Gems & Gemology

GIA

SUMMER 1970

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SUMMER, 1970

IN THIS ISSUE

A RARE ALEXANDRITE GARNET FROM TANZANIA

by

ROBERT CROWNINGSHIELD

One of the most intriguing pieces of gem rough we have seen recently was left with the staff of the New York Gem-Trade Laboratory for identification by Dr. John Saul of Nairobi, Kenya. It was a dark, dull-appearing rolled pebble weighing approximately 3 1/2 carats (*Figure 1*), and had been added to his collection during the course of his regular commercial beryl enterprises in Ruanda. Lying in a stone paper among other more colorful specimens, the pebble would arouse little excitement or interest. However, on closer examination, we must say that the land of gem surprises, Tanzania, has produced yet another mineral with the beauty and durability of a gemstone.

The potential for this stone was recognized when it was noted that in daylight it appeared blue-green, whereas under incandescent light it became a beautiful, clear, purple-red. The color change was dramatic and complete and very much like that of a fine Russian alexandrite.

With a refractive index of 1.765, single refraction and a specific gravity of 3.88, the initial hunch was that we were looking at yet another unusual

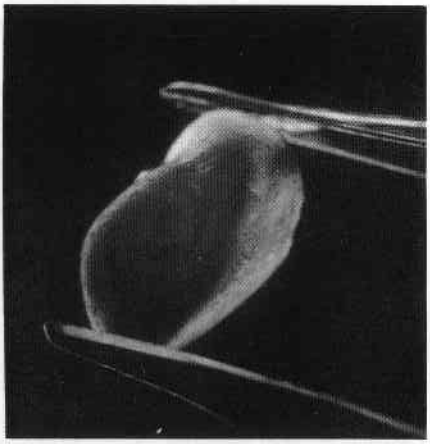


Figure 1.

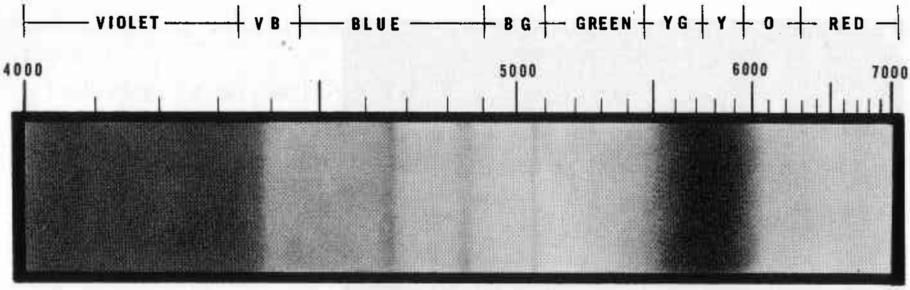


Figure 2.

garnet from this gem-rich country. The absorption spectrum was somewhat disappointing for such a striking stone *(Figure 2)*. The stone was inert to ultraviolet, but it did show bright red through the color filter. Its hardness seemed to be the normal 7 to 7 1/2 for garnet.

That the specimen was a garnet was confirmed by X-ray-diffraction tests conducted in the Los Angeles Laboratory by Charles Fryer. A semi-quantative spectrographic analysis of a small sample by Pacific Spectrochemical Laboratory, Inc., gave the following results:

	% Present	% as Oxides
Silicon	18.0%	38.35%
Aluminum	14.0	26.45
Manganese	13.0	16.73
Magnesium	7.9	13.1
Calcium	1.7	2.38
Iron	1.0	1.45
Chromium	.37	.54
Vanadium	.22	.324
Titanium	.085	.1418
Copper	.0015	.0019
Nickel	.0032	.0041
Other elements	Nil	

TOTAL = 99.4718

This new kind of garnet is not a new species but an isomorphous mixture, principally of the pyrope and spessartite molecules. Vanadium may be the cause of the color change, in which case it is similar to synthetic alexandritelike corundum in which vanadium is present for that purpose. Chromium undoubtedly plays a part in the color, too. (The classification of the stone is

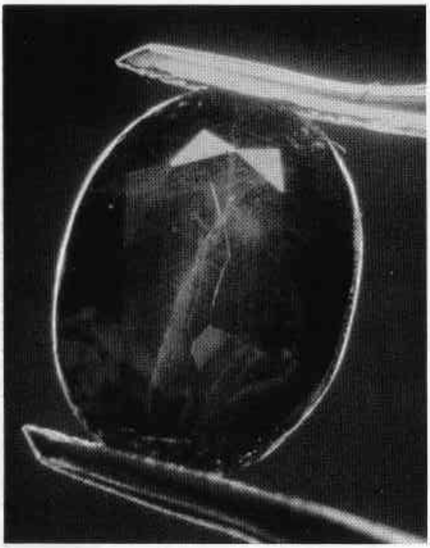
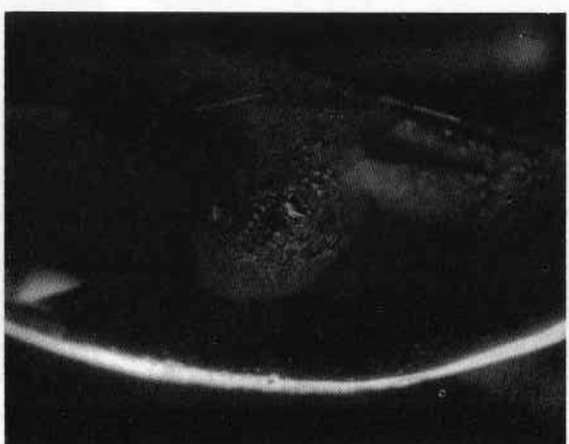


Figure 3.

Figure 4.

Figure 5.



currently being worked out in Los Angeles.)

Following the necessary X-ray and chemical observations, the pebble was beautifully cut by Eldot & Co., New York City, into a 1.70-carat oval (*Figure 3*). The cut stone exceeded the expectations of the staff, since as a rough stone it appeared somewhat too dark in color. The cutting brought total internal reflection into play, so that the stone was bright and the color change remarkable, despite inclusions of an unusual nature for garnet. Needlelike crystals extended unbroken the entire length of the stone (*Figure 4*); they occurred in three directions, so that a star is potentially possible. In *Figure 5* is seen a fingerprint inclusion, somewhat rare in garnet, which more closely resembled a human fingerprint than any we have ever seen.

The pebble was reportedly picked up in alluvial gravels near the North Pare Mountains of northern Tanzania. While preparing this paper, we learned from a telephone conversation between Dr. Saul in Nairobi and his father in New York City that the prospector who found the pebble had been searching in vain in the area for the past three months for more of the material. It is possible that it is the only specimen of its kind; thus, we may have one of the rarest gems in the world. Since it is a rolled pebble, it may have formed at a great distance from the area in which it was found, or, conceivably, it could have been dropped by a bird.

WORLD'S LARGEST PHENAKITE

by

ROBERT CROWNINGSHIELD

Readers of the Spring, 1969, issue of *Gems & Gemology* may recall the 1470-carat phenakite fragment described on pages 25 and 26 as possibly the largest yet reported. Since it was a partially polished rolled pebble, the owner decided it should be cut. It was certain to yield the largest cut phenakite ever reported, and might produce others larger than any recorded. The Smithsonian Institution records a 22-carat stone, for instance, and a 40-carat cut stone is claimed to be the world's largest.

