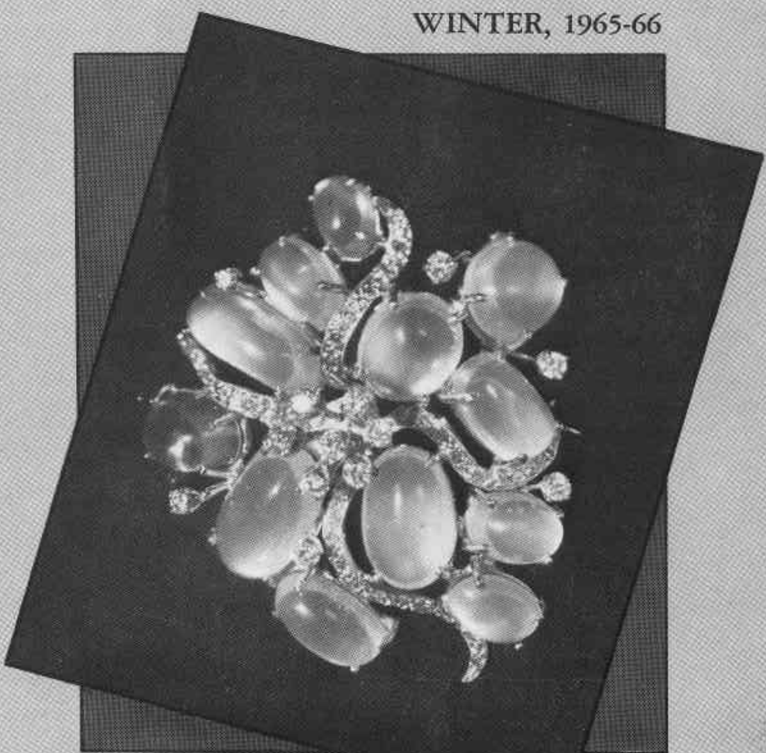
Gems and Gemology

WINTER, 1965-66



Gems & Gemology

VOLUME XI WINTER, 1965-66 **NUMBER 12**

IN THIS ISSUE

On the Cover

Moonstones and "earth stars" are set together in this romantic pin by Lindemann Jewelry Co., of San Francisco. This pin is one of 24 pieces in the 1965 Diamonds International Academy Collection.

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

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The Black Opals of Lightning Ridge

by
John Hamilton

From the air, it looks rather like the surface of the moon — or an air-force practice-bombing range. Acre upon acre of white pockmarks (little white craters) weave their way through the stunted scrub of Australia's great out-back.

It seems even more desolate from the ground. A dusty track winds its way through a maze of holes and hil-locks of white sandstone from which the sun bounces with a glare that nar-rows eyelids to a cautious squint. The track leads to a strip of asphalt, which is the main street. There is a store, a two-room hotel called the Digger's Rest, and a scattered collection of rather battered-looking cottages. In spite of a recent remarkable growth of civic pride, it is not an impressive-look-ing settlement. But this is Lightning Ridge, home of one of the world's rar-est gems — the fabulous black opal, with the world's production in the hands of three dozen or so miners.

It is situated in the north of the State of New South Wales, 45 miles from Queensland, in sheep-station country where they measure holdings by square miles instead of acres.

The black opal that lay hidden under the thin crust of sandstone remained undiscovered until the turn of the cen-tury. It was formed thousands of years ago when Australia had a vast inland sea. For the first three years after it was discovered, it was considered near worthless and sold for a pound or two *an ounce*. Today, it sells for up to £120 ($250) *a carat.*

Australia is now exporting nearly $6,750,000 worth of opals a year, and the cream of these are the black opals of Lightning Ridge.

In 65 years, the world has come to love, appreciate and want this strange black stone with the inner fire that flashes with every color of the spectrum.

How the Opal Chose its Home

In Cretaceous times a shallow sea stretched like a broad silver sash across Australia from the extreme tip of Cape York to the Great Australian Bight. Over millions of years this inland sea was gradually filled and the waters receded. Over much of the area a sand deposit remained that became consolidated into a sandstone.

Opal is composed of silica and water, and silica is of volcanic origin — yet there is nothing volcanic in the Cretaceous crust where opal is found. There is, however, rock of volcanic nature below the old sea bed, and the silica came from there. In the course of time, silica and water in hot solutions rose from deep-seated magmas. It percolated through cracks and crevices until it met the desert sandstone, beneath which it cooled off and formed opal. In its upward course, it replaced anything it came in contact with — shells, bones, corals or wood — the replacement by opal sometimes being complete.

This is how a geologist explains the formation of opal. But the colors of the opal, and especially the inner fire of a black opal, remain a mystery, explained only by the belief that they are prismatic due to very minute fractures that occurred in the opal's formative process. (Editor's note: See the article entitled, *The Origin of Color in Opal, Based on Electron Microscopy,* by P. J. Darragh, B.Sc., and J. V. Sanders, Ph.D., in the Summer, 1965, issue of *Gems & Gemology.*)

It remains one of the few gems that defies successful imitation by man.

For thousands of years the black opals remained undiscovered, imprisoned in the gritty clay layer under the overburden of sandstone. Late in the last century, a drover was pushing a huge flock of sheep through the dry country of northern New South Wales when he decided to camp for the night, since a storm was brewing. The storm struck with sudden fury. There was a tremendous flash of lightning. Legend has it that 700 of the drover's sheep were killed by the one lightning bolt. Violent electrical storms seemed to follow the low-lying ridges of the area; thus the drover's misfortune coined the name Lightning Ridge for the area.

In 1900, men were mining pale milky opals at a place called White Cliffs, west of Lightning Ridge. There were many who had no luck and either packed their belongings together and went in search of other fields, or else drifted into other jobs. Charles Nettleton, one of the men who left White Cliffs, was a lean, tough bushman, who demonstrated his stamina by walking the 400 miles from White Cliffs to the town of Walgett (45 miles from Lightning Ridge) in the searing hot summer of 1901-2. At the little pastoral town of Walgett he was told that gold had been discovered near the Queensland border, about 90 miles away, so he walked north only to find that the supposed gold was mica.

The black opal mines of Lightning Ridge. This photo was taken in the Three-Mile area, from which some of the richest gems in the world have been mined.
Courtesy Australian News and Information Bureau

Still undecided about what to do next, Nettleton met some drovers who, over the campfire, told him about some strange black stones that some of the boys had picked up while following their flocks of sheep. The stones were strange because they flashed in any kind of light and gave out beautiful colors.

Intrigued, Nettleton managed to get some samples, which he immediately recognized as being opal. But they were quite different from the opals of White Cliffs and, somehow, seemed alive with color under their black velvetlike mantle.

Nettleton had no money. He contacted a hotel keeper, called Joe Beckett, convinced him that he could find the source of the strange new stone and managed to get a grubstake for the venture. He sank his first shaft at Lightning Ridge on October 15, 1902. He found traces of opal, but nothing of value.

Early in 1903, the wife of a boundary rider on a nearby sheep station showed him some pretty black stones her family had found while picnicing six miles to the east of the main ridge of Lightning Ridge. This proved to be a real strike. Four local sheep-station owners each put up $60 and formed a small prospecting company. The company provided Nettleton with a salary of $2.56 per week and keep, and he began work with a friend called Charlie Troy. They soon had some parcels of beautiful black opal, but little realized that their troubles had only begun.

Nettleton, still fascinated by the inner fire of the stones, packed a parcel and sent it off to a dealer in Sydney, capital of the State of New South Wales. The dealer wrote that the black *nobbies* (the name given to black opal before cutting) were a near-worthless matrix (the rock in which gems are often enclosed) and he offered Nettleton $2.24 for the lot. Nettleton refused the offer and requested the return of the opal. He then sent it to other dealers who also rejected the stones as worthless.

