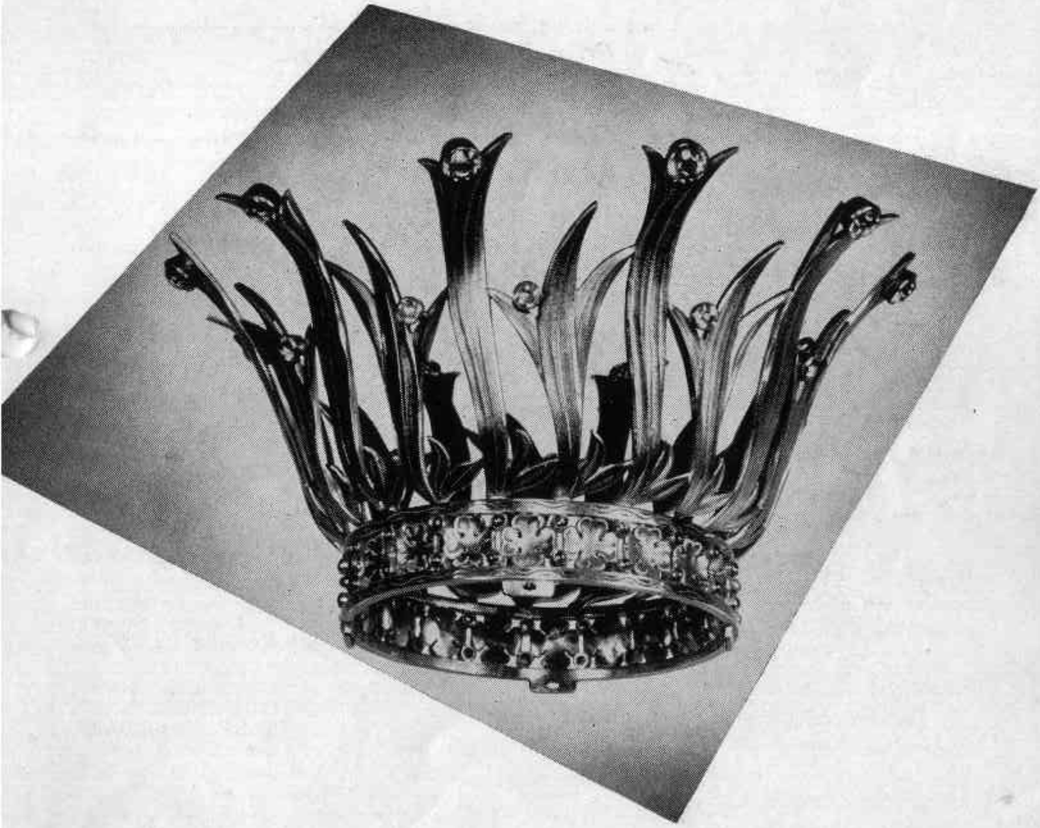
Gems and Gemology



Swedish Wedding Crown

See story on page 35

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Refractive Indices of Cabochon Cut Stones

by

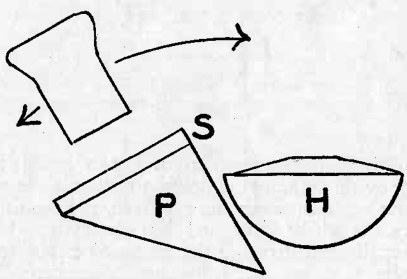
LESTER BENSON, C.G., F.G.A.

ALTHOUGH the refractometer has long been recognized as one of the most important gem testing instruments, its use to date has been restricted to faceted stones, thus, leaving the numerous cabochons, carvings, and other ornamental gem materials that presented only rounded surfaces to be identified by a limited number of tests. Such determinations were often very difficult and more so when the stones were mounted. This difficulty encountered in gem identification has been largely overcome through the development of a new technique possible on refractometers with simplified optical systems such as the new Erb & Gray.

ON THE COVER

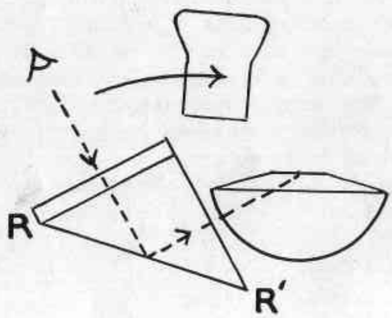
Born back in the forgotten centuries, the tradition of the jeweled crown for the virgin bride still exists in Sweden. In many families these crowns are handed down from generation to generation as is the heirloom bridal veil in our own country. When not furnished by the bride's family, the traditional crowns are provided by the church. The gold crown pictured on our cover was fashioned by artisans of Hugo Stromdahl, Stockholm, Sweden. Studded with blue sapphires, the gems at the base of the crown are cut cabochon and are encircled with an "emblem of happiness," closely resembling our own four-leaved clover . . .

The optical system of the average gem refractometer on the market today consists of a hemisphere or prism, a series of correcting lens, a reflecting prism, scale and eyepiece. When a stone is placed on the hemisphere the critical angle of the hemisphere-stone will be in direct proportion to the refractive index of the stone. By focusing the shadow produced by the critical angle through the intermediate lens to the calibrated scale, the refractive index of the stone may be determined. This same principle is used



I

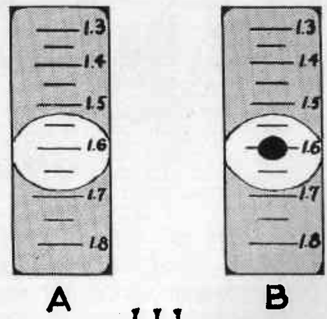
in the Erb & Gray refractometer, however the intermediate lens has been eliminated in favor of a greatly simplified optical system. This system, illustrated in Figure I, consists of one large hemisphere (H), a reflecting prism (P), a scale (S), and a movable eyepiece that is focused on the scale and which can be raised or lowered to take in the full range of the scale or raised completely above the scale. By referring to Figure II it can be seen that if the eyepiece is raised above the scale, one can look directly into the prism and because of the reflecting surface RR[1], actually see into the hemisphere and view the underneath side of the table. Figure III A illustrates how the table of the hemisphere would look when viewed through the scale and prism. The best distance for such an observation is 12 inches to 15 inches from the scale. The value of this is that it enables one to look directly at the surface of a stone that is in contact with the hemisphere (Figure III B). When testing a stone



II

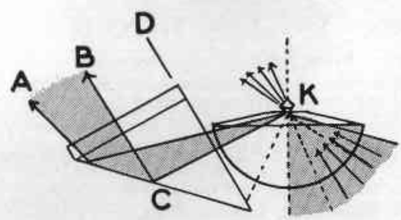
with a contacting surface too small to provide sufficient reflection to be visible on the scale through the eyepiece, the reading can still be obtained by observing this small area through the prism as explained above, using the following procedure.

