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On the Cover

Ninety-six round diamonds surround a pair of natural baroque pearls, one black and one white, in this award-winning pair of earclips, designed by Julius Cohen, New York City. It was one of the 24 precious-jewelry designs that received awards in the Diamond-International Awards, at the Waldorf-Astoria, New York City.

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

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Highlights at the GEM TRADE LAB in Los Angeles

by

Lester B. Benson, Jr.

Nineteen large red cabochons that had been represented as rubies were submitted for verification. All specimens were highly fractured, and duplicated closely some of the crackled synthetic rubies on the market. Magnification revealed numerous, tiny octahedral crystals in nine of the specimens. R.I. and optic characteristics quickly verified these as spinel, and the remaining ten as natural corundum.

* * *

A manager of one of the gambling casinos in Nevada submitted a not-too-fine strand of pearls that had been offered to the house as a proposed settlement for a $7500 gambling debt. They were represented as natural pearls with a claimed value of $10,000. Radiographs quickly identified them as cultured and, obviously, not the medium by which this debt was to be discharged.

* * *

We encountered our first good star peridot. It was a cabochon of approximately three carats and displayed a well-defined four-rayed star reflected from tiny needlelike oriented inclusions.

* * *

Representative samples from parcels of stones taken from an estate of a former gem dealer were presented for identification. The bulk of the stones supposedly consisted of zircons; however, the majority proved to be glass.

* * *

A strand of dark-green impure jadeite beads, two carved pendants and a larger carving were encountered separately but within a period of two weeks. This material was similar to numerous specimens that we have encountered in the past, except that these were all heavily saturated with a paraffinlike wax to improve luster and to help conceal some of the cracks.

* * *

One transparent, yellow scissors-cut sapphire of rather fine quality caused the owner some difficulty because the style of cut, plus the absence of bubbles, suggested strongly that it was synthetic. The spectroscope, however, proved it to be a natural sapphire.

The accompanying photographs were taken of a rather unusual synthetic sapphire. A mass of gas bubbles and faintly curved striae were concentrated in the pavilion of the stone, although a few bubbles were in the crown area. In addition, several twinning lines and distinct needlelike inclusions were present. The crown facets had obviously been re-fused, resulting in the etched appearance. There is no reasonable explanation for the combined characteristics.

Pavilion of the synthetic sapphire showing the mass of gas bubbles and needlelike inclusion.

Crown facets of synthetic sapphire showing etched appearance and needlelike inclusion.

An interesting star sapphire was encountered that displayed double asterism. The intersections of the stars were approximately one-eighth inch apart. Under magnification, a distinct almost parallel line was visible between the two crystals that showed the stars. The axes of the original crystals were oriented at a slight angle to each other.

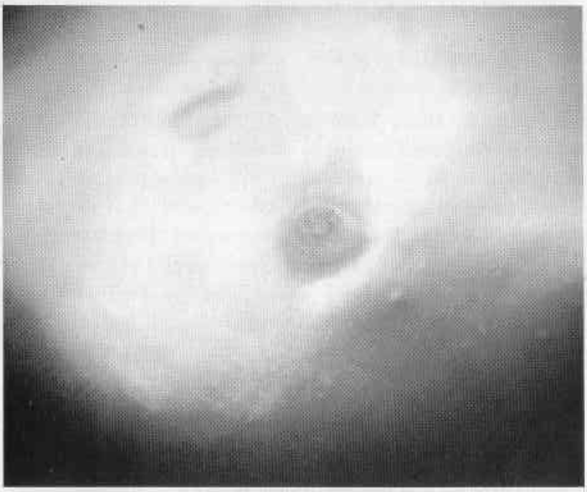
* * *

There is an increasing use of crack and fissure sealers in the colored-stone trade. The best sealers consist of a clear epoxy resin, which, after curing, provides a reasonably hard surface that takes a good polish. Several stones have been encountered in which major cracks and cavities have been so well concealed that detection would be difficult in the absence of at least 30x.

* * *

The jeweled ornament in the accompanying photograph is part of a large collection of historical pieces. Re-

Jeweled ornament of the Bishop who officiated for the Czar in the Great Palace of the Kremlin. Courtesy, Count Ivan Podgoursky.



Pearl showing a pit that resulted from the removal of a welt by polishing.

cently, a question arose concerning the identity of some of the stones in the ornament. Careful examination displayed numerous settings that were not consistent with the nature of the piece. Specifically, some stones, either too large or too small for the bezels or prongs, had merely been cemented in place. The stones, supposedly natural, proved to consist of 242 pieces of glass, two pieces of rock crystal, five amethysts and one garnet-and-glass doublet. Since some of the stones had obviously been replaced, the conclusion on the part of the owner was that all of them had, at some time, been substituted. The unit was the ornament of a bishop who officiated for the Czar in the Great Palace of the Kremlin. The center painting was on a mother-of-pearl back.

* * *

An interesting problem arose when a jeweler's customer purchased a new pearl-cleaning solution and proceeded to clean a strand of large cultured pearls according to the instructions on the bottle. In the process, the string broke; therefore, the pearls were taken to the jeweler on the assumption that the solution might have affected both the string and the pearls. One of the salesman recalled having sold the pearls to the customer, so he inspected them thoroughly for possible damage. His conclusion was that the solution had deteriorated the string, changed the color of the pearls and pitted them. Since the strand had cost a considerable sum, a claim was submitted for total loss. Subsequent tests on a number of pearls and pearl strings failed to confirm that any potential damage would result from using the solution. An analysis of the liquid revealed that it was just a common neutral detergent. The few so-called pits in the pearls were nothing more than welts that had originally been removed from the pearls by polishing. The accompanying photograph was taken of one of the larger

(continued on page 30)

Highlights
at the
GEM TRADE LAB
in New York

by

G. Robert Crowningshield

A lady's ring containing three green octagon step-cut stones was submitted for identification of the stones. Magnification and refractive index indicated synthetic emerald. However, under long ultraviolet radiation the edges of the stones fluoresced yellow and the centers only faintly reddish. It was only when the stones were thoroughly cleaned on the back and a roll of black velvet inserted in the shank that they showed the expected fluorescence of synthetic emerald. The matter of backgrounds against which fluorescence is observed is important. The fluorescence of rubies on a white background under short ultraviolet is of some value in identification, and is further used by some dealers to separate so-called Burma and Siam grades. One dealer called in alarm that a ruby he was testing in a ring showed a greenish fluorescence. It was only when he discovered that the rolled-up handkerchief he was using in the shank to provide the background fluoresced blue that he realized his error. Most bluings and bleaches used in both commercial and home laundries today contain blue fluorescing chemicals to provide the "blue-white" appearance so desired in white textiles. (It is present in many white papers, also.)