The first opal company at Lightning Ridge folded.

Then trouble began with the nearby sheep-station owners.

In spite of Nettleton's failure with his black stones, other men had drifted to Lightning Ridge in the hope of finding white saleable opal of the White Cliffs variety.

The sheep-station owners objected to the presence of the miners on their properties. They could not stop them from sinking their shafts because they held Miners' Rights that conferred powerful rights to the prospector. So they impounded the miners' horses, claiming that they were grazing illegally. They charged .25 for the release of every animal, which was a considerable sum in those days to a struggling miner. But this action did not break the spirit of the men who had come to Lightning Ridge, so the sheep-station owners decided on a more drastic action. One station manager controlled the only water supply available to the miners of the Ridge. He fenced it in, stating that although the law allowed the miners to sink shafts, it did not force him to supply them with water. The resourceful miners dug a number of small drains that sloped down and beyond the fenced dams, allowing water to flow under the fences. The incensed station manager told the miners that he had poisoned the water to kill rabbits. Although the miners did not believe him, they did not drink the water. Instead, they organized a string of pack horses that traveled long distances to bring them in a meager supply of water, only enough to allow them to hold out at the Ridge.

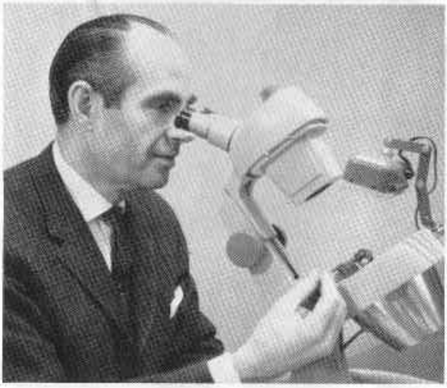
The tense situation was relieved at the end of 1903, when Lightning Ridge had its first opal rush. At Simms Hill, deposits of opal had been found that were on the white side and, therefore, saleable.

The squatters were prohibited from impounding the miners' horses and were also forced to give the miners access to the dams until the Government could arrange a water supply. The Government also declared 1200 acres to be a mining field.

Nettleton, meanwhile, disheartened by the rejection of his black opals, traveled over the border to the while-opal fields of southwestern Queensland. He worked there for a while, but the lure of the black opal was too strong for him. He returned to Lightning Ridge, packed his belongings once again, and set off on foot for White Cliffs 400 miles to the west, determined to sell his black opals. He walked the first 120 miles to Brewarrina, and then worked his way from sheep station to sheep station until he reached Bourke. From Bourke he caught a paddle steamer carrying wool down the Darling River to Wilcannia. From Wilcannia he walked the 50 miles to White Cliffs.

To be continued in the Spring, 1966, edition

Developments and Highlights



at the GEM TRADE LAB in New York

by
Robert Crowningshield

Doctored Turquois

Turquois continues to be popular and we continue to see attempts to utilize very light-colored material. One interesting strand of graduated beads was of very good color with prominent black "matrix"; at least it appeared to be matrix until examined under magnification. It was then discovered that the beads were painted blue, the black matrix had been applied by what appeared to be a dribbling technique and the whole coated with clear lacquer. *Figure 1* illustrates the nearly white turquois exposed near a drill hole, and *Figure 2* shows the painted matrix.

Imitation Turquois

A compressed imitation of turquois was found to be essentially plastic with undetermined amounts of quartz and turquois — the first time that such an imitation has shown the presence of turquois. With a specific gravity of 2.01, the percentage of either quartz or turquois must be small. The client expressed surprise when we informed him that the usual gem-testing methods or even X-ray diffraction are not enough to determine precise percentages of the powdered minerals in the plastic.

Clam "Pearls"

One of the largest edible-clam "pearls" that we have been asked to identify is shown in *Figure 3*. It is nearly spherical, measures 13.50 mm.,

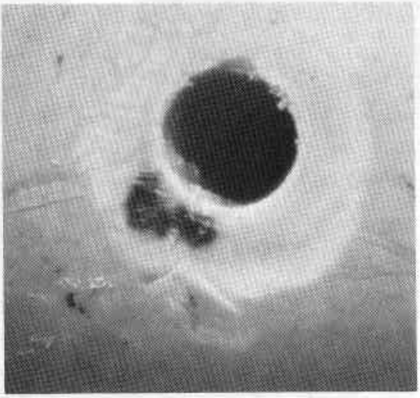


Figure 1

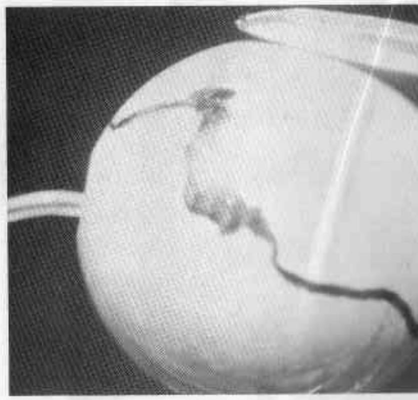


Figure 2

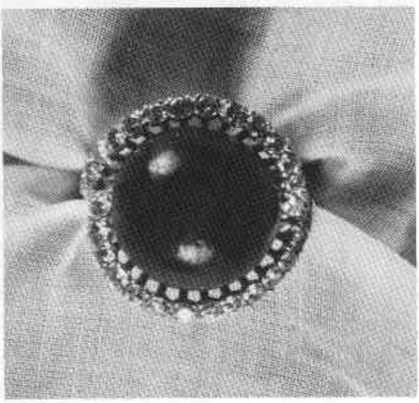


Figure 3

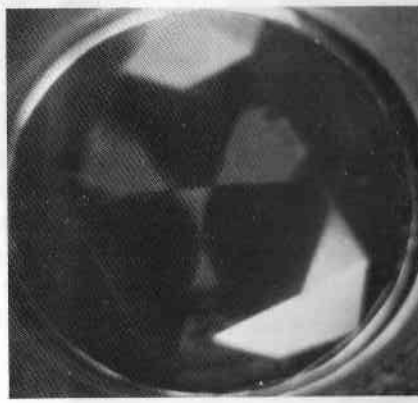


Figure 4

and is an intense purple-black. Set with many diamonds in a platinum ring, it made a striking piece of jewelry in spite of the fact that the trade does not accept non-nacreous mollusc concretions as true pearls.

Natural Brown Diamond

When a natural color dark-brown diamond was examined under ultraviolet light, the staff was surprised to see that only certain areas fluoresced a bright yellow and appeared to resemble the face of a whimsical, big-eyed cat. *Figure 4* is a photograph taken of the stone under ultraviolet light, using the Photoscope and a five-minute exposure.