In Figure IV, K represents a stone that is too small to cause a shadow edge on the scale that is intense enough to be read using the eyepiece. It can be seen, however, that when looking into the prism in a direction parallel to BC and at any point between A and B that the image of the contacting surface reflected by the prism will appear light, but if the observer is looking in the area BD, the image will appear dark. This is explained by the fact that the area between A and B represents the angle and which is outside the critical angle of this portion of the hemisphere. Therefore all light striking this small contacting area within this angle will be reflected to the observer. The area BD corresponds to the critical angle and any light that strikes within



III

this angle is refracted out through the stone. Therefore, in this position the image will appear dark. Figure V shows three separate readings that further illustrate the above discussion. The black dot in the white circle is the way the above stone (in Figure IV) would appear when observed through the scale. At position A the spot appears dark. At C, it is light. However, between these two points we find a position where the spot appears half light and half dark. By correlating this shadow edge with the scale the re-



IV

fractive index may be determined. In this case it is 1.54. This shadow edge which represents the edge of the critical angle in Figure IV will remain constant for any given stone. To determine the point on the scale at which this occurs, merely requires the raising or lowering of the line of vision until the reflected image changes from light to dark or dark to light depending upon the direction moved.

The above method for determining refractive indices may be used for any flat surface whether large or only a fraction of a mm square, as well as for rounded surfaces. The tiny point of contact between a rounded surface and the hemisphere will be slightly enlarged by use of the contact liquid. Figure VI A illustrates this point. Inasmuch as it is not necessary that a surface actually contact the hemisphere when using a liquid, the slight distance between the two surfaces at equal distances from the center point of contact is so small (providing this radius does not exceed .10 to .30mm) that for the above method they may be considered parallel. Inasmuch as this area is determined by the size of the drop of

A
B
C

V

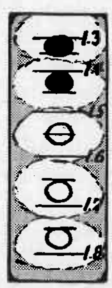
liquid, if the drop is too large the overall surface exposed to the hemisphere, (Figure VI B) will be so rounded as to cause considerable distortion thus making the determination of the critical angle only an approximation. To apply the small drop necessary the easiest method is to apply a drop to the hemisphere and touch it with the stone. When the stone is removed the tiny drop that remains on it should be sufficient after removing the rest from the hemisphere. If it is still too large touching it again will usually suffice. The final drop should be almost pin point size.

Occasionally a stone will be encountered that will not give a sharp change but rather will show a gradual change that may extend over as much as .10 of the scale. This may be due to poor polish

A B

VI

or a slightly irregular surface as well as to a large drop of liquid. In either case an approximate reading can be obtained by taking an average between the two points where the image first becomes completely dark and completely light. The five positions illustrated in Figure VII bring out this point. Position A shows the last point where the image is completely dark. From this point on it becomes lighter and when position C is reached it is completely light. The average reading then would be at the third position (B) which in this case is approximately 1.55. For those who find the scale a little difficult to read without mag-



A
B
C

VII

nification 2x to 3x lens may be used. Any higher magnification, however, will not focus on both the scale and image at the same time which is necessary in this type of determination.

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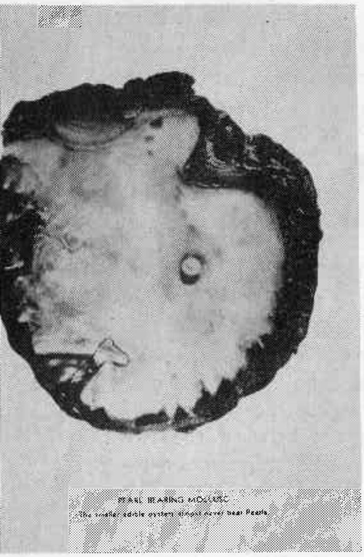


PEARL BEARING MOLLUSC

Pearl Fishing
in the Persian Gulf

By A. E. Alexander, Ph.D.

Gem Trade Laboratory, Inc.

In the spring of 1947, plans were made to visit the pearl fishing waters which surround the Bahrein Islands, Persian Gulf. After neccessary British and American government approval had been granted to travel in the Middle East, arrangements were made with the British Overseas Airways Corporation to fly from New York to Bahrein.

Once at our destination, Mr. C. Dalrymple Belgrave, British Administrator to His Highness, Sheik, Sir Salman al Khalifa, immediately placed at our disposal a boat to permit our party to reach the pearl fishing grounds. A member of his Arabian secretarial staff was assigned to us to act in the role of interpreter. His personal police boat, as it was officially called, turned out to be a 40-foot native teakwood sailing dhow equipped with an auxiliary 75-horsepower motor. Before we were through with this particular expedition, we arrived at the conclusion that sailing in a dhow can be a very rugged experience!

The time set for the overnight trip turned out to be rough for water travel, but we left port regardless. During June strong, steady winds blow continually off the Arabian desert. The relatively shallow Persian Gulf, like our own Lake Erie, is capable of being whipped into considerable turbulence, with this difference: the ensuing storms produce no clouds as we know them, and of course there is no rain. Except for the crew, the members of our party became violently seasick as the small craft rolled and pitched for hours on end.

We anchored for the night in reef water, some twenty miles off shore. Here, the water did not exceed five feet in depth. At dawn we moved out to the fisheries proper, some 20 miles beyond our point of anchorage. In the 1920's, when genuine pearls were the royalty of jewels and money was no object, as many as 600 native sailing dhows left the ports of Bahrein for the pearling grounds.

Missionaries living on the island a half century ago state that as many as 3500 boats were employed. This figure we believe to be high, unless it represented the pearling fleet for the entire Persian Gulf. Each dhow has a crew of from 40 to 50 men. On the basis of these figures the number of men engaged in pearl fishing in years gone by was considerable.

An account of the perilous occupation of pearl fishing in the Persian Gulf as observed by Dr. Alexander during a visit to the Bahrein Islands, and as reported by him at the A.G.S. Conclave in Washington.

Today, the picture has changed. Fewer than 150 boats now leave port. Diving helmets and related underwater paraphenalia, as in the past, are still not used. The methods of diving are the same as used in the Gulf for more than 2,000 years of recorded time.