Gem-quality phenakite is rarely other than colorless. Although mineralogical texts mention a bright wine-yellow and a pale rose-red, none has been recorded as a cut stone.

The name of the species comes from the Greek word *phenakos*, meaning *deceiver*, because of its resemblance to quartz.

Phenakite occurs in the hexagonal crystal system, as does quartz, and with a refractive index of 1.654-1.670 and a dispersion of .015, cut stones are not much brighter nor more dispersive than rock crystal. The specific gravity approaches 3.00 (compared to 2.65 for quartz) and the hardness is greater than quartz (approximately 7 1/2 to 8).

Gemologists are probably better acquainted with phenakite as an occasional included crystal in some synthetic emeralds, rather than as cut stones.

Readers may recall the gift to GIA of a faceted phenakite of less than 1 carat that was discovered by New York City jeweler Wesley Bergen in an old-fashioned, gold solitaire ring.

When a Santa Barbara jeweler (the first owner) received the rough stone as a gift in Ceylon, it had one polished side through which one could see that it was filled with thin, reflective, needlelike inlcusions. The present owner had read of GIA New York staff member Jerry Call's work in cutting large stones, and decided to ask him to examine the rough to see if it warranted cutting in view of the needles (*Figure 1*).

Call felt that although cut stones would undoubtedly appear "sleepy," the present specimen had two factors in its favor for maximum weight yield: (1) the needles lay at right angles to the existing polished face, which would be the table of the largest stone, and (2) the table would be at right angles to the optic axis. Since the birefringence is considerable (.016), this would mean that the doubling of needles and back facets would be

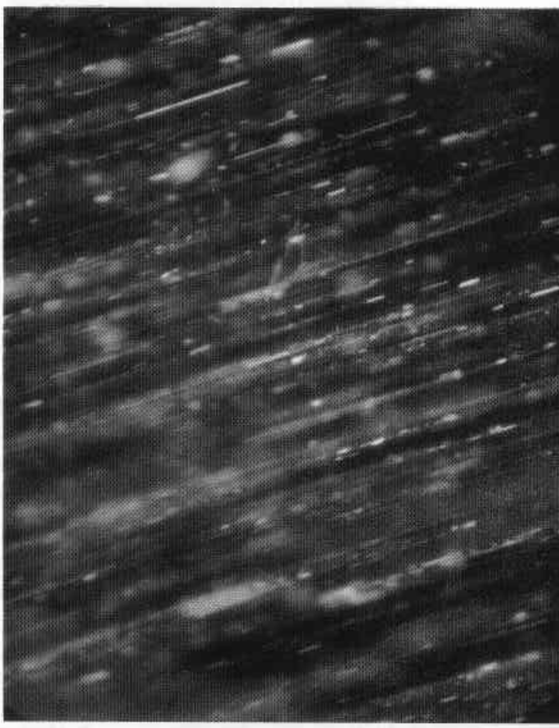


Figure 1.

eliminated when viewed through the table.

Call first estimated that the largest stone would be an oval step cut of approximately 550 carats, with enough extra material for a number of smaller stones. His experience in cutting replicas of famous large diamonds indicated that he could use his Lee equipment with standard 6- and 8-inch laps (*Figure 2*).

After an estimated 50 hours of work, the finished stone (*Figure 3*) was weighed and found to be 569 carats. Further work produced 3 additional stones, the largest of which was an oval cut and weighed approximately 36 carats (*Figure 4*). The final

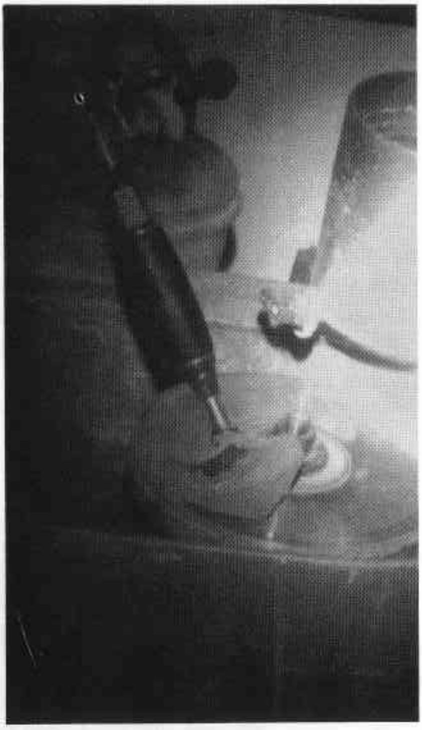


Figure 2.

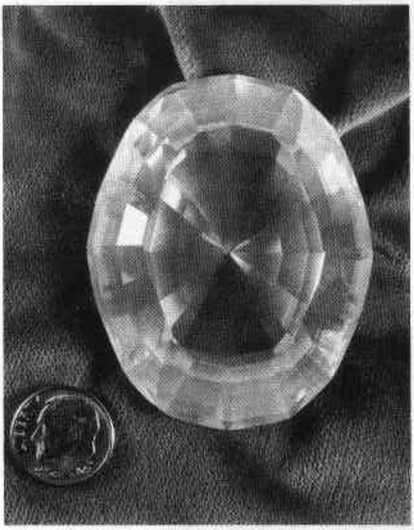


Figure 3.

yield may be in the vicinity of 50%, which is considered better than average for colored stones. Because of the concentration of needles in some of the remaining rough material, there is a good possibility of cutting a cabochon with a cat's-eye effect. The needles in the second largest stone, a 12.76-carat emerald cut, are shown in *Figure 5*.

It is reported that the 569-carat stone is destined for the gem collection of the Smithsonian Institution, Washington, D.C.

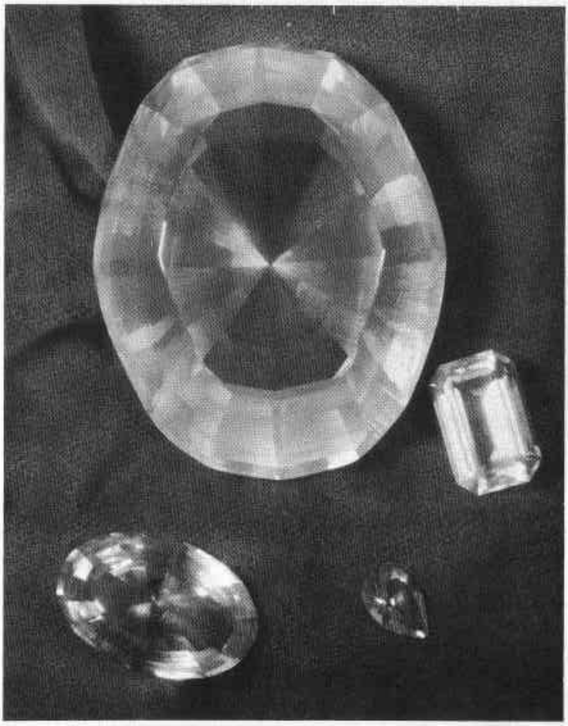
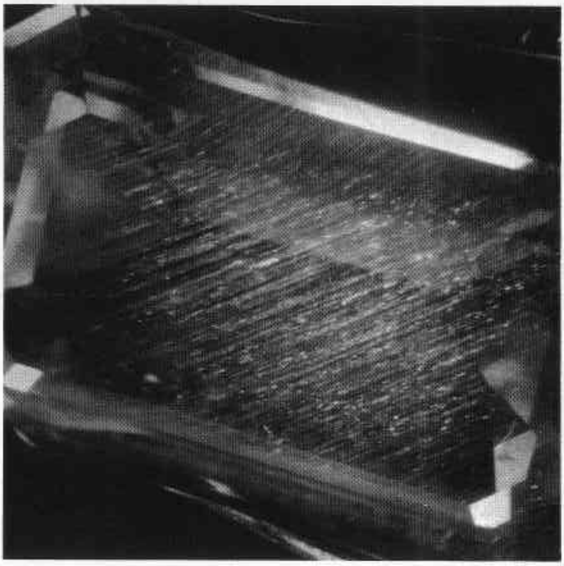


