Gems and Gemology

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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. 11940 San Vicente Boulevard, Los Angeles 49, California, U.S.A.

The New Eastern Headquarters and Gem Trade Lab of the GIA

Introduction

Early in 1960, the Eastern Headquarters of the Gemological Institute of America was moved from the quarters it had occupied since 1948, at 5 East 47th. St., to larger air-conditioned quarters, at 580 Fifth Avenue (northwest corner of 47th St.). The new space, Suite 615, is approximately twice as large as that at the East 47th. St. address; also, in contrast to the earlier quarters, it was designed specifically for the Eastern Headquarters' functions. This allows for an adequate waiting and reception area; three offices; a large laboratory divided into diamond-grading area, stone-identification area and a darkroom for pearl X-radiography, ultraviolet examination and spectroscopy; and, finally, a much needed classroom. The larger space also allows for efficient filing, packing, storage, and mineral- and gem-display areas.

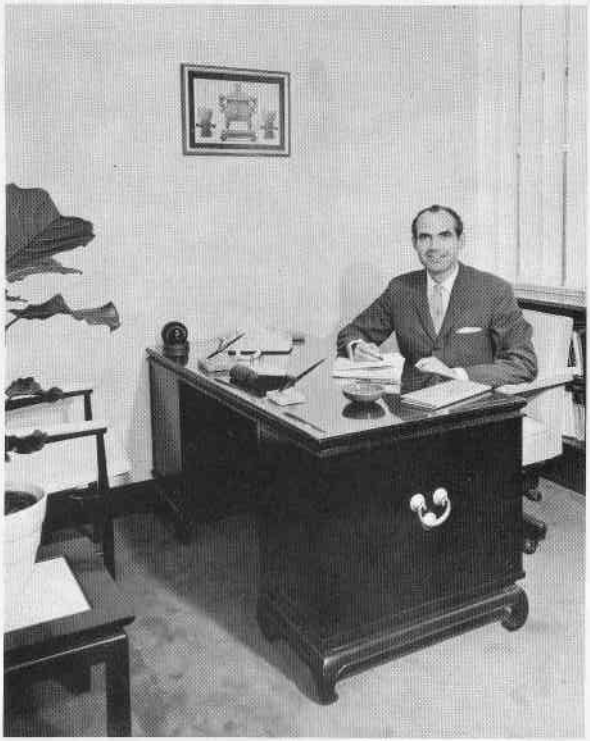
History

Eastern Headquarters of the Gemological Institute was opened in New York in the summer of 1948 by Mark C. Bandy, Ph.D., assisted by Robert Crowningshield, the present Laboratory Director. Only a matter of months after the office was opened, Dr. Bandy was called away from the Institute by the Atomic Energy Commission. Richard T. Liddicoat, Jr., then GIA Assistant Director, was sent East to replace him.

In 1948 and 1949, Eastern Headquarters of the GIA was equipped for stone identification and diamond grading only. Pearl testing was a function of the Gem Trade Laboratory, Inc., a separate organization. In the summer of 1949, Dr. A. E. Alexander, then operating the Laboratory, assumed a position with Tiffany & Co., and the Board of the Gem Trade Laboratory, Inc., asked the GIA if the Institute would take over

Entrance.

Reception Room.

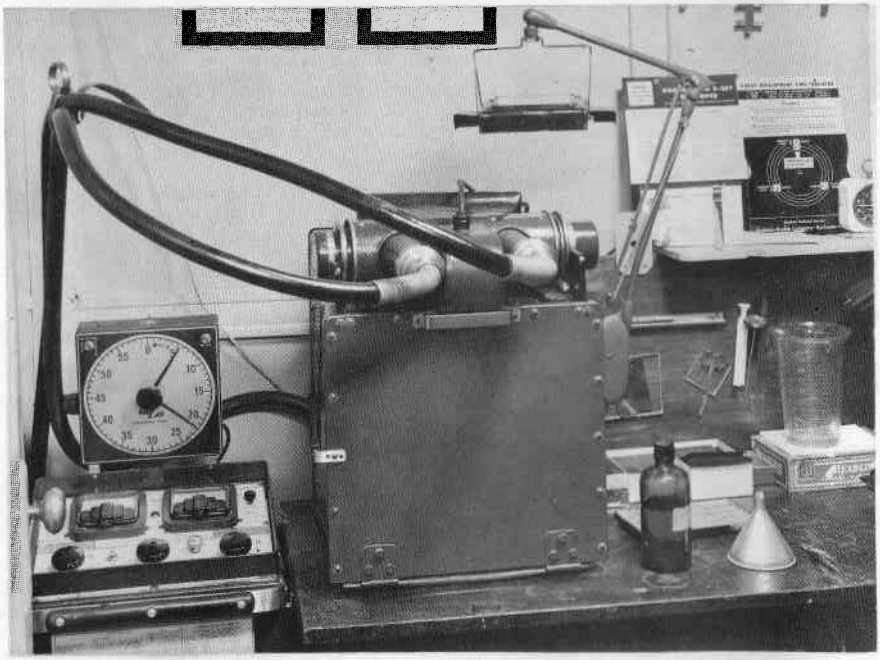


G. Robert Crowningshield, Director of the GIA's Eastern Laboratory.

and agree to continue to operate the Laboratory. The Laboratory and its pearl-testing equipment were turned over to the GIA in October of 1949, at which time the New York office began a dual function as the Institute's Eastern Headquarters and the Gem Trade Laboratory of the GIA. In February of 1950, Richard Liddicoat returned to Los Angeles and Robert Crowningshield was appointed Director of the Institute's Eastern Headquarters and its Gem Trade Laboratory in New York City. For several months in 1951, during Crowningshield's convalescence from a spinal operation, Lester B. Benson, Jr., GIA Research and Laboratories Director, served as acting director of the Gem Trade Laboratory. During this period the original X-ray equipment was replaced by a new and larger unit constructed to GIA specifications. With the installation of pearl-testing equipment at the Institute's main headquarters in Los Angeles, in 1951, a complete gem-testing service became available on both Coasts through the facilities of the Gem Trade Laboratories of the GIA.

Structure of the Gem Trade Laboratory in New York

The Gem Trade Laboratory in New York City has approximately thirty supporting member firms,



X-ray pearl testing equipment.

many of whom were supporters of the original Gem Trade Laboratory, Inc. These members pay an annual fee of $250, for which they are entitled to testing rates even lower than those charged to the trade at large. However, few of the Laboratory's supporting members look upon membership as a means of saving money. Their purpose for membership is to support an organization they consider essential to the well being of the jewelry industry. In fact, the Laboratory is considered so vital to the trade that a group of Laboratory members contributed nearly one-quarter of the cost of the move to the new quarters. This contribution was over and above the members' yearly dues. Since annual memberships and testing fees charged do not cover even the salaries of the New York staff, other activities (e.g., numerous classes conducted by the staff, both in New York and out of town) are necessary in order to provide support for the maintenance of the Institute's New York Headquarters and Laboratory.