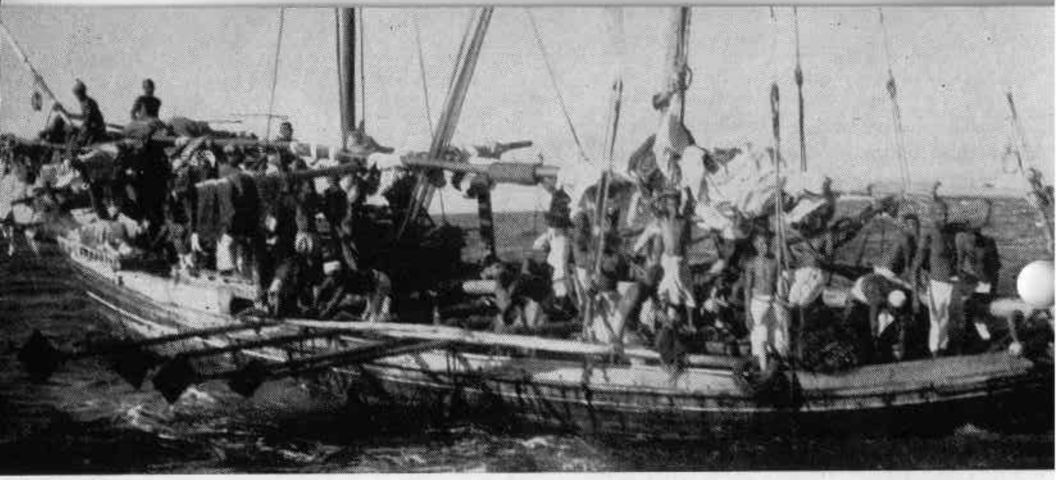
In flying from Basra to Bahrein a good view of the limestone reefs through the clear waters of the Persian Gulf can be seen. It is from these reefs that the pearlers seek their fortune. In days gone by the pearl divers inherited the debts of their fathers. If these debts were large, the chances were that the son, or sons, would dive for a lifetime and never earn enough to pay off the outstanding debts. In recent years, if the sale of pearls proved good, the pearl diver might receive several hundred rupees for the season's work. On the other hand, if business was poor, the local pearl merchant might supply his crew with only enough food for himself and his family.

Today, the trend is toward higher wages, continually paid. The Bahrenian laborer, whose status might be compared to that of a Chinese coolie, at one time received 16 rupees a month or less. With the discovery of oil on Bahrein, native help became a sought-after commodity. A minimum wage of 60 rupees a month was offered to unskilled workers, and higher wages became possible for the natives in this area as skills and a trade were acquired.

Although many pearl divers, during the off season, are among the natives working in the American refineries, it is interesting to note that when Sheik, Sir Salman announces the opening of the pearling season in late spring, hundreds of workers leave their jobs to head for the fishing boats! It is the element of chance, of sudden local fame and fortune that draws them back to an old profession. Each diver feels that the next pearl oyster may be the one which will contain a rare gem of great beauty, presumably worth the proverbial king's ransom!

On arriving at the fisheries, we watched the divers go through their routine. Large oars extend from the side of the dhow. These oars serve two purposes: one, to help steady and propel the craft; two, to furnish a place to which the descending rope can be attached. To this rope is fastened a stone which may weigh up to 50 pounds. The diver stands on this stone. When he is ready to submerge he takes a deep breath, clamps a clothespin-like device on his nose, pulls the slip knot which frees the rope and descends rapidly to the bottom. He carries with him a small net basket which is also fastened to a rope. As soon as he reaches bottom he slips off the rock and feverishly starts plucking as many pearl oysters as he can find in the immediate vicinity. While some divers descend to depths of 60 feet, the usual distance is more likely to be nearer 30. When ready to ascend, he jerks the rope attached to the basket. This signals his helper who at once starts hauling the rope, the basket,

On the way to the Pearl Fisheries, Charles Murray, New York dealer in genuine pearls, and Dr. A. E. Alexander (right) discuss the industry with two Bahrenian pearl dealers.



At the Pearl Fisheries in the Persian Gulf. This typical native pearl sailing dhow shows divers and their crew. Overboard ropes indicate some divers are submerged to the pearl beds.

and the diver upwards. During the ascent the diver may assist himself by climbing hand over hand on the rope, if he is approaching the limit of his endurance. Total elapsed time under water may be as much as two minutes. A minute and a half, however, may be taken as average. These men are not physically powerful, but on the contrary are thin and wiry. Age does not appear to be a factor, for men 70 will be found diving with boys in their teens.

No attempt at conservation is made, In fact, once at the source the diver collects every pearl oyster within his reach. This results in immature shells being plucked, as well as those considered full grown. A pearl oyster reaches maturity during its fourth year of life though its life span may cover 12 to 15 years. The diver brings about a dozen shells to the surface at a time. Depending on weather conditions and depth of water at a given place, a diver in a single day may dive 25 to 30 times. If half the crew of a boat is engaged in diving, the number of pearl oysters brought to the surface in one working day can be considerable. As a matter of fact, the number may exceed 7,500 shells per day, per boat. To go further, 150 boats each working daily for an entire season of 120 days will yield a total of 135,000,000 shells from the Bahrein pearling area alone. In the old days when 600 boats left Bahrenian ports to "pearl," the total number of shells obtained in one season staggers the imagination!

Since hundreds of pearl oysters are barren on opening, it necessitates obtaining tons of shells in order to supply the genuine pearl needs of the world. It is interesting to note that only 35% of the genuine pearls of the Persian Gulf come from the waters around Bahrein Island. Kuwait to the north and the Trucial Oman coast waters to the south of Bahrein supply the remainder of the crop.

There are fresh water springs in the Persian Gulf and the native divers insist that it is the existence of these springs that is instrumental in imparting the lovely cream and rose tints which characterize the genuine pearls of this region. We tasted this water and found it to be brackish. Drinking water obtained from native wells on the island of Bahrein was also found to be definitely saline to the taste.

During the summer months, which constitute the pearling season, withering heat and high humidity are the order of the day. Rain is a rarity in this part of the world and a flash storm becomes an historical event. During one pearling season, some 15 years ago, a sudden rain squall of violent proportions descended on the pearl fleet at anchor. In a short space of time, 100 dhows were destroyed and many of the fleet's best divers lost their lives.

Contrary to general belief, large sharks do not inhabit the waters of the Persian Gulf. The natives informed us that a small fish up to three feet in length and presumably resembling our own Barracuda will occasionally attack a diver.

At the completion of the pearling season, the merchants of Bahrein (some 30 of which we met) sell their pearls to the traders of Bombay—a practice which has been engaged in for generations. At Bombay the pearls are drilled, polished, and graded. Few Bahrenians have ever sold pearls directly to New York dealers. As is known, the trading so far as the United States is concerned, always has been done between London and Paris brokers and the dealers of New York.

On the subject of drilling, the suggestion was made before an assembled group of Bahrenian pearl merchants (arranged at the invitation of Commissioner Belgrave) that this type of work become part and parcel of the Bahrein's pearl industry. In short, eliminate Bombay from the picture where possible. The suggestion aroused considerable interest, but if left to the natives to undertake, it is doubtful if anything will be done in this direction.