Figure 4.

Figure 5.



Developments and Highlights at GIA's Lab in Los Angeles

by

RICHARD T. LIDDICOAT, JR.

Table-Cut Replica

While examining a group of fluorite cleavages, Charles Fryer found some very interesting pyrite-crystal inclusions that resembled closely the early table cut. Seemingly, an octahedral shape appeared to have been modified by just two opposing cube faces that differed greatly in size. On both of the crystals pictured in *Figure 1*, a large cube face resembled the table of this style of cutting and a much smaller, cube-face modification at the "culet" end resembled the "table" surface.

Horn

We were called upon to identify two small carvings that showed an interesting banded, platy structure we associate with some horn. The refractive index was about 1.55 and the specific gravity, 1.31. It effervesced slowly with dilute hydrochloric acid and showed a strong-blue fluorescence under long-wave ultraviolet light, which was slightly masked by the dye that had been used to color them brown. A hot point, applied to an inconspicuous spot on both, gave a burnt-hair odor that is expected from many organic materials. The carvings are shown in *Figure 2*.

Bicolored Diamond

Glenn Nord bought back from Israel a very unusual bicolored diamond that had been loaned to him by a man who emigrated from this country to Israel after having been a jeweler in New York City. The marquise was generally yellowish green, but in the center area of *Figure 3*, outlined by the white arrows, a rich, medium-red color was visible. It was not the usual garnet-red color of so-called red diamonds.

Figure 1.

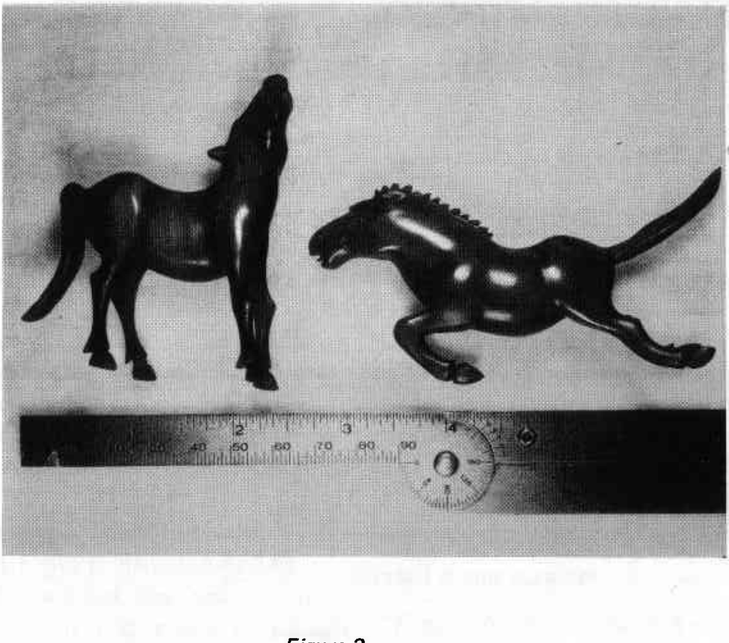


Figure 2.

Figure 3.

The spectrum was quite unusual: a pair of lines near 5000 Å, probably the 4980-5040 pair; a rather diffused line at approximately 4750 Å; a sharp, narrow line at about 5950 Å (probably the 5920 line, rarely encountered in naturally colored diamonds); a diffused line at 6200 Å; and another very sharp line very close to 6400 Å (*Figure 4*). Light that was transmitted through the diamond gave an intense yellowish-green cast to its path. We were satisfied that the color was natural.

High-Property Chrysoberyl

We received for identification a cat's-eye mounted in a man's ring that showed a sharp eye (*Figure 5*) but that was semitranslucent. Despite the high refractive indices (1.76-1.77), there seemed to be little doubt that the material was chrysoberyl. However, just to be certain, a minute amount was scraped from the back and an X-ray powder diagram was made on the material by Charles Fryer. The

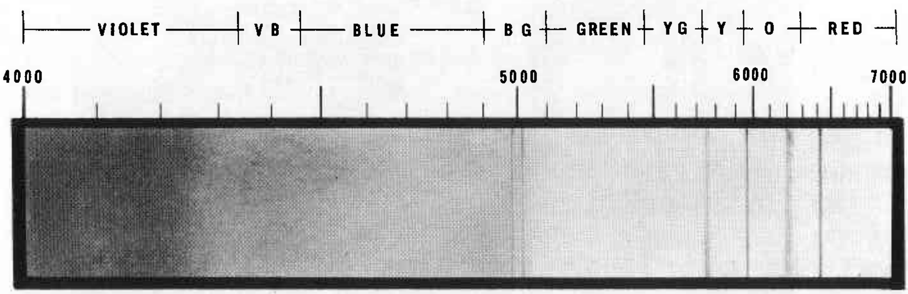


Figure 4.

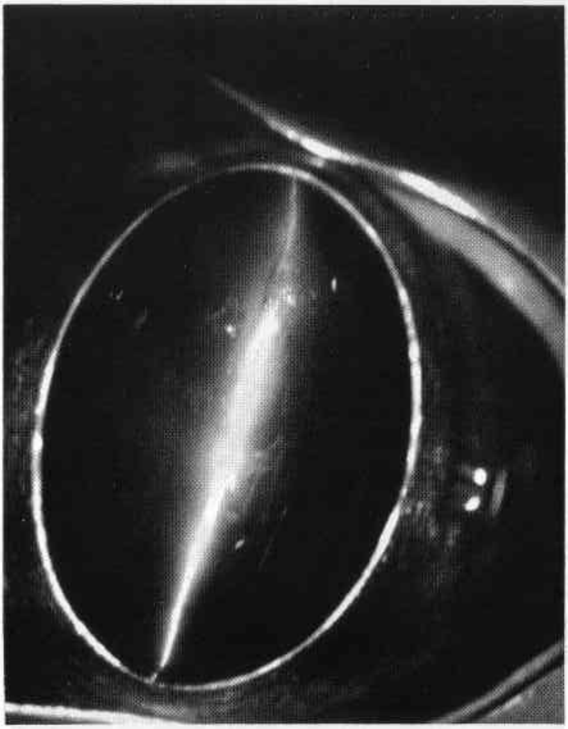


Figure 5.

pattern was chrysoberyl, as expected, and although such high refractive indices are certainly not unknown, they are rather unusual.