* * *

Mr. Harold Branch, of Schenck and Van Haelen, diamond cutters in New York City, called to tell the Laboratory of the second largest diamond found in Arkansas in the past 20 years. He offered it to us for observation and write-up. The crystal weighs 6.43 carats and measures 9.80 x 7.62 x 9.20 millimeters. The color is a fine "cape." Mr. Branch is confident that it will be accepted as

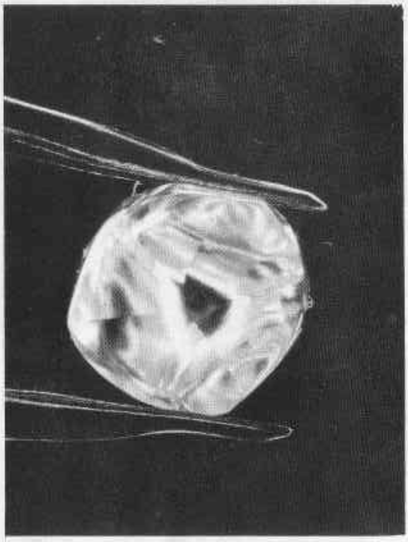


Figure 1

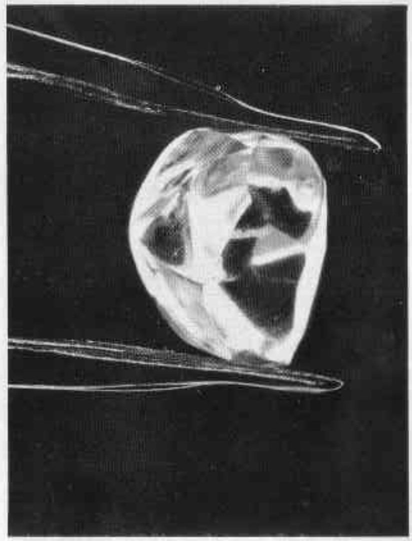


Figure 2

Figure 3

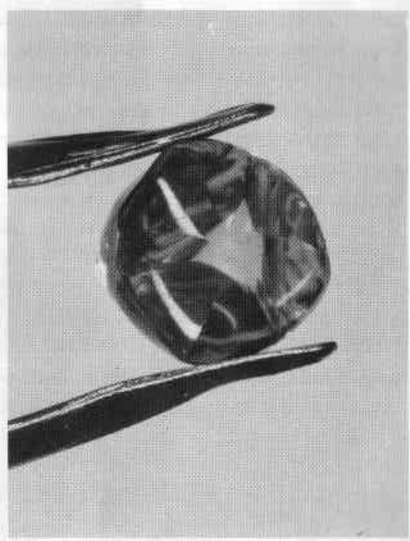


Figure 4

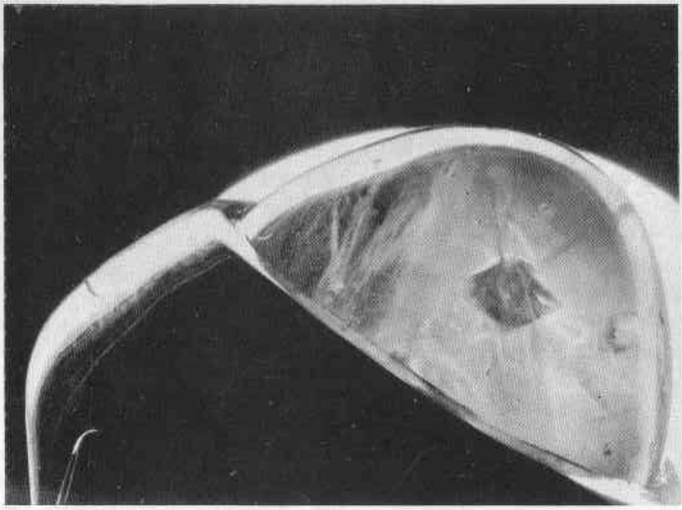


Figure 5

a canary diamond, if it is cut. The crystal is flawless and only lightly etched on the surface. We are unable to say precisely what its crystal form is, but our first impression was that it is a modified and distorted hexoctohedron. The photographs, *Figures 1 and 4,* are of the broad side of the crystal, which is the point that would probably be the table of a two-point stone, according to Mr. Branch. *Figure 2* is a side view (the face at the left being the flat face shown in *Figures 1 and 4.)* The stone is not too well shaped for fashioning as a round brilliant; however, a rather deep emerald cut could be made with a not-to-great loss of weight. The decision to cut the stone has not been made.

* * *

Figure 5 is a photograph of a large cabochon sapphire in a man's ring. The crystal inclusion proved to be a blue spinel of such a size that it could be identified by analyzing with a hand spectroscope the light that passed through it.

* * *

An interesting fabrication consisted of a heat-crackled synthetic ruby cabochon into the back of which a hole had been drilled and a natural ruby inserted and the whole polished, to make it appear as if the natural piece was merely a rather more highly flawed area in an otherwise clear natural ruby. The identification was a simple matter of finding the curved striae and gas bubbles. Not so easy was another red stone submitted for identification. In appearance, it resembled the brownish purple-red of the so-called Siam trade grade of ruby. The inclusions appeared to be those that are characteristic of this type of ruby as illustrated by Dr. Gubelin in his book, *Inclusions as a Means to Gemstone Identification.* They consisted of cracks filled with flat films resembling two-phase inclusions. It lacked the dark crystal inclusions that are so often associated with Siam rubies. When the stone was finally unmounted and carefully observed under immersion and high magnification, both striae and gas bubbles were found. The stone illustrates another application of heat cracking, in which the stone is immersed in a colored liquid instead of water in order to cause the crackled effect. In the process, the liquid is drawn up into the cracks and stays there to resemble natural inclusions.

* * *

A very handsome black-dyed so-called South Seas cultured pearl measured approximately 17 x 14 millimeters. It was the largest dyed cultured pearl that we have encountered.

* * *

Bert Krashes had occasion to use the electrical-conductivity test for natural blue diamonds, which was devised by J. F. H. Custers, and implemented by Lester B. Benson, when he examined the Hope Diamond recently in Washington. (The Hope "behaved good like a blue diamond should!") As expected, the stone was highly conductive. Thus far, the only electrically conductive diamond encountered in the laboratory, aside from the steel-blue to sapphire-blue natural stones, has been a nondescript grayish-greenish yellow stone. According to the Diamond Research Laboratory of De Beers, only type IIb diamonds are electrically conductive, and these have always been described as blue, or bluish gray. The laboratories of the Institute continually check all diamonds of unusual color for the conductive property, since much is yet to be learned about them.

Encouraged by the sight of the yellow crystal found by the Michigan man in the "Crater of Diamonds" at Murfreesboro, Arkansas, the author of this column stopped by to visit with Mr. Howard Millar and to search for diamonds in the company of student Stanley Kahn and family of Pine Bluff, Arkansas. A new appreciation of the rarity of diamonds was gained by the party — they found none!

* * *

Unusual gem minerals fashioned as gemstones that the Laboratory was called upon to identify recently included a one-carat benitoite that showed very distinct color banding, similar to that seen in some blue sapphires. Also identified were two faceted willemites, an axinite, a sphene, sodalite, scapolite (both cat's-eye and transparent, step-cut materials), ordinary andalusite and the weakly dichroic, intense-green variety of this material (the latter was in a parcel of demantoids, which also contained two peridots, three chrysoberyls and three green sapphires). Also identified were purple, green and colorless apatite, datolite, amethyst with cacoxenite inclusions (these resemble brown bunches of silk similar in appearance to some tiger's-eye). Iolite, tektite, danburite, sinhalite, faceted sunstone, beryllonite, phenakite and green quartzite resembling jade complete the list of unusual stones. Unusually large stones seen included a 207-carat gypsum cat's-eye of a handsome orangy-brown color, a 110-carat fine morganite and a still finer 71-carat morganite, and a fine 23-carat orange spessartite. However, perhaps the most unusual stone encountered since the last issue of *Gems and*

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A New Emerald Substitute

by

Ralph J. Holmes, Ph.D.
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and

G. Robert Crowningshield
New York Gem Trade Laboratory

A new, durable emerald substitute of a very attractive color has appeared on the market that bids well to fill a long-felt need for a satisfactory, yet reasonably priced, substitute for this gem. It should complement, rather than compete with, Chatham's synthetic. Although its color approximates that of good-quality emerald, it is expected that it will be sold for a fraction of the price of available synthetics. Like the Chatham product and Igmerald, the new material is best described as a form of synthetic emerald.