However, with the coming of air travel in this part of the world, evidence of alertness to the art of merchandising may be gathered by the following incident: Bahrein is an overnight stop, both east and west on the British Overseas Airways Corporation, which operates flying boat service from Poole, England, to Sydney, Australia. A few native pearl merchants have become aware of the fact that these stopover travelers are potential cash customers. The big flying boats always carry their quota of Far Eastern potentates, Lords and Ladies of the realm, and industrial magnates of every nationality. All these people are interested in buying something, even if that something is only a genuine pearl!

Since we were staying at a B.O.A.C. hotel we saw, on several occasions, colorful Arabian pearl merchants of distinguished mien showing their finest pearls to interested travelers. If the customer proved to be a personage of some importance a resident official of His Majesty's Service was usually on hand to expedite the job of selling.

In conclusion, it should be pointed out that during the war, trading in genuine pearls, particularly with East Indian dealers, was exceedingly active. Last year civil strife in India closed this market to the Bahrenians. Furthermore, the native dealers expressed concern over the competition that might arise from Venezuelan sources, evidently unaware of the fact that the demand for fine pearls in the United States is for those of pink and cream color.

We also found that the Arabian pearl dealers knew little or nothing about the structural or physical characteristics of the Japanese cultured pearl. They were, of course, aware of the fact that there existed an inexpensive product called the cultured pearl which greatly affected the sale and interest in their own commodity. Lack of knowledge about cultured pearls is understandable when one considers that cultured pearls are not permitted in the Gulf area, and of course, few Bahrenians, in turn, have ever left their native land.

Industrial Diamonds and Their Uses

by

SYDNEY H. BALL

TO PRIMITIVE man, stones—some of them precious—served not only the purposes for which we use them, but also the functions of metals. Stones furnished man his ornaments, his munitions, his tools, his currency, much of his household equipment, his pigments, and some of his objects of worship. The worker in stone was the research man, the engineer, and the artisan of that day. As the metals were discovered—first gold and copper, and then iron—these raw materials were found more suitable for certain purposes, and the use of stones declined.

Pliny states that splinters of diamonds (and here they began their brilliant industrial career) were essential to gem engravers of his day in cutting seals.

The Arab from the ninth to the 15th century, as Sinbad tells us, used diamonds to bore holes in "minerals and jewels, porcelain, and onyx." The method of mining is both amusing and astounding. Scene: A vastly deep and steep valley in the East, captioned the Valley of Diamonds. Actors: Lambs whose skinned carcasses were thrown into the abyss; "miners" who did the throwing; huge birds who swooped down and carried the carcasses in their claws onto the heights. Re-enter the "miners" who, frightening off the birds, recovered the gems embedded in the carcasses, made their fortune, and lived happily ever after.

The Renaissance, thanks to the rebirth of gem cutting and the establishment of the cutting of the diamond, increased the use of gems industrially, but the real upsurge occurred about 30 years ago, with the high industrialization of American life.

The industrial diamond, long the Cinderella of its socially registered and socialite sister, the gemstone, has now come into its own. Anciently, kings fought for the glistening gem; in World War II, the industrial diamond fought for us and freedom.

Sir David Brewster, one of England's greatest scientists, prophetically wrote in 1935: "Had the diamond not been placed at the head of the mineral kingdom from its unrivaled lustre and high value as an ornamental gem, it would have attained the same distinction from its great utility in the arts." In the late war we produced no weapon in the manufacture of which the diamond in overalls was not concerned, and, because of its use, manufacture was speeded up. Luckily, in World War II, the United Nations controlled 99.9 per cent of the world's diamond production, by possessing the Borneo deposits—Japan a measly one-tenth of one per cent.

In this machine age of ours, two of the marvels center around the industrial diamond: first, our ability—starting at the surface with a diamond drill hole two inches in diameter—to get a columnar section of rock from over two miles below the surface, and, secondly, by the use of diamond dies, to draw from a single pound of copper almost 100 miles of invisible wire.

A generation ago the diamond industry was a luxury trade. Today, of the world's sales of rough, probably 15 to 30 per cent by value and over 80 per cent by weight is of industrial stones. This shift in sales has been succinctly summarized by my English friend, A. Tremayne, "from jewels to tools." In 1919 we imported 25,000 carats of industrial diamonds worth $39 a carat; in 1944 we imported (and used) 12,614,000 carats worth $1.81 per carat.

Place in Industry

There are three types of industrial diamonds and each has its own particular place in industry:

First: Bort, a trade name for diamond crystals too badly flawed, too off-color, or too spotted to be used for jewelry;

Second: Carbonado or black diamond, a porous but tough aggregate of excessively small diamond crystals and impurities; and

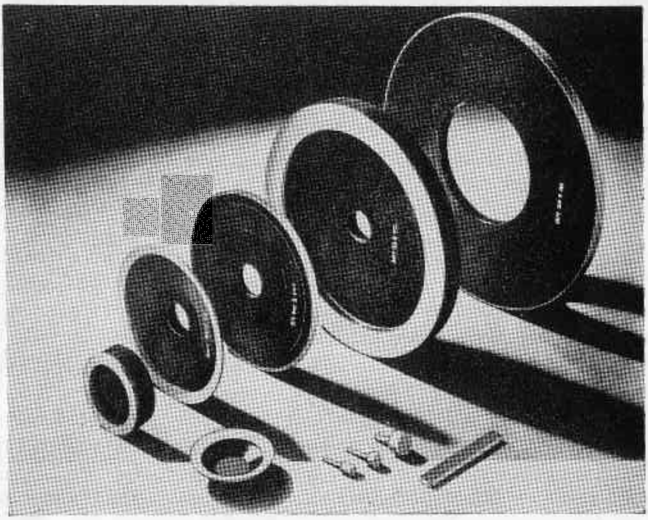
Third: Ballas, a globular mass of diamond crystals radiating from a common center.

The line dividing gem and industrial stones is indefinite and is moved to the right or left, according to demand. During the war, for example, many stones were used industrially that normally would have been cut for jewelery. Research during the war proved that many of the so-called lower quality stones perform as well as the supposedly high quality stones. But some toolmakers are slow to change; inertia in industry can only be conquered by time.

Relative Values

Bort has as its virtues hardness and comparative cheapness (it is, however, worth from $2,500 to $14,500 a pound—five to 25 times the worth of gold); *carbonado,* extreme toughness; and *ballas,* both hardness and toughness. Bort is a by-product of all gem diamond mines and the main product of the rich B.C.K. mines in the Belgian Congo. Carbonado comes from Bahia, Brazil, and its production is small, only 20,000 to 30,000 carats a year—say, roughly, ten pounds. Ballas is even more rare, accounting for less than

Diamond Wheels for Grinding and Lapping. ***Courtesy Industrial Diamond Association of America, Inc.***



one-twentieth of one per cent of the world's production.