The absorption spectrum showed a line at 4500 Å to 4600, somewhat higher than the usual chrysoberyl absorption band, probably caused by a higher iron content that also, in all probability, was responsible for the higher indices.

New Hydrothermal Synthetic Emerald

Recently, we received a synthetic emerald from a new source that proved to be of hydrothermal origin. It is apparently being made by an individual entrepreneur, who once worked for one of the major synthetic-crystal manufacturers.

Figure 6 shows many two-phase inclusions parallel to the table, each of

Figure 6.

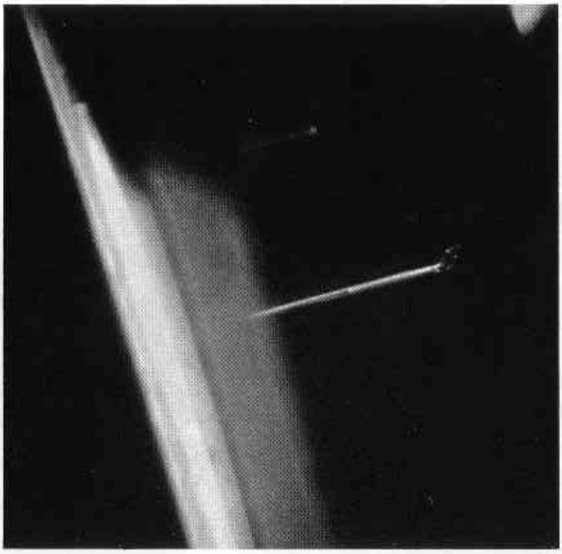


Figure 7.

which resembles a spicule; and *Figure 7*, a very large two-phase inclusion with a liquid-and-gas interface, shown about half way up the pointed inclusion, with phenakite crystals capping the larger end to the right.

The properties were very close to those of the latest Linde synthetic emerald: refractive indices, approximately 1.574-1.580; and the specific gravity, between 2.68 and 2.69. The stone was moderately strongly fluorescent under long-wave ultraviolet, but not as pronounced as the early Linde product. The properties, of course, were well within the range of natural emeralds. But without the typical hydrothermal spicules and the higher long-wave fluorescence, they could prove to be very difficult to distinguish from the natural.

Although some of these stones have been cut and offered on a limited market, we do not know whether the grower plans to market them commercially.

Odd Girdle Surface on an Emerald

We recently received for identification a Trapiche emerald that had the normal properties for emerald of this type, but the girdle thickness was unlike anything we had seen in the past (*Figure 8*). The rough, somewhat shiny surface appeared to have been etched.

Usually, the girdles of emerald-cut emeralds are polished. Rarely, however, as described in a recent issue of *Gems & Gemology*, we have encountered natural surfaces at least in

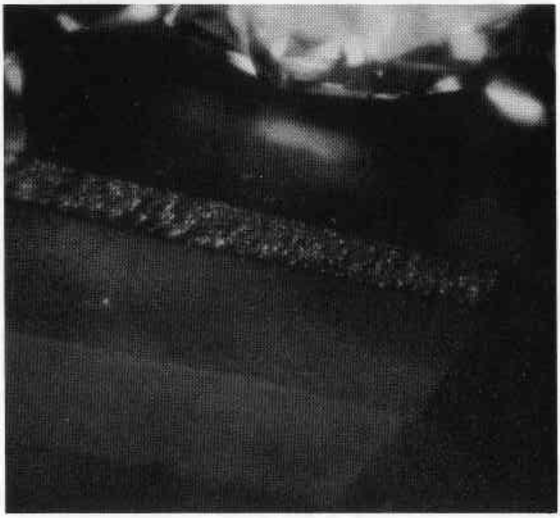


Figure 8.

portions of the girdle. In this case, the rough, shiny surface suggested that the finished stone had been cut from an etched crystal, and that the girdle facets had not been polished.

Lapis-Lazuli *Pietre Dure*

We receive for identification a lovely lavaliere, in which the background material was lapis-lazuli and in which a bouquet of flowers had been inset (*Figure 9*). This kind of work, referred to as *pietre dure* in Italy, is more often called *intarsia* in the gem-hobby field, even though the latter term applies specifically to such inlay work in wood.

The flowers were in tones of pink and white, mostly shell and chalcedony, and the green leaves were primarily chalcedony.

The workmanship was beautiful, and the overall effect was very unusual. We haven't seen a pin of this kind in memory, and were pleased to have the opportunity to examine it in detail.

Figure 9.

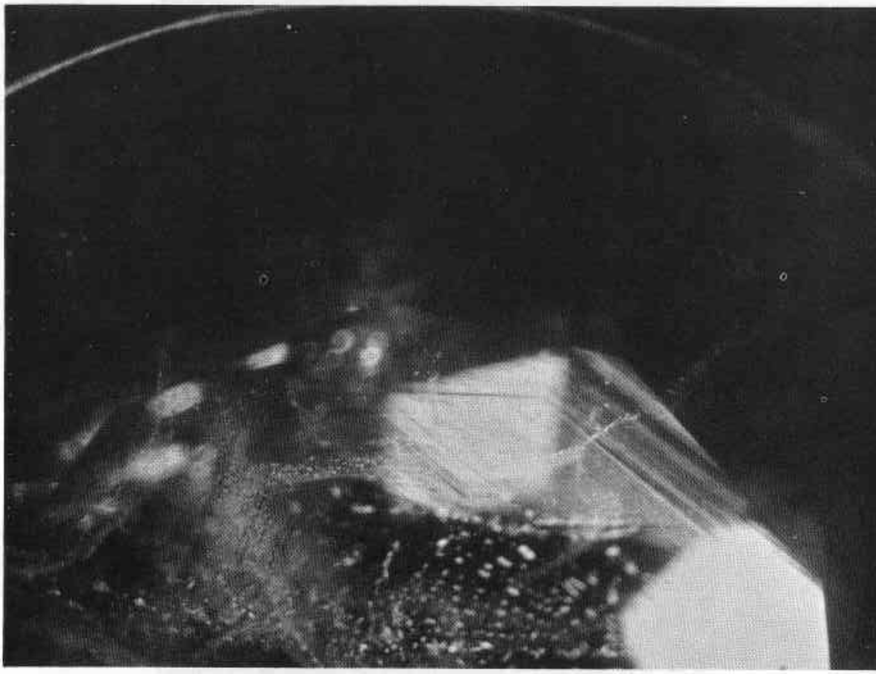


Figure 10.

Unusual Spessartite Garnet

We encountered a very fine spessartite garnet containing many inclusions, which fortunately did not detract from the beauty of the stone. In addition, there were very strong growth lines (*Figure 10*), which had the combination of the appearance of the color zoning of a Burma ruby and the heat-wave effect of a hessonite garnet.

