# Gems and Gemology

WINTER, 1962-63

See Inside Cover

# *Gems & Gemology*

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### *On the Cover*

*Blossom heads paved with round diamonds and tipped with a tapered baguette form a flower motif for this pin, created by Lindemann Jewelry Company, of San Francisco. The curving platinum stems are set with baguettes. It was one of the fifteen that received awards in the Diamond International Awards, at the Waldorf-Astoria, New York City, October, 1962.*

Photo Courtesy N. W. Ayer & Son, Inc.
New York City

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# Diamond-Coating Techniques and Methods of Detection

*by*

Eunice Robinson Miles, G.G.

*Editor's Note: Mrs. Miles, long a staff gemologist at the Gemological Institute's New York Gem Trade Laboratory, has been investigating diamond-coating techniques and methods of detection for over two years. Initially, she called on industrial research laboratories to learn what substances were being employed in industry, as well as the methods of detection available. Cooperative laboratories were very helpful to her.*

*Mrs. Miles then undertook an exhaustive series of experiments with various substances and methods of application, which were followed by many different approaches to detection. This article contains numerous illustrations of coatings on diamonds and the author's recommendations regarding the development of acuity in visual perception of them.*

The purpose of this article is to present for the first time in print a discussion of the practice of raising the color grade of certain diamonds to near colorless by disguising the true light-yellow or brown body color by application of a foreign substance to the surface of the stone. For want of a more accurately descriptive word, *coating* will be used for any material or film added at a point or points or in larger areas to a diamond's surface. Means of detection by the jeweler and cautions will be summarized.

The art of intensifying the color of gemstones by the application of colored coatings has been practiced for centuries. However, attempts have been made more recently to mask the yellow in off-color stones by a neutralizing coating or film. Some of the first media still occasionally used were solutions made with indelible pencil or inks and applied to the culet, pavilion or girdle of the diamond; these are usually applied by simply dipping the stone in the solution *(Figure 1)*. The streaked appearance thus imparted can frequently be seen with a 10x loupe and, as most appraisers are aware, the coat-

*Figure 1.* **Ink-Dipped Pavilion**

ings are soluble in alcohol, commercial jewelry cleaners or water. Few in the trade are deceived by these methods today.

Efforts to apply more resistant coatings include vacuum sputtering of fluorides as an outgrowth of lens-coating techniques. Although resistant to ordinary solvents and quite durable, fluoride coatings are considered unsatisfactory by coaters, since they are easily detected by their purplish-blue iridescence. From the viewpoint of the "artist," effective coating requires skillful application in a manner and in positions minimizing the possibility of detection.

Since World War II, coating and thin-film research for electronic and military applications has developed rapidly. However, the detection of thin coatings lagged far behind the advances in their application. The nearly invisible and resistant coatings on diamond are an outgrowth of this research. In the early 1940's, an invisible resistant coating was rumored to be available. The jewelry industry generally was not aware of refinements in coating techniques until about 1952. During that year, the Laboratory was shown a mounted diamond that was thought to be an example of an excellent professional coating job. Permission to unset the stone was not granted by the owner and consequently actual visual proof of coating was not established. However, when the stone was boiled in concentrated sulphuric acid, its true yellowish body color became apparent.

In the 1950's, contact was made with a firm offering a service for coating diamond and the New York Laboratory secured a few small stones for testing and research. The Jewelers' Vigilance Committee, the Diamond Manufacturers' and Importers' Association and individuals in the industry submitted coated diamonds and prepared specimens to specialized laboratories in Europe and South Africa, as well as in this country. None was able to detect the nature of the coating or it's position, so they were unable to suggest a practical test. The problems facing an analyst using X-ray spectroscopy and other standard industrial or university laboratory techniques are clearer when one realizes that the coatings are usually only a fraction of a wavelength in thickness and applied only in small areas, often concealed by a mounting. Also, many different media are used. However, working with an industrial research laboratory staff, the author gained background knowledge in the nature of coatings and their detection.

About this time, a coating was detected under the Gemolite in the Los Angeles Laboratory and photographed in color. (The photographs were taken by Jeanne Martin, working with the late Lester B. Benson, Jr.) At the same time in the New York Laboratory, the coating was found to be attacked by "jewelers' pickle" and ultrasonic cleaners and removed by heating the stone in an open flame or boiling the diamond in concentrated sulphuric acid. But the New York jewelers were pressing for tests they could apply quickly without altering the appearance of the stone in any way. When it became obvious that X-ray and chemical tests were unavailing, it was concluded that future study should be of the surface of the diamond in reflected light for locating areas of coating. Although this avenue held out no promise of an easy-to-apply test with a newly devised instrument or reagent, it seemed to offer the only possibility of success.

Many jewelers were losing important sales due to unfair competition from coated stones. Several New York newspaper articles had brought the practice to the attention of the public. The traffic in coated diamonds seemed to be confined mainly to New York; however, few stones reached the Laboratory and these were not available for experimental testing.

At this time, those widely considered to be the most skilled coaters went out of business. For sometime thereafter no stones were available for study by the Gem Trade Laboratories and it was presumed that the practice was quiescent. After a period of two or three years, coating again became a serious problem. By early 1962, traffic in coated diamonds had become "big business." It was obvious that more than one coater was at work; in fact, at least one operator canvassed the trade offering his services. By this time, pawnbrokers, loan associations and legitimate auction galleries were being victimized in a nation-wide racket, so the Jewelers' Vigilance Committee and the Diamond Manufacturers' and Importers' Association took action. As early as 1957 the Federal Trade Commission Ruling (#36) had stated that it was unfair trade practice to sell a diamond that had been coated without disclosure of the fact. But the rules do not have the force of law. Encouraged by these organizations and others in the industry, the New York State Legislature became the first to write into law the following bill:

> *Any person, firm, corporation or association, and any agent or employee thereof, who or which shall sell or offer for sale any diamond which shall have coating, irradiating, heating, nuclear bombardment or by any other means, without written disclosure to the purchaser, or prospective purchaser, that such diamond has been artificially colored or tinted, or without written disclosure that the artificial coloring or tinting of such diamond is not permanent, if that be the fact, shall be guilty of a misdemeanor.*

This Act became effective on September 1, 1962.

Meanwhile, many jewelers came to the Laboratory to ask for practical tests. Consequently, controlled testing was carried out to develop teachable methods of perception of coating for the jeweler, efficient laboratory-detection tests without altering the coating, and a method of recording the latter for permanent laboratory report records.

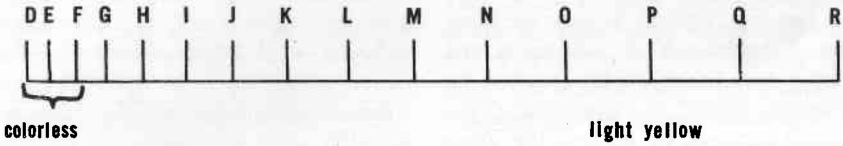


*Figure 2.* **GIA Color-Grading Scale**

## Perception

When a Gem Trade Laboratory staff gemologist examines a suspect diamond, the initial impression of color and general characteristics of cut are noted first. On the usual coated diamond, his immediate visual sensation is that the stone is subnormal in both brilliance and dispersion, and that it appears dark. Suspecting a coated stone, he notes its cut, nature of the girdle (whether polished or rough), and its proportions, and he then finishes his initial examination under a 10x loupe by noting details of the mounting. These characteristics can be important factors to consider in detection of possible coating of the stone. The next step is to clean the diamond by methods that will remove dirt but not resistant coatings. Then the diamond is graded under a controlled light against a set of master stones (diamonds that have been electronically graded on a colorless to yellow scale). On the GIA color scale *(Figure 2),* D - E - F represent colorless and G - P indicate a progressive increase in yellow. The GIA Diamondlite is especially valuable for color grading, since it eliminates surface reflections and is free from ultraviolet radiation. When stones are viewed edge-up against a white background, it has been the experience of the Laboratory that it has been impossible to assign a precise color grade to coated diamonds. Based on the observation of stones that we have had coated for research purposes, as well as stones boiled out for clients, we have found that coated stones with original body color M to P usually appear gray-green, bluish gray, or even less commonly light reddish purple, with varying degrees of a yellow undertone partially masked by one of the aforementioned tints.