A 122-facet Diamond

We were pleased to examine a 1.06-carat, modified round brilliant-cut diamond with 122 facets, the brain child of New York diamond cutter, Harry Steinbach. The design bears a U.S. Design

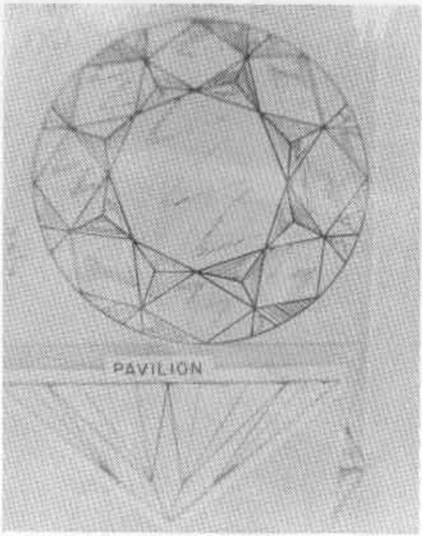


Figure 5

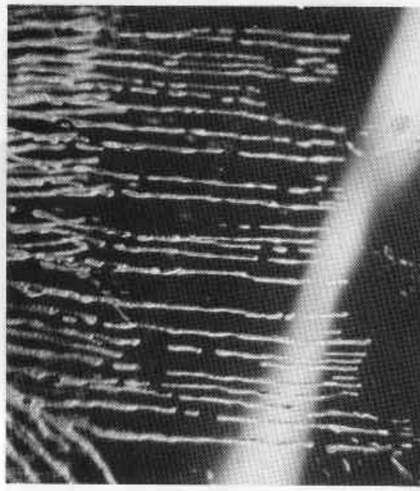


Figure 6

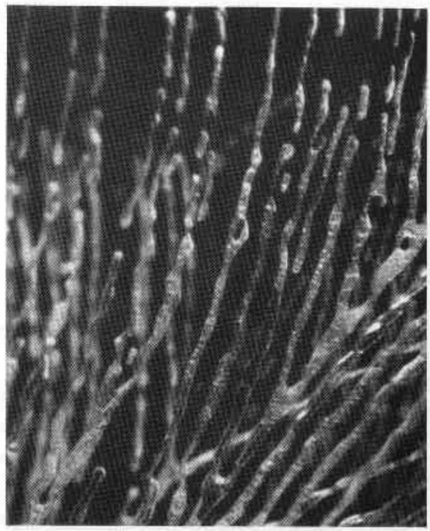


Figure 7

Patent (#140283), dated February, 1945. (*Figure 5* illustrates the placement of the facets.) The cutter mentioned that he had cut a few of this same design with an additional 40 facets on the girdle, making a total of 162 facets.

Solution-Grown Synthetic Rubies

A pair of approximately five-carat each, solution-grown synthetic rubies were examined and photographed recently in the Laboratory. We were unable to ascertain if they were grown from a flux or a hydrothermal process, but the inclusions do not resemble anything yet seen in natural stones. *Figures* 6 and 7 show streamers of what initially appeared to be two-phase inclusions but they could be solid-flux inclusions, similar to those seen in a Chatham synthetic emerald. We could detect no evidence of a seed, as we did in the three specimens reported on in the Spring, 1965, issue of *GEMS & GEMOLOGY*. Since examining this pair of stones, we have

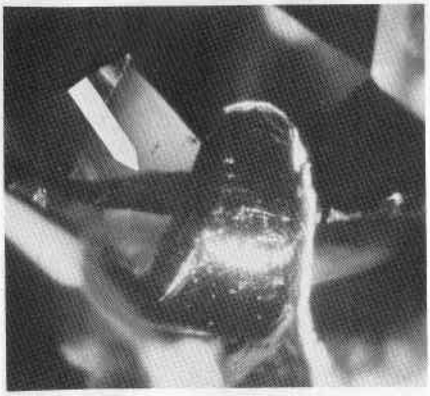


Figure 8

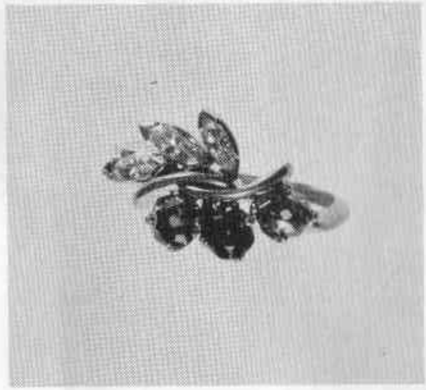


Figure 9

had occasion to see a fragment of rough and a two-carat solution-grown synthetic ruby. To date, the only consistent characteristic is a peculiar greenish to whitish glow, in addition to the normal red fluorescence seen under short-wave ultraviolet light (2537 Å). We feel confident in predicting that many more of these potentially troublesome synthetics may be entering the market.

Natural-Color Green Diamond

We recently examined the first natural-color green diamond having the deep-green color associated with atomically treated stones. In several places on the girdle of the stone were dark-brown naturals that graded into the green, internally. They had been positioned under or near prongs, as seen in *Figure 8.*

Green, Blue and Red Diamonds

Another green diamond, almost as dark as the previously mentioned one, was in a ring with a dark-blue and a true-red stone that weighed approximately .60 carat each. *Figure 9* cannot do justice to this unusual group of colored diamonds.

"Piggy-Back" Diamond Ring

We encountered our first "piggy-back" diamond ring in which three thin diamonds, not touching one another, were set so that they resembled a single stone. *Figure 10* is a view through the crown of the piece. The extremely thin marquise-shaped top stone has an enormous culet. The center diamond is virtually a flat sliver, whereas the bottom one is almost all pavilion. Note that in the crown view *(Figure 11)* at the edges near the tapered baguettes, one can see details of the mounting through the bezel facets. The mounting is, of course, designed to hide the triple nature of the diamond.

Mexican Topaz

Figure 12 illustrates fibers in a Mexican topaz. The fiber that forms a loop appeared to make a simple knot — a feat difficult to understand for an inclusion in a crystalline material.

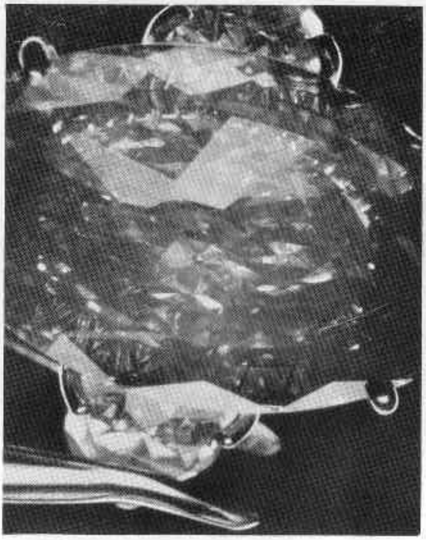


Figure 10

Figure 11

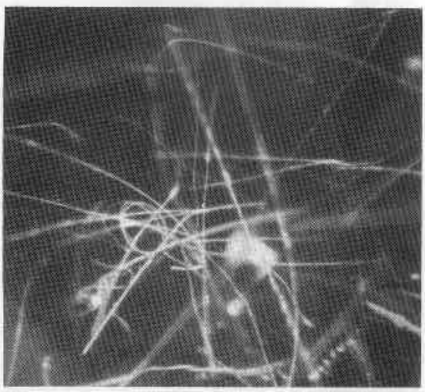


Figure 12

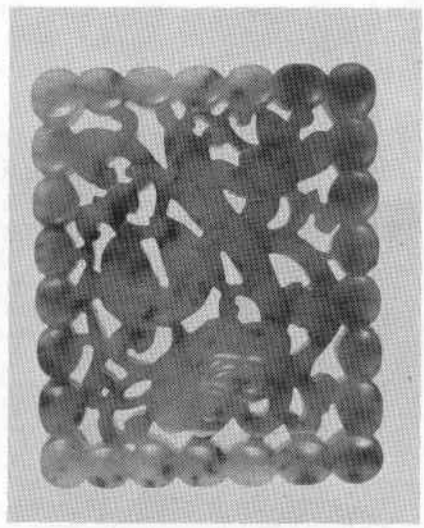


Figure 13

Dyed Nephrite Jade

Since we first encountered dyed jadeite, in 1956, we have expected the appearance of dyed nephrite, but until recently, however, we had not seen or heard of any. *Figure 13* is a photograph of a well-carved nephrite tablet with chrome-green mottling. Spectroscopic examination of the green areas proved to us that the color is due to dye. Pos-

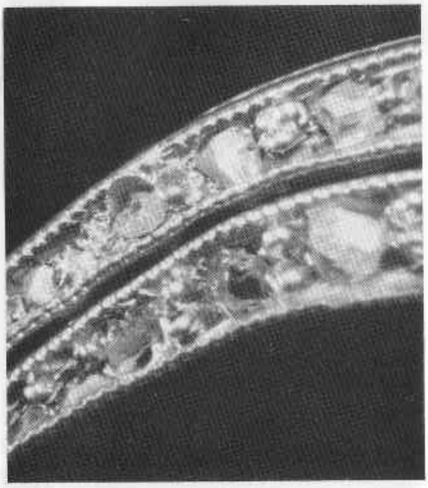


Figure 14

Figure 15

sibly, nephrite does not take the dye uniformly; therefore, this accounts for the absence of dyed material in the trade.