Crushing bort retails at about $2.00 a carat; small, good quality bort at from $5 to $10 a carat; and carbonado and ballas, according to size, respectively, from $20 to $80 and $20 to $100 a carat About 15 years ago Brazilian brokers cornered the carbonado supply and ran the price up to $185 a carat. Until then, all diamond drill bits—one of the larger commercial outlets—were set with large carbonados. An industrial diamond firm with vision set a bit with a large number of small borts; two results, carbonados lost their most important outlet and diamond drilling costs were halved and its speed doubled.

Industrial Diamond Consumption

The principal consumption of industrial diamonds is as follows: diamond impregnated wheels, drill bits, diamond set tools, and diamond dies.

The consumption of industrial diamonds dropped markedly shortly after V-J Day by weight—less so by value—but its future is brighter than that of many other commodities. For, during the war, thousands of plant foremen aand tens of thousands of artisans learned that, by the use of the diamond, closer tolerances could be obtained, the expense of grinding and shaping the hardest steel could be reduced greatly, and the time consumed cut to a fifth.

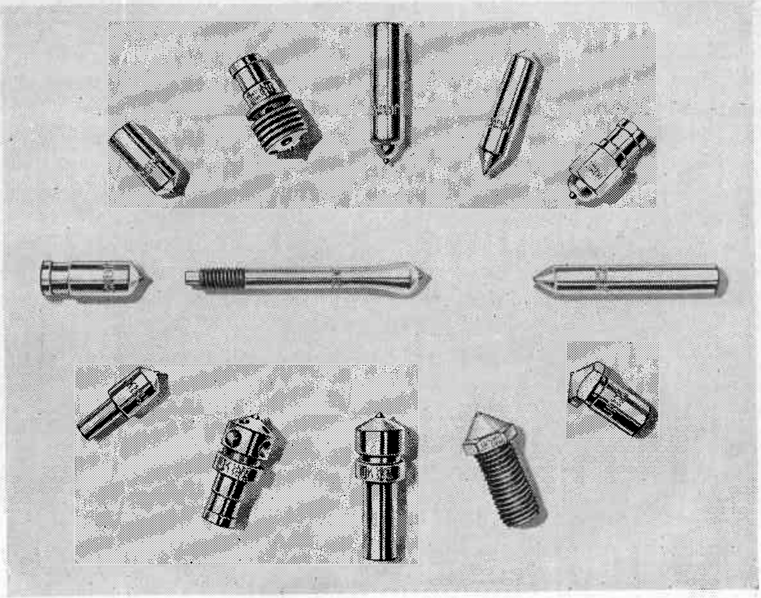
The diamond drill is the mining industry's most important tool for prospecting and developing new ore bodies of gold or base metals, and in recent years much ore has been broken underground by a new mining technique called blast-hole drilling. The drill is also used by civil engineers in locating dams, reservoirs, and water tunnels. Basically, however, it is the rifle with which the mining engineer hunts and gets ore bodies. While the drill was a Swiss invention of some 80 years ago, American engineers, in the seventies of the last century, first applied it to mining. Most improvements in both drill and bits have been by American engineers and industrialists.

The Diamond Drill

The drill consists of an engine which rotates, at great speed, a string of hollow steel rods cooled by water forced into the hole. Screwed onto the bottom rod is a bit, which may be one of several shapes. Commonly, however, it is ring-shaped, about two inches long and from one to two and one-half inches in diameter. The bit is of steel or some other tough alloy, in which are mechanically set 70 or 80 small borts, the cutting agents.

Special bits may contain as many as 2,000 diamonds, a useful, if not particularly beautiful, crown. Up to 15 years ago, bits set with from eight to 10 relatively large carbonados cost up to $5,000 each. Today, bits are obtainable for as little as $50. In consequence, we engineers today are, where the ground is treacherous, less cautious than we once were. The drill cuts a cylinder of rock, its diameter being that of the inner diameter of the bit. As drilling progresses, the core of the rock is forced up into the hollow rods. At regular intervals the rods are pulled and a sample of the rock traversed is recovered. The deepest hole ever drilled, one in South Africa, is a little over two miles (10,715 feet) long.

Two rather unusual instances of the use of the diamond drill may be cited. Ten years ago three men were trapped by a rock cave-in between them and the tunnel portal of the Moose River Gold Mine in Canada. A vertical drill hole was sunk to the chamber where the men were, and liquid food furnished them nutrition until miners could repair the tunnel and rescue them. Some years ago,



St. Paul's Cathedral, London, due to the faulty character of the rock on which it is built, got out of plumb and it was feared it might collapse. A host of diamond drill holes were put down beneath the grand old church, a cement emulsion was forced down them, and the beautiful structure was saved.

Various types of diamond-set dressing tools. *Courtesy J. K. Smit & Sons, Inc.*

Use of Diamond Tools

Diamond tools, first used in 1779, consist of a steel arm in which is set either a rough diamond or one especially shaped for the intended purpose. Sometimes two or more stones are set in a single tool. These tools are used to shape steel, to sharpen hard alloy steel tools, to true abrasive wheels, to give a high finish to crankshafts and other aircraft parts, and in countless other ways. The fine tolerances which permit interchangeability of parts of a thousand engines of the same model are obtainable only with a diamond-pointed tool, nor without its grinding could engines be driven at their present speed. Billiard balls, ceramics, plastics, felt rolls, and vulcanite pipe mouthpieces are also shaped with diamond-set tools.

The main consumption of crushing bort (say 80 per cent) is in the manufacture of diamond-impregnated wheels used in accurate grinding and precise tooling. They are the most satisfactory tools to shape, sharpen, and hone cemented carbide tools. These wheels were introduced in 1933 and between 1936 and 1942 the consumption of wheels increased fiftyfold. The wheels are now turned out in shapes suitable for every type of grinding. For instance, the tiny ball bearing races used in precision instruments are given a finish-grinding with a special diamond wheel and glass lenses are ground en masse with other diamond wheels.

Diamond Dust

Although diamond dust was the super-abrasive long before his time, the old Portuguese physician, Garcias ab Orta, long a resident of India, in 1565 is the first to describe the method of making diamond dust. In the manfacture of the wheels today, the diamond dust is carefully sized for the special use required.

It is then evenly mixed with the bonding material, either a plastic, powdered metal or a ceramic. The mixture is then subjected to high pressure and is sintered, the temperature not being high enough to injure the diamond. The bonded material is then used as a thin facing to a metal pre-form wheel of the required size and shape. Wheels range in diameter from one-eighth of an inch to 20 inches.