Perhaps the most successful stones to coat from the coater's standpoint are those that grade approximately I, J or K. An effective coating can increase the apparent value of some stones as much as 25%. Since the layman rarely keeps diamonds as clean as they were when purchased, the stones may never be suspected, even though the coating has been diminished due to wear. If subsequent microscope examination proves a stone is coated, the Laboratory advises the client of the fact, and therefore does not assign a color grade. Incidentally, we have yet to examine a coated diamond upgraded to the D - E - F range, and research suggests the probability that this will never be accomplished. Thus, a critical examination for color may lead to a suspicion of coating; i.e., the inability to assign a color grade to

*Figure 3.* Coating Seen as Single Line Through Crown

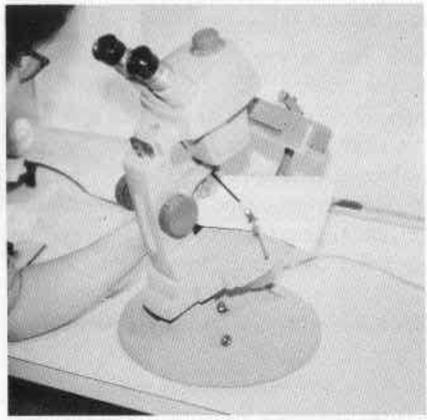

*Figure 4.* Stroboscopic Test

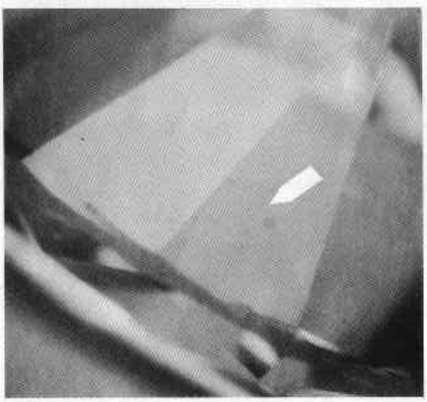

*Figure 5.* Bubbles in Coating

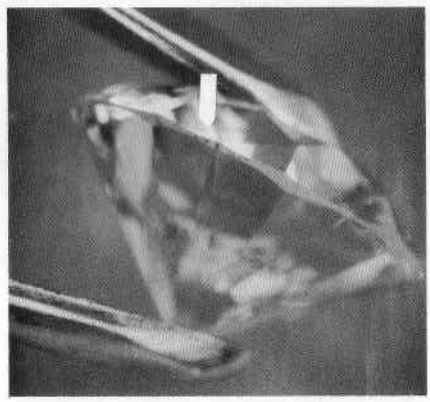

*Figure 6.* Coating Remnants on Girdle

mond is rotated in the stoneholder by turning the stone as rapidly as possible using the handle of a paint brush or a pencil *(Figure 4)*. A stroboscopic effect is created because of the fluorescent light overhead. A coating adjacent to the girdle becomes visible as a dark line during the fast rotation of the stone. A little practice is necessary to develop this technique; however, the movement does make it easier to detect the coating.

Since coating techniques vary, we cannot limit our observation to the area adjacent to the girdle. In some small stones in particular, effective coatings have been observed confined to the girdle only; these have usually appeared to be blue or purple spots or patches. Under high magnification, these areas may contain collapsed bubbles *(Figure 5)*.

It is possible in some girdle (or near-girdle) coatings to see remnants of the film in cleavages, rough areas and

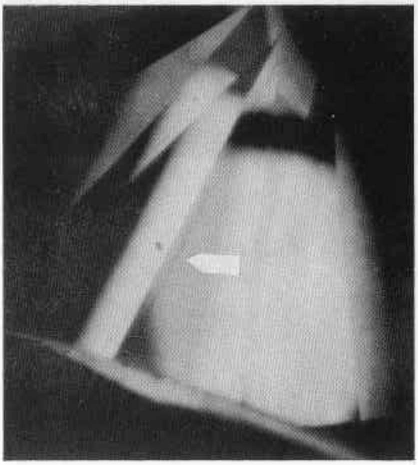

*Figure 7.* Coating Parallel to Facet Junctions

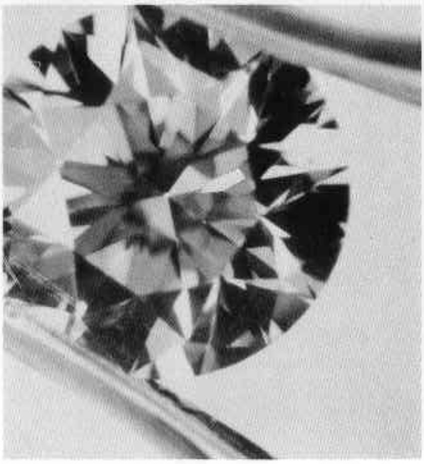

*Figure 8.* Coating at Culet

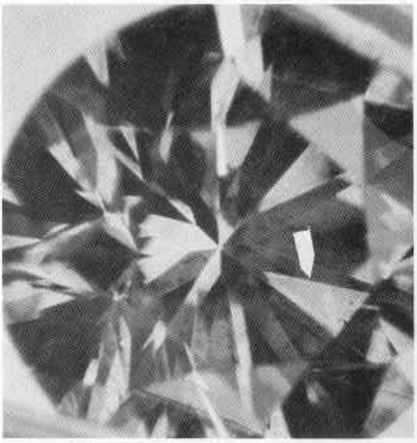

*Figure 9.* Coating Over Pavilion Facet

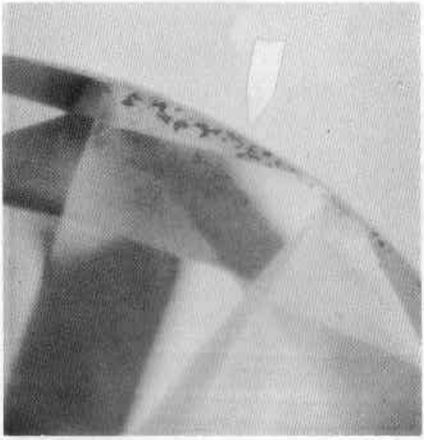

*Figure 10.* Spotty Appearance

beards *(Figure 6)*. It is important not to confuse with a coating ordinary foreign material, such as metal from tweezers embedded in a frosted girdle. Some effective coatings have been produced by carefully applying the media parallel to areas of a few pavilion facet junctions *(Figure 7)*. Less effective and more readily detected are coatings at the culet *(Figure 8)* or over the entire pavilion *(Figure 9)*.

Once a definite coated area has been detected, it is possible to note several characteristics of modern resistant coatings. Features that may be seen are a spotty appearance *(Figure 10)*, a

*Figure 11.* Splotchy Appearance

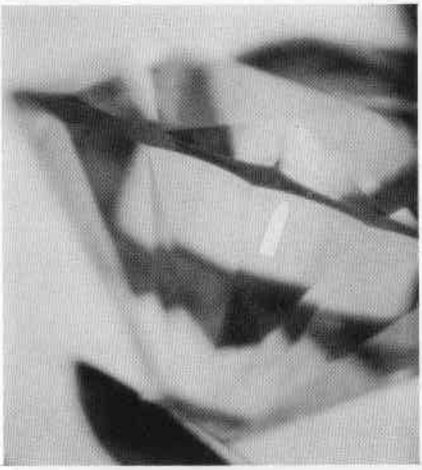

*Figure 12.* Bubbles in Thick Girdle Coating

*Figure 13.* Brush-Stroke Appearance

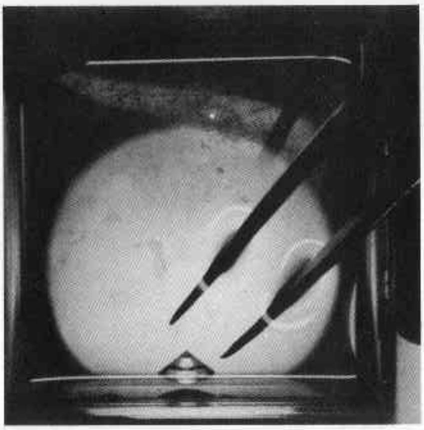

*Figure 14.* Plastic Holder for Oil-Immersion Test

splotchy appearance *(Figure 11)*, a granular appearance and definite craters or bubbles in the thickest area of the coating *(Figure 12)*, and a brush-stroke appearance *(Figure 13)*. After observing a diamond as described, your heightened perception will make a coating, present on the reflecting surface or opposite facets, obvious.