Diamond Chips

Although laymen use the term diamond chips frequently, the stones to which they refer almost invariably are faceted diamonds. In fact, so infrequently do we see unfaceted chips of diamond used in jewelry that we can recall only two or three items in the past eighteen years. *Figure 14* shows a few diamond chips used at the extremities of an old jewelry piece. The larger stones were old miners and Swiss cuts.

Odd Diamond Inclusions

Perhaps the most unusual series of inclusions that we have seen in a faceted diamond are those shown in *Figures 15* and *16*. The six-carat stone was obviously imperfect, but had excellent color. One set of inclusions resembled a growing root and the longest measured at least five millimeters. Opposite this inclusion and deeper in the stone were a series of hollow tubes, resembling icicles. Because of reflection, they appear like church spires mirrored in water in the photograph.

Figure 16

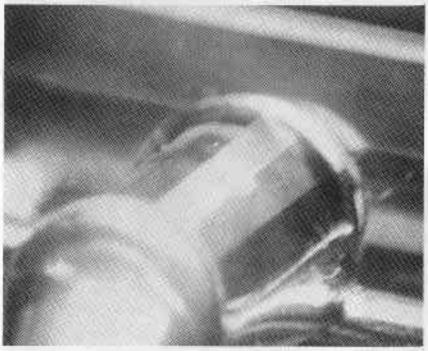


Figure 17

Unusual Cut for Natural Sapphire

Figure 17 illustrates a natural sapphire, one of two side stones mounted with a large natural emerald. To the client, the stones resembled faceted halves of synthetic-rod material.

Odd Reaction in a Natural Spinel

Figure 18 is a drawing of the absorption spectrum of an unusually fine-colored natural-blue spinel of

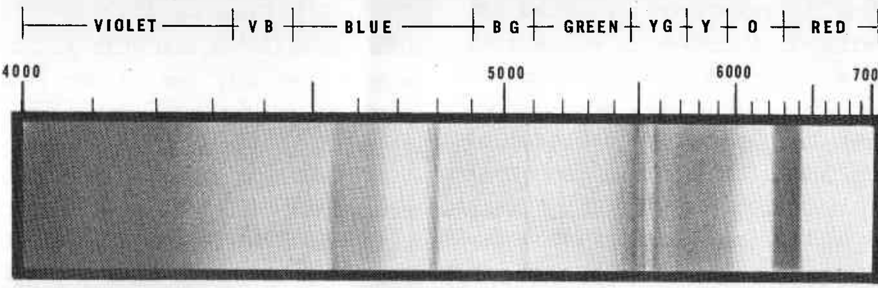


Figure 18

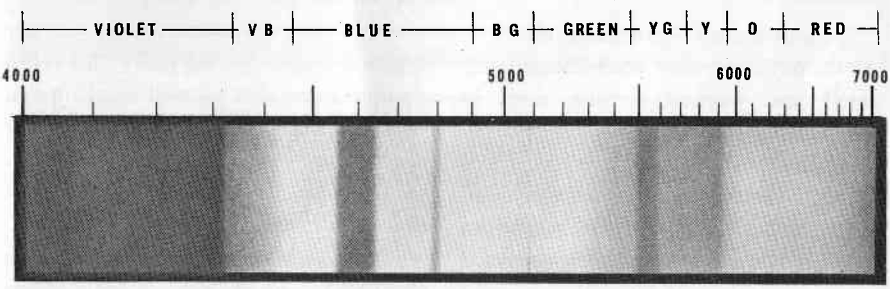


Figure 19

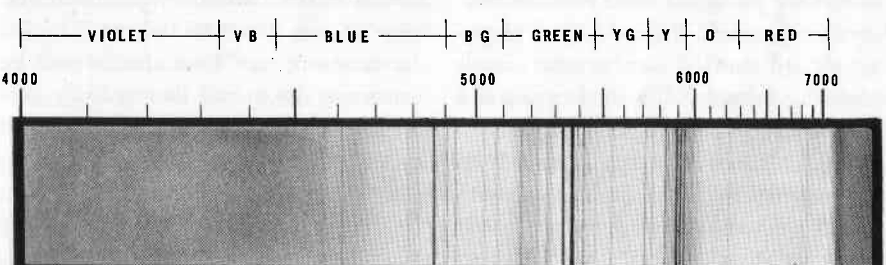


Figure 20

approximately 10 carats. The stone appeared red under the color filter, but the refractive index, specific gravity and inclusions were normal for a natural spinel. The usual spectrum for a natural blue spinel is shown for comparison purposes in *Figure 19*.

Synthetic Yttrium Aluminum Garnet

We were pleased to have received an example of synthetic yttrium aluminum garnet, with chromium and deodymium coloring agents, from Dr. Kurt Nassau, Bell Telephone Laboratories. Our Laboratory had received an intense-green crystal fragment for identification and suspected that it was one of the new materials. In response to our request, Dr. Nassau forwarded samples in time to make comparison checks. *Figure 20* illustrates the amazing absorption spectrum of this potentially attractive gem material.

Laminated Tortoise Shell

Although we had read about laminated and worked tortoise shell in reference books, we had never encountered any until recently. It is stated that the thin plates may be joined by a combination of pressure and heat from boiling water. We were quite surprised to see a necklace of laminated tortoise shell that graduated from seven to thirteen millimeters. *Figure 21* is a photograph of one of the smaller beads showing the wavy flow of the color and one contact plane. For comparison, *Figure 22* shows the appearance of an unworked thin piece without swirls with the brown color merging into the nearly transparent yellow areas.

Yellow Fluorescent Diamond

A dark, yellow-brown 3.57-carat marquise-cut diamond with intense sulphur-yellow fluorescence yielded the rather odd absorption spectrum shown in *Figure 23*. The lines and bands at approximately 5230 Å, 5480 Å, 5580 Å and 5640 Å form a combination that we had never encountered.

Fluorescent Idocrase

Until recently, we had no reason to disbelieve the statement in Webster's authoritative GEMS, that green grossularite is the only one of the jade substitutes that fluoresces orange when exposed to X-rays. We found that the jadelike idocrase from Pakistan, if quite translucent, will sometimes show the same intense-orange fluorescence. We were interested to see if any of our specimens from California would fluoresce, but the only one that showed any reaction was a mottled white-and-green opaque stone that glowed bright green — a reaction not seen in the other specimens.

Rosser Reeves Star Ruby

We were very much impressed with the 138.7-carat star ruby recently, when it was in the Laboratory for photography. It was given to the Smithsonian Institution, and henceforth will be known as the Rooser Reeves Ruby (the largest star ruby on record). We had admired it from a distance at the American Museum of Natural History, in 1953, when it was on temporary display with the 100-carat de Long star ruby.