New York personnel consists of Director Robert Crowningshield, Bert Krashes, who joined the staff in 1950, and Mrs. Eunice R. Miles, who joined in 1953. Crowningshield and Krashes have conducted classes in gem identification or diamond appraisal from Boston to Miami and Minneapolis to Houston. In New York City, the three

Bert Krashes in his office beside the Laboratory.

Diamond Class in session.

Eunice Miles at her desk.

share class instruction. Prior to her affiliation with the Institute, Mrs. Miles had wide museum experience working with minerals and gems. At the Boston Society of Natural History, she was assistant to Edward Wigglesworth, Ph.D., second president of the GIA. At the American Museum of Natural History in New York, she was engaged in classifying, exhibiting and photographing minerals and gems over a period of nearly ten years.

In New York, as well as in Los Angeles, staff members are called upon to appear on television and radio. Many state retail jeweler conventions have heard either Krashes or Crowningshield as a speaker, and all three staff members have been called on for popular lectures to local groups. Members of the staff have written magazine articles, reviewed manuscripts of books and articles, and written entries for encyclopedias.

Major Functions of Eastern Headquarters

Eastern Headquarters of the GIA is most widely known in New York for its function as the Gem Trade Laboratory and for its public-relations activities in disseminating information and holding consultations.

Each year, the Laboratory examines over 100,000 diamonds, colored stones and pearls. Of these, the vast majority are for members of the jewelry trade — importers, wholesalers, manufacturers and retailers — al-

South side of the Laboratory.

Classroom

Eunice Miles at the gem display.

though an increasing number of reports are being issued to the public. The new fee schedule, adopted May 15, 1960, calls for considerably higher fees to the public than to nonmember-jewelers. An original laboratory report will not carry the fees charged for services performed; therefore, a retailer who obtains a report as a service for his customer can charge a retail price, as he does for other services done outside his store.

A listing of the most frequently requested services offered by the Gem Trade Laboratories would include, in addition to general stone testing and X-radiography of pearls, the following: complete or partial diamond grading for make, color, clarity and weight; weight estimation for recutting a damaged or old-style-cut diamond; weight estimation of both diamond and colored stones in mountings; verifying the quality of the recutting of a diamond; detection of artificial color of diamonds, jadeite, turquois and black pearls; jewelry photography; quality control for melee; separating natural and synthetic stones in lot quantities; new product testing and description; and determination of cause, time, and ex-

tent of damage for insurance adjustors.

In addition to the jewelry trade and public, a number of official organizations have called upon the Laboratories for consultation and testing. Among these are the U.S. Customs, Better Business Bureaus, the FBI, the police departments of several cities, the New York Bureau of Frauds, the New York Bureaus of Weights and Measures, the FTC and many banks and insurance companies. The Director of the Gem Trade Laboratory is a member of both the diamond and colored-stone standing committees of the Jewelers' Vigilance Committee.

Recent Testing Advances and Activities of the Gem Trade Laboratories

In conjunction with the Los Angeles Laboratory, the New York Laboratory functions as a research organization to keep the jewelry industry's testing methods abreast of developments in synthetic and other gem substitutes, as well as conducting research to devise better means of detecting the various means of altering the color or other characteristics of both natural and synthetic gem materials. Toward these ends, the Institute enjoys cordial relations with gem-testing and other laboratories in London, Paris, Lucerne, Idar-Oberstein, Milan and Johannesburg. Perhaps a few examples of recent activities will give a clearer picture of the research function of the Laboratories.

A number of years ago, irradiation by subatomic particles, first from a solution of radium bromide and later from cyclotrons and atomic piles, were shown to produce an attractive green color in diamonds. Cyclotron-treated stones that were surface treated are detected with magnification, whereas radium-treated stones are detected by exposing them to a sensitive photographic or X-ray plate. Some cyclotron- and all atomic-pile treated stones are colored completely through and are not detectable visually. Moreover, the colors of stones that had been changed from cyclotron-induced green to shades of yellow and brown by subsequent heat treatment were not detectable. Faced with an increasing number of such stones, the New York staff devised a means by which they could be detected with a hand spectroscope. Meanwhile, in Los Angeles, acting upon the discovery by the Diamond Research Laboratory in Johannesburg that natural blue diamonds are electro-conductive, Lester B. Benson, Jr., Director of Research of the Gemological Institute, constructed a simple conductometer with which natural blue diamonds could be separated from bombarded or blue-coated diamonds. (See Los Angeles Lab Column, this issue.)

Not many years ago, it was discovered in the New York Laboratory that jadeite of a fine green color being imported from the Orient was dyed. Again, with the spectroscope, the Gem Trade Laboratory devised a means of separating the dyed from the naturally colored green jadeite. Similar tests are also employed to detect that jadeite triplets that were discovered entering the country about

Northwest corner of the Laboratory showing special diamond color-grading unit and the GIA Jewelers' Camera.

the same time. (See **Gems & Gemology,** Spring, 1958.)

As a result of successful research conducted in the Los Angeles Gem Trade Laboratory into the problem of detecting treated black pearls, the Laboratories are now issuing reports specifying the origin of their color. (See article, this issue).

Among the important gem-testing instruments utilized in the Laboratories, most were designed and developed by the Institute. These include the **Gemolite** (or **Gemscope**), diamond color-grading units, illuminator polariscopes, refractometers and dichroscopes, special light sources for spectroscopy and refractometry, and others. The problem of store lighting and display has long been of concern to the Institute. The need for a constant, diffused light source that approaches normal north light as nearly as possible for the correct rendition of color and for diamond color grading has been met with the **Verilux Luminaire.** The development of the **Verilux** over a five-year period was observed by the New York staff. The need for a light source that could give such exact color rendition while displaying the diamond's unique brilliance and dispersion to best advantage, was met with Lester Benson's ingenious addition of

(continued on page 63)

Developments and Highlights

at the

GEM TRADE LAB

in Los Angeles

by

Lester B. Benson, Jr.