"Unpolished" Nodule

A jeweler sent us one of a large number of nodules he had received from a customer who told him they were unpolished. The piece we received measured approximately 21.2, 24.6 x 12.0 mm., and under magnification the surface showed that the stone had been polished. This example had a dark-brown color, but under transmitted light it was brownish green to yellowish green. When very intense light was placed beneath it, it had the structure shown in *Figure 11*. This structure suggested immediately an organic, rather than inorganic, material. But when the spot method was used,

Figure 11.

the obvious, approximately 1.60 refractive-index reading changed to a darkening of the whole refractometer scale to the cut-off at the 1.81 R.I. reading of the liquid.

The high birefringence, plus a very slow effervescence with cold, dilute hydrochloric acid, made it obvious that the material was a carbonate. Its S.G. was in the vicinity of 3.90, by the use of heavy liquids.

The properties, plus the color, made it apparent that the nodule was the iron carbonate, siderite. This finding was reinforced by a very strong iron spectrum: there was almost a complete cut-off, and absorption below about 5000 Å and a strong band in the 5200-5300 Å area.

Acknowledgements

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

To **Walter S. Morris**, Jeweler, GG, CG, Morehead City, North Carolina, for an interesting clam pearl.

To **Julius Alberts**, former president of the California Retail Jewelers' Association, Ventura, California, for two rare books: *Rings*, by Kunz, and *Diamonds & Precious Stones*, by Emanuel. These books will make welcome additions to GIA's ever-increasing library.

To student **Lowy Breckenridge**, Anaheim, California, for a laboratory-made silicon cabochon.

To student **Edward Koski**, Goodrich, Michigan, for a selection of star sapphires and pearls. These will augment very effectively our student study sets.

To **Fred O. Couch**, RJ, Anniston, Alabama, for a pair of keystone-cut emeralds of attractive color.

To the **Lizzadro Museum of Lapidary Art**, Elmhurst, Illinois, for a rough cube of nephrite jade.

To **Paul Johnson**, Gemologist, CG, jeweler of Phoenix, Arizona, for an assortment of stones, including opal, peridot and pearls.

To Graduate Gemologist **Ben Gordon** of Gordon Jewelry Co., Houston, Texas, for another well-appreciated assortment of genuine, synthetic and imitation stones.

Developments and Highlights at GIA's Lab in New York

by

ROBERT CROWNINGSHIELD

Another Diamond Substitute?

We are indebted to Mr. R.C. Anderson, manager of the Ceramics Processing Unit of the Metallurgy & Ceramics Laboratory of the General Electric Co., Schenectady, N.Y., for the opportunity to examine and recut a specimen of one of their products called Yttralox (trademark). It was a colorless brilliant of 2.36 carats and was reported to have a refractive index of 1.92, a dispersion factor of .039, and a Knoop-Mohs' conversion of 7.2. Practical abrasion testing indicated a Mohs' hardness of approximately 6 to 6 1/2. When we received the cut stone, it had the facet appearance and proportions of an old-European-cut diamond (*Figure 1*). Our staff lapidary, Jerry Call, recut the stone with more modern-appearing faceting with a weight loss of .20 carat (*Figure 2*). We determined the specific gravity to be 5.30–somewhat higher than for strontium titanate.

Yttralox is being produced by G.E. as a unique optical ceramic – an especially sintered, polycrystalline product containing about 90% yttrium oxide and 10% thorium oxide in solid solution, according to the descriptive brochure. Its high melting point, transparency, low light absorption and high infrared transmission, together with relatively low optical dispersion (when compared with glass of similar R.I.), all contribute to make this a useful industrial product. With its nearly colorless body color (approximately H on the GIA diamond color-grading scale), good dispersion and R.I. and tolerable hardness, it could become another diamond substitute with a

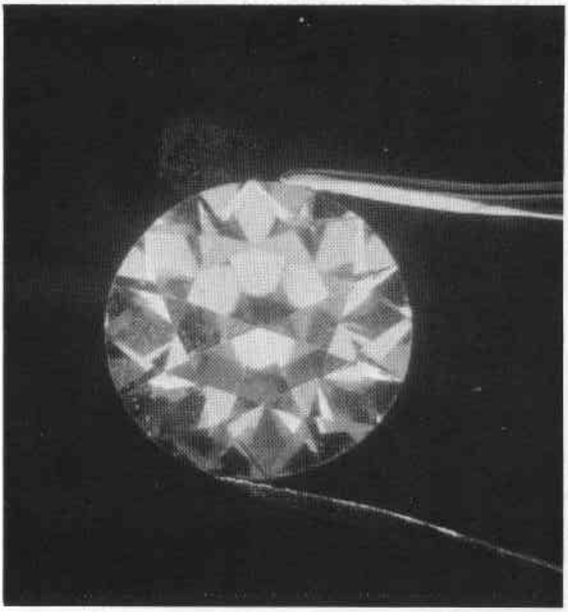


Figure 1.

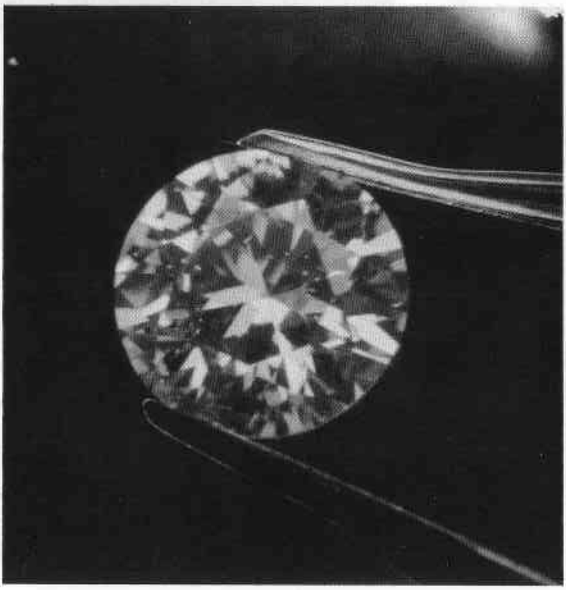


Figure 2.

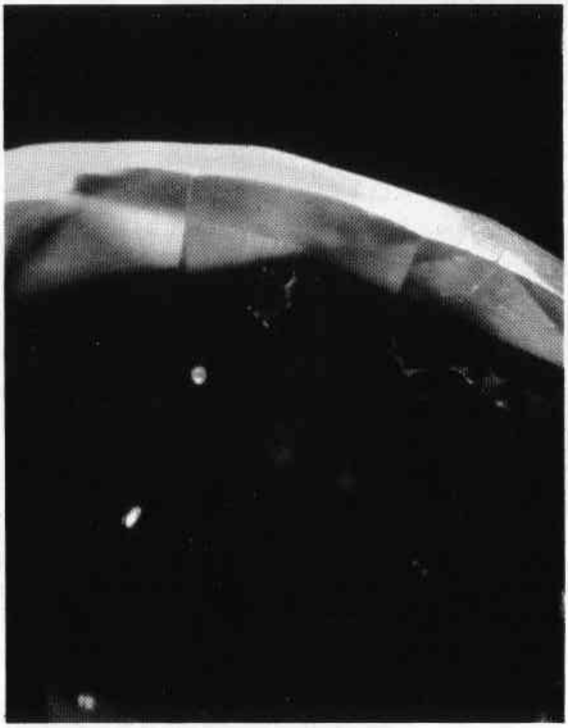


Figure 3.

future, although our specimen did have a few angular gas bubbles and a host of nonspecific, dustlike inclusions (*Figure 3*).