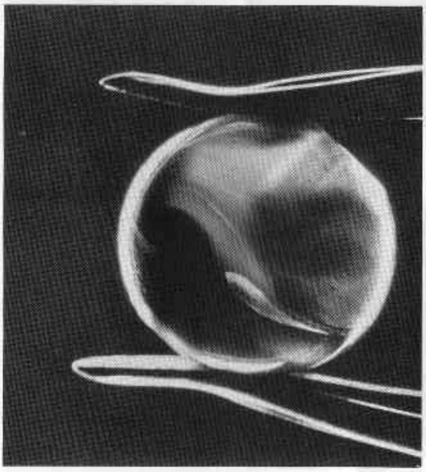


Figure 21

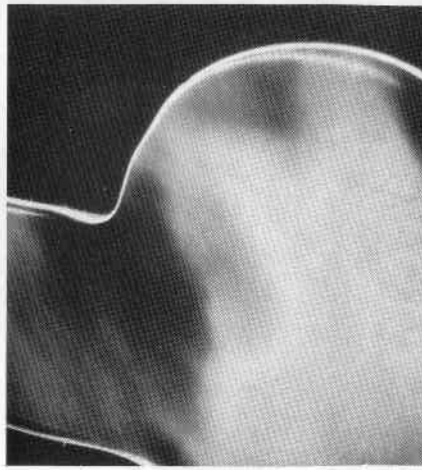


Figure 22

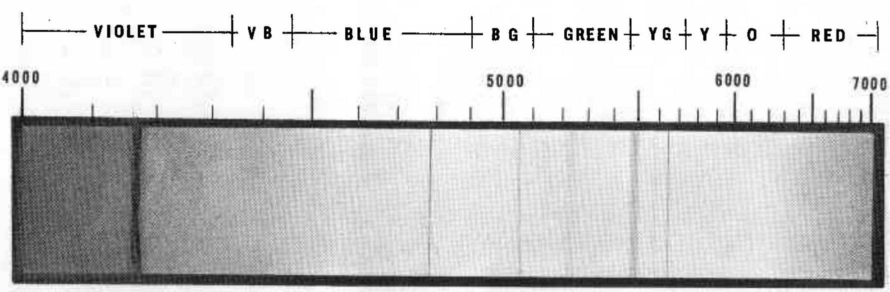


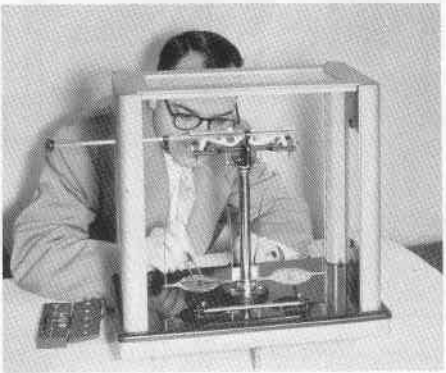
Figure 23

Acknowledgements

We are indebted to **Mr. Ralph Esmerian** for a selection of several species of faceted garnets. Through the good offices of graduate **Robert Clark,** Krementz Co., Newark, we received a fine selection of many stones and pearls that will find good use in our expanding colored-stone correspondence course. We wish to thank **Mr. Ed Cambare** of Trifari Co., for a selection of black and white Majorica Imitation Pearls.

We wish to thank the following individuals and firms for loans of stones for study and lecture purposes: **H. R. Benedict & Sons,** for Gilson synthetic emeralds; **Maurice Shire,** for Sandawana emeralds; **Alfred Engel,** for Brazilian rubies; **Robert C. Nelson, Jr.,** for Brazilian opals; **William V. Schmidt Co.,** for Tanzania rubies and sapphires and rhodolite garnets; and **Manning Opal Corp.,** for black-treated opals.

Developments and Highlights



at the

GEM TRADE LAB

in Los Angeles

by
Richard T. Liddicoat, Jr.

Unusual Light-Colored Emerald

Usually, detecting the difference between synthetic and natural emerald is one of the more easily accomplished testing operations. The flux-fusion synthetic usually has very low property values, with refractive indices of 1.561-1.564, and a S.G. near 2.65 or 2.66, in contrast to indices over 1.57 and S.G. of 2.70 or more for the natural. As a result, it is usually easy to separate the two. In addition, the inclusions in flux-fusion products are distinctive. Exceedingly rarely, however, a stone is encountered that is in between in several respects, making the separation difficult. Recently, we received a twelve-carat pale emerald that was lighter in color than any synthetic we have seen. It had indices of approximately 1.565-1.57, no visible inclusions, and a weak to moderate-red fluorescence under long-wave ultraviolet. In addition, this stone transmitted short-wave ultraviolet slightly. Although we were satisfied the stone was natural, we removed it from the setting before making a decision. We found that the specific gravity was low, as might be expected from a pale stone, but not as low as the flux-fusion product. It had an S.G. of 2.67 +, but in a liquid slowly adjusted to a point where most natural emeralds sank. It sank while the Chatham and Gilson synthetic emeralds continued to float fairly buoyantly. For some time we have

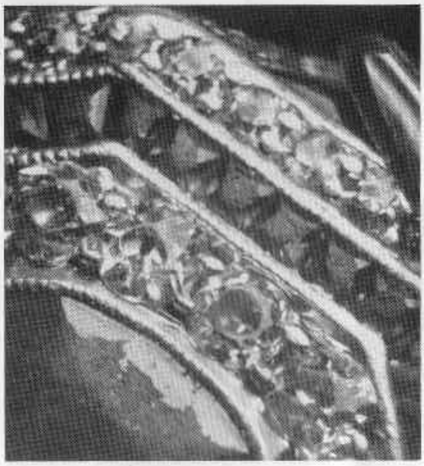


Figure 1

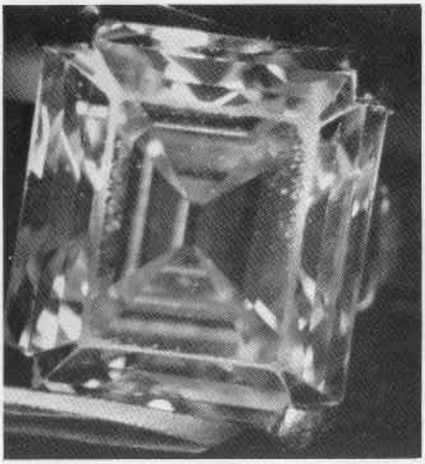


Figure 2

questioned the efficacy of the short-wave ultraviolet transparency test as a distinguishing factor between synthetic and natural emeralds, since we have found several natural emeralds that pass enough short-wave ultraviolet to cause scheelite to fluoresce. This stone was one more example.

Badly Worn Diamonds

Occasionally, we see diamonds that have been abraded noticeably during wear. The extent of abrasion is in such marked contrast to the usual effects of even long-term use in rings that one cannot help but wonder what was responsible for the great wear. We have illustrated two pieces of jewelry submitted to the Lab by a jeweler because he was so surprised at the worn appearance of the stones. *Figure 1* shows a sapphire and diamond ring, the center stone of which (a sapphire) was worn almost beyond recognition. The row of sapphires between the two rows of round diamonds also was so worn that all crown facets had long since disappeared. Of particular interest, when examining these stones, was that the row of diamonds next to the center stone, as well as the diamonds in the outer rim, were worn so evenly that the table edges of each of the diamonds had the appearance of a girdle surface. We had never encountered such evenly worn stones. It looked as if they had been subjected to an even, consistent rubbing against other diamonds over an extended period of time. The same wearer had an emerald-cut diamond, on which the edges of the table were completely worn away *(Figure 2)*.