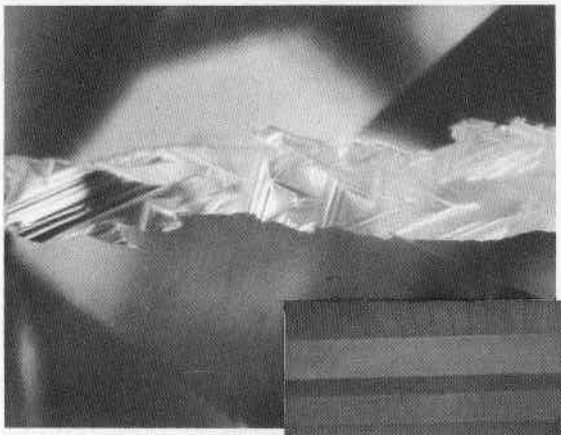
Director of Research and Laboratories

Diamonds

Three white diamonds displayed what appeared to be a bluish adularescent effect. The stones were nonfluorescent under ultraviolet light but displayed a strong blue fluorescence when exposed to X-rays. The adularescent effect was found to result from a combination of extremely minute impurities in the stones, plus bluish fluorescence excited by visible light.

* * *

Three pink diamonds, weighing .18, .50 and .51 carat, respectively, were checked to verify the characteristics of pink stones as reported recently by Bob Crowningshield, of the GIA New York Laboratory, B. W. Anderson, of the London Laboratory, and Dr. Gubelin, of Switzerland. As expected from these previous reports, the stones changed color when subjected to X-radiation. The change was somewhat in proportion to the depth of color, as follows: One stone was very light pink, and it reverted to colorless. The second stone, which was medium pink, changed to a very light brown. The third stone was deep pink, similar to the color of a fine kunzite; this specimen reverted to a purplish color with a slight brownish overtone. All specimens reverted to their original colors when exposed to incandescent light plus slight heating for a period of about five minutes. No unusual absorption characteristics were noted on the light- and medium-pink stones. However, the dark-pink stone displayed



Fissure in diamond.

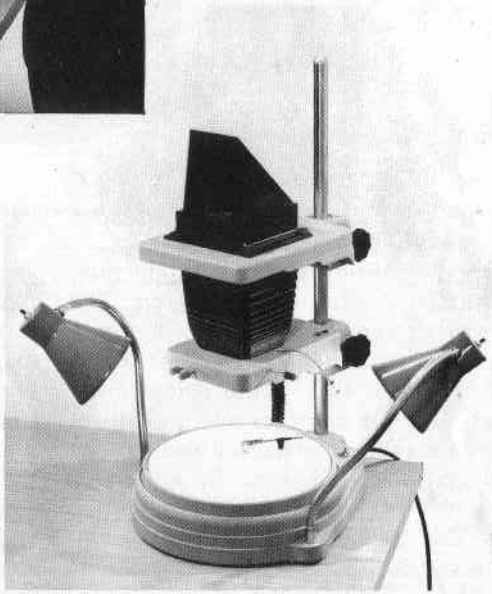
Olle Torndahl, Stockholm, Sweden, sets up the unusual diamond mentioned above as Jean Luc Roulet, Basel, Switzerland, looks on. The young men are spending several months studying all phases of gemology at the Los Angeles Laboratory.

a series of emission lines ranging from approximately 4500 to 6000 Å. This was fluorescence in the form of emission lines, rather than a continuous spectrum resulting from excitation by visible light in the blue-violet portion of the spectrum.

* * *

The accompanying photograph shows an elongated fissure observed in a 1.02-carat brilliant-cut diamond. The fissure, although relatively wide, is extremely thin, and under low magnification appears as a normal cleavage. It opens on one of the pavilion facets and is characterized by the well-detailed surface markings; i.e., trigons that are common to an octahedral face, suggesting that a gap was left during growth so that the crystal growth marks were left on both sides of the gap. In other words the gap could be considered a long, flat and narrow negative crystal.

Kenneth M. Moore taking photographs using Polaroid Land Back.

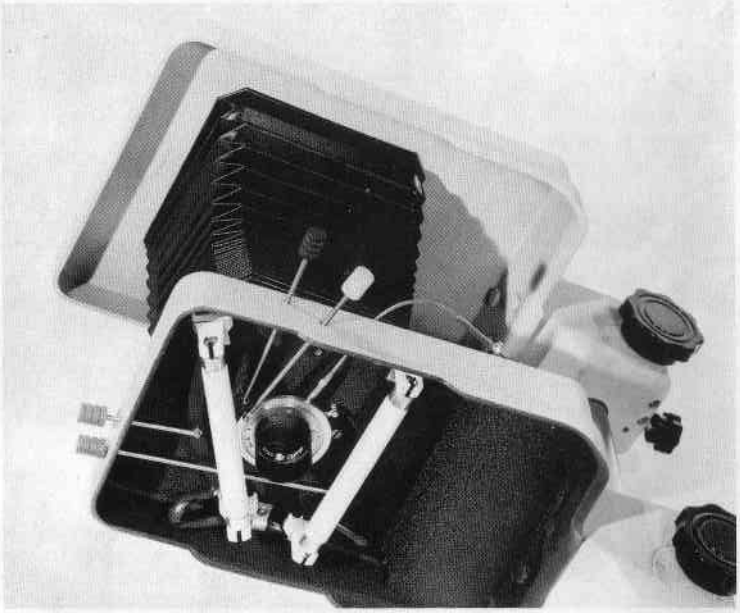


Camera with viewing screen in position.

INSTRUMENTS

The New Jewelers' Camera

The latest addition to the GIA Gemological instruments is the new Jewelers' Camera. The first large production run has just been completed, climaxing more than five years of research at the Los Angeles Laboratory. Four prototypes were constructed during this period and thousands of photographs were taken to develop utmost versatility, combining effective lighting with push-button ease of operation for appraising,



Arrangement of adustabjle overhead lights and lens controls.

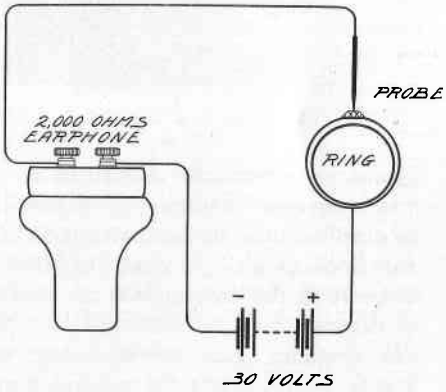
stock recording, design reproduction, illustrations for advertising, etc. The basic design of the final camera was given considerable attention, to assure a unit that would complement any interior decor, as well as to provide maximum efficiency and ease of operation for anyone in a jewelry store.