Crude metal dies for wire drawing date from at least the third century of our era. But it was not until 1869 that even the more progressive of the Italian and French drawers of gold wire, to be woven into fine textiles, were using diamond dies. Sixty years ago the extraordinary growth of the electric lamp industry put diamond dies on the map, and today they are used to produce most wire less than 0.08 inch in diameter. Before the war, diamond die making was a non-mechanized, family cottage industry centering at Trevaux, near Lyons, France. During the war, we successfully mechanized the process.

The diamond, a sound crystal of one-quarter to one-third of a carat, is first mounted in a metal container after the top and bottom of the stone are ground parallel. Then, by hand or by machine, the hole is drilled by a needle moistened with olive oil loaded with diamond dust. The hole from one side is funnel-shaped, from the other, bell-shaped. The aperture is then carefully polished, diamond dust being again used.

The object of all artisans is to make a die with the smallest possible aperture (0.0003 inch or less in diameter), the kind our friend Dr. Edward H. Kraus, so aptly described as "putting a wire you cannot see through a hole that is not there." But, even the best artisans frequently fail to make the holes drilled from the two sides meet exactly. The die is then reamed out to the smallest size conditions permit. In the process of making fine wire for lamps or for the instruments on the panel of an airplane, the metal is successively drawn through a set of dies, each with a smaller aperture. The diameter of the resultant wire is but a small fraction of that of a human hair. Provided there are readers who are disciples of Izaac Walton—and I am sure there are—I may add that the gut leader of a fine fishing outfit is drawn through a diamond die.

One of the earlier industrial uses of the diamond, dated back in Europe at least to the 14th century, is the glazier's diamond, a small octahedral crystal. These stones are also used to cut the edges and ends of plate glass as it comes from the annealing kilns.

Gem Diamonds

Splinters of diamonds were used to cut intaglios by the Greek gem engravers as early as 300 B.C. Today, in gem engraving we use, in addition, diamond-charged wheels and burrs. Diamond points are also used in engraving lithographer's stones, copper and other metal plates, glass, ebonite, etc. Other splinters are used in boring small holes in watch jewels and in various types of instruments to test hardness. They are also used in repairing fine porcelain, and the dentist uses them and other small diamond tools.

The Hindoo, early in our era, had a saying, "Only the Vajra (diamond) cuts the Vajra." Many water-white rough diamonds are not particularly beautiful and to bring out their full beauty, all require scientific cutting.

Hindoos probably began to smooth the natural faces of diamonds as early as the 10th century and our French friend, Tavernier, warns purchasers to beware of Indian diamonds with many polished facets, as most of them were cut to hide blemishes. The art of diamond cutting was transferred from India, via Constantinople and Venice, to northern Europe by the 14th century. Since then, century by century, it has improved, and today the best cutting in the world is done in New York City.

There is but time to name the steps in transforming the rough stone into a beautiful brilliant or emerald-cut gem: cleaving (the slot into which the cleaving knife is placed is abraded with a diamond); sawing (the tool, a rapidly revolving paper-thin copper wheel fed with diamond dust); brutting (shaping the stone by a diamond set in a tool revolved by a lathe), and polishing (faceting and polishing the stone on a revolving soft iron wheel fed with diamond dust in olive oil).

Diamond dust is also used in cutting all of the harder precious stones, including quartz plates, a "must" in radio communication.

Some gramophone needles are tipped with diamonds; some Diesel engine jets are made of pierced diamonds; bearings for large electric meters are made of diamonds. In 1759 a New England jeweler advertised an excellent "Silver watch that goes upon diamonds." Huge circular saws set with diamonds or diamond-set bandsaws are used in cutting and shaping building stone. The earliest American use of the industrial diamond however, well over a hundred years ago, was to furrow grist-mill stones which had worn smooth. Small gemstones have recently been employed as counters for alpha, beta, and gamma rays, they being more sensitive than any man-made counter. It is a new alarm instrument to protect lives of atomic workers.

There is also the inventive genius who some years ago compounded a toothpowder with diamond dust as the abrasive. It was a brilliant success: first every trace of tartar was removed, then the teeth.

In this review I trust that I have proved that the diamond, besides delighting all lovers of the beautiful, was a fighter in our holy war and that our deserved victory was attained at an earlier date than any of us had hoped for, in part because of the genius of American industry and labor in shaping diamond tools, dies, and wheels.

(Continued to page 58)

Diamond-set oil well drilling bit. ***Courtesy J. K. Smit & Sons, Inc.***

The Orthorhombic System

by

MARK CHANCE BANDY, Ph.D

Director of Research, G.I.A.

IN THE orthorhombic system, there are three crystallographic axes at right angles to each other and of different unit lengths. The ratio of unit lengths varies in different minerals but, of course, is constant in the same mineral. The system is a logical development from the isometric system with three axes at right angles to each other and of equal lengths, through the tetragonal system with three axes at right angles to each other but with two horizontal axes of equal length and interchangeable and the third, vertical, axis either shorter or longer.

In the isometric system, any axis may be the vertical, while in the tetragonal system, the variable length axis is always vertical. In the orthorhombic system, any axis may be vertical but the longer of the two horizontal axes is then always considered as the b or macro-axis. When an orthorhomic crystal is properly oriented, the b axis is normal to the line of sight and the a or brachy-axis is parallel. The b axis is taken as unity and the a axis will always be shorter, while the c axis may be either shorter or longer than unity. The axial ratio for aragonite is a:b:c=.622:1:.721, and for barite .815:1:1.314.

For the gemologist, the orthorhombic system ranks third in importance following the isometric and hexagonal systems respectively. The important gem minerals which crystallize in this system are chrysoberyl, peridot and topaz. The less common transparent gems include andalusite, beryllonite, brazilianite, brookite, danburite, enstatite, hambergite, iolite, kornerupine, sillimanite and staurolite. The non-transparent gems of less importance include aragonite, calamine, dumortierite, prehnite, variscite and zoisite. There are several minerals which have been cut at one time or another; for example, natrolite, stibiotantalite, samarskite, bertrandite, celestite, lawsonite and diaspore. This system outranks all others in the number of minor and unimportant gem materials.