New Type of Jadeite Triplet

A jeweler brought in a type of jade substitute we had never encountered. It was a long, thin, narrow cabochon made up of two pieces of translucent jadeite to which a rich-green color had

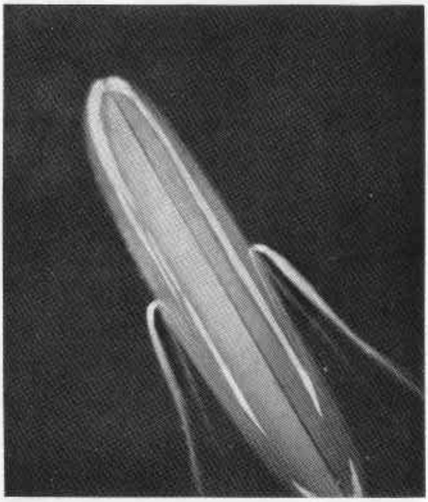


Figure 3

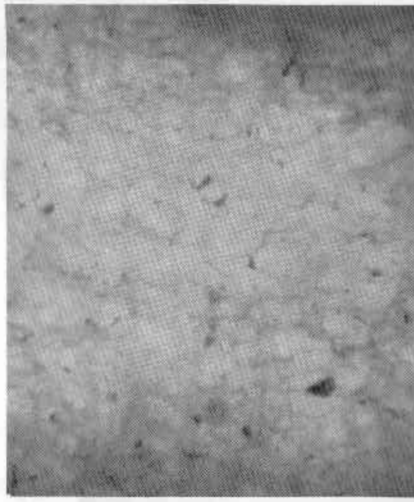


Figure 4

been imparted by the layer of coloring. A side view of this type of jade triplet is shown in *Figure 3*.

Dyed Quartz

Occasionally, we see crystalline quartz of a deep-pink color that is sold as pink jade. These are most frequently dyed quartzite, which show, characteristically, a strong dye concentration in cracks. One examined recently is shown in *Figure 4*. Note that the color is concentrated in the cracks.

Pressed Amber

In the last several months, we have seen quite a few examples of pressed amber. Instead of having the appearance that we had expected, most of them had a strongly mosaic appearance, which is visible under ultraviolet light or strong overhead lighting. A good example is shown in *Figure 5*. Note that the grains are rather easily visible under 20x.

Four-Rayed Star Diopside

Four-rayed star diopside, a gem material that was rarely encountered a year or two ago, is now very common. It is characterized by a very broad ray in one direction and a rather thinner ray at right angles. In other words, two of the four rays are thin and two are broad. The inclusions in this material show a metallic reflection under overhead lighting; *Figure 6* shows their unique nature rather well. We have come to regard these distinctive inclusions as characteristic of star diopside.

Green Synthetic Spinel

One of the stones sent in for testing recently turned out to be a green synthetic spinel, which had some rather interesting properties. Under shortwave ultraviolet light, we noticed first a greenish-yellow surface-smudge effect similar to the appearance under

Figure 5

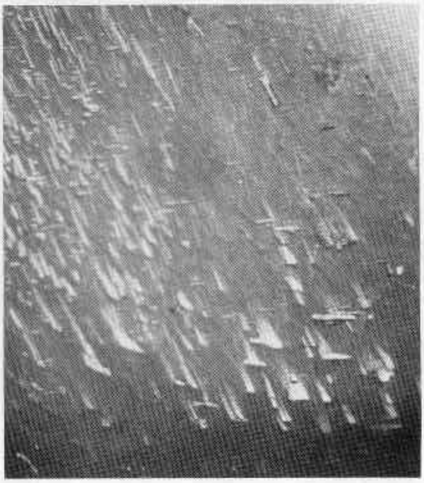


Figure 6

short wave of blue synthetic sapphires, but in this case, of course, the stone being tested was green. Under long-wave ultraviolet, there was a very rich-red fluorescence. The same stone, when being subjected to a thin beam of transmitted light, showed a strong red appearance. As might be expected of a stone of this appearance under the spectroscope, chromium lines were in evidence.

Red-Backed Colorless Topaz

Several pieces of antique jewelry, consisting of a large stone-set brooch, matching earrings and necklace, were set with pink stones. On testing, each of the stones in the ensemble proved to be topaz. On close examination, it became evident that all the topaz was colorless and that the red color had been imparted by backing the colorless topaz with a rich-red dye. One of the stones is shown in *Figure* 7, in which the dye is evident by concentrations of the color. (Note the arrows showing the color concentration.)

Figure 7

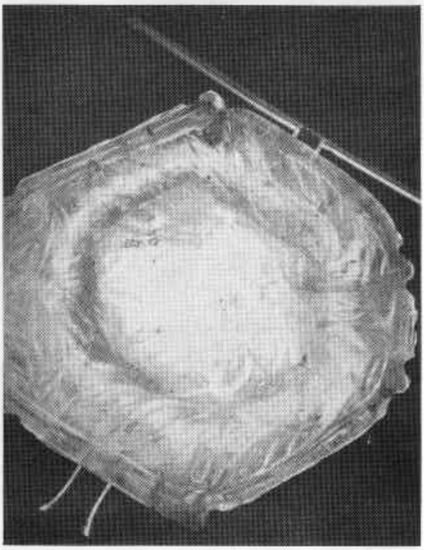


Figure 8

Linde Synthetic Emeralds

To date, we have had the opportunity to test only about a dozen of the new Linde hydrothermal synthetic emeralds. However, those that we have examined showed a characteristic noted by Glenn Nord of the GIA staff (Los Angeles) that may prove of great value in testing. Nord noted that under short-wave ultraviolet the red fluorescence of the Linde synthetic was much stronger than that of the flux-fusion synthetic emeralds, such as those produced by Chatham and Gilson. This has come to be a useful test for separating the Linde from the other synthetic emeralds.

Although quite a number of the new Linde synthetics have now been produced, they are not yet on the market; it will probably be a matter of several months before they appear in quantity.

Prominent Color Zoning in Natural Emerald

Another stone of interest mounted in a flat hexagonal brooch, which was submitted recently for identification, proved to be a natural emerald. In transmitted light, there was a strong color zoning that is shown rather clearly in *Figure 8*. This was not a really unusual specimen, but the color zoning was so prominent that we decided to photograph it.

Cat's-Eye Apatite

A stone that has not been used to any great degree in jewelry, and which is even rare among collectors, has become fairly common just recently. It is cat's-eye apatite. Apatite has been known for many years in a variety of colors; however, recently, imports from the Orient have contained quite a number of greenish-yellow or yellowish-green cabochon gemstones in which a rather sharp eye is evident, and which upon testing proved to be apatite. These are being offered at a rather low price of a dollar or two a carat. Cat's-eye apatite is of interest to those looking for the unusual in gemstones.

A New Color in Dyed Chalcedony

One of our most recent testing problems involved a pair of green cabochons, one with a flat back and the other in the form of a pendant. The two stones had a bluish-green color somewhere between that of the dyed chalcedony usually known as green onyx and the chrysocolla quartz that never has been, to our knowledge, duplicated by a dyed chalcedony. In

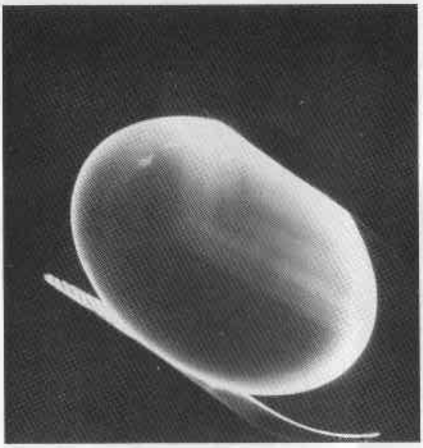


Figure 9

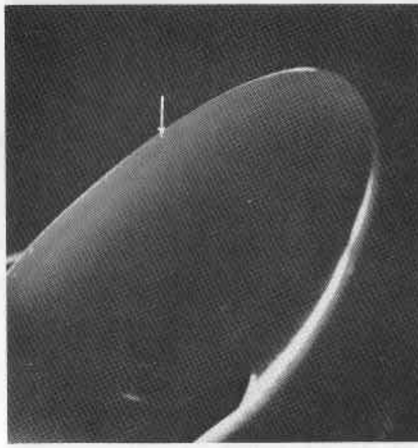


Figure 10

the course of routine testing, we noted that the material, we assumed to be some form of dyed chalcedony, showed several unusual characteristics. Under the spectroscope, there were three distinct lines in the red approximating the lines one would expect in a naturally colored jadeite. However, in transmitted light, the characteristic structure of chalcedony was evident as shown in *Figure 9*. Closer examination under magnification showed that the flat-backed cabochon had distinct brownish color zoning parallel to the flat back. Our first impression was that this was some sort of doublet, but closer examination demonstrated that the brown zone *(Figure 10)* was irregular and was roughly parallel to the flat back, rather than having any relationship to the agatelike structure, which ran almost at right angles. Further study suggested that the brownish zone was caused by the heat generated in the rapid polishing of the flat back. It was not a doublet. It is quite obvious from our findings in this case that a new dye is being used to color chalcedony; it is one that we have not previously encountered in dyed chalcedony.