Although the following test may be used with the Gemolite, it is one of the few that is also practical for those who have only a loupe; however, it requires great care and knowledge of what to look for. The 10x corrected loupe may be used in conjunction with a substage lamp and immersion oils. A clear, thin, plastic box can serve as an immersion dish *(Figure 14)*. (A box of this type is available in stationery or art supply stores.) A colorless oil is necessary. Castor oil is suggested because of its viscosity and the fact that it does not attack the plastic as do some other oils, such as cinnamon oil. The diamond is placed on its girdle with the table of the stone resting against the side of the plastic dish. (The thickness of the oil holds it on its girdle edge.) Diffuse the light by placing a thin gray paper, such as art-tracing paper or a very light-orange tissue, over the substage lamp opening. Translucent art-color swatches varying in per cent of light transmission can be used effectively (sample books containing many colors are obtainable from artist-supply stores). All of these not only act as diffusers but they also offer color contrast to the coating on the stones. Roll the diamond slowly by touching it slightly with the tweezers. The coating will be visible under the 10x loupe, usually showing a definite color in contrast to the diffused background. The loupe must be held close to the eye and just above the immersion dish. Immersion of a diamond in oil has an occasional advantage of making areas under the prongs easier to see.

In view of the fact that in most cases the presence of a coating needs to be established without removing it, the following tests that may remove all or part of the coating are to be avoided, if an owner's permission has not been granted.

**Abrasives** — Once a coating is located, it may be tested for abrasion resistance. Test results have shown that most coatings studied to date can be abraded by a well-sharpened, pencil-type eraser. The location of the coating, of course, may be such that it makes an abrasion test impossible, unless the diamond is removed from its mounting.

**Solvents** — The least-resistant coatings are attacked by acetone or cold acids. More resistant coatings, as stated previously, may be removed completely by boiling in concentrated sulphuric acid, using a standard diamond-boiling kit. Diamonds in platinum mountings may be boiled without fear of damage, although soldered joints may have to be buffed. However, experimentation with ultrathin metallic coatings to disguise the body color of diamonds is being carried on. Such coatings will be attacked by aqua regia, but the stone must be removed from the mounting.



**Ultrasonic cleaner:** Some coatings are removed completely by such cleaning units; however, more resistant coatings may be only partially removed.

**Heat:** As mentioned earlier, heat will completely destroy some coatings. Heat from a blowpipe flame or even the flame of an alcohol lamp will remove most coatings. This method of removal is not recommended, since it is impossible to control the temperature and it is possible to cause damage.

**Cautions:** *Do's and Don'ts* in observing diamonds for evidence of coating.

1. *Don't* suspect truly colorless diamonds. Remember, thus far, coated diamonds exhibit a grayish or greenish body color and a dull appearance.
2. *Be sure* the diamond is as clean as possible. Iridescent areas of grease or other residue can be mistaken

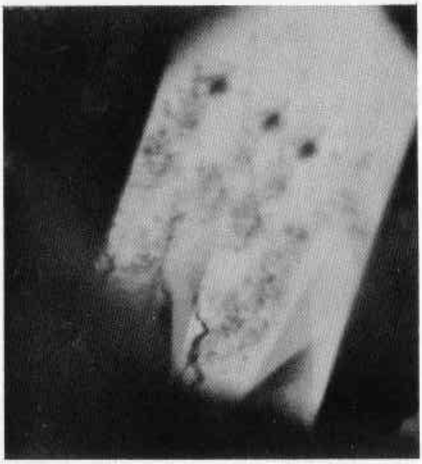

*Figure 15.* **Residue Masking Coating**

*Figure 16.* **Coating Visible after Removing Residue**

for an intended coating *(Figures 15 and 16)*.

3. When viewing a girdle for coating,
   a) *Don't* confuse foreign material such as metal in frosted areas with a coating.
   b) *Don't* be misled by greenish or reddish-brown naturals.
   c) *Beware* of grayishness due to polishing residue under and near prongs, or residue in the girdle from rhodium plating.
4. *Don't* confuse the grayishness of twinned stones, cloudy stones, or stones with off-color zoning with coated stones.
5. *Don't* confuse the grayish or blackish face-up appearance of badly proportioned stones, especially marquises and pear shapes.
6. *Don't* confuse body color with color that may be due to included crystals, stains in fractures or cleavages, or other internal characteristics.
7. *Don't* be misled by the occasional body grayishness of highly fluorescent stones.
8. *Do* remember that a conscious effort must be made to concentrate on observing the surface.
9. *Do* remember that this report is only a summary of information and observation to date, and that it is not meant to be the final discussion of the subject.

At one time, the Gem Trade Laboratories issued reports only after a stone was examined for color before boiling and graded for true body color after boiling. With present perception and detection tests and rapid photography of coating in reflected light, the Gem Trade Laboratories now issue reports without altering the appearance of the coated diamond. Boiling is usually unnecessary, so the possible danger of damage to a stone is eliminated. The testing period is shortened and a photograph of the coating is part of the permanent report record. In conclu-

*Continued on page 383*

# Rapid Sight Estimates of Diamond-Cutting Quality

Part II

*by*

Richard T. Liddicoat, Jr.

It was clear from the earlier series of photographs that the table reflection darkened as the pavilion angle increased, and that this provided useful corroboration of increased table-reflection size in proving a greater-than-ideal pavilion angle. As might be expected, a decreasing pavilion angle is accompanied by a decrease in the size of the table reflection, other factors being equal. Here, too, there are other changes that substantiate the evidence furnished by decreasing table-reflection size. The table reflection becomes slightly more difficult to see, but it tends, in part at least, to become lighter and brighter. Often, only a part of the table reflection is visible, and that part is sometimes, but not always, bright, depending on the angle at which it is viewed.

Around the smaller table reflection usually appears another bit of corroborating evidence: the presence of small triangular or kite-shaped reflections from the bezel facets. These are apparent in several of the photographs showing a small table reflection. *Figure 16* shows a slightly distorted, bright table reflection and scattered bright reflections around it. In this photograph, the table size is 63%, the depth 56.1%, and the pavilion is slightly shallow.

In *Figure 17,* the depth is slightly greater (average 56.6%), but the table is smaller (58%) and the crown is about 2% thicker, so the pavilion angle is smaller than that in *Figure 16.*

*Figure 18* has approximately the same size table reflection; however, notice that the bright reflections around the table do not extend close to the edges of the table, and that a portion of the table reflection itself is bright.

Near the lower right-hand edge of the table, one more very significant clue is in evidence: a reflection of the girdle. A girdle reflection seen through the table with the line of sight perpendicular to it is proof of a shallow pavilion. When the crown and girdle thickness total no more than 17%, a girdle reflection will not be visible, unless the pavilion angle is less than approximately 39°