White Star Quartz

Some years ago we were shown several milky-white star-quartz stones found by famed marksman Lucky McDaniels. Recently, he has formed a company, Starphire, Inc., in Columbus, Georgia, to market the latest production, which is considerably more attractive. *Figure 4* illustrates an especially pleasing blue-gray stone in a man's ring.

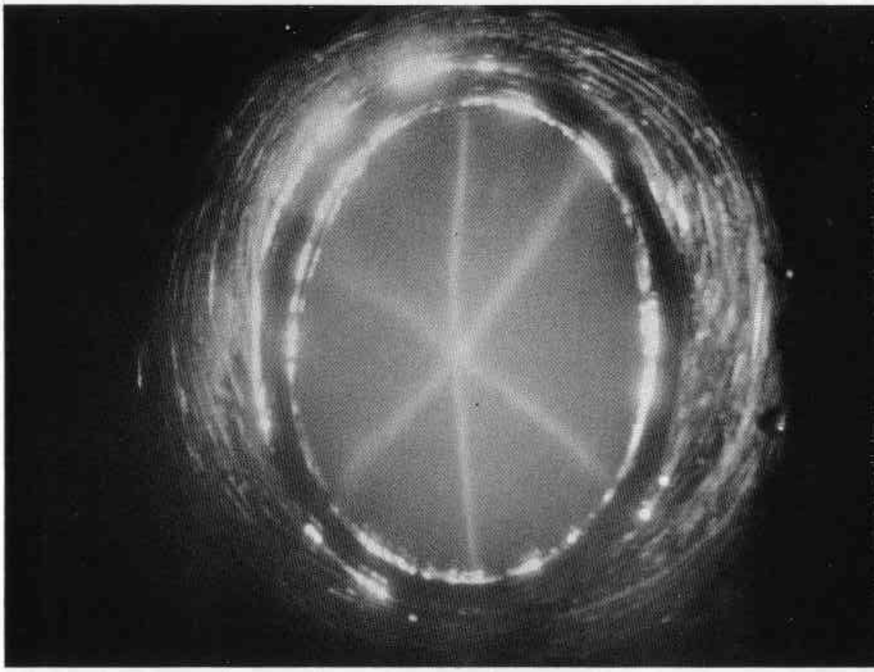


Figure 4.

Trapiche Emerald

Trapiche emerald is famed for its excellent color, but the general mistiness of the material makes the larger stones appear very much like green-dyed chalcedony. We have seldom seen stones weighing more than 2 or 3 carats, and one can rarely see the culet through the table in stones of this size. *Figure 5* illustrates a 7-carat Trapiche in a fine cluster ring. In spite of the low transparency, the stone merited the lavish setting.

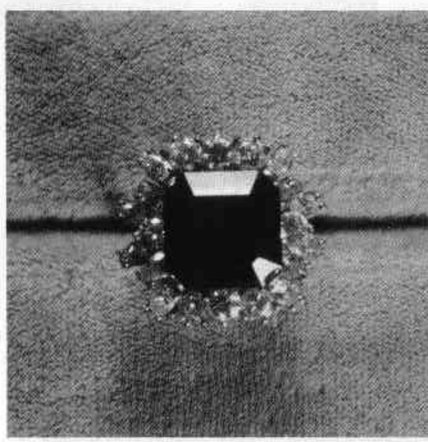


Figure 5.

Figure 6.

Figure 7.

Unusual Garnet Inclusions

The inclusions in a green grossularite garnet, recently cut by Jerry Call, are illustrated in *Figures 6*, *7* and *8*. Hollow tubes like fulgerites, breadcrumblike inclusions, platy metallic-appearing inclusions and misty areas all seemed foreign to our experience in observing garnets.

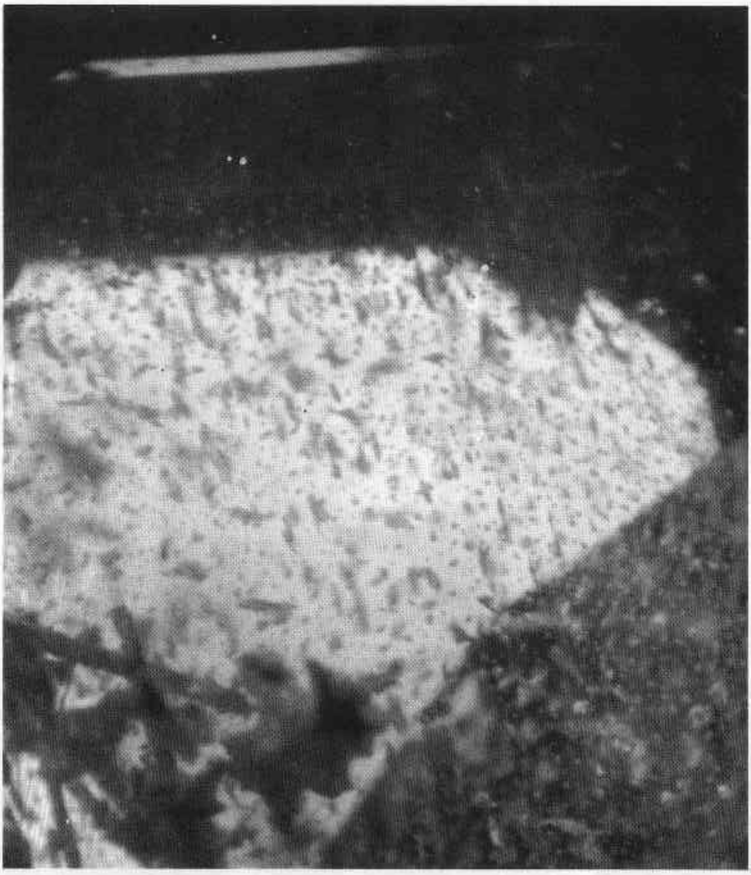


Figure 8.

Spessartite Spectrum

Ordinarily, when viewing the absorption spectrum of a brown to orange stone, one expects to find almost complete absorption beyond approximately 4300 Å. It is usually impossible, for instance, to see the jade line at 4370 Å in a brown jadeite. It was a surprise, therefore, to see well-defined lines and bands in a beautiful red-orange Tanzanian spessartite garnet of 4.30 carats, well below the expected cut-off point. In fact, we have rarely been able to discern absorption lines below the one seen in many diamonds at approximately 4155 Å (*Figure 9*).