The process employed in its manufacture was developed by Mr. Johann Lechleitner in the Austrian Tyrol. The stone has been tentatively referred to as *Emerita,* for brevity. The name suggests a combination of its association with emerald and the word "merit," which is in token of its pleasing appearance.

Method of Production

The details of the production method have not been revealed, but the properties of the finished product suggest either a hydrothermal or flux-fusion process. The material is unusual (in fact as far as we know, unique) in that the finished stone consists of a large core, or "seed," which has been faceted or shaped from a single-crystal piece of colorless or faintly colored beryl. These shaped stones, or seeds, approximately the size of the finished product, are said to be placed in an apparatus under controlled conditions of temperature and pressure, in the presence of a medium in which beryl and a chromium compound are dissolved. Under these conditions synthetic emerald is deposited in crystallographic continuity on the shaped beryl seed. When this overgrowth has attained a sufficient thickness, a stone of a very attractive color results.

Basically, there appears to be little difference between the method of production of this material and that employed in the manufacture of the Chatham synthetic emerald. The method of producing the latter has been described as one involving the crystallizing of synthetic emerald on a seed crystal. The difference in the case of the Lechleitner product is that the beryl seed accounts for the bulk of the stone. The relatively short time required to produce a satisfactory overgrowth will naturally influence the market price of the stones.

History of Emerald Synthesis

The beauty, desirability and value of genuine emeralds have prompted numerous attempts to reproduce them artificially. The Lechleitner material adds another chapter to these efforts, which extend over more than half a century. The earliest recorded experiment seems to have been that of Hautefeuille, in the 1880's,[2] in which he produced tiny crystals of synthetic emerald of no commercial significance. The culmination of these efforts occurred in the 1930's, when successful synthesis of stones of gem size and quality was first announced by I. G. Farben in Germany, and a little later by Chatham in San Francisco. I. G. Farben never pursued commercial production of their synthetics; therefore, Chatham has enjoyed a virtual monopoly in this field for many years.

Material Available for Study

The data presented here are based on a study of numerous faceted and cabochon stones, both "rough" (i.e., with crystalline overgrowth but unpolished) and polished, of various sizes, weighing up to 12 carats.

Physical Characteristics
Specific Gravity

Specific-gravity determinations on the finished stones are of limited significance, since the beryl seeds differ somewhat in specific gravity and make up variable proportions of the finished product. However, the bulk specific gravity may be useful in identification; therefore, the determinations are recorded. The specific gravity, as measured on ten stones, exhibited a range from 2.649 to 2.707, averaging 2.684, which lies within the range of that recorded for beryl. Stones of low density proved, on examination, to be ones in which the beryl seed contained numerous gas- or liquid-filled cavities. These values are compared with those of various natural emeralds and other beryls in the tabulation below.

Specific Gravity

Lechleitner Synthetic Emerald (polished)	2.649 to 2.707
Chatham Synthetic Emerald	2.645 to 2.665
Igmerald	2.645 to 2.655[6]
Colombian Emerald	2.690 to 2.710[1]
Uralian Emerald	2.720 to 2.740[1]
Indian Emerald	2.725 to 2.745[1]
Sandawana (Rhodesian) Emerald	2.744 to 2.768[1]
Aquamarine	2.680 to 2.740[4]
Beryl (all types)	2.63 to 2.85

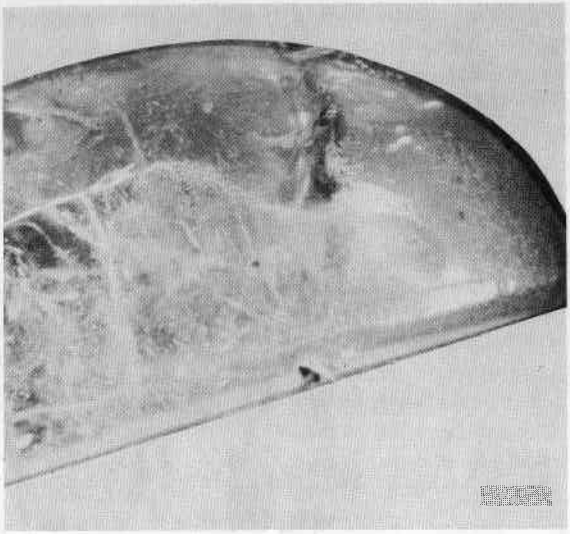

Figure 1 Cross section of a sawed cabochon, showing relative thickness of synthetic emerald overgrowth (dark rim) compared to the size of the beryl "seed."

Hardness, Tenacity and Fracture

The surface hardness of the synthetic material agrees with that of both natural and other synthetic emeralds. Stones, deliberately fractured, break with a conchoidal pattern that disregards the boundary between the beryl seed crystal and the overlaying synthetic emerald. This is to be expected, since the encrusting material is in crystallographic continuity with the underlying seed. In some of the earlier-formed stones, scattered filmlike patches can be seen within the stone at the base of the overgrowth. It was suggested to the producers that this might be due to improper cleansing of the prepared seeds, since any foreign material, such as grease, would interfere with the bonding between the seed and the overgrowth. Later stones show no evidence of this imperfection.

Optical Characteristics

Color and Pleochroism

The depth of color depends on the thickness and color intensity of the synthetic emerald overgrowth *(Figures 1 and 8)*. The stones thus far produced do not have an overgrowth thick enough to provide the depth and richness of color observed in fine natural emerald. Observations on sectioned polished stones reveal an overgrowth that does not exceed half a millimeter in thickness. Two groups of stones have been supplied for study, presumably manufactured some months apart. It is of interest to note that those in the second group have a heavier overlay and are greatly improved in color. Although the color is not as intense as that of fine natural stones, it is better than that of a large percentage of natural emeralds available on the market today. The color is a pleasing green, comparable to that of lighter Colombian stones, but not as bluish as the Chatham synthetics. The bluish-green color of most of the synthetic emeralds now available is partly due to the preferred crystal orientation of the cut stones.

The pleochroism of deeply colored natural emeralds, and especially Chatham synthetics, is strong. It is not surprising, therefore, that the new stones are distinctly pleochroic; however, the strength of the pleochroism is clearly related to the thickness of the overgrowth. All three vary from yellow-green parallel to ω to a bluish green parallel to ε.

Index of Refraction

One of the most striking differences between the Lechleitner and other synthetics is the appreciably higher index of refraction of the former. The indices of refraction of the new stones lie within the range of the natural gem, and are measurably higher than those of other synthetic emeralds.