Two-Toned Plastic Cameos

Approximately a year ago, a representative of a large U. S. industrial corporation called at the GIA, in Los Angeles, to show some very delicate two-toned cameos he had fashioned from plastic. This gentleman, who has had no connection with the jewelry industry, is a very fine engraver, an art he practices as a hobby. With his interest in plastics in his work, he decided that there were real possibilities for plastic-imitation cameos if the dies used to form them were delicately engraved. Some of the results of his efforts are indeed delicately and beautifully executed.

It is difficult to see in just what man-

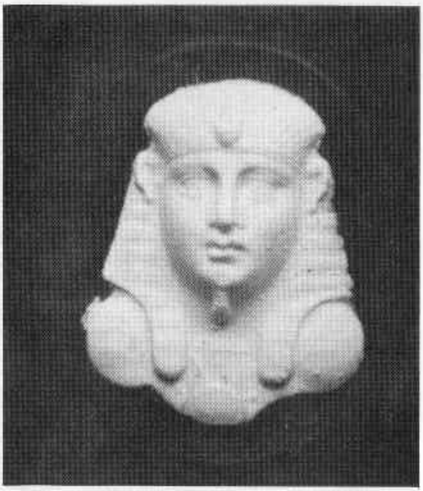


Figure 11

Figure 12

ner these imitations will be used in the jewelry industry, but perhaps there is a possibility for them in some variety of costume jewelry. In the meantime, the producer has sought out the finest examples of early cameo carving, with the intention of making careful reproductions. His engraving is delicate, and the dividing line between the color of the raised figures and the background is very sharp. *Figures 11* and *12* show examples of his efforts.

Surface Deterioration in Opals

Two opals were submitted for study to determine the cause of the surface deterioration apparent on the stones. Although they had been polished to a high luster at one time, the stones now have surfaces that are exceedingly rough and dull. *Figure 13* shows the nature of the surface in reflected light. Even though the surface was very dull, some fire showed through to prove that the stones had been gem opals. The stones had been etched by a cleaning solution —undoubtedly, one of a strongly alkaline nature. Opals are easily attacked by alkaline solutions; therefore, all use of them for opal must be avoided.

Rough Table on Diamond

A one and one-half-carat diamond brilliant was examined recently, the table of which had an uneven appearance, not quite frosted, but certainly not well polished. *Figure 14* shows this condition under 200x. The surface more nearly resembles the surface of a pearl than it does that on a diamond. Although this gives the impression, perhaps, of having been cut parallel to the grain, this is not the case, since this brilliant is a four-point stone; i.e., with the table parallel to the cube direction. In *Figure 15*, the frosted appearance may be seen faintly (under about 20x) on most of the table visible in this photograph. Apparently, the table had been etched subsequent to polishing.

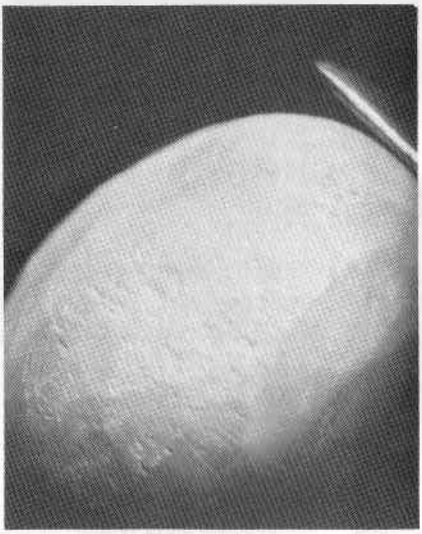


Figure 13

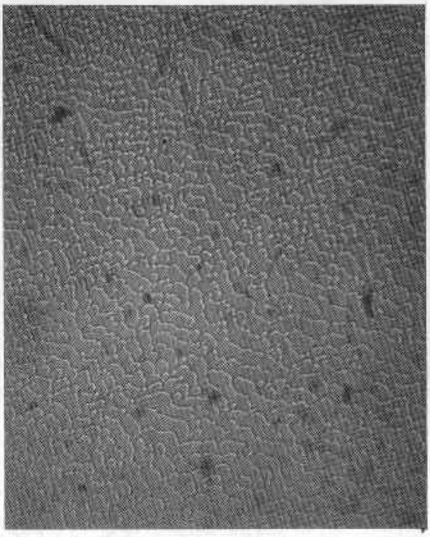


Figure 14

We Appreciate

The generous gift from **Wm. Ballreich** of Ballreich & Co., Ltd., ring manufacturers of Los Angeles, of 30 natural star rubies and sapphires. They will be especially useful to show the range of colors available.

From **Percy K. Loud,** former Chairman of the GIA Board, Bloomfield Hills, Mich., we received several gemstones that will be useful for displays and in our gem-identification sets.

GIA student **Paul W. Kriegler,** Hopewell, Va., donated a bag of rough amazonite and moonstone material, in addition to specimens of petrified wood and miscellaneous stones.

GIA student **Lawrence Reiner,** Scottsdale, Arizona, visited the GIA recently and donated several pieces of turquois that will be used to advantage in our colored-stone sets.

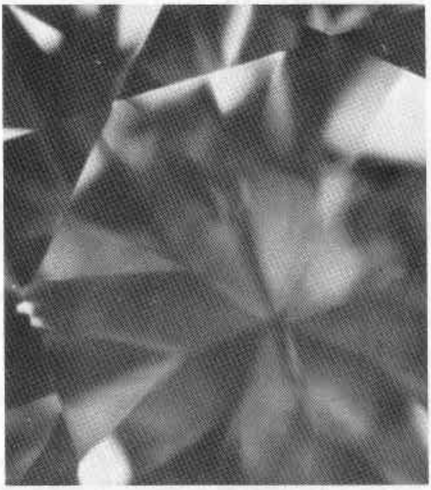


Figure 15

We are grateful to GIA student **Walter Coleman,** Denver, Colo., for the addition of a nice lace-agate cabochon to our chalcedony collection.

Our thanks to **Eric Engle,** Brazilian Trading Co., for the epidote crystal recently donated to the GIA.

We are grateful to **Arthur Schwemmer,** Reading, Pa., for the cleavage of diamond that can be used in a gem-identification set.

We appreciate the assortment of doublets, triplets, opal, coral and various synthetics received from **Runyan's,** Vancouver, Washington. They will be used to good advantage in our gem-identification sets.

And, our thanks to **Bernard Burnstine** for the synthetic ruby that we have a need for in our colored-stone sets.

From GIA student **George F. Harvey,** Denver, Colo., we received several pieces of microcline with polished surfaces that can be used in making up stone sets.

Dean Kraus Gives Valuable Books to GIA

Edward H. Kraus is Dean Emeritus of the College of Literature, Science and the Arts of the University of Michigan. He is best known to jewelers not only as President of the Institute, but as senior author of *Gems and Gem Materials,* which was first written with the late Edward Holden as junior author in the early 1920's, and later, the junior author was the late Chester B. Slawson.