Remember that the size of the table reflection is affected not only by pavil-

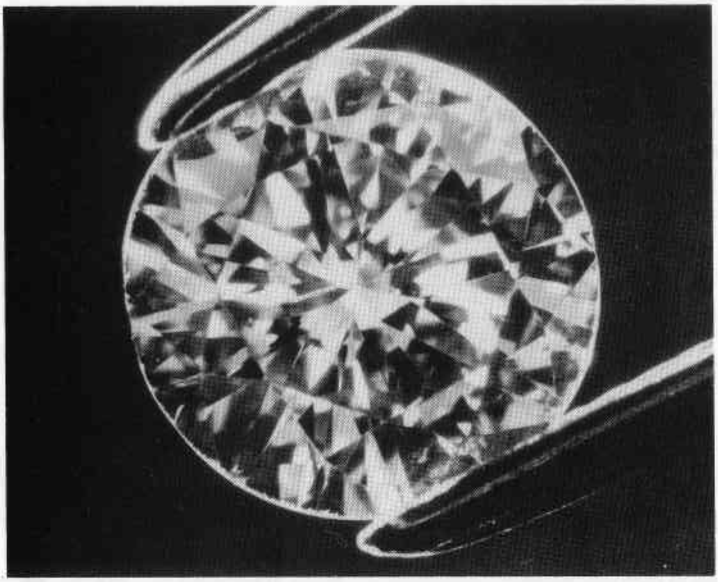

*Figure 16*

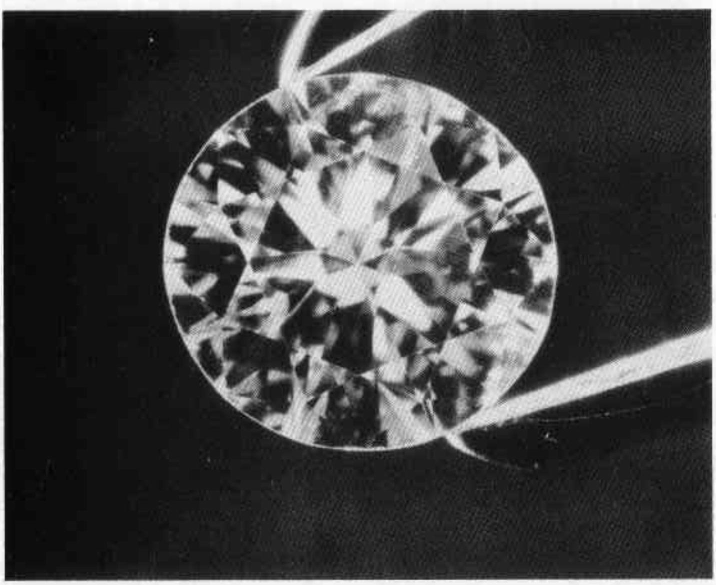

*Figure 17*

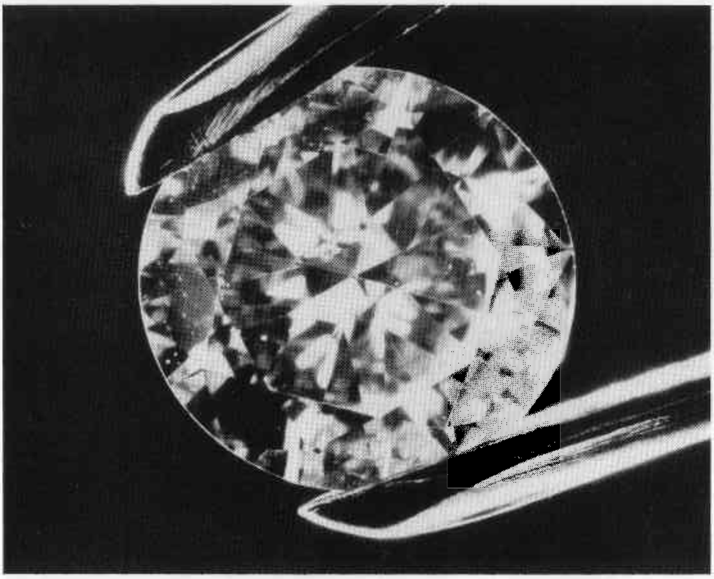

Figure 18

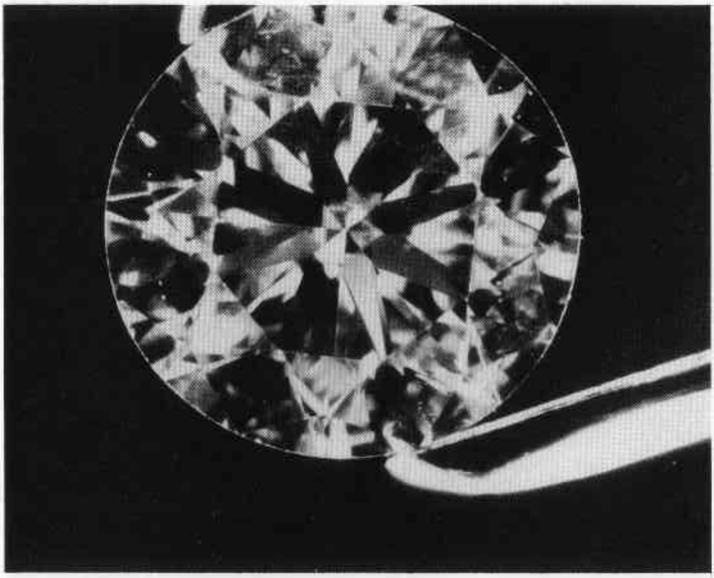

Figure 19

ion angle, but by table size and the distance of the table from the pavilion. *Figure 19* has a 58% table but the bezel angle is 37° (about 2½° greater than ideal) ; therefore, the crown is as thick as if the table were 53% and the bezel angle ideal. The thick crown and the relatively small table, plus a 40° pavilion angle, account for a tiny table reflection, despite an overall depth of more than 59% of the girdle diameter.

*Figure 20* has a larger table reflection than that of *Figure 19,* but it is smaller than the ideal. The table is 53% and the pavilion angle is ideal, but a slightly thick crown and thick girdle make the total depth 63%. The table is smaller than most seen today, and its distance from the pavilion is greater than ideal. This makes the table reflection so small that on a thin-crowned stone, it would mean a flat pavilion angle. With experience, this situation is readily detected by looking at the girdle and crown thickness, as disclosed by a side view.

A second quick crosscheck is provided by the girdle reflection. If the table reflection is rather small but the cause is a thick girdle and crown, as in *Figure 20,* the diamond must be turned through several degrees before the girdle reflection is seen through the table. If the pavilion angle is less than 40¾°, as in *Figure 19,* a reflection of the girdle is visible with a rotation of the stone-holder of only two or three degrees. When the reflection of the girdle is seen in the table with the line of sight at right angles, the stone must be well into the "fisheye" category.

In a stone that has a pavilion angle considerably less than the 41° of the ideal, the resulting smaller table reflection often appears considerably different than that of stones with normal to slightly deep pavilion angles. When the stone is viewed exactly at 90° to the table, the table reflection may not be evident; the entire area may appear dark, except for the triangular or kite-shaped bright reflections mentioned previously. This condition is well illustrated in *Figure 21.* It is easily distinguished from a dark-centered stone, which results from a too-deep pavilion, by tilting the stone a degree or two in the tweezers. *Figure 22* shows the stone in *Figure 21* tilted just slightly. As soon as it is tilted, the girdle reflection becomes obvious all across the lower portion of the table. The beginnings of a bright table reflection can be seen just to the upper left of the culet. The stone in *Figure 21* has a depth of 55%, with a 63% table. It is not quite a "fisheye," but it definitely leaks too much light.

*Figure 23* shows another round brilliant in which no table reflection is evident when looking straight through; however, by tilting it slightly, a bright table reflection is seen just below the culet and a girdle reflection completely across the upper half of the table.

In *Figure 24,* an off-centered table reflection is accompanied by a girdle reflection across the right side of the table. By switching the light behind this "fisheye" to light field, bright light comes through the stone, in contrast to any light transmission in this area, except through the culet in a well-cut brilliant; this is one way of checking for a "fisheye." By removing the baffle to light the background of the stone, light in a "fisheye" will leak around the culet *(Figure 25).* This stone has a