Refractive Indices

	ω	ε
Lechleitner Synthetic Emerald (av. of three)	1.575	1.581
Chatham Synthetic Emerald	1.560-1.562	1.563-1.565
Igmerald	1.559-1.562	1.563-1.569
Colombian Emerald	1.565-1.578	1.570-1.584
Uralian Emerald	1.579	1.588(1)
Indian Emerald	1.586	1.593(1)
Sandawana Emerald	1.586	1.593(1)
Aquamarine	1.570-1.580	1.575-1.586(7)
Common Beryl	1.564-1.595	1.568-1.602

Transparency

The transparency is greater than that of most natural emeralds, since the large beryl core usually contains fewer imperfections and inclusions. They are likewise more transparent than Chatham synthetics, due to the colorless character of the core and its freedom from the wisplike inclusions that are characteristic of the latter.

Absorption Spectra

Using a Beck Hand Spectroscope, the absorption lines were compared with those of natural emeralds, as well as Chatham synthetics. The spectra of the new stones are in agreement with the other two, except for the absence of two lines in the blue range. However, since these two lines can usually be seen only in the spectra of deeply colored natural or synthetic emeralds, their absence here is not surprising.

Fluorescence

The intense red fluorescence of Chatham synthetics provides one of the best clues in distinguishing them from natural emeralds. The new stones exhibit visible reddish fluorescence under long-wave ultraviolet light; however, the effect is less intense than that observed in Chatham synthetics and is definitely related to the thickness of the overgrowth.

Microscopic Observations

The "rough" stones consist of faceted or cabochon seeds on which a crystalline overgrowth of synthetic emerald has formed in crystallographic continuity. As might be expected, the rate of deposition on the various facets of the seed, with their differing relations to the crystallographic axes, is not uniform. In addition, the surface markings, pits, grooves and other irregularities, many of which have a definite pattern, are strikingly different on adjacent facets and present a considerable variation in relief *(Figures 2 and 3)*. This is also to be expected, since the pattern of surface markings on a particular facet is determined by the symmetry of the atomic arrangement on the crystal planes paralleling the surface in question. Since the atomic pattern on planes that parallel differently oriented facets of the cut stone will be different, the growth markings on these facets will be different. It is also well known that under a given set of conditions crystal growth is more rapid in certain crystallographic directions. On some stones it can be seen that crystallization was initiated at numerous centers over the surface. These appear as scattered, crude hexagons exhibiting a parallel growth arrangement *(Figure 4)*. With a gradual increase in size they coalesce to form a single crystalline unit covering the entire surface.

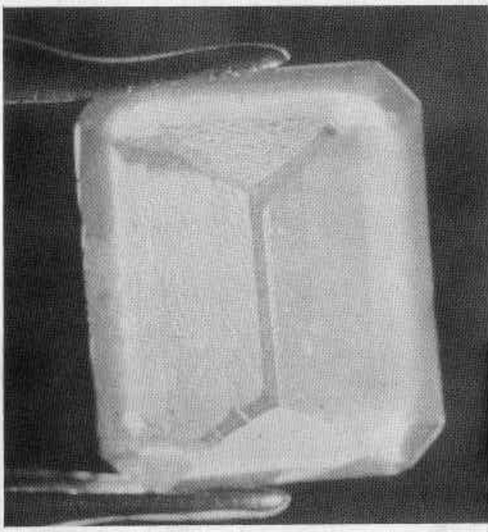

Figure 2 Unpolished "rough" stone, showing variation in growth markings on different facets. *Magnification 5x.*

Another striking crystallographic aspect, observed on some unpolished cabochon stones, is the development of well-formed crystal faces on the stone itself *(Figure 5)*. The forms observed are those of combined first- and second-order hexagonal bipyramids. The effect is that of two rings of twelve inclined faces centered about the C axis on opposite sides of the stone. Such pyramidal crystal faces are more characteristic of aquamarine than of emerald. Natural emerald crystals tend

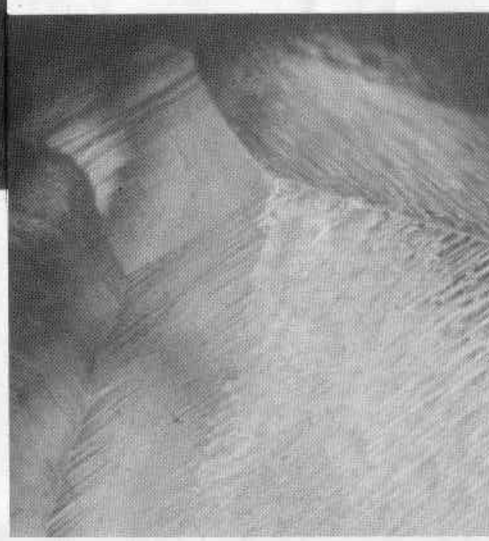

Figure 3 Details of surface growth markings on various facets of unpolished "rough" stone. Note variations in relief of the crystalline overgrowth on adjacent facets. *Magnification 15x.*

Figure 4 Crystallization showing scattered, crude hexagons that exhibit a parallel growth arrangement. *Magnification 10x.*

to consist of simple hexagonal prisms terminated by a flat base or a pinacoid. Aquamarine, on the other hand, tends to develop additional minor forms such as hexagonal bipyramids. The pyramidal faces developed on these cabochons are clearly due to the influence of the beryl or aquamarine seed crystals on the crystallizing synthetic mantle, even though the overgrowth is synthetic emerald.

Polished Stones

Polishing reduces the thickness of the synthetic emerald overgrowth considerably, since it is necessary to remove all surface irregularities, or relief, developed during crystallization. As a consequence, polished stones have both a paler color and greater transparency than the unpolished "rough." In a few instances, polishing has removed all of the overgrowth on certain facets

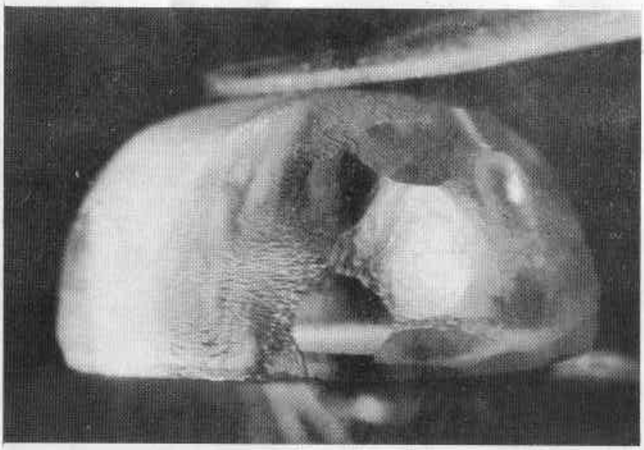

Figure 5 Cabochon showing well-developed pyramidal crystal faces near right end of stone. Note the contrast between the smooth pyramidal faces, the moderate relief area in the vicinity of the optic axis, and the strong relief and ridgelike growth pattern in the vicinity of the prism zone on the left. *Magnification 15x.*

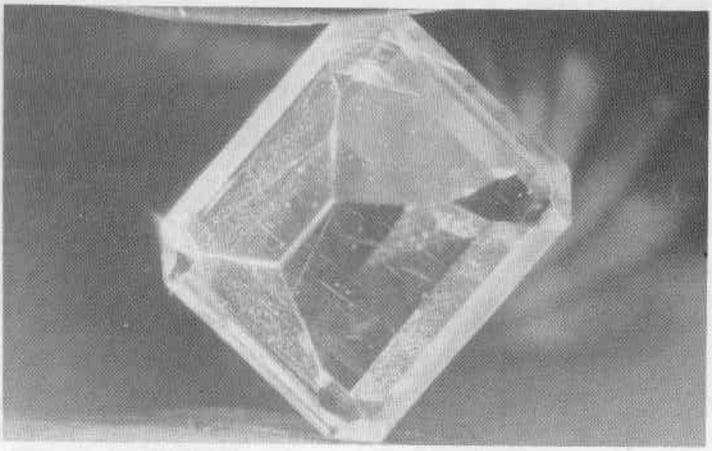

Figure 6 Polished faceted stone showing the streaklike internal fracture lines in the synthetic emerald overgrowth, a characteristic feature of the material. *Magnification 5x.*

thus producing a colorless "window." There is reason to believe that stones can be produced that will have a thicker overgrowth, therefore, overcoming this difficulty. The depth of color achieved, in spite of the limited thickness of the overgrowth, shows that the color of the mantle material is very deep green.