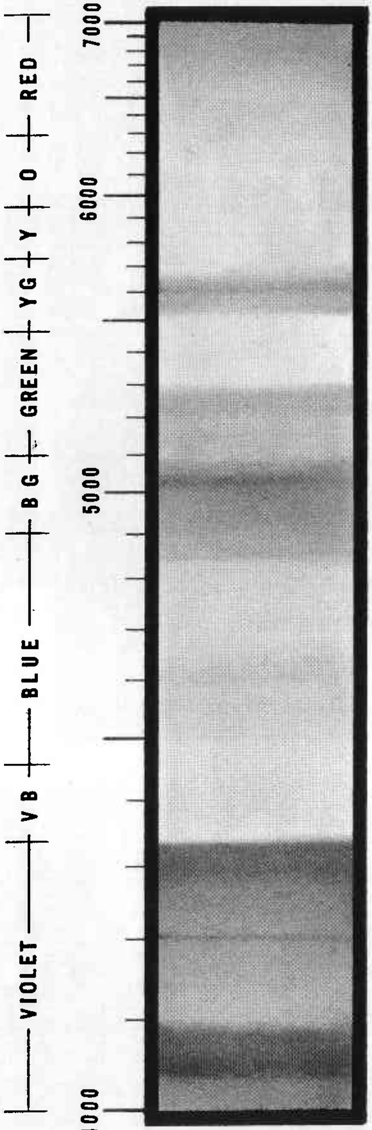


Figure 9.

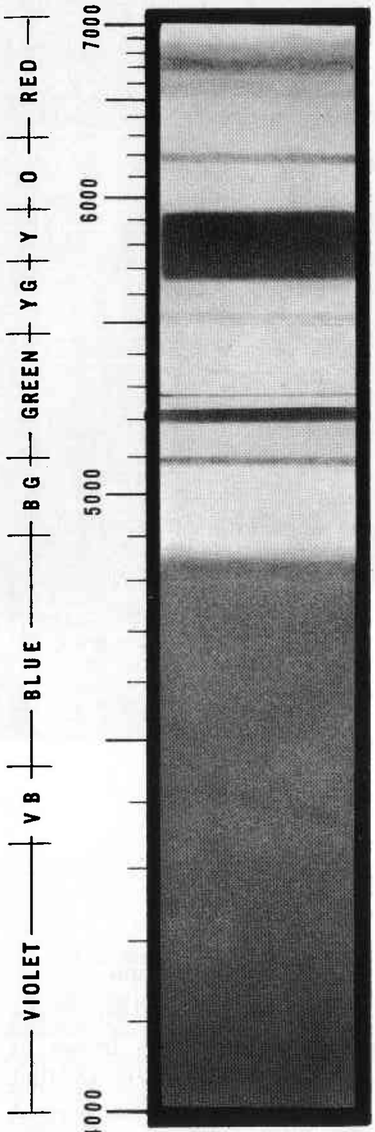


Figure 10.

Monazite Spectrum

While checking the accuracy of our observation about the absorption spectra of orange and brown stones, we examined as many transparent to translucent stones in those colors that we could. An orange crystal of monazite gave us the striking spectrum shown in *Figure 10*. It reflects beautifully the rare-earth components of this mineral, seldom cut except for collectors, and is reminiscent of the rare-earth spectra of synthetic garnets.

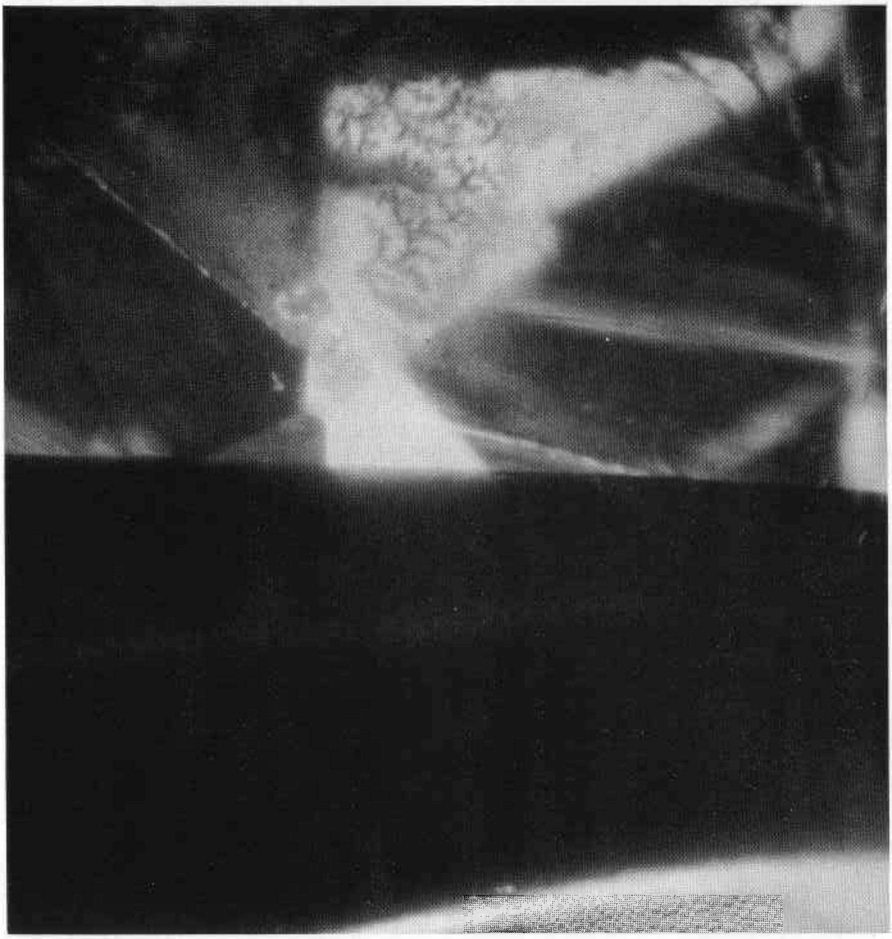


Figure 11.

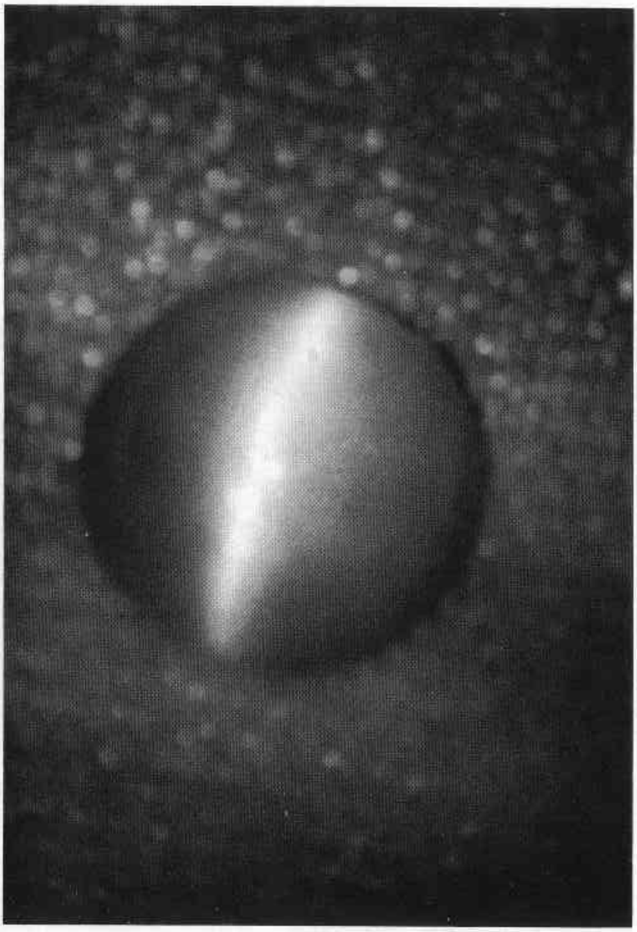


Figure 12.