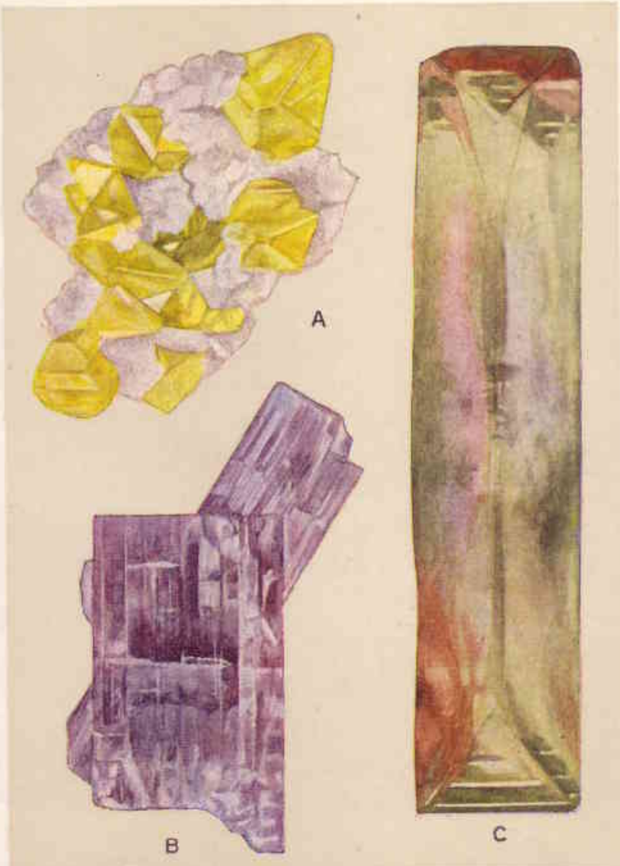
With the possible exception of hemimorphism, the minerals in the orthorhombic system probably display more interesting features than those of any other system.

The accompanying plate shows characteristic orthorhombic minerals. Sulphur (A) is the only native element known to crystallize in this system. The crystals shown here are of characteristic color, although the presence of selenium may change the color to red and when the mineral is in the form of a fine powder, it is often white. Common sulphur is orthorhombic, but there are two modifications found in nature that are monoclinic and four other modifications which belong to other systems. The orthorhombic mineral will invert to a monoclinic modification at less than body heat. For this reason, fine crystals should not be held in the hand, since the inversion produces flaws and gives a cloudy appearance. The luster and rafractive index are

TOPAZ

The stones pictured here clearly illustrate that the color of topaz is not confined to yellow. The crystal at (A) approaches red at the top. It also shows an excellent basal cleavage face and the pyramidal termination characteristics of topaz crystals. The yellow crystal (D) also illustrates the latter. Both are from Brazil. Figure (B) shows a fashioned Brazilian stone, while figure (C) shows a blue topaz crystal in pegmatite from the Ural Mountains. Specimens from the collection of British Museum (Natural History), London.

PLATE XII



CRYSTALS: ORTHORHOMBIC SYSTEM

The illustration (A) is a group of sulphur crystals from Girgenti, Sicily. This is a fine example of the bi-pyramid form of the orthorhombic system. Anhydrite (B) occurs in a prismatic or tabular form. The silicious variety is sometimes cut and polished for ornamental purposes. Barite (C), also known as heavy spar, is not suitable for gems, although some varieties have been used for ornamental purposes. This fine prismatic crystal is from Cumberland, England. Specimens from the collection of British Museum (Natural History), London.

PLATE XIII

Printed in England.

higher than zircon but the hardness, 1.5-2.5, precludes its use as a gemstone.

Anhydrite (B) has never been cut as a gemstone and rarely as an ornamental stone. The mineral usually occurs in sedimentary masses of considerable size but is rarely either white or of any attractive hue, although reddish and bluish tones are known. The ornamental variety is called vulpinite.

Crystals are not common but when found often have the appearance of tetragonal crystals rather than orthorhombic. The b and c axis are essentially of equal length. Fine crystals, such as those shown here, commonly are found associated with and imbedded in gypsum, calcite, salt and other minerals. Through absorption of water, anhydrite will change to gypsum and this transformation is common in nature.

Barite (C) is noted among minerals for the perfection and beauty of its crystals and the range of colors. Although some massive varieties have been cut for ornamental objects, the lack of transparency, the softness (3), and the three perfect to imperfect cleavages found in the crystals make them unsuited for faceting or polishing. Rough groups of crystals are found in many areas of red sandstone and are known as barite roses, sand roses and a host of other names. These are common in Oklahoma and other parts of the Middlewest. Fine crystals are found in South Dakota and every mineral collection that lays any claim to being complete will have several examples of the magnificent crystals from Rumania, France and England.

Topaz

ALTHOUGH the name topaz immediately brings to mind a yellow to brown gem with moderate luster, few people realize the vicissitudes the name has undergone. The origin of the name is uncertain but it probably comes from the Sanskrit or another oriental language and was first corrupted by the Greeks. The Red Sea Island, presently known as St. John's, was first called Cytis and later Topazion, or Topazios by the Greeks and Latins. The basic word meant "to seek" but whether it was applied to the island because it was so difficult to find or because the gem mineral topazion was even more difficult to find is not clear. The island is usually blanketed with heavy clouds or fog and presented a problem to the ancient mariners. According to the stories of the old writers, a shipload of Troglodytic pirates were wrecked on the island and to survive, were forced to dig roots for food. This search disclosed the bright yellowish green crystals of peridot, for which the island is still justly famous. As a sailor's yarn, the story was told that the stones could only be found at night when they glowed with an unearthly light.

Peridot was known as topazios until the early years of the Eighteenth Century when Henkel gave the name to a mineral from the tin mines of Saxony, which is the modern topaz. Apparently the name was gradually transferred from the yellowish green peridot to yellow topaz during the Seventeenth Century for some reason not obvious today. The early name for all yellow gems, including the modern topaz, was chrysolithus, a golden yellow stone. This name comes down to us today as chrysolite, a synonym for peridot.

Today many jewelers give the name

topaz to citrine quartz, and, to date, efforts to correct this practice have been somewhat unsuccessful except with the more reputable firms. Olivine, another synonym for peridot, was introduced in 1790 and today many jewelers use it incorrectly for demantoid garnet.

Topaz, a fluosilicate of aluminum, occurs in hues of yellow, brown, blue, colorless and pink to red. The yellow and brown shades, which are the more popular, are relatively rare and the gem was little known prior to the Eighteenth Century when the magnificent crystals from near Ouro Preto began to appear in Europe. Colorless and blue stones have long been known from Siberia and Europe but they were never popular because of their pale tints when faceted. The large crystals from Japan were mostly of these pale tints. Since there was little gem material of outstanding color known to the ancient world, topaz lacks the background of romance so common to other gems. The confusion of names has also mitigated against this. What it has lost in romance however, it has more than made up in a wealth of varietal names, many of them incorrect. Place names, for example, Indian-topaz, are usually incorrect as well as such terms as Oriental topaz, king-topaz and many others. Due to the limpidity and luster of the colorless rounded pebbles often found in gem gravels, the name of "drop of water" is common to most Latin languages.