Internal Structures

Numerous parallel and subparallel short, straight lines *(Figure 6)* constitute the most striking internal structural feature observed. In some instances groups of these lines nearly encircle the stone. They are apparently minute, parallel internal fractures in the synthetic emerald overgrowth, and may be attributed to relief of strain. Such strain developing at or near the boundary would be a likely consequence of slight differences in lattice dimensions of the underlying colorless seed and the chromium-bearing synthetic mantle, or of lattice strain in the chrome-rich overgrowth itself. The producers are attempting to reduce or eliminate this feature, and it is less evident in the later stones.

X-ray Diffraction

Powder X-ray diffraction patterns were obtained from both the underlying beryl seed and the synthetic emerald overgrowth. For comparison, patterns of Chatham synthetic emerald, Uralian emerald, Colombian emerald, aquamarine and common beryl were also prepared. The X-ray patterns are all in agreement, establishing identity in structure. Essential identity of structure and composition between an artificial material and its natural counterpart is the basic criterion of the concept embodied in the term "synthetic." On this basis, the Lechleitner, I. G. Farben and Chatham stones all qualify as synthetics. A comparison of the pattern is shown in *Figure 7.*

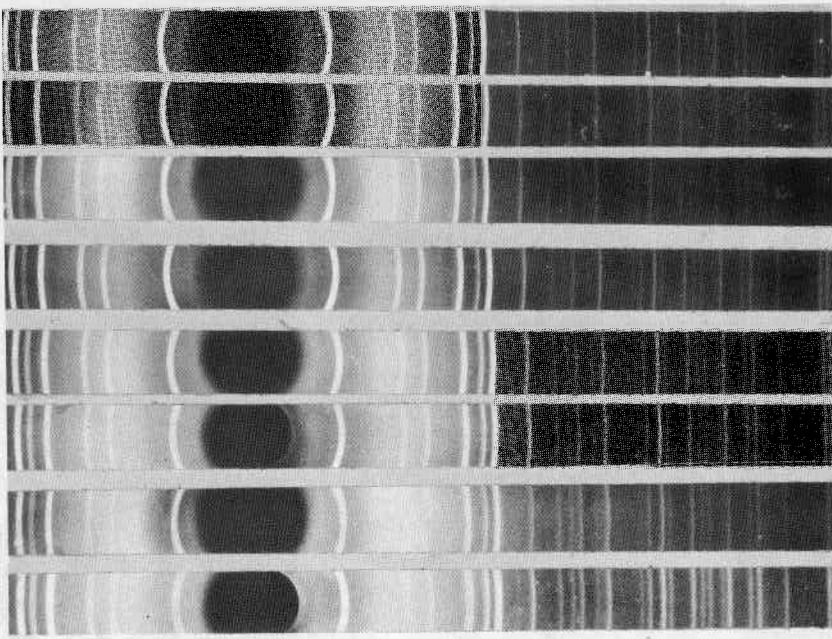

Figure 7 Powder X-ray diffraction patterns, taken with Cu radiation, of natural and synthetic beryls.

A. Synthetic emerald overgrowth of Lechleitner synthetic emerald

B. Colorless seed crystal of Lechleitner synthetic emerald

C. Lechleitner synthetic emerald plate (experimental)

D. Chatham synthetic emerald

E. Emerald, Ural Mountains

F. Emerald, Colombia

G. Aquamarine, Brazil

H. Common beryl, Portland, Connecticut

Essential agreement of patterns provides evidence of the structural identity of all materials.

Identification

In the following tabulation, some of the basic physical and optical properties of the new product are compared with those of natural emeralds and both the I. G. Farben and Chatham synthetics. Study of the table shows that it is possible to distinguish the new material produced thus far from both the natural and other synthetic emeralds.

Summary of Properties

Probably, the best clues to identification are (1) the high refractive index and (2) the internal structure. Both criteria distinguish it from other synthetics and the second separates it from natural emerald. However, one of the easiest ways to distinguish this material from both natural emerald and other synthetics is to observe the stone in an immersion liquid of approximately 1.55 to 1.60 R.I. The synthetic

Summary of Properties

	Lechleitner Synthetic Emerald	Igmerald Synthetic Emerald	Chatham Synthetic Emerald	Natural Emerald
Specific Gravity	2.649 to 2.707	2.645 to 2.655	2.645 to 2.665	2.690 to 2.768
Hardness	7½ — no significant difference			
Typical Refractive Indices	1.575-1.581	1.560-1.563	1.561-1.564	1.570-1.575
Color	Medium to light green	Deep green	Deep, slightly bluish green	Green to deep green
Pleochroism	Distinct blue-green to yellow-green	Strong blue-green to yellow-green	Strong blue-green to yellow-green	Blue-green to yellow-green
Luminescence (Ultraviolet)	Pale to distinct red	Deep red	Deep red	None to pale red
Absorption Spectra	Agree, with one exception: Two lines in the blue are absent in the Lechleitner stones			
X-ray Diffraction	Essential agreement (Igmerald not available)			
Inclusions and Microstructures	Minute, parallel, straight fracture lines	Wisps	Wisps 2-phase inclusions	2- or 3-phase inclusions and crystal inclusions

emerald overgrowth shows up strikingly as a narrow, dark-green band rimming the stone. This is well shown in *Figure 8*.

significant factor is that, for the first time, a satisfactory emerald substitute has been produced at an initial price that makes it available to an extensive

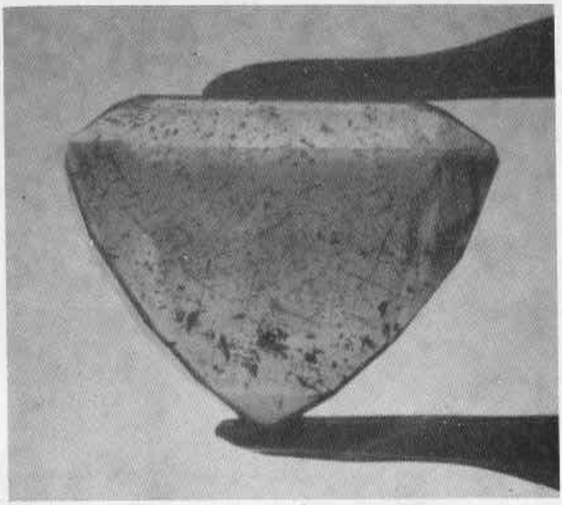

Figure 8 **Faceted stone, photographed in an immersion liquid of index 1.60, in which the synthetic emerald overgrowth shows as a narrow dark rim bordering the underlying beryl "seed." The numerous inclusions are in the "seed" crystal. *Magnification 6x.***

market for which the Chatham synthetics are beyond reach.