Acknowledgements

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

To **Phil Thompson**, Arthur Cooley Jewelers, Springfield, Massachusetts, for a quench-crackled synthetic spinel in which foreign material in cracks made a very natural-appearing dendritic pattern (*Figure 11*).

To **Tom Mariner**, Graduate Gemologist, the Linde Co., for 5 cut synthetic emeralds and a 56-carat synthetic-emerald crystal for our collection and student use.

To **Maurice Shire**, New York City gem dealer, for three very jadelike cabochons of Rhodesian emeralds

from Sandawana.

To **Ed Coyne**, Created Gemstones, Inc., New York City, for a 1.13-carat transparent cabochon of Chatham synthetic emerald.

To **James Drilling**, New York City gem dealer, for another large group of synthetic and imitation cut stones, which are always welcome for student study purposes.

To **Sal LaSalle**, William V. Schmidt Co., New York City gem dealers, for several handsome brown cat's-eye moonstones, which resemble closely chrysoberyl cat's-eye (*Figure 12*).

To **Aldo Del Noce**, jeweler, New York City, for many thousands of imitation stones in a myriad of colors, sizes and shapes. Such stones are always in demand for study sets.

Book Reviews

MINERAL DIGEST–The Journal of Mineralogy. Published by Mineral Digest, Ltd., New York City. Volume I, No. I, 1970.

What is without doubt one of the most exciting and breathtakingly beautiful magazines in the mineral-and-gem field or any other field of human endeavor made its debut in midsummer, 1970. Its title is *MINERAL DIGEST–The Journal of Mineralogy.*

A descriptive brochure preceding publication of the first issue had these words about the magazine:

"A quarterly journal of specific, authoritative information on gems and minerals . . . so broad in scope that it will appeal to professionals and amateurs alike . . . strongly researched and carefully edited by prime authorities in the fields of mineral science and art, gathered into one international editorial staff . . . printed in Europe in full color . . . all in all, a very special, unique periodical of unsurpassed beauty."

One's initial impression of the journal is one of ultimate quality in every respect: color photography and reproduction (truly superb, 4-color-process photographs, mostly of extra-fine-quality rough and cut gems and mineral specimens, presenting a riot of color); extra-heavy, brush-coated, semigloss enamel paper stock; imaginative artwork, design and format; and an imposing list of by-lines under the well-selected, -written and -edited articles, including such prominent names in gemology and mineralogy as Pough, Sinkankas, Hurlbut, Desautels and others.

Subscription prices for the journal are: United States, $12 a year and single copies, $3 each; Canada, $13 a year and single copies, $3.50 each; foreign, $16 a year air mail and single copies, $4 each airmail. Subscriptions should be sent to Mineral Digest, Ltd., PO Box 341, Murray Hill Station, New York, N.Y. 10016.

Although these prices may seem somewhat high when compared to those for many popular magazines, the striking appearance and worthwhile content will quickly dispel any reservations one might have had about cost.

Without doubt, the establishment of *MINERAL DIGEST* will prove to be a significant event in the world of gems and minerals. The Institute heartily wishes the publisher, editor and other *DIGEST* staff members every success in this important new venture.

AUSTRALIAN OPALS IN COLOUR, by Nance and Ron Perry. Published by Charles E. Tuttle Co., Inc., Rutland, Vermont, and Tokyo, Japan, 1969. 112 pages. Clothbound. 7" x 7" format. Illustrated with black-and-white photographs and 86 color plates. Price: $5.

This is a delightful, informative little book designed to acquaint the reader with the beauty of Australian opal through excellent photographs and easy-to-read text. The authors' first book, *Australian Gemstones in Color*, was written in 1968 and reviewed in the Spring, 1969, issue of *Gems & Gemology*.

The bulk of the book consists of armchair visits to the various opal-producing fields, both important and unimportant; e.g., Lightning Ridge, Andamooka, Coober Pedy, etc. The account of each area tells the reader in interesting, storylike form about location, mileages, road conditions, climate, topography, vegetation, accommodations, kind of opal produced, current mining activity, mining methods, tips on buying, supplies and equipment and more.

A later chapter explains the current theory of the play of color in opal, based on recent studies of the stone's internal structure with the electron microscope.

Concluding chapters describe briefly opal cutting, treated opal and how doublets, triplets and opal chips in plastic are made. The book is profusely illustrated, and the color plates, many of fine opals and opal jewelry, are particularly attractive.

The authors are members of the New South Wales branch of the Gemmological Association of Australia and the Sutherland Gemcraft Guild. Both are practicing lapidaries. Mr. Perry is a dealer in lapidary equipment and supplies; his wife specializes in color photography, jewelry designing and opal cutting.

Like their first publishing effort, this attractive, inexpensive book should find ready acceptance among all those who appreciate opal's unique and ever-intriguing beauty.

BOOKS

for every gem library

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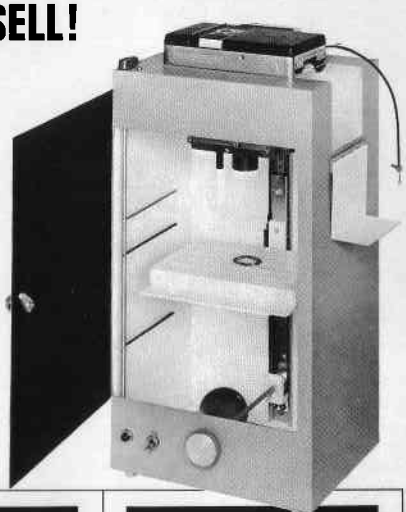

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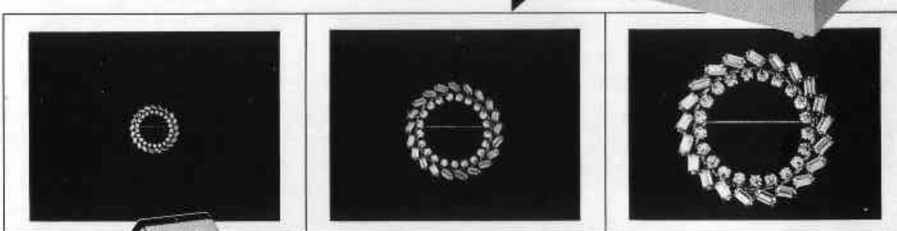

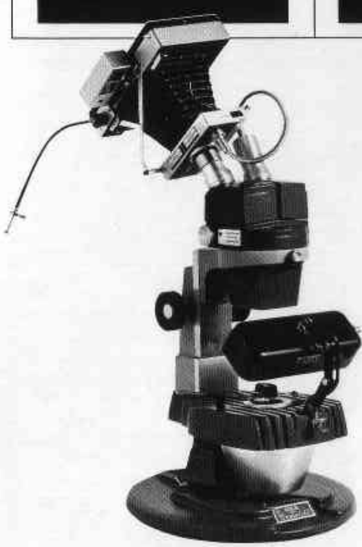

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