The new camera presents many outstanding features; for example, it utilizes a modified Polaroid Land camera to provide one-minute pictures. It incorporates an exceptionally fine 103-mm. F2 Graftar lens, converted for simple push-button control. Three independent sources of illumination for background, side and overhead lighting are built into the unit. The overhead illumination comes from two small adjustable fluorescent tubes mounted on each side of the lens, to provide contrast and highlights for magnified shots of both mounted and unmounted diamonds and colored stones. The camera and lens mountings are easily adjusted for height by the high-ratio gear boxes, with traverse roller bearings, that are mounted on the sturdy stainless-steel column. All of these features combine to present a completely self-contained unit, requiring no additional light sources, mounts, developing and printing facilities or other special equipment common to general photography. With the push-button control, the complete photographic cycle consists of merely opening the diaphragm and lens shutter with the

control buttons. The jewelry is then mounted on any one of the special holders provided for this purpose. One or more light sources are combined to provide the desired image and highlights in the viewer. After adjustments, the viewer is replaced by the camera and the control buttons reversed to close the lens and the diaphragm. The picture is then snapped through the use of the cable release. The unit covers a full field up to 7½ x 10 inches, and provides magnification up to 8x. This range is more than adequate to handle all jewelry photographic requirements. The Camera manual includes illustrated instructions covering illumination combinations and exposure times for various types of jewelry to ensure satisfactory results from the beginning. For those jewelers who are interested in an even more complete range of photographic activity, the special **Graflok** back built into the instrument will also accommodate such accessories as cut-film holders, roll-film backs, and enlarging projectors. Recent announcements from the Polaroid Land manufacturers state that one-minute color film will be available early in 1961. This will increase the scope of photography of this new unit to include all possible methods of both black-and-white and color photography. The unit is already attracting considerable interest throughout the jewelry trade, since it fulfills a long-existing need in gemological recording equipment.

Complete information may be obtained from the GIA Headquarters in Los Angeles.

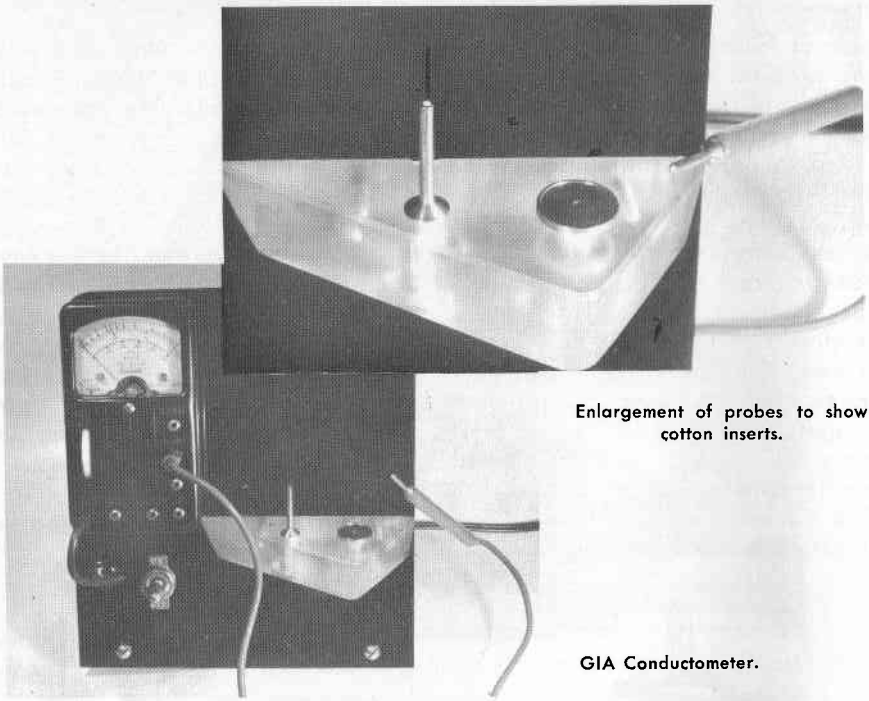
Audio Conduction Detector.



Electrical circuit of the Conduction Detector.

Audio Conduction Detector

A recent report from Dr. J. F. H. Custers, of the Diamond Research Laboratory in Johannesburg, South Africa, included the accompanying photograph of a simple instrument devised for detecting electrical conductivity in *type IIb* diamonds. It consists of a ground plate, or holder, upon which a stone is mounted or clamped,



Enlargement of probes to show cotton inserts.

GIA Conductometer.

and a contact probe connected to a low-resistance earphone. The power is supplied by a 30-volt battery. With this hookup, a slight scratching noise is heard in the earphone as the probe is drawn across the surface of a *type IIb* diamond. Due to the nature of the semiconductivity of natural blue diamonds, it is essential that the probe be connected to the negative pole of the dry battery.

GIA Conductometer

In response to several recent requests for additional information on the conductometer used in the GIA Laboratories, the unit in use is shown in the accompanying illustrations. This simple instrument incorporates a small voltmeter connected to a 110-volt A.C. current. Two ground contacts are provided, one of which is a flat base plate and the other a vertical hollow probe. Stones may be placed table down on the base plate or, if the specimens are mounted with the prongs extending above the surface of the stone, they may be placed over the vertical probe with the culet centered in the opening. The hand probe, in either case, is merely brought into contact with the stone. Because of the difficulty of making good electrical contact, wet surfaces are used to overcome this limitation. As shown in the illustration, a small cotton pack is imbedded in the tip of the hand probe, as well as in the vertical ground probe. Moistening the surface of both the

base plate and the cotton packs permits an ideal method of providing suitable contacts.

Turquois

During the last three months, there has been a considerable increase in the demand on the West Coast for large turqouois beads. A large quantity has been imported from Japan, where it presumably had been sent for treatment. All of the beads tested from this source were treated with paraffin or a related wax. In view of the superior nature of the plastic-impregnation method, it is surprising that anyone is continuing with wax treatment. The deeper color resulting from this method is not permanent, and some trouble is almost inevitable with the sale of every such strand, particularly since many of the larger strands are being sold as natural turquois for $300 to $500. One strand from another source proved particularly interesting because it represented a new method of treatment. The turquois consisted of highly compact, medium-blue natural material (specific gravity, approximately 2.71) that had been too dense to lend itself to impregnation by plastic or wax. The medium-blue color, however, had been darkened by a process that involved etching the beads in acid, presumably hydrofluoric. This treatment imparted a myriad of minute pits over the surface. It was then coated with a blue-colored epoxy resin and repolished to remove the excess resin. The colored resin that remained in the minute pits imparted an attractive deep-blue color to the beads, in addition to a lustrous, durable surface. To the unaided eye, the beads appeared as good-quality turquois, but the speckled nature of the coloration in the pitted surface was readily apparent under magnification. This process was duplicated successfully in the laboratory, using turquois from our display materials.

Unusual Stones

A beautiful gold-brown kornerupine cabochon of approximately four carats displayed an extremely sharp chatoyancy. It is the finest specimen of this type we have encountered.