President Kraus is now 90 years old. He recently decided upon the disposition of the many books, reprints, manuscripts and other items in a library on gemstones that he had started to collect long before his first class in Gems & Gem Materials, over 40 years ago. He started that course when he was Chairman of the Mineralogy Department of the University of Michigan. GIA's faculty is proud that Dean Kraus chose the Institute's library as the repository for many books and pamphlets that will add greatly to its historical value. Included among the many volumes are the following: *Die Seele der Edelstein,* by Holstein & Koch; *Edelsteinkunde,* by William Rau; *Diamonds,* by Herbert S. Zim; *Nachahmungen und Verfalschungen der Edelstein und Perlen,* by Dr. Hermann Michel; *Praktikum der Edelsteinkunde,* by Georg O. Wild; *Diamond Tools,* by Paul Grodinski; *Diamond,* Emily Hahn; *Minerals, Metals & Gems,* by A. Hyatt Verrill; *Diamant-Werkzeuge,* by Paul Grodinski; *Diamonds,* by Sir William Crookes; and numerous reprints.

The Siberian Diamond Deposits

PART II

by

Dr. N. Polutoff, Frankfurt a.M.

The Diamond

The morphology of the Siberian diamonds is rather manifold. In this respect, they are not akin to the diamonds from other deposits in the world. Almost all Siberian diamonds exhibit growth markings. Their morphological differences are restricted first of all by the characteristics of the growing progress, which express themselves in the manifold formation of the crystals. The solution processes do not play a great part. Very characteristic for the stones are sharply pronounced buildups in the layers of the crystals. Many crystals give the impression that they consist of many relatively thick layers of lamellae, one on top of the other.

The Siberian crystals are arranged in ten morphorlogic basic types. These types make up 75% to 90% of all diamond crystals in each bed. Therefore, of these basic types in each bed, only three to four appear subordinately.

Isometrically developed diamond crystals are relatively rare; they are mostly distorted and far away from the ideal forms. The most frequent crystal forms are the octahedron, rhombic-dodecahedron and transitional forms from the first to the second. In comparison, crystals with cubic habit are very rare. Twinned and deformed crystals are widely distributed; the twins predominate according to the spinel law (macles).

A comparative study of Siberian diamonds proves that their outer shape is related to other properties. The regularly developed octahedra are almost always very transparent; they also have a strong luster. Stones with cubic habit are predominantly yellow. Rounded crystals, as a rule, have the highest degree of clarity.

Most of the stones are colorless; they differ only in degree of transparency. Light and intensely colored crystals are very rare; most abundant are greenish yellow. In the *Mir* pipe, about 0.5% are greenish yellow; in the *Udatschnaja* pipe, 0.3%. In nearly the same quantity, this color appears in the kimberlite deposits as well as the alluvials. In the *Mir* pipe also are pale blackish-violet stones (about 2%), which are completely unknown in the Daldyn-Alakit district. Much rarer is the color approaching aquamarine, and rarest are those with a bottle-green color. Also very rare are intense lilac-cherry and brown-cherry colors. Pigment spots are rarely observed. Especially characteristic are grass-green spots.

Siberian diamonds also show fluorescence, as do stones from other deposits.

As is well known, diamond crystals, although they belong to the cubic system, are commonly anisotropic (show anomalous double refraction). Siberian diamonds, with different habit and from different districts, appear also to be primarily anisotropic.

Small inclusions of transparent and opaque minerals are generally not rare. By attentive examination, in nearly every crystal one or more microscopically small crystals can be seen (commonly olivine and graphite, rarely pyrope). Included diamond crystals are rare.

The size of the Siberian diamonds ranges from 0.1 to 0.2 milligrams to stones of a few carats. The first large stone, which was found in the *Mir* pipe in the fall of 1956, weighed 32.50 carats. The stone discovered in 1957, *Jubilejnyj,* weighed 54 carats. In June, 1959, a stone of 37.35 carats was found, which was called *Firstling of the Seven-Year Plan.* It was followed soon by two more larger stones of 40.40 and 46.85 carats. A stone found in 1961, weighing 52.50 carats, was named *325-Year Jacutien.* In August, 1962, in the *Mir* pipe, was found a stone of 56.20 carats, which was named *Mirnyj.*

There are divergent opinions on the time and place of crystallization of diamonds. Many researchers believe that diamonds crystallized in the deeper magmatic center, whereas others contend there was a parallel crystallization in the pipe itself during the elevation of the kimberlite magma in the explosion channel. Observations in the pipes of the Malaja-Batoubija and Daldyn-Alakit districts have shown a relatively even distribution of diamonds in the whole kimberlite mass, as well as in the size of the crystals and the rate of richness. This would hardly be possible if the diamonds crystallized in the pipes. Because of the small diameter of the pipe, the cooling effect of the country rock on the pipe could not have been avoided, and it would have influenced the size and quantity of the diamond crystals in different parts of the pipe. One would have to expect smaller stones near the contact and smaller ones in the center, where the temperature lessens slowly. Since this is not the case, the only viable theory is that the diamonds formed in the magma chamber and were conveyed upward by the explosion.

Economics

According to a statement by the Minister of Geology and Mines, the discovery of the Siberian diamond deposits was one of the richest of its kind in the world and a great event in the long mining history of Russia. The *Mir* and *Udatschnaja* pipes alone show, according to him, deposits of worldwide significance. They will fulfill the needs of the Soviet economy for a long time. At present, the following five diamond districts on the Siberian Plateau stand out: (1) Malaja Batoubija district, 252 kilometers north of the city of Lensk on the Lena River, with the city of Mirny in the valley of the Iireleech River, 32 kilometers from the flow of the Malaja Batoubija; (2) Daldyn-Alakit district, which encloses the Daldyn River, a tributary of the Olenek; (3) upper Muna district; (4) Olenek district; and (5) Aladyn district.

Extensive prospect work has been carried out to date, mostly in the first two districts. Meanwhile, the opening up of the third richest pipe, *Aichal,* is making good progress. Already a worker's settlement has been built. The center of the present production of the *Trusts Jakutalmaz* lies on the *Mir* pipe in the city of Mirny, whose population is already over 15,000. An auto road, which will connect the cities of Mirny and Lensk on the Lena River, will be ready soon. In Lensk, modern and mechanized harbor installations will be built. For the purpose of providing electricity, the building of a waterpower works on the Wilui River, about 100 kilometers from Mirny, has been started. Here, the Wilui is about 200 meters wide, and on both sides confined by steep banks. Because of the permanently frozen ground, the construction will be very difficult. The power station will be ready sometime in 1965.

Soviet production, including industrial diamonds, was:

1958	650,000	metric carats
1959	800,000	metric carats
1960	950,000	metric carats
1961	1,000,000	metric carats
1963	2,750,000	metric carats

Surplus production is channeled to the world market through the Central Selling Organization, with which the Soviet Union signed an agreement originally for one year. But the arrangement developed so favorably for both parties that the agreement was extended for another year. At the end of May, 1962, a meeting took place in Paris at the convention of the *Biennale Internationale des Industries Mecaniques et Eletriques.* This was an exhibition under the designation *Diamond in Industry,* which was organized by De Beers Consolidated Mines, Ltd., Industrial Distributors, Ltd., the Diamond Research Laboratory (Johannesburg), and the Industrial Diamond Information Bureau (London). Mr. Harry Oppenheimer, Chairman of De Beers, has confirmed at a press conference that the Diamond Syndicate has the right to sell the Soviet diamonds outside of the Soviet Union. He added that the greatest part of the production was gem diamonds of excellent quality.

(Editor's note: Subsequent to the time the original manuscript was published, it was announced that this marketing agreement has been discontinued.)

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(Spring, 1963—Winter, 1965)