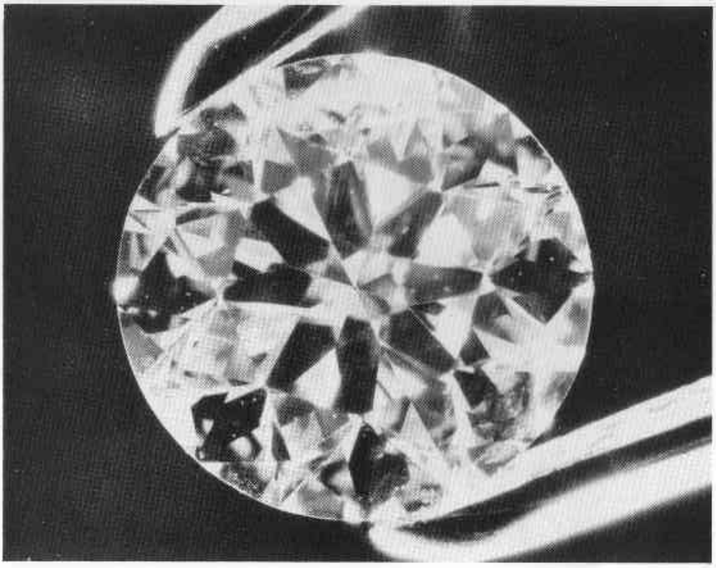

*Figure 20*

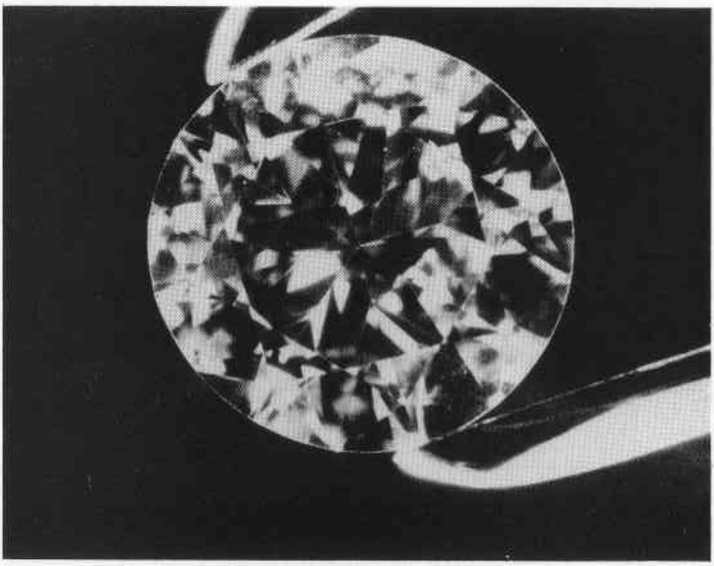

*Figure 21*

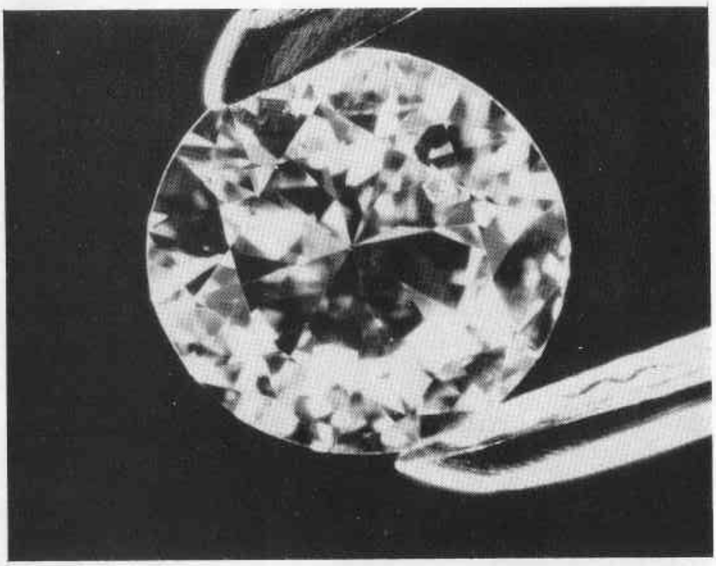

*Figure 22*

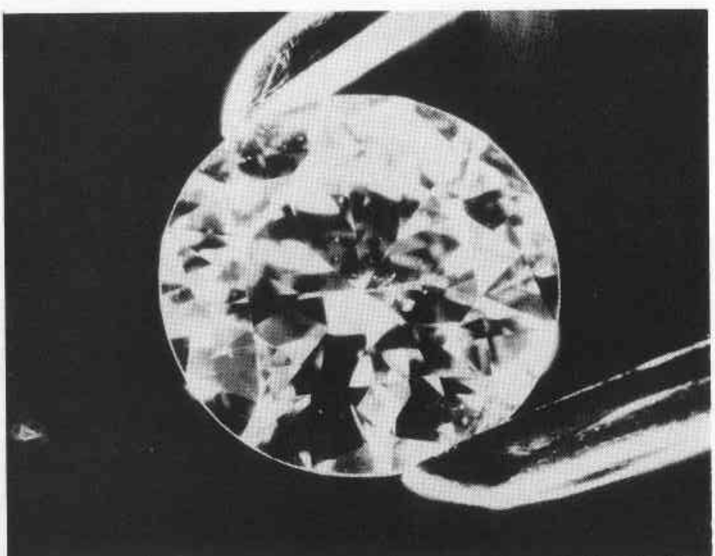

*Figure 23*

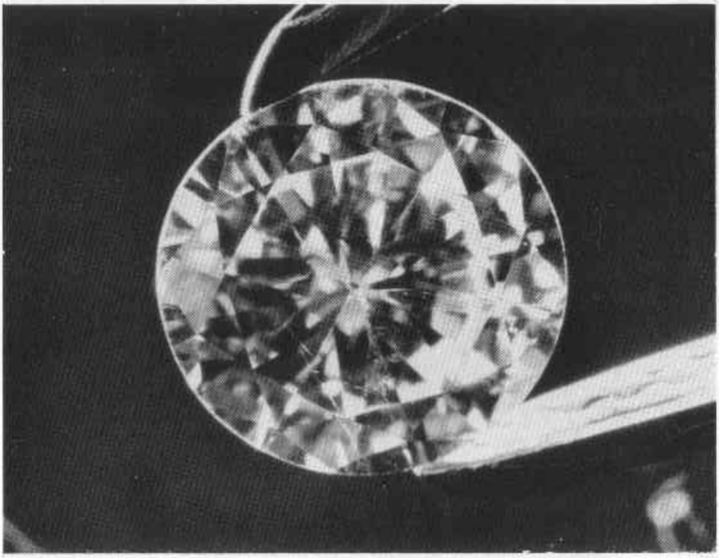

Figure 24

Figure 25

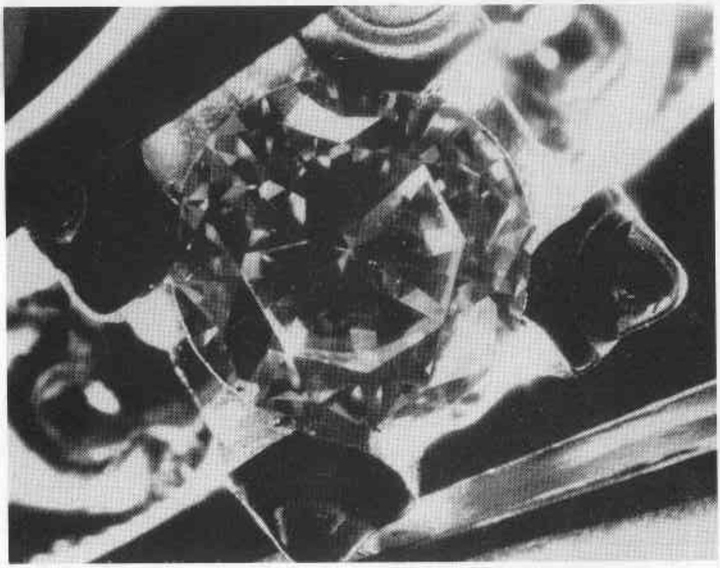

Figure 26

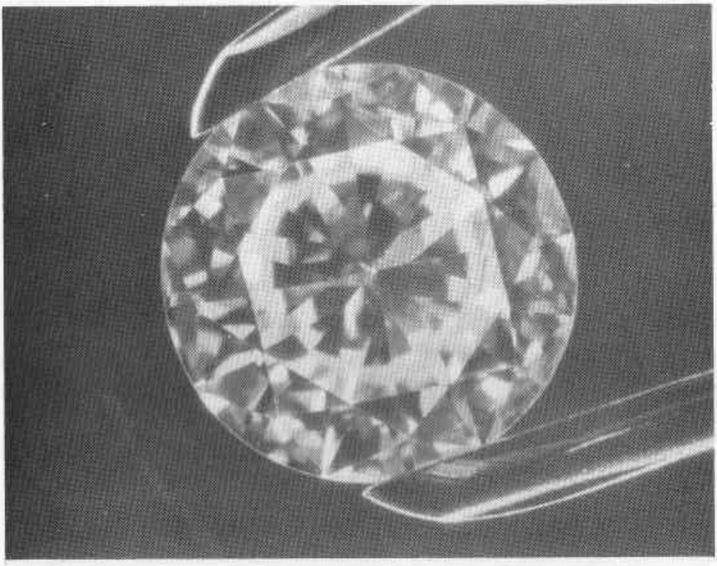

Figure 27

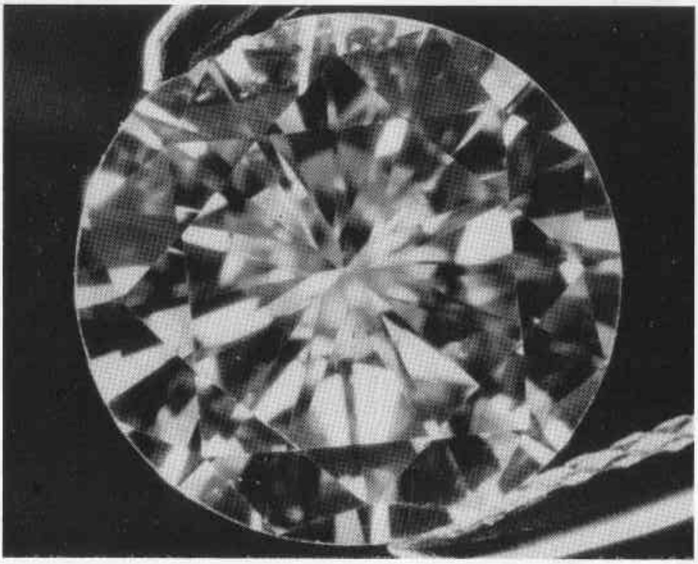

*Figure 28*

68% table and a depth of approximately 52%.

*Figure 26* shows a "fisheye" with a tiny table and girdle reflection around most of the table area. This is included merely to show that a girdle reflection is just as evident in a mounted stone as any other. It has a 54% table and a 52% depth.

*Figure 27* is a photograph of a stone that has a very flat pavilion, with the result that the girdle reflection extends far into the table. This stone is almost totally devoid of brilliance. It has a 63% table and a 51.5% depth.

When the table or culet is off center, the table reflection is displaced from the center of the table when viewing the pavilion through the table in a perpendicular direction. *Figure 28* shows a diamond with the culet displaced toward twelve o'clock; as a result, the pavilion angle is steeper on the short side than on the long side. This condition makes the table reflection larger and closer to the edge of the table on the steep side than it is on the flatter side of the pavilion. An off-center table reflection is a quick indication of an off-center culet.

If a diamond is out of round, the table reflection may be elongated in one direction and compressed in another. *Figure 29* depicts a diamond that is out of round, with a result that the table reflection appears elongated in the two-to-eight o'clock direction and narrower and darker from eleven to five o'clock, creating the type of "bow-tie" effect often seen in marquises and pear shapes.

If a diamond cutter has not taken care that opposite facets are perpendicular to a plane passing through both of them, the result may be almost a total lack of distinguishable reflection pattern; this is seen in both *Figures 30 and*

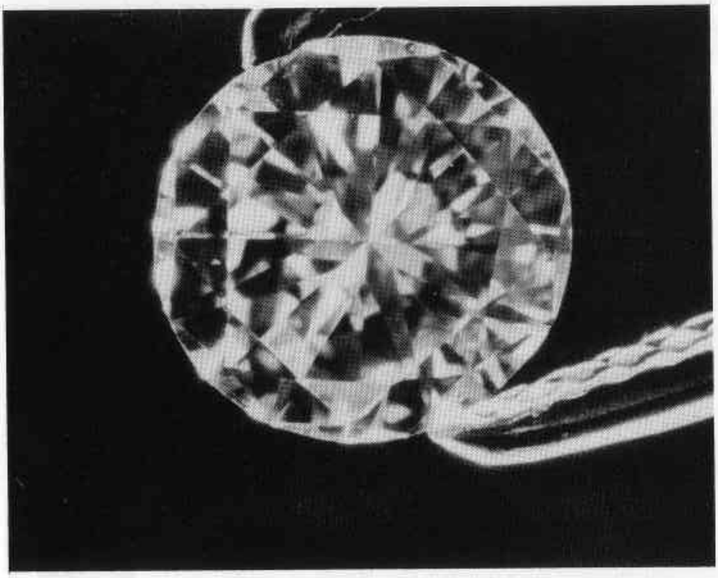

Figure 29

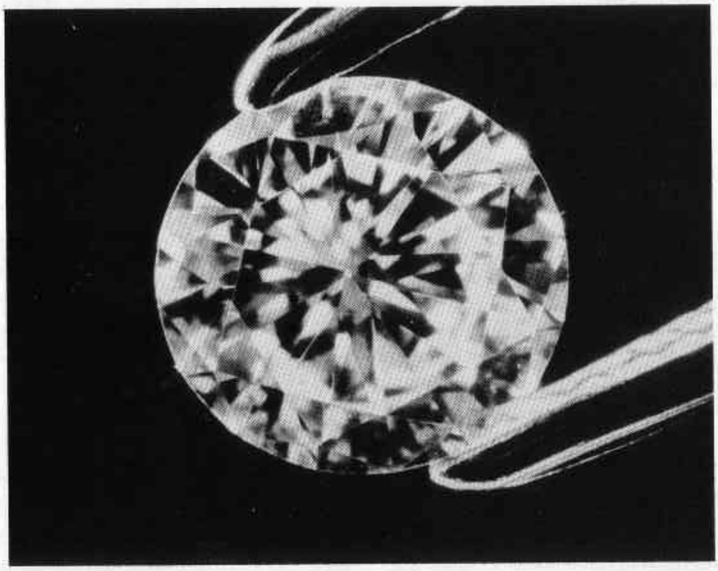

Figure 30

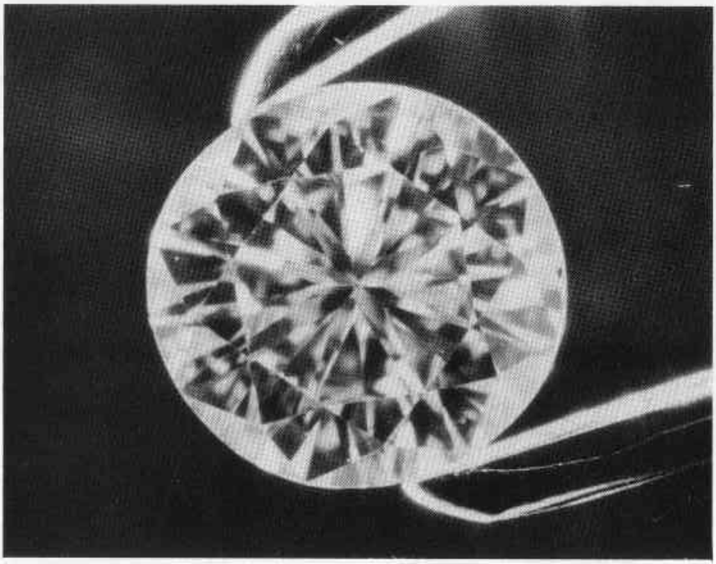

*Figure 31*

*31.* In addition, *Figure 30* shows an off-center culet. There is no readily distinguishable table reflection, but a girdle reflection may be seen on the flat side of the pavilion, extending from approximately three to eight o'clock, near the edge of the table. This stone has a depth of 55.5%, but the off-center culet gives the lower half of the stone an appearance typical of a "fisheye."

*Figure 31,* which is also unsymmetrical to the point where no clear pattern can be seen, is actually too deep. Vaguely, perhaps, it can be seen that the table reflection extends almost to the edges of the table. In this case, the depth is about 62%, despite a thin crown (the table is 60% of the girdle diameter), so the pavilion is much too deep.

With practice, a diamond man should be able to estimate the depth percentage of any round diamond within a very narrow tolerance.

This is a four-step process:

1) Estimate the table size
2) Using the method outlined herein, estimate the pavilion depth.
3) Turn the stone for a girdle-on view, to estimate girdle thickness.
4) Adding together gives the stone's total depth as a percentage of table diameter.

In the beginning, it is wise to take the girdle diameter and depth measurements to check visual findings, but this will soon become unnecessary.

To summarize, the angles and proportions of a brilliant-cut diamond may be judged by eye alone. By noting the characteristics seen through the table, plus glancing at the stone in cross section, it is possible to judge depth measurements and angle of crown and pavilion very closely.

# Developments and Highlights

## at the GEM TRADE LAB in New York

*by*

Robert Crowningshield

### Abraded Facets on Diamond

Diamonds that have been abused or worn in such a way that other diamonds may rub against them for long periods of time may begin to show facet-junction abrasions that are very similar to the effect one so frequently sees on zircons. Often, jewelers themselves are fooled into telling a customer that the stones are not diamond. *Figure 1* shows extreme facet-junction abrasion on the French-cut diamonds in a guard ring; *Figure 2* shows the same thing on old-European cut diamonds in a long rope necklace.

### 3-Phase Inclusions in Fluorite

An intense-green cabochon-cut fluorite gave us quite a start when we examined it under the microscope and noticed well-developed 3-phase inclusions. Except for the corner-of-a-cube-shaped liquid-filled cavities, they could be easily mistaken for the 3-phase inclusions of emerald. *Figures 3 and 4* illustrate them.

### Unusual Inclusions in Peridot and Sinhalite

*Figure 5* illustrates an unusual series of needlelike inclusions in a peridot, a gift to the Institute from Andrew Heinzman, of H. R. Benedict and Sons. By coincidence, at the same time that we received this stone, we were able to photograph some unusual, unoriented needlelike inclusions in a large brilliant-cut sinhalite *(Figure 6)*. Needlelike inclusions are rare in either gemstone and as readers are aware, prior to about 1952, sinhalite was often identified as peridot, in the absence of a

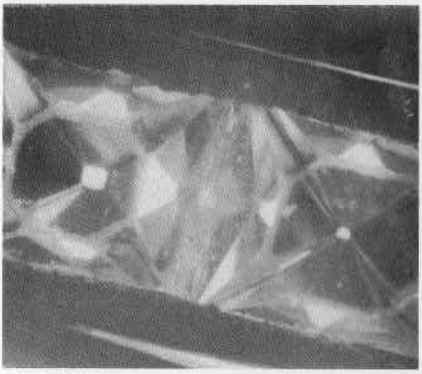

Figure 1

Figure 2

Figure 3

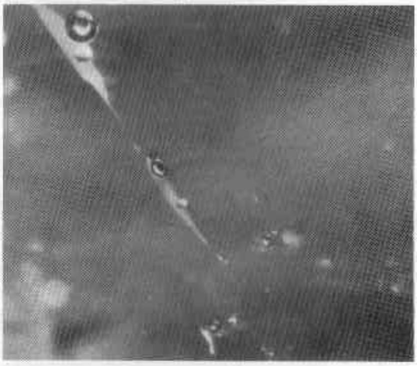

Figure 4

Figure 5

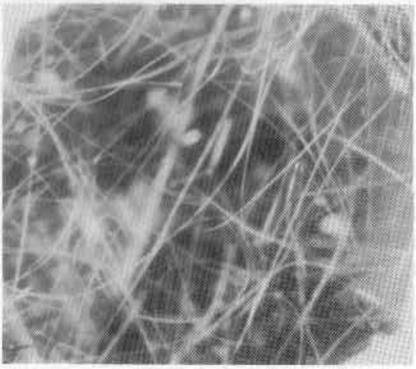

Figure 6

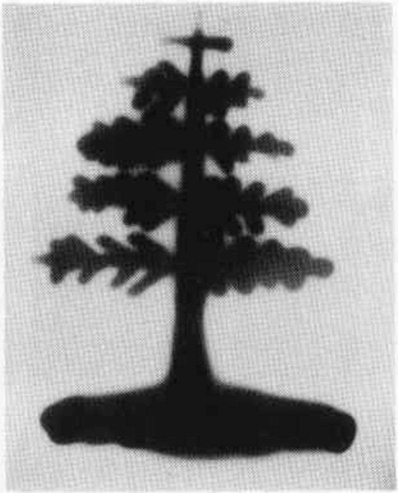

Figure 7

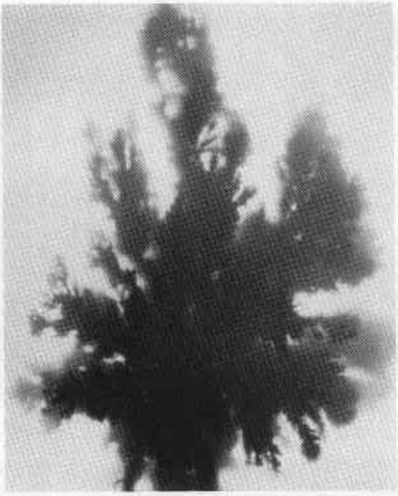

Figure 8

proper mineralogical description of it.

## Moss Agate Effect

*Figure 7* illustrates what the staff feels is an example of the ancient Roman art of selective sugar treating of chalcedony, although whether an ancient or modern work is not known. By this technique, a tablet of polished chalcedony is coated with a wax and the design carefully etched through the wax with carving tools, so that when the stone is soaked in the sugar solution, only the part exposed by the carving will take the sugar. Subsequent treatment produces the color, in this case dark brown, leaving the waxed areas untouched. *Figure 8* is a photograph of a natural arborescent brown inclusion in agate, for comparison purposes.

## Repeated Twinning in Both Natural and Synthetic Rubies?

We were delighted to receive as a gift from graduate Julius Reichert, of New York City, a synthetic ruby that a coworker of his had purposely overheated with his blowpipe out of curiosity. *Figure 9* shows that the stone developed a decided repeated twinning at one end, along with an indication that the temperature was enough to begin melting the surface. Actually, we cannot be sure that the stone did not have repeated twinning prior to the "experiment." However, shortly after receiving this stone we identified a natural ruby with the color, inclusions and ultraviolet fluorescence of a typical Burma ruby but with the unusual features of repeated twinning and distinct quench crackling, as one finds in synthetics so frequently. This stone is illustrated in *Figure 10.* There is a possibility that it may have been overheated during manufacture or repair. *Figure 11* illustrates the typical repeated-twinning pattern found in so-called Siam rubies. We are curious to know if there is any relationship or if it is only coincidence that the repeated twinning should be found

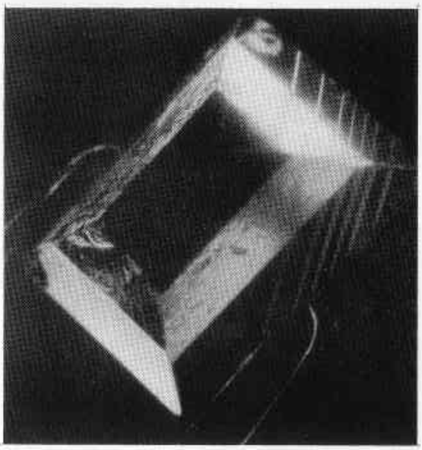

Figure 9

Figure 10

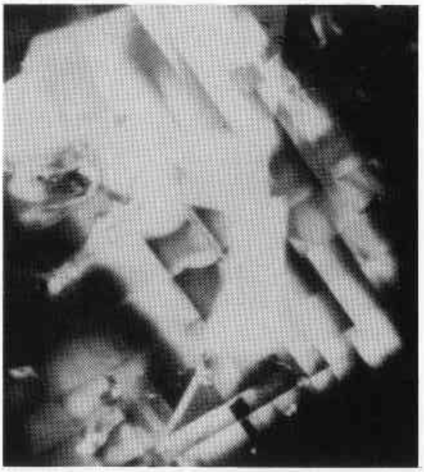

Figure 11

in material of such widely different origin, two of which could possibly have been influenced by overheating.

### Emeralds with Green Plastic Pavilions

*Figure 12* is a photograph of a pair of pale-green, pear-shaped emeralds that had been set into a dark-green plas-

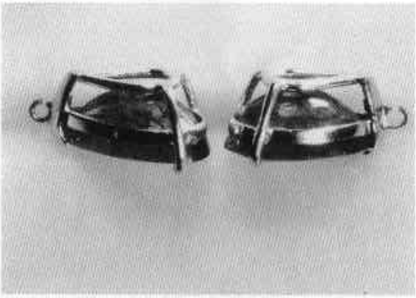

Figure 12

tic "pavilion" (the plastic was not attached to the stones). The effect was to deepen the color of the stones when observed face up and to intensify the red color under the color filter.

### Diamond and Synthetic Sapphire Doublet

We have noted before the scarcity of diamond doublets in the trade, although in past months we have seen and reported on some with diamond crowns and synthetic spinel or sapphire pavilions cemented with one of the modern epoxy cements. Prior to the epoxy products, no good adhesive was known.

Figure 13

*Figure 13* illustrates what occurs when an ordinary cement is used. This stone was in an old piece of jewelry and is one of the diamond-synthetic sapphire combinations. The separation of the cement is clearly shown.

### Fresh-Water Pearls vs Salt-Water Pearls

We have frequently wondered why apparently identical pearls, one fresh water and the other salt water, should be regarded so disparately by the trade, insofar as value is concerned. Perhaps a bit of light was shed on the problem when we showed a 114-grain fresh-water pearl to an experienced pearl dealer, and one skilled in "peeling." The pearl *(Figure 14)* lacked luster over much of its surface and showed banded areas of discoloration. It was the dealer's opinion that the pearl was virtually worthless, since it was his experience that it was practically impossible to "peel" (improve by controlled scraping) fresh-water pearls. With a salt-water pearl, it probably would be

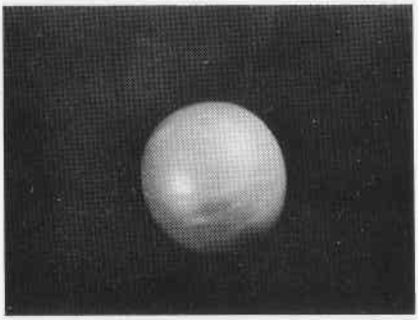

Figure 14

worth a gamble. In fact, some salt-water pearls we have observed with equally poor prospects have been remarkably improved by skilled working.

### Treated Black Opal

*Figure 15* is a photograph of seven different qualities of the treated black opal that was reported in the last issue of *GEMS & GEMOLOGY* (Fall, 1962). The center stone is an excellent imitation of black opal. We examined another lot of nine large stones of this quality that the purchaser refused to receive from customs, since the price seemed too low. His suspicion that they might be treated was justified.

### Straight Color Zoning in Chatham Emerald

Although straight color zoning is occasionally seen in Chatham synthetic emeralds, we have rarely encountered it as strong as is illustrated in *Figure 16.* On the strength of the zoning, the stone was assumed to be natural, but its peculiar blue-green color, typical of Chatham stones, prompted a laboratory test.

### Natural Nonnacreous Pearls

A problem in nomenclature was brought to our attention when we identified some nonnacreous, black calcare-

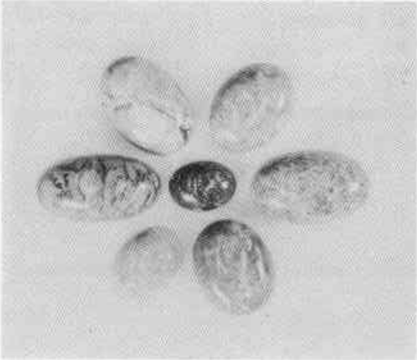

Figure 15

Figure 16

ous concretions with the typical red fluorescence of natural black pearls. We subsequently learned that these "pearls" frequently are found in the same molluscs that produce black nacreous pearls. Without their reddish fluorescence and lower specific gravity, one would easily mistake them for ordinary cherrystone- or quohog-clam pearls. Although the characteristic overlapping platy structure of nacre is presumed responsible for the orient of a true pearl, definitions of pearl available to the public make it difficult to insist that such nonnacreous concretions are not true pearls. In the interest of protecting the consuming public, we will identify such objects in the future as natural nonnacreous pearls. *Figure 17* is a photo of three of these intense-black, red-fluorescent nonnacreous pearls that illustrates one peculiarity they have in common with so-called edible clam pearls: a tendency to crack when drilled. In the cracks one can see with the microscope that the structure is quite coarse and probably consists of the prismatic structure like that of part of the shell.

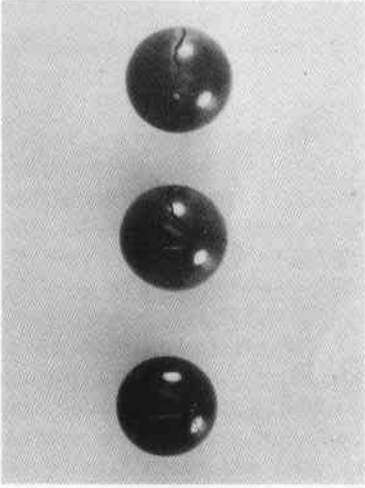

Figure 17

## Yellow-Orthoclase Spectrum

Our study of the absorption spectrum of yellow orthoclase has always been limited by the small size of the specimens available for observation. Although two vague and rather broad bands have been mentioned as characteristic, we were never able to see them as strongly as we were when we had the good fortune to examine a spectacu-

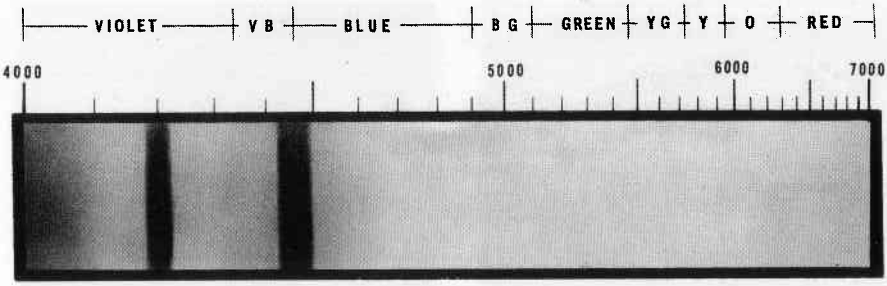


*Figure 18*

lar greenish-yellow 250-carat emerald-cut stone. *Figure 18* illustrates this.

### Odd Orientation of Rutile Needles in Corundum

One ordinarily expects to see the rutile needles in corundum arranged at right angles to the optic axis. We were surprised to see the needles in a 50-carat orange sapphire oriented in what appeared to be parallel with the rhombohedral direction. *Figure 19,* which was taken parallel with the optic axis, indicates that the needles are not at right angles to it.

### Wax-Treated Rubies

A necklace of round, dark-red rubies were found to have been treated with a red wax that gave them a somewhat better color and made the abundant cracks less objectionable in appearance.

### Green Amethyst Misnomer

Ever since the discovery of green quartz in deposits of amethyst, which itself often turns green when heated, the trade has been faced with a sales problem for lack of a recognized name. Attempts have been made to popularize such names as "prasiolita," "peridine" and "greened amethyst." One potential user seemed quite upset that we could not condone "green amethyst" for the material, since amethyst for millenia has meant the purple variety of quartz and no other.

By a similar unfamiliarity with the species-versus-variety nomenclature of minerals, attempts have been made to sell green spodumene as "green kunzite."

One identification problem for which we have no answer is the request to determine if a yellow sapphire that lost color during setting procedures was originally a natural or a treated color. Since some natural-yellow sapphires lose color with moderate heat and since X-ray-treated stones also fade, determining this requires considerably more research than has yet been devoted to this color of sapphire.

### Unusual Stones

Unusual stones identified in recent months included a matched pair of chrome-diopside cat's-eyes, which were outstanding for their superb polish. We also identified an unusual enstatite cat's-eye and encountered faceted natrolite, dolomite, blue apatite and transparent cerrusite. A platinum-and-diamond ring setting for an emerald-cut iolite made a beautiful piece of jewelry for this rarely worn stone. A parti-colored topaz, half pink and half blue, was a conversation stopper. During the period since the last column was printed, we have seen more colors of orthoclase moonstones from several different trade sources. Perhaps the most unusual was a 45-carat cat's-eye moonstone of a soft green, very much like that of some smithsonite. A black orthoclase moonstone of 19 carats was attractive. We saw several pieces of jewelry containing the more common gray-green moonstones.

The writer was very pleased to visit Mr. Herbert Walters and Mr. Elbert MacMacken, of Treasure Crafts, in Ramona, on a recent trip to California. Under the expert guidance of Captain John Sinkankas, USN (retired), we visited some of the famous pegmatite localities near Ramona under balmy, blue skies. We acknowledge with thanks gifts of numerous tumbled stones from all of these gentlemen and particularly specimens of idocrase from various California sources, as well as dyed and natural howlite. The dyed material is an excellent substitute for turquois. Other valued additions to our study material are rough and polished deep-blue chalcedony of a natural hue we thought impossible.

*Figure 19*

## DIAMOND-COATING TECHNIQUES AND METHODS OF DETECTION

*Continued from page 364*

sion, the report states that the true color of the diamond cannot be determined due to the surface coating.

This article is not intended to imply that the practice of coating diamonds is general; in fact, most jewelers purchasing stock through their regular wholesale channels will never encounter a coated diamond.

### Acknowledgements

For scientific and technical assistance, grateful appreciation is accorded to following personnel and to individuals who wish to remain anonymous: **Claremont Polychemical Corporation, Eastman Kodak Company, E. I. DuPont de Nemours, Inc., Engelhard Industries, Inc., Materials Research Corporation, Philips Electronics & Pharmaceutical Industries Corporation, Rohm & Haas Company, California Institute of Technology,** and **Columbia University.**

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