Suitability as a Gem Material

The new stone is a welcome addition to the list of emerald substitutes. It has already been produced in a color of sufficient depth and quality to rate as an attractive and interesting material. Its hardness is equivalent to that of natural emerald and the stone takes a fine polish. Since the bulk of the stone is colorless beryl, its tenacity should be greater than that of the more brittle natural emerald. Improvements in the production technique, resulting in the development of a heavier overgrowth, are likely to result in stones of deeper and more uniform color. From the standpoint of the jeweler, the most

Classification and Nomenclature

In spite of the unique character of this material, there is little question of basic classification and nomenclature. There is no doubt concerning the identity of the deposited overgrowth, the structure of which is the same as that of natural emerald or of Chatham's synthetics.

The Lechleitner stone, like the Chatham product and other man-made crystals such as synthetic quartz, is grown from a seed of crystal, which is an integral part of the process and the product. Although the method of pro-

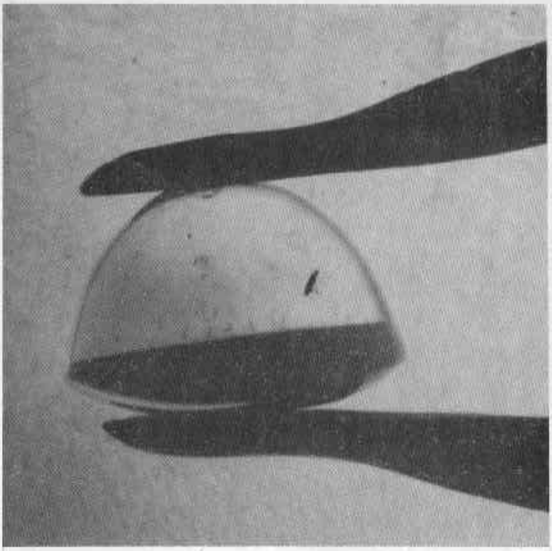

Figure 9 **Natural emerald cabochon immersed in a liquid of comparable index, showing sharply limited distribution of color at base of the stone.** ***Magnification 5x.***

duction of Chatham synthetics has been described as involving the use of seeds, such nuclei are not observed in the finished product, since the stones are cut from relatively large crystals that developed from small nuclei.

In the new synthetic, the large seed makes up the bulk of the finished stone. However, fundamentally, there is no difference between this and other synthetic emeralds, either in the product or the basic principle underlying the process. Both involve a method in which synthetic emerald is deposited in crystallographic continuity on a seed. The thickness of the coating and the relative proportion of seed to synthetic do not change the basic classification of the product. It is noteworthy that the material fits the concept implied by the term "cultured" (as it has been used in reference to pearls) better than do the Chatham stones. However, in view of the justifiable objections that have been raised against the use of this term, it is not recommended.

In this respect, they are similar to many emeralds and other natural colored stones in which extensive "tunnels" or other colorless portions are frequently found. In the hands of an expert cutter, the colored portions of such partially colored natural stones can be positioned (usually at the base or culet) in such a way that complete uniformity of color is achieved, especially when the stone is viewed from above. It is only when such a stone is immersed in a liquid of approximately its own refractive index that one becomes aware of the limited distribution of color. A striking example of a very attractive natural emerald cabochon immersed in this manner *(Figure 9)* shows that, in this case, the green color is confined to a very narrow layer at the base. In spite of the fact that the bulk of the material is colorless beryl, no one has ever hesitated to call such a stone an emerald, as long as the overall color effect is satisfactory. In other words, the proportion of colored to non-colored material has never been considered a criterion for nomenclature in the designation of natural stones. There is no reason for its being held as a criterion in the case of synthetics, nor has it been so held in the past. The recent successful production of hydrothermal synthetic ruby is a case in point. Laudise and Ballman of the Bell Telephone Laboratories, in their paper on *Hydrothermal Synthesis of Sapphire,*[3] describe a typical example of their synthetic ruby as having an overgrowth of only three-tenths of an inch on a seed crystal with a seven-eights-inch diameter.

The term "synthetic" as applied to minerals, has, by long usage, been universally understood by both mineralogists and gemologists to mean one thing only: a man-made product having essentially the same chemical composition and crystal structure as the natural mineral it represents. The question of method of production does not enter, and by this token neither does the question of the use of a seed or core, nor the size relation of seed to overgrowth.

Acknowledgements

We take this opportunity to thank the producers of this new material, and the distributor, Jean Bach, for making available material for study. We are also indebted to Mr. Charles Derby of Rahway, New Jersey, and Mrs. Jeanne G. M. Martin of the Gemological Institute of America, Los Angeles, for the photographs of "rough" and polished stones.

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Gemological Digests

Russia

It has been mentioned in a Soviet publication that Soviet physicists have invented a portable apparatus to detect diamonds in soil samples in the field. The instrument, called the "diamond compass," makes use of the diamond's luminescence when irradiated by radioactive isotopes.

USA

It has been reported that the Smithsonian Institution was recently given a black diamond, believed to be the largest in the country. The carbonado variety of diamond, weighing 740 carats and resembling a piece of coal, was presented to the Institution by Diamond Distributors, Inc., N. Y.

De Beers

The Diamond Corporation has announced that an exclusive agreement has been signed in London whereby all the diamonds from the Soviet Russian production that the Soviet authorities wish to export for marketing in the Western world will be purchased and sold through the Central Selling Organization.

Venezuela

Diamond production has recently gained substantially in Venezuela, according to the Venezuelan Chamber of Commerce in the USA. Production in the first half of last year amounted to 60,495 carats, representing an increase of more than 45 percent over the corresponding period in 1958.

Holland

Several firms in Holland are now undertaking synthetic-diamond research. Asscher's reveals it has applied for a patent, and says its process is based on a system of "guided" explosive charges that enable the necessary high pressures to be attained. The firm states the process is not like General Electric's, and that its experimental work is "entirely independent" of synthetic-diamond research now in progress at two other Dutch firms: N. V. Bronswerk, Amsterdam, and Philips, Eindhoven. Asscher's prefers to refer to its new material as "man-made hard materials from graphite" and not "diamonds."

USA

It has been reported that the Tiffany diamond, the largest and finest canary diamond in the world, is for sale, priced at $500,000. It weighs 128.51 carats and has 90 facets.

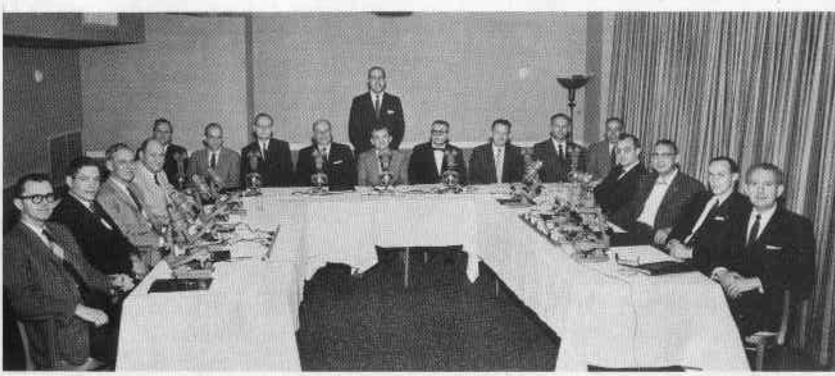
USA

The Electronic News reports that the Army Research and Development Laboratory at Fort Monmouth has developed synthetic diamonds. The manu-