* * *

A strand of purple beads sold as purple jade turned out to be dyed aventurine quartz. It is the first time that we have encountered dyed aventurine. The specimens were not too attractive and, under any name, would not have had much value.

* * *

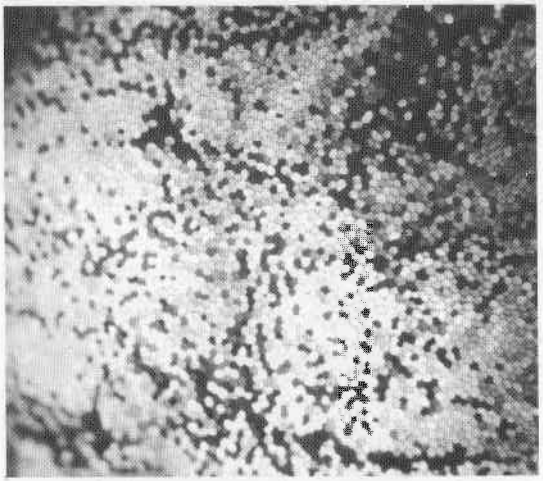
Someone in Arkansas apparently thought that he had found a new diamond mine when he submitted a small greenish crystal for identification. It was stated to have been mined by him, but it proved to be silicon carbide.

* * *

One gentleman was highly enthusiastic over the phone and was anxious to show us a very rare emerald displaying a pronounced play of color. It was reported to be the only opallike emerald known. Unfortunately, it proved to be an extremely flawed specimen that displayed some iridescence from the air-filled fractures.

* * *

A blackish-green step-cut stone,



Pearllike formation.
Magnification 30x.

measuring approximately 13.5 x 9 mm. proved of interest to the owner when its properties failed to correspond to any of the normal figures listed on property tables; viz., it was singly refractive, had an R.I. of approximately 1.79 and an S.G. of approximately 4.50. The stone was gahnite (spinel).

* * *

Another pearllike formation similar to one reported in a recent column was submitted for identification. It consisted essentially of parallel semi-transparent crystals. It transmitted light readily parallel to the crystals (see accompanying illustration) but was opaque at right angles to this direction. It was an orangy-brown color and had been represented as a black pearl. The surface characteristics indicated polishing, and it is possible that it had been fashioned from a section of a large shell.

* * *

Through the courtesy of John R. Fuhrbach, G.G., FGA, San Antonio, Texas, one-half of the huge garnet crystal shown in the accompanying photograph has been added to the

Garnet crystal.

GIA collection. The crystal, which was found in Ontario, Canada, shows the combination form of the trapezohedron and the rhombic-dodecahedron. It measured 71.6 x 95.4 mm. prior to sectioning and weighed 793.5 grams. Although it is not of gem quality, it is translucent through the thin edges and shows a dark reddish-orange color.

Testing Black Pearls

by
Lester B. Benson, Jr.
Director of Research and Laboratories

The emphasis in recent years on treating gem materials has introduced many problems for dealers who specialize in natural, untreated specimens. One of the principal problems is concerned with natural black pearls, which range in color from an almost jet black with little or no orient to light grays with pronounced overtones of different colors and a high degree of orient. Nearly all color possibilities have been duplicated successfully by treating white or off-colored pearls. Many appear so nearly identical to the natural that they defy visual detection, even by the trained pearl merchant. The detection of the various methods of treatment is made particularly difficult by the opaque or, at best, semi-translucent nature of pearls, which eliminates many of the optical tests used in the identification of transparent materials. Moreover, pearls are easily damaged by some of the agents that are ordinarily used in the detection of coatings and dyes.

Recent work on the various kinds of black pearls encountered to date has disclosed two basic types of treatment. In the first method, either dye or a coating is applied to the surface, which makes the treatment effective on both drilled and undrilled specimens. The second is a center treatment of drilled pearls, which may involve the distribution of a dye between a few near-surface layers of nacre or a general saturation of the dye throughout the entire central part of the pearl. As a rule, well-formed layers of nacre are almost impenetrable to dyes; however, apparently capillary action permits dye penetration between some layers. Some undrilled cultured pearls have been encountered with nuclei that had been treated prior to insertion in the mollusc.

Silver nitrate was used extensively at one time to dye pearls. It was readily detectable by X-radiography, since even a small amount of the silver formed by reduction of this compound is sufficiently opaque to X-rays to be visible on a radiograph. Only a small percentage of the recently examined treated pearls have shown the presence of a metallic deposit. Experiments conducted in Los An-

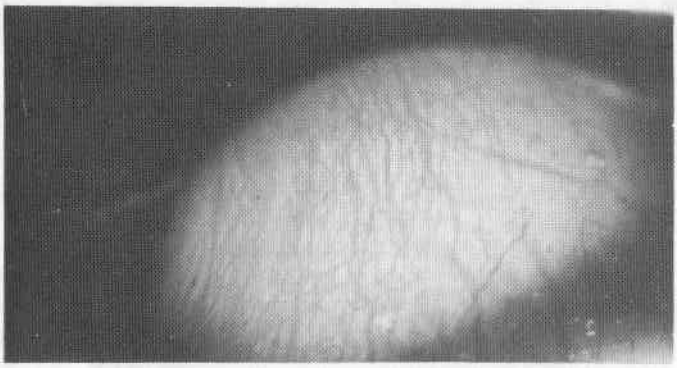
geles by Gale Johnson on various methods suitable for dyeing pearls has confirmed the advantage of other dyes over silver nitrate.

Of the several thousand natural black pearls that have been examined in recent months, all but a small percentage have proved to be sensitive to visible radiation, centered at approximately 4000 Å. (this borders on the edge of the violet portion of the visible spectrum). Excitation by this radiation results in a red fluorescence, which, under proper conditions, is very strong. The excitation of fluorescence by visible light in various materials was reported as early as 1853 by George G. Stokes, who demonstrated it by using a light filtered through a copper-sulphate solution. Such a solution will filter out the long, or red and yellow, wavelengths from the spectrum. Many specimens so illuminated will fluoresce and emit light in the yellow or red wavelengths. It is readily observed by viewing the specimen through a filter that transmits only the longer wavelengths. This method of examination has been referred to as the *crossed-filter method*. Its application to gem materials has been the subject of several articles by B. W. Anderson and Robert Webster, of the London Laboratory, who have mentioned the reddish fluorescence of black pearls. There are a few limitations to the test, however, when considering its overall application to the detection of treated pearls. The copper sulphate solution transmits all wavelengths except those in the red, orange, and yellow; as a result, the blue and green light, in excess of that required for excitation, often tends to mask weak fluorescent effects, particularly of pearls other than black that fluoresce a strong white or nearly white. The observation of the latter is essential in detecting some of the white pearls that have been dyed black.