There is a close chemical and crystal relationship between topaz, andalusite and sillimanite. All have the same basic chemical composition with the addition of two atoms of fluorine and one of oxygen in topaz. The three minerals crystallize in the orthorhombic system and there is a close similarity in the crystal elements. Topaz ranks next to diamond in the anamalous relationship between refractive index and specific gravity. While diamond has a refractive index much higher than would be expected from the specific gravity, topaz has an index which is much lower, due to the presence of fluorine.

Because of its 8 hardness, topaz will take a high fine polish and when cut with proper proportions the stones are moderately brilliant. The larger gems are usually given a mixed cut with additional facets to increase the brilliancy.

Crystals of topaz have a number of interesting characteristics. Often one set of faces will be deeply etched and all others will be sharp and brilliant. Many of the smaller crystals show a wealth of forms. Crystals of large size had been known for years but five years ago a vug was opened in a pegmatite at Limoeira Lavra, Minas Gereas, Brazil, which yielded crystals of size and perfection never before known. Several crystals weighing hundreds of pounds each were recovered and can be seen today in United States museums. Most of these are of a greenish tone and remarkably free from imperfections. The largest crystal is in the American Museum of Natural History at New York City. A large blue crystal of non-gem quality was found in Brazil, which is estimated to weigh six hundred tons.

A number of topaz gemstones weighing more than one thousand carats are known. The famous 1680 carat Braganza diamond is probably a colorless topaz. There is a fine 1643 carat blue topaz from Siberia in the collection of the American Museum of Natural History and other similar gems are found in many collections.

Many of the brown topaz stones can be changed to a fine pink or red by heating. Although red topaz occurs in nature, especially in Brazil, probably all of these gems on the market today have been heat treated.

As stated before, there is little romance associated with topaz as a gem. St. Hildegard recommended it as a cure for dim vision when soaked in wine for seventy-two hours and then rubbed on the eye

(Continued to page 56)

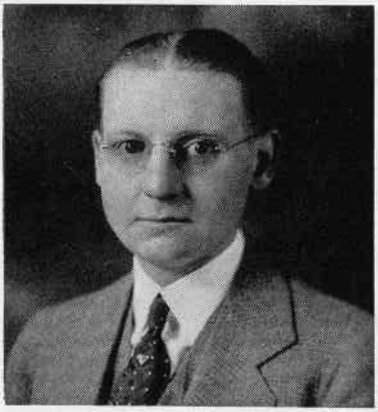
GIA Officers and Board Named at Annual Meeting

AT ITS annual meeting, April 30, in Chicago, the G.I.A. Board of Governors elected Edward H. Kraus, Ph.D., Dean Emeritus, College of Literature, Science and Arts, University of Michigan, to his third term as president of the Gemological Institute of America.

Dean Kraus who has held this position with the Institute since the passing of the late Dr. Edward Wigglesworth, was elected in 1932 as an Honorary Member of the G.I.A. in appreciation for his contributions to the furtherance of gemology. He also serves as a member of the Examinations Standards Board.

Dean Edward H. Kraus

H. Paul Juergens



C. I. Josephson

Succeeding Percy K. Loud, President of Wright, Kay & Company, Detroit, C. I. Josephson, Jr., Certified Gemologist, C. I. Josephson Jewelers, Moline, Illinois, was named Secretary-Treasurer of the G.I.A. The new treasurer, a former president of the American National Retail

(Continued to page 56)

The Story of the GIA Laboratories

by

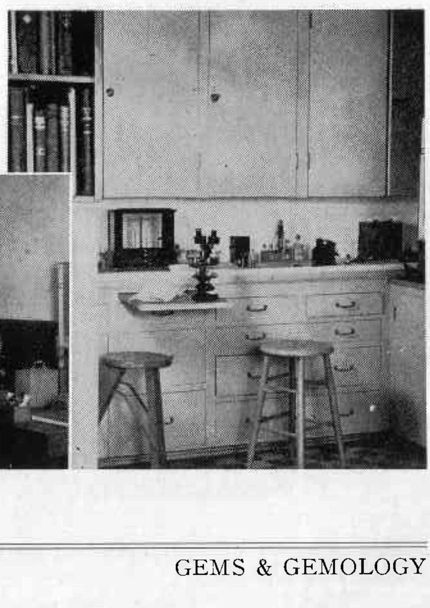
DOROTHY M. JASPER

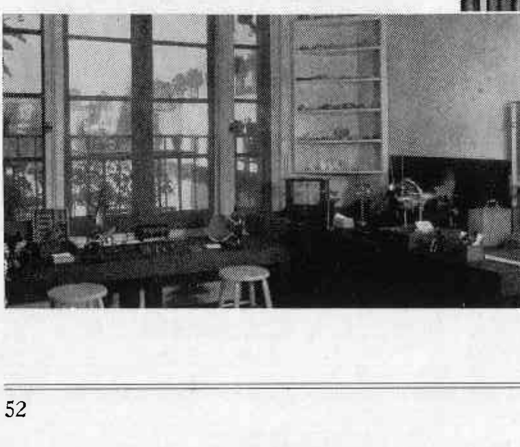
ONE OF the greatest factors in the constructive influence of the Gemological Institute of America on the American jewelry industry can be attributed to the growth and steady expansion of its research and testing laboratories.

Opened in 1931 when its first Board of Governors Chairman, the late Godfrey Eacret for whom the Los Angeles Laboratory is named, donated a pearl endoscope and special pearl testing equipment especially designed by Prof. Paul F. Kerr of Columbia University, the GIA laboratory today is one of the leading gemological laboratories of the world.

Since its establishment this laboratory has been, and still is, constantly developing new methods to test gemstones and grade diamonds. For four years, until 1945, the Los Angeles headquarters was

View of the first GIA Laboratory is seen at the right, with an enlarged but still early view below. A portion of the present Los Angeles Laboratory is shown at the top of the page.





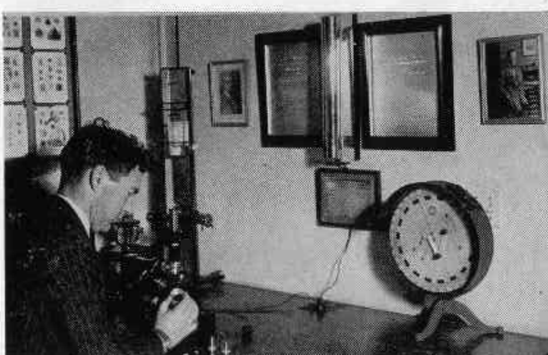
assisted in this work by GIA's eastern laboratory in Boston under the direction of the late Dr. Edward Wigglesworth. In August of this year this eastern laboratory will be reopened in New York City as a part of the reactivated eastern headquarters of the Gemological Institute.

In the early days of the GIA laboratories, many hours and much untiring effort were expