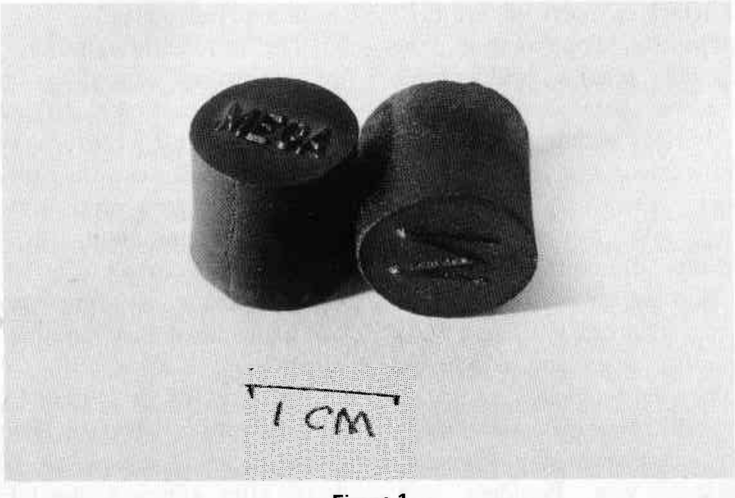


Figure 1.

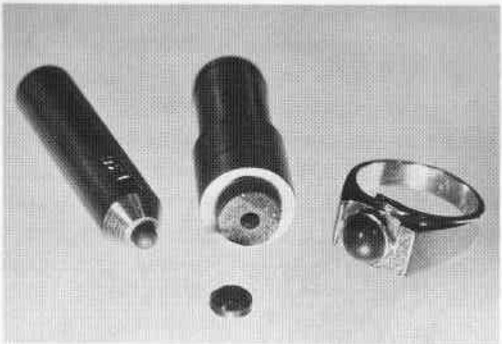


Figure 2.

of the Chemical Engineering Department at BYU, detailed two other significant advantages of Megadiamond: "Natural diamonds, used in many industrial applications, are single crystals; consequently, they cleave along certain planes. This means that the angle of attack at which a natural-diamond tool contacts the work is critical and must be held within narrow limits to avoid chipping the diamond. Because Megadiamond is a many-crystalled material and the crystallites are randomly oriented, uniform hardness is achieved and the angle of attack is much less critical."

"Additionally," Pope went on, "the Megadiamond process will enable industry to put diamond particles and powder back together. This is of tremendous importance, because most processes involving cutting and processing with diamond produce by-product diamond chips and powder. Now we can reassemble these pieces, thereby reducing manufacturing costs and conserving existing diamond supplies."

Asked why Megadiamond doesn't look like engagement-ring diamond, Dr. Horton, Vice President and Secretary-Treasurer, said that "something happens in the bonding process – we're not certain just what – that absorbs all light in the diamond material. We're conducting further research on this phenomenon."

Horton added, however, that "carat-wise, about 80% of the diamond market is industrial; consequently, that's the area of first priority."

Although the time required to produce Megadiamond is company proprietary, Horton said, "there is no question about Megadiamond's economic feasibility."

The manufacturing process consists of subjecting natural or synthetic diamond particles to ultra-high pressure and temperature in Megadiamond's six-ram, high-pressure press. "The press rams have enough thrust," Horton said, "to lift 36 100-ton locomotives off the ground simultaneously. As for temperature, it's higher than that required to melt steel."

The story of Hall's press has drama all its own. Hall first synthesized diamond on December 16, 1954, six years after joining General Electric's

Research Laboratory at Schenectady, New York, and three years after beginning research specifically on diamond synthesis.

Synthesizing diamond was a twofold achievement: Hall not only delineated the precise chemistry of diamond formation and determined how to reproduce it, but he also designed and directed construction of the "belt" – a high-pressure device light years ahead of its time in high-pressure technology and principally responsible for the 600 high-pressure research laboratories in operation world-wide today.

Because GE's proprietary interest kept Hall from using the belt after he left the company in 1955, he designed a totally different high-pressure apparatus to continue his research. He accomplished this in 1957, but it took a top-brass directive from the Pentagon to lift federal secrecy orders and clear the way for Hall to use his own invention.

Megadiamond Corporation was organized in 1966 by Hall, Pope and Horton. The Corporation is housed in a 2000-square-foot block building in north Provo. The structure includes executive offices, laboratory, press room, shop area and store room.

The company draws its name from the fact that it is conducting research and development, as well as manufacturing operations, at pressures of more than one million pounds per square inch (*mega* denoting million).

In addition to its work with diamond, the firm is actively engaged in research across the entire spectrum of high-pressure/high-temperature technology.

BOTSWANA BACKGROUNDER

The following is an article reprinted from the November, 1970 issue of Diamant Magazine.

They started in the Tuli Block in 1955, southeast of the Bamangwato, but the De Beers geologists prospecting in Botswana found nothing of interest, so they turned their attention to the Bakgatla area to the south. Two kimberlike pipes were discovered in this area, but both proved to be barren.

The search was then moved to the Bamangwato area itself, northwest of the Tuli Block. This area had already been prospected by another mining company, whose geologists had found two small diamonds in the Macloutsi River, northwest of Foley. Their geologists followed the river to its apparent source but failed to locate the source of the diamonds. The company then allowed its prospecting option to lapse.

Kimberlitic Searches, Ltd., the De Beers operating company, started with the river, and within a short time found kimberlitic indicator minerals and confirmed the presence of diamonds in the terrace gravels.

Dr. Gavin Lamont, who headed the

search, followed the river upstream and noticed, at a point quite near where the river appeared to peter out, traces of what was apparently an old, but large, shallow river valley. While searching for an explanation for this, he recalled a theory expounded some years earlier by Dr. Alex du Toit – who was a consulting geologist to De Beers at the time – who believed that an extensive crustal upwarp of the earth's surface, extending from Rhodesia well into Botswana, had taken place. This could have cut off the head of the river, which, in turn, could have drained a considerable area to the west of the upthrow. Therefore, the source of the diamonds could well be in this area.

To test this, Dr. Lamont and another geologist, Jim Gibson, carried out a rapid-reconnaissance-prospecting program of the area and found abundant evidence of the proximity of kimberlite.

Subsequently, a more detailed program was carried out in the area by Manfred Marx, and this led to the discovery of the Letlhakane group of kimberlite pipes.

The first of these, known as BK 1, was discovered on March 1, 1967, and a month later AK 1 was found – just twelve years after De Beers first began its search.

Kimberlitic Searches then handed over its option to a newly-formed company – De Beers Prospecting Botswana (Pty.) Limited – which set out to prove the pipes.

Pipe AK 1

Because of its enormous size, work has concentrated on AK 1. This pipe covers more than 278 acres and is the second largest in size in the world, being six times larger than the Finsch pipe. The new company's first task was to define accurately the pipe's surface outline by drilling. This was followed by much deeper drilling, to determine the nature of the pipe's sidewalls. The initial evaluation of grade was made by digging a series of widely spaced pits, measuring 5 x 7', to depths of either 20 or 40'. The ground from these pits was treated in small rotary pans.

The second stage of this sampling program involved the sinking of more pits at closer intervals. These reached depths of up to 120', and their ground was treated by one of three heavy-media separation plants that had been erected. Total treatment capacity of these units was 300 tons a day, although this was tripled later with the installation of a pilot treatment plant. Final diamondiferous concentrates were passed over vibrating grease belts. The diamonds recovered indicated an industrial-gem ratio of 90:10; therefore, the average price per carat will be low.

On November 13, 1968, the Chairman of De Beers Consolidated Mines, Mr. H.F. Oppenheimer, announced that the Orapa pipe was a major discovery.

Detailed prospecting of the pipe continued throughout 1969. Pits were sunk to depths of 120' with encouraging results, for they showed that good values persisted in depth – to the limit of the test – beneath the high-grade, superficially enriched zone. Normally, such values decrease with depth.

Geology

The geology of the pipe shows that its host rock is basalt, which is also found as inclusions in places. Apart from black cotton soil (similar to that found covering the Williamson pipe) and occasional patches of red sand, the pipe is covered by a layer of calcrete, varying between ½" and 30' in thickness.

During 1970, the prospecting company handed the pipe over to De Beers Botswana Mining Co. (Pty.), Ltd. Today, the pilot plants are continuing to treat ground until such time as the main plant is completed in mid-1971. Final recovery of diamonds will be by means of X-ray separators and vibrating grease belts, whereas mining will be by open-cast methods.

First-Stage Development

The first stage of the mine's development should be completed by June, 1971, when it is expected to be treating 7.250 metric tons (10,000 loads) daily. This should yield about 2 million carats annually. Estimated capital expenditure for the plant and services at this stage (excluding prospecting expenses of R 4,500,000) is R 11,500,000.

In March, 1970, a taxation agreement between the Government and De Beers Botswana was signed. It provides for royalty to be paid to the Government for all diamond sales and for the company's rates of taxation. In terms of the agreement, the company undertakes to allocate to the Government, free of charge, 15 percent of all shares issued by it from time to time.

Construction work on the main crushing and treatment plant, the power station, workshops and stores has started and is on schedule. Because of the distance and the lack of clay for bricks, the mine built its own concrete-block-making plant on the site–using sand from a deposit discovered by De Beers' geologists quite near to the pipe – to provide the estimated 1,200,000 blocks required for the first-state building program. This includes 162 houses for married employees and single quarters for 210 men, a hospital, clinic, two schools, an adult-education and training center, a large shopping center and full recreational facilities.

In order to develop and service the mine, a good all-weather gravel road had to be built from Francistown, which is 140 miles to the east, to carry the thousands of tons of equipment and supplies needed. De Beers made available a loan of up to R 2.3 million to the Government for the cost of this road, which has now been completed, and for the cost of new telex and telephone lines to the area.

Water Supplies

When treating 10,000 loads daily, the mine will use about 2,000,000 gallons of water, and domestic needs will consume another 200,000 gallons each day. Temporary supplies are drawn from a network of boreholes spread over a wide area. However, this source cannot supply the mine's eventual needs, so work has started on an extensive scheme to draw water from the Botletle River, which is fed from the Okavango Swamps.

Other Prospecting in Botswana

Further general prospecting in the Letlhakane area has revealed a number of other kimberlite pipes. One of these, DK 1, is promising enough to warrant a detailed investigation. However, it is much smaller than the Orapa pipe and apparently of much lower grade, although the diamonds are of better quality.

As part of its general prospecting program in the country, Anglo American has entered into an agreement with the owners of the mineral rights covering the Tati Concession, which extends about 80 miles NNW from the Shashi River and runs parallel with the Rhodesian border.

Under the agreement, the Corporation can prospect the area until the end of May, 1971, after which it has three months to evaluate the results. It is not known whether the area contains any minerals in payable quantities, although copper/nickel traces are known to exist. If any payable deposit is proved, then the Corporation will have technical and administrative responsibility for its development.

Book Reviews

WESTERN MINING, by Otis E. Young, Jr., PhD. Published by University of Oklahoma Press, Norman, Oklahoma, 1970. 342 pages. Clothbound. Illustrated with line drawings. Price: $8.95.

This is a clearly written pictorial and verbal history of the American frontier during the gold-rush days, relating mining methods and operations. Mr. Young has distilled the essence of numerous major mines of the Old West, from Spanish times until the year 1893–a time marking the repeal of the Sherman Silver Purchase Act.

The Spanish, Indians and Cornishmen all had varied mining techniques, but how these systems were extracted by American practicality is the key to this work. All facets of prospecting, placer mining, lode mining and milling are examined in detail while maintaining laymen's terminology. Besides day-to-day accounts, the reader becomes involved with personalities of the camps, adding lore and romance to the early-day West.

Throughout the text are more than 80 reproductions of original drawings and maps of the mines and their activities. Of special interest is the *Glossary of Mining Terms,* including common terms in Cornish, Spanish and Mexican–the languages of the principal workmen.

The author, a Professor of History at Arizona State University, has written many books and articles relating to mining and western history.

A notable and informative book, *Western Mining* will be of special interest to the historian and folklorist, as well as to those searching for unparalleled mineralogical and geological material.

GEMSTONES IN COLOR, edited by Dr. Ichiro Sunagawa. Published by Shueisha Co., Tokyo, Japan, 1970. Clothbound. 167 pages. Illustrated with numerous black-and white and color photographs and line drawings. Written in Japanese. Price: $1.25.

It is seldom that such an array of experts assemble to contribute an essay relating to all phases of gemology. Contained within this volume are the following articles: Takako Shibusawa, a leader in civic affairs, has written on the romantic aspects behind gemstone giftgiving; Hisao Sawana, a popular novelist, related his awe and amazement upon viewing rare gems during his world travels; D. Ichiro Sunagawa, a university mineralogist, sheds technical light on the history of diamonds and their characteristics; Akira Chikayama, a recognized gemologist, gives a capsulized summary of gems under the heading of *From Diamonds to Malachite;* Hiroshi Atotake, Director, Mikimoto Pearl Co., accounts briefly a history of jewelry used as accent pieces; Akiko Yosano, a prominent essayist, expounds on the current etiquette of jewelry wearing; Yasuhiko Hishido, a jewelry designer, gives a fine overview on the present state of contemporary jewelry; Yuzo Yamamoto, a metal-company president, relates the feasibility of specific metals as used in jewelry manufacturing; and Eiichi Matsui, a jewelry manufacturer, explores the applicability of gemstones as investments.

Since this work is in Japanese, its value to the average Western reader is in its lovely color plates. Its multiple-color photographs lend beauty to its vast subject matter.

JEWELS, by Mr. Motoo Eto. Published by Hoikusha Co., Osaka, Japan, 1970. Clothbound. 85 pages. Illustrated in multiple-color photographs. Written in Japanese. Price: upon request from the publisher.

Jewels, a work published in commemoration of the 70th anniversary of the Shobido Jewelry Co., can be properly called a visual compendium of important gemstone material. Accompanying each color photograph depicting rough and fashioned gems is a brief descriptive analysis of all the important points concerning mining operations, history and sources. Minerals covered include diamonds as well as colored stones, both common and uncommon. In addition there is a property chart of physical and optical characteristics. Of special interest is an up-to-date section on synthetic stones, containing necessary information on testing methods to distinguish them from their natural counterparts.

Mr. Eto has compiled a fine book, invaluable to those seeking general gemological knowledge.