It is not intended to infer that pearls are not excited by ultraviolet. At least some excitation stems from exposure to ultraviolet light, but the greater percentage comes from the low portion of the visible spectrum. If all of the wavelengths that can cause excitation are present in a given source, but to the exclusion of all other light, a maximum effect will be achieved. Standard ultraviolet lamps do not provide maximum efficiency for this purpose, since their emission consists only of isolated mercury-emission lines, some of which are in the ultraviolet and others in the visible.

Since no suitable source of adjustable monochromatic light covering the low visible radiation is yet available in a simple unit, the possibility of critical fluorescence testing of the majority of gem specimens as a routine test is greatly limited. In addition, the variation in existing ultraviolet filters, as well as in lamps, makes the present standardization of fluorescent tests very difficult to establish. This accounts for what appears to be wide discrepancies in the fluorescent characteristics of various gem materials published by different authors.

Obviously, fluorescence holds a key to the identification of treated and natural pearls. Experimentation



Unusual hairlike lines below surface of a natural pearl.

has shown that when used properly, some currently existing lamps provide an aid in overcoming this problem.

To gain a complete picture of the identification problem involved, the nature of treated pearls must first be understood. Specimens tested have ranged from poor-quality black pearls that were spottily coated (to even out inherently uneven coloring) to white pearls that were center treated to impart a desirable dark body color. When a white pearl is center treated, and the surface nacreous layers are not saturated with the dye, the white fluorescence still remains (although in some cases it is extremely weak regardless of the darkness of the resultant body color. White fluorescence has not been encountered in any natural black pearl tested to date, except in mottled low-quality specimens. A pearl that has been surface treated, whether by coating or by dye, is sufficiently dense to absorb both the fluorescence-exciting radiation and the fluorescence itself.

Not all black pearls fluoresce. Although well over 99% of the pearls tested did, a few were encountered that would not respond. One was obviously a blister that had been rounded up by polishing. It displayed no orient and apparently was almost pure conchiolin. It resembled a conch pearl, in that it did not contain nacreous layers. The few remaining specimens, which appeared to be from one isolated source, were characterized by a highly translucent nacre that was sufficiently clear to permit the observation of subsurface defects to a depth of as much as one millimeter. In transmitted light, this translucent nacre appeared to be a light grayish-green color. Still more unusual, all of these pearls displayed a number of darker green hairlike lines just below the surface (see photograph); they were not associated with cracks or other structural defects. Although these fine lines have not been observed on pearl-bearing shell, some shell has been examined that possessed this same highly translucent nacre that

does not fluoresce under either ultraviolet or visible light. The origin of these shells is unknown, but it is possible that the few pearls with similar characteristics came from the same locality.

Referring back to the coated pearls, the coating was found to be insoluble in any common solvent. It could be removed with a solution of glacial acetic acid, but only as a gummy residue. It is soluble, however, in a weak nitric- or hydrochloric-acid solution. Obviously, any tests used on pearls must be nondestructive. The use of acids is dangerous, since pearls are basically calcium carbonate and thus are attacked violently by both of these acids. Experiments, however, did show that a very weak solution of approximately two parts acid to one hundred parts water would not harm the pearl, except under prolonged contact. At the same time, such a solution dissolves the coatings slowly. A satisfactory test was therefore found in the use of a tiny cotton swab moistened with this weak solution. By rubbing a coated pearl lightly, a slight brownish discoloration accumulates on the cotton. Any discoloration is indicative of treatment, so it is not necessary to pursue the test to remove other than a trace of the coating. Prolonged rubbing strips the coating and thus reveals the true color of the treated pearl, and, in contrast to the coating, it usually appears as a discolored spot. Such an induced color blemish does not occur if the test is performed properly, and the pearl itself is unaffected. Pearls tinted other colors (bronze and pink, for example) also have been encountered that were surface treated, and they reacted equally well to the solvent test.

When checking pearls for fluorescence, as mentioned before, the source of the radiation is most critical. In addition, wide variations have been noted in the sensitivity of different persons to light containing ultraviolet, as well as to low visible violet radiation. It has been found that some persons, when attempting to observe a specimen that imparts a very weak fluorescence under an ultraviolet lamp, may have the effect masked completely by the glare created by the reflected near-ultraviolet radiation. Those who are not so sensitive to this violet light may see the fluorescence quite easily under the same conditions. For safety, it is always best to observe any specimen illuminated by ultraviolet lamp through a glass filter that will absorb the ultraviolet content. This is particularly true if a strong lamp is used, since it takes only a few minutes to burn the eye tissue seriously with excessive ultraviolet light. In addition, the filter should also remove the low visible violet light, to assist those who are highly sensitive to this radiation. Since personal requirements vary so widely, the selection of a suitable filter is a matter of individual research. Depending on the type of ultraviolet lamp used and the efficiency of the filter, either the long- or short-wave type may be most efficient for checking pearl fluorescence. Work done in conjunction with other commercial laboratories in Los Angeles revealed that, for the most part, their standard-model fluor-

escent lamps were completely unsatisfactory for this purpose. This is undoubtedly true of many existing lamps elsewhere. Essentially, the requirement for maximum excitation is a relatively high-intensity output in the vicinity of 3800 to 4500 Å. The lamp that has proved most successful in the GIA laboratory is a large unit utilizing a 100-watt G.E. mercury spot. With this kind of illumination, the characteristics of the pearls tested to date may be summarized as follows:

Fluorescent Black Pearls

The majority of natural black pearls fluoresce varying degrees of red. The effect is not necessarily related to the depth of color, since some light grays, as well as some almost black pearls, fluoresce a vivid cherry-red color. Specimens that display a weaker chalky-pink color usually are accompanied by a rather grayish overtone and poor orient; again, however, this is not always true. Some specimens display a mottled color, including patches of red or pink, together with areas of bright-white fluorescence. Similar mottled fluorescent effects have been observed on certain pearl-bearing shell. The areas that fluoresce white, if isolated from the remainder of the pearl, would hardly fall into the classification of black pearl.

Nonfluorescent Natural Pearls

A few isolated specimens have been encountered that displayed no fluorescence under X-rays, ultraviolet or visible radiation. Almost all of the specimens tested to date have displayed a typical hairlike discoloration, as shown in the photograph accompanying this article. These also displayed the highly translucent surface layers of nacre, which were of a light grayish-green color. These pearls can be separated easily from coated pearls by the presence of the translucent nacre. The completely opaque, black, nonfluorescent natural concretions encountered appeared to possess no nacre or orient; thus, they failed to qualify as pearls in all respects. Generally, they would be classed as clam pearls. One large sphere of this type displayed a distinct color zone, the edge of which circled the pearl below the center. Magnification showed that this specimen had been a blister pearl with the base rounded by polishing. It had been suspected of artificial coloration, because of the abrupt change from black to light gray near the base. Furthermore, the top surface displayed an iridescent metallic appearance, similar to that produced by some coatings. It was the result of numerous near-surface separations between the layers of which it was composed and subsequent light interference from the thin films of air. On the basis of the very small percentage of the nonfluorescent natural pearls found in the large number tested, the nonfluorescent category should seldom be encountered by the average jeweler.

Center-Treated Natural Pearls

These are specimens that, for the most part, were originally white pearls that displayed typical white fluorescence. Treating them through the drill hole to saturate the layers near the surface results in an excellent duplication of the various colors of natural blacks. Under suitable exci-

tation, these specimens display the white chalky appearance that is typical of white pearls. The degree to which the chalky-white fluorescence is visible depends on the extent of saturation, as well as on the nearness to the surface of the treating agent. In all specimens tested, the white fluorescence was very weak, in relation to that of an untreated white pearl.

Surface-Treated Natural Pearls

Obviously, surface treatment, which is present in the form of a thin coating, is the least expensive method of treating pearls. Normal wear, however, results in discoloration as the coating is removed. Orient is invariably lacking, although slight orient may be displayed by specimens with an extremely thin coating. These pearls have their fluorescent characteristics masked by the coating and appear black, similar to the rarer natural black pearl described above. These types can be distinguished readily by the solvent test, using the weak water-and-acid solution applied with a tiny cotton swab.

Center-Treated Cultured Pearls

The primary requirement for the identification of cultured pearls is the verification that they are cultured, and, in the case of colored specimens, the radiographic method is the only adequate test. Endoscopic methods are not always applicable, since the treating agents can prevent transmission of light through the nacrous layers. If it is established that a pearl is cultured, any coloration that is not common to normal cultured pearls will have been the result of treatment. Such specimens display the typical white fluorescence of white pearls, appearing similar to center-treated natural pearls. A second type of center treatment involves those pearls containing nuclei that were colored prior to insertion in the mollusc. Such pearls may not possess drill holes. Again, if an undrilled pearl is proved by radiography to be cultured, it follows that any coloration is the result of a previously colored nucleus.

Surface-Coated Cultured Pearls

Such specimens rarely display orient or fluorescence and are readily detectable by the solvent test described above.

In conclusion, it can be stated that any black pearl should first be tested for fluorescence, preferably against known specimens, to ensure that the correct radiation is being used. If it fluoresces a pink or red color, the reaction is typical of a natural colored pearl. If the fluorescence is spotty (i.e., with black areas), the latter should be checked for a coating with the solution test. A mottled white-and-pink fluorescence is also typical of some natural colored pearls, but those encountered to date have presented a relatively poor appearance, in that the color was uneven and dull. If the pearls appear black but with a gray or whitish fluorescence, the reaction is typical of center-treated cultured or natural pearls. A total absence of fluorescence indicates a coated specimen or possibly a clam pearl; these can be separated by the solvent test.

Developments and Highlights at the GEM TRADE LAB in New York

by

G. Robert Crowningshield

Director of Eastern Headquarters

"Diamond-ite," "Trulite," etc.

The rash of advertisements extolling the virtues of synthetic colorless sapphire disguised under such names as "Diamond-ite," "Trulite," "Brillight" and "Vespa Gem" has produced some very peculiar information. One advertisement by a prominent Brooklyn department store states that " 'Diamond-ite' is 9.6 in hardness 'M.O.H.*' " The asterisk calls attention to a statement at the bottom clarifying M.O.H. as "Molecules of Hardness!" Not only is synthetic colorless sapphire 9 in hardness (not 9.5 or 9.6, as some testing laboratory has reported), but the advertising-copy man evidently never heard of Friedrich Mohs (1772-1839), who, in 1818, devised this relative scale of hardness, that is still widely used by mineralogists and others. However, it has been the source of a great deal of misinformation, such as appeared in another advertisement in which it is stated that "Trulite" is 95% as hard as diamond. It should be reemphasized that Mohs' scale of hardness is only relative. The report from the testing laboratory referred to earlier is apparently the basis for the misleading advertisements to the effect that the synthetic colorless sapphire offered under a variety of meaningless names is 9.5 or 9.6 in hardness. The report does not even identify the material tested. However, all such stones tested in the GIA Labora-

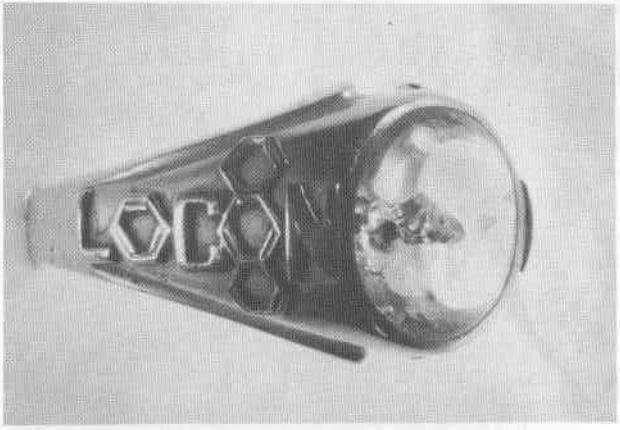


Figure 1.

tory so far have been normal synthetic colorless sapphire, differing only in the quality of cut and polish. The fact that all have been scratched by both natural and synthetic sapphire and that each has, in turn, scratched both natural and synthetic sapphire substantiates Mohs' scale of hardness. There are no commercially available gemstones to which the figure 9.5 can be given.

"The Unidentified-Factor Ring"

A ring set with an eight-carat pale-blue sapphire cabochon containing a large inclusion *(Figure 1)* claims an original and most interesting background. It was presented to Dr. Leo Norris, Cornell University, by students and coworkers upon his retirement. The sapphire was chosen especially for him because of the inclusion (actually a negative crystal), which symbolizes the unknown, since Dr. Norris, one of the foremost authorities on nutrition, has for forty years searched for the unknown. In addition, it is coincidental that the engraved initials, LCN, when separated with the proper chemical symbols, symbolizes a discovery made by Dr. Norris. Two GIA students, Dr. Ray Bunnell and Sam Preisner, are credited with the unique design and its execution. A matching tie clasp completes the set.

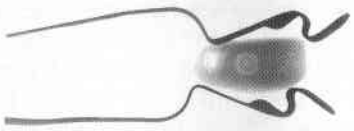


Figure 2.

Blister Pearls

Out of curiosity, we made a radiograph of an attractive blister pearl and were surprised to find that the nucleus consisted of two natural pearls, which were evidently ejected by the mollusc but were caught between the shell and the mantle to become part of the larger blister. *(Figure 2).*

Hollow-Centered Cultured Pearls

We have encountered two cases in which travelers in the East have been sold large "natural" pearls by dealers who also had similar-appearing cultured pearls for sale. In both instances, they proved to be hollow-centered (i.e., without nuclei) cultured pearls. The largest was more than 16 mm. in diameter and was slightly button shaped.

Synthetic Emeralds

It has been reported before, both in the New York and the Los Angeles Laboratories, that occasional synthetic emerald crystals contain metallic crystals, which were identified as platinum by Bell Laboratories, Murrayhill, New Jersey. We encountered these crystals for the first time in a fine-quality cut stone, and they were large enough to make the stone sink in emerald liquid, which has an S.G. of 2.67. This is also the first cut synthetic emerald we have seen that did sink in this liquid.

Diamond Fluoresces Yellow

Although students of the Diamond Course are well aware that the majority of fluorescent diamonds fluoresce blue and thus pose a grading problem, it should be mentioned that an almost colorless diamond may occasionally fluoresce a distinct yellow, thus making it grade lower in daylight than in incandescent light; this is the reverse of blue-fluorescent diamonds. A stone of this type came to our attention recently when a cutter and potential customers were in disagreement regarding its color grade.

Synthetic Rutile

It would seem that synthetic rutile has become so rare in the trade that a new generation of dealers is becoming aware of it for the first time. We have identified more specimens of it since the last issue of **Gems & Gemology** than during the previous six months. One quite unusual yellow-orange stone had been sold in a fancy gold ring for more than $4,000 as a "canary diamond."

Conch-Shell Beads

Once again this summer, at least one department store in New York has taken a commercial advantage over its competitors by advertising beads cut from conch shell as "shell coral." The material can be sold for much less than the increasingly popular white coral. In addition, due to the structure of shell, the luster is not as uniform as that of coral beads. We have been informed that steps have been taken to prevent further use of this deceptive name.

Natural Glass

We encountered three types of natural glass in the past few months. These included an uncut, strangely pitted tektite, a cut stone of green moldavite and a very large faceted specimen of Libyan silica glass.

Unusual Stones

Among the more unusual items identified in the Laboratory recently was a massive specimen of lazulite with occasional clear areas in which one could check the material's amazing dichroism.

* * *

A transparent brown emerald-cut

cassiterite weighing more than 50 carats is the largest we have encountered of this high-density material, almost exactly twice that of diamond.

* * *

An emerald-cut specimen of zincite weighing more than two carats makes the fifth such stone, and by far the largest, that we have had in the Laboratory.

* * *

An attractive 12-carat round brilliant-cut sphalerite was an impressive specimen of this fragile mineral.

* * *

Other rarities included benitoite, danburite, phenakite, sphene, brazilianite, smithsonite, amblygonite, diopside, yellow transparent labradorite, scapolite, epidote, dioptase, enstatite and fine-green cat's-eye apatite.

* * *

An unusual specimen that came into the Laboratory was a dark-brown chrysoberyl with a four-rayed star. Had the color of the stone been more attractive, the stone itself would have been unique.

* * *

One of the most unusual quartz specimens we have encountered was a series of parallel grown crystals at the base, with a twinned crystal that was medium-light amethyst at the top of one area. The amethystine area was above a deep coppery pink base. The latter color was caused by inclusions of fairly fine rutile needles in an interesting orientation caused by the twinning. The pattern was prominent in the cabochon that was cut from a section. The needles were oriented roughly in pie-shaped sections, pointing toward the center of the crystal. For this reason it would have been impossible to cut either a cat's-eye or a star from the material, although a cabochon cut from the piece had an intriguing coppery sheen in a deep-pink background. Here and there in the rough were clear rock-crystal areas that had sparsely included rutile needles.

Citrine Triplet

Another unexpected stone encountered recently points the importance of examining under magnification every stone on which a report is to be issued. This stone appeared to be ordinary citrine quartz of a pleasant uniform yellow color. The refractive index on the table gave the normal quartz readings, and an interference figure showed up almost automatically in the polariscope. Under the microscope, and later with immersion in water, the stone was seen to be a quartz triplet made up of two parts of rock crystal cemented together with yellow plastic or resin-type cement. The client asked to have the stone separated, to convince himself that the parts were indeed rock crystal; this, of course, was unnecessary. The assembled stone had been properly represented to the client, it was later learned, and the reason for making a complicated triplet to imitate such a common stone seems to have been a desire for uniformity in filling a huge order for matched stones.

* * *

A transparent brownish willemite, when examined with the spectroscope, showed a distinct absorption spectrum. Since little mention has been made in textbooks concerning

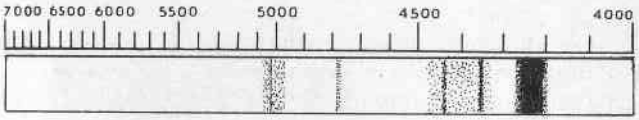


Figure 3.

this unusual gemstone, it is worth noting. (See *figure 3.*)

* * *

We wish to thank **Mr. Raphael Esmerian,** New York City, for a gift of natural black pearls, some of which will be sacrificed for study purposes.

Also, we wish to acknowledge with thanks a gift of several cut datolites and phenakites from **Mr. Ronnie Romanella,** New York City mineral dealer.

We are indebted to **Astro Lapidaries,** New York City, for a fine specimen of transparent blue-green apatite, a color until now missing from our collection of apatite.

EASTERN HEADQUARTERS

(continued from page 44)

baffles to the **Verilux** diffusion screen; this resulted in the **Diamondlux Luminaire,** which is distributed to the jewelry industry by the GIA. The new quarters of the New York Laboratory are illuminated by both types of fixtures. Jewelers with lighting problems are invited to see the several types of installations, to gain ideas for their own stores.

At the present time, the Laboratories, both in Los Angeles and New York, are working on a number of problems of major importance to the jeweler. One of the most important is the development of a means of detecting the coating that is being used to improve the color of off-colored diamonds. Means of detecting possible new colors induced by subatomic-particle bombardment and subsequent heat treatment are also being studied at the present time. Since the income of the Gem Trade Laboratories had never covered basic operating costs, much less underwritten the numerous pieces of equipment that have been required to perform laboratory services adequately and the increasingly expensive equipment needed to do research, an increase in service charges was instituted on March 15, 1960.