(continued on page 29)

New York City Diamond Class

Washington D.C. Diamond Class



Atlanta Diamond Class

New York City Diamond Class

Members of the New York City Diamond Evaluation Class which met February 1st, through February 5th. Seated left to right: **Robert Bookin**, Ottumwa, Iowa; **William I. Lugo**, Rio Piedras, Puerto Rico; **Mrs. Susan Jolly Ragsdale**, Raliegh, N.C.; **Mrs. May Peebles Waite**, North Adams, Mass.; **Edward J. Randall**, Madison, Wisc.; **George H. Hammann**, Buffalo, N.Y.; **Andrew Tessler**, Union, N.J. Standing left to right: **Bernard Bartikowsky**, Wilkes-Barre, Penna.; **David P. Alderman**, Fairfield, Conn.; **John Walker**, Newburgh, N.Y.; GIA instructors, **Bertram Krashes** and **Mrs. Eunice Miles**; **Peter Zack**, Newburgh, N.Y.; GIA instructor, **G. Robert Crowningshield**; **Floyd Barringer**, Newburgh, N.Y.; **Kenneth J. Van Cott**, Binghamton, N.Y.; **Robert Spreer**, Newburgh, N.Y.; **J. N. Mappin**, Montreal, Canada; **Carmen Mignoni**, Bristol, Penna.; **William T. Partridge**, Boston, Mass.; **Michael Miller**, Philadelphia, Penna.; **Nat Drenger**, New York City; and **Arthur Russakoff**, Skowhegan, Maine.

Washington, D.C. Diamond Class

Members of the Washington, D.C. Diamond Evaluation Class that met February 8, through February 12th. Standing left to right: **Samuel Lakein**, Baltimore, Md.; **Robert J. Kenney**, Frostburg, Md.; **Garland Reedy**, Newport News, Va.; **Robert S. Lippman**, Bethesda, Md.; **Patrick Stager**, Washington, D.C.; **Harry Brott**, Washington, D.C.; GIA instructor, **Bertram Krashes**. Seated left to right: **Bill Witt**, Harve de Grace, Md.; **George Olifer**, Arlington, Va.; **Lenore A. Davis**, Washington, D.C.; **Paul R. Mueller**, Havelock, N.C.; **Edward Schleifstein**, Washington, D.C.

Atlanta, Ga., Diamond Class

Members of the Atlanta, Georgia, Diamond Evaluation Class that met February 15th, through February 19th. Left to right: **Guy R. McVay**, Florence, Ala.; **Elwood Watson**, Atlanta, Ga.; **Carter H. Evans**, Chattanooga, Tenn.; **Tom Self**, Gaffney, S.C.; **Walter R. Thomas, Jr.**, Atlanta, Ga.; **L. D. Penny, Jr.**, Athens, Ga.; **D. N. Herbert**, Fort Valley, Ga.; **Joseph L. Morrow**, Birmingham, Ala.; **Louis Mintz**, Gainesville, Ga.; **Edward B. Wall**, Thomson, Ga.; **Carl Hays**, Macon, Ga.; **William E. Slade**, Hawkinsville, Ga.; **Macon A. Brock**, Rome, Ga.; **Lamar Ware**, Auburn, Ala.; **Ralph H. Young**, West Palm Beach, Fla.; **Ted A. Gowdy**, Canton, Miss.; **Oscar Levin**, Marietta, Ga.; GIA instructor, **Bertram Krashes**, standing.

Indianapolis Diamond Class

Indianapolis Diamond Class

Columbus Diamond Class

Indianapolis Diamond Class

Members of the Indianapolis, Indiana, Diamond Evaluation Class that met February 22nd, through February 26th. Seated left to right: **Carl James Palmer**, Indianapolis; **D. W. Williams**, Crawfordsville, Ind.; **James Brown**, Frankfort, Ind.; **Philip E. Nelson**, Brownsburg, Ind.; **Donald S. Murray**, Muncie, Ind.; **Leo R. Glotzbach**, Monon, Ind. Standing left to right: **Anthony M. Roskin**, Marion, Ind.; **Eugene R. Burger**, Petersburg, Ind.; **Charles Seashols**, Huntington, Ind.; **Morris Edwards**, New Castle, Ind.; **Michael L. Booher**, Indianapolis; **Malcolm Ross**, Columbus, Ind.; **Walter A. Freeman**, Fort Wayne, Ind.

Indianapolis Diamond Class

Members of the Indianapolis, Indiana, Diamond Evaluation Class that met February 29th, through March 4th. Standing left to right: **Robert Barker**, Kendallville, Ind.; **John Williams**, Celina, Ohio; GIA instructor, **Bertram Krashes**. Seated left to right: **Robert G. Walton**, Indianapolis; **Paul C. Henderson**, Mooresville, Ind.; **Joe E. Hensley**, Crawfordsville, Ind.; **Rosina Baumgartner**, Syracuse, Ind.; **Wayne Clark**, Crawfordsville, Ind.; **Leonard J. LeBeau**, Kentland, Ind.

Columbus, Ohio, Diamond Class

Members of the Columbus, Ohio, Diamond Evaluation Class that met April 18th through April 22nd. Front row, left to right: **Louis Zuckerman**, Wooster, Ohio; **E. A. Burnham**, Alliance, Ohio; **Bertha Stern**, Columbus, Ohio; **Arthur B. Levy**, Columbus, Ohio; **Sam Smoller**, Columbus; and **Harry F. Thomas**, Mt. Gilead, Ohio. Second row, left to right: **Robert M. Gray**, Greenville, Ohio; **Catherine Peters**, Columbus, Ohio; and **John McLaughlin, Jr.**, Urbana, Ohio. Standing, left to right: GIA instructor, **G. Robert Crowningshield**; **Carl W. Labuscher, Jr.**, Mansfield, Ohio; **Harry B. Schuler**, Portsmouth, Ohio; **Earl M. Stewart**, Akron, Ohio; **John W. Walker**, Marion, Ohio; **William E. McCormick**, Charleston, West Virginia; **Wilbur Lee Willis**, Columbus, Ohio; **William H. Young, Jr.**, Newark, Ohio; **Russell Wise**, Mt. Vernon, Ohio; and **Garland Rower**, Galion, Ohio.

Kansas City, Mo., Diamond Class

St. Louis, Mo., Diamond Class

The Diamond Evaluation Classes, which cover GIA's diamond appraisal system and important diamond merchandising features, are given to jewelers only. The purpose of these one-week classes is to teach diamond evaluation and appraisal; therefore, the major portion of the classwork is given to supervised practice in color, imperfection, proportion and finish grading, and the final pricing. Early in 1960, twenty-one classes were scheduled by the GIA for major cities throughout the nation. During the first five months classes under the direction of G. Robert Crowningshield and Bertram Krashes of the Institute's Eastern Headquarters were held in the following cities: New York City, Washington, D.C., Atlanta, Indianapolis, Columbus, Kansas City, St. Louis, and Tulsa. During the last six months of 1960 classes will be held in the following cities: Detroit, Chicago, Minneapolis, Milwaukee, New York City, Los Angeles, Phoenix, Denver, Dallas, Omaha and Des Moines.

Kansas City, Mo., Diamond Class

Members of the Kansas City, Missouri Diamond Evaluation Class which met May 2nd, through May 6th. Front row, left to right: **Merle W. Staats**, Liberal, Kansas; **G. Thorpe Clark**, Sioux City, Iowa; **Kenison J. Hart**, Topeka, Kansas; **Josef Derryberry**, Topeka, Kansas; **Mrs. Norville Amspacker**, Herington, Kansas; **Richard B. Vaughn**, Kansas City, Missouri; and **James W. Grinter**, Oskaloosa, Kansas. Back row, left to right: **Vincent A. Gray**, Hiawatha, Kansas; **Ralph W. Hale**, Kansas City, Missouri; **H. J. Winkler**, Kansas City, Kansas; **Duane J. Shriver**, Carroll, Iowa; GIA instructor, **G. Robert Crowningshield**; **Vernon See**, Fayette, Missouri; and **James B. Hubbard**, Dexter, Missouri.

St. Louis, Mo., Diamond Class

Members of the St. Louis, Missouri, Diamond Evaluation Class which met April 25th, through April 29th. Seated, left to right: **Chester L. Lieder**, St. Louis; **M. L. Chazen**, St. Louis; **Kenneth Harper**, St. Louis; **Gene Frank**, St. Louis; **Jerry Cuquet, Jr.**, St. Louis; **Joseph S. Frank**, St. Louis; **Mrs. Dolly Wolter**, Mascoutah, Illinois; and **Mrs. Sertella Causey**, O'Fallon, Illinois. Standing, left to right: **Al R. Hoemann**, Kirkwood, Missouri; **Paul Walters**, St. Charles, Missouri; **William E. Stout**, Springfield, Illinois; **Frank Gooden**, Kansas City, Missouri; **Marvin J. Kaiser**, Jefferson City, Missouri; **Norman E. Rebsamen**, St. Louis; **Frank Wykry**, Florissant, Missouri, **John S. Gillam**, Marshalltown, Indiana; GIA instructor, **G. Robert Crowningshield**; and **Forrest C. Becker**, Breese, Illinois.

(Gemological Digests, continued from page 23)

facture of the rough diamonds was said to be the result of work in high-temperature and high-pressure processing.

Russia

It has been reported that Russia is to build five new mechanized factories to produce diamond tools with the diamonds from the new mines in Siberia. The new plants are scheduled to be built in the Northern Caucasus, in the Ukraine, and in Siberia, and it is planned that by 1965 they will be manufacturing diamond-cutting tools, drilling bits, diamond-cutting wheels, saws, drills and other tools.

Arkansas

The latest find at the diamond mine near Murfreesboro, Arkansas, and the second largest found in Arkansas in the past twenty years, was a six and one-half carat canary-yellow diamond. The diamond was found by Niels Bach, Ludington, Michigan.

L A LAB NOTES

(continued from page 6)

polished welts. They were not easily seen with the unaided eye and had obviously been overlooked at the time of sale. The moral in this story is that it is better to submit any problems relating to damage directly to the insurance adjuster or a laboratory, rather than to hazard a guess, which can lead to additional costs and loss of customer confidence.

* * *

It should be noted that, as of May 15, an adjustment in laboratory fees has gone into effect. In addition to a small increase for all services to the trade, there is now a greater difference between the rates to the trade and the public. All reports in the future will be issued in attractive folders, to provide retailers with a more saleable service to their customers. A complete schedule of fees may be obtained from the Gem Trade Laboratory in Los Angeles.

* * *

A well-formed, three-quarter-inch garnet crystal of the trapezohedral habit was recently added to the GIA collection through the generosity of student **H. H. Price,** Fort Morgan, Colorado.

From **Edward Swoboda,** Los Angeles gemstone dealer, we received a pair of hinge pearls that display a nice orient and luster.

Several imitation gemstones donated by **A. D. Pattie,** jeweler, Hillsboro, Illinois, will be put to good use in our practice-stone sets.

Student **John Krzton,** Chicago collector, recently donated several gemstones to the GIA for our practice-stone sets. Frazer River nephrite (Canada), albite feldspar, sunstone, moonstone, star ruby, black goldstone, "fire" agate, thomsonite, rose quartz, and several imitation gemstones comprised the selection.

Black coral specimens from the Phillipines and from Hawaii were donated to the GIA for comparison tests by **J. E. McDowell,** Los Angeles.

When gemologist **Walter Woods,** Los Altos, California, visited the GIA recently, he added two very nice chiastolites to our collection.

A very welcome gift of ten various-sized diamonds that can be used to good advantage in our practice sets were presented to the GIA by **Harold Tivol,** Kansas City, Missouri.

A uvarovite garnet (on diopside) specimen from **Jack Stachura,** Stachura Minerals, Uxbridge, Massachusetts, was greatly appreciated, especially, since this happens to be our only specimen of this species of the garnet group. At the same time, he presented us with a nephrite specimen.

Our appreciation goes to **Martin Ehrmann,** Los Angeles gemstone dealer, who recently brought the GIA two large rough pieces of faceting-quality amblygonite and kyanite from which stones can be fashioned.

Our gratitude is extended to the **California Division of Mines,** San

Francisco, for the continual flow of literature that finds its way to the GIA. Many of the maps, bulletins, etc., are a great aid to our research librarian.

N. Y. LAB NOTES

(continued from page 10)

Gemology was a natural sapphire that changed color from green in daylight to a reddish brown in incandescent light—colors considered quite respectable for an alexandrite. (That such stones do exist we knew from our experience with a similar stone in 1951.) The stone was submitted many times by various dealers over a period of a month, since it seemed impossible that corundum could so closely resemble the alexandrite chrysoberyl. The identification of this stone was made obvious immediately since the optic axis was at right angles to the table and the uniaxial interference figure was easily obtained. The higher specific gravity, different absorption spectrum and, of course, the slightly higher refractive-index reading were typical for sapphire.

The New York Laboratory is pleased to accept on behalf of the Institute a collection of stones that are ideal for study purposes, as well as a selection of colored slides of inclusions taken by the late Erwin A. Harvey, GIA student. The gift was presented by Mr. Harvey's widow, **Maurine Price Harvey.** Mr. Harvey's proficiency in color photography of gemstone inclusions was given national recognition when these color photographs were used to illustrate a fine article entitled, "Look into the Heart of a Gem," by Creighton Peet, which appeared in the March, 1957, issue of *Popular Mechanics*. Members of the **American Gem Society** will recall that Mr. Harvey provided the colored slides that were used to illustrate a talk on unusual gem materials encountered in the New York Laboratory, which the writer gave at their annual Conclave in Chicago in 1957.

We wish to thank the colored-stone firm of **William V. Schmidt & Co., Inc.,** for several gifts in the past few months consisting of much needed iolites, peridots, andalusites and many other stones.

Also, we are indebted to the firm of **McTeigue & Co.,** manufacturing jewelers, for a fine selection of colored stones for use in student identification sets.

Mr. Harold Tritt, specialist in black pearls, gave the Institute many specimens of this lovely gem for research purposes.

Also, we are indebted to **Rene Bloch,** pearl dealer of New York City and Paris, for specimens of black-dyed cultured pearls and hollow-center, freshwater cultured pearls for research work.

We wish to thank **Mr. Howard A. Millar** of Murfreesboro, Arkansas, for the identified specimens of peridotite, kimberlite and volcanic breccia from his "Crater of Diamonds." The main difference between the peridotite and kimberlite, which were found in the same spot, is the greasy feel of the kimberlite, the diamond-bearing variety of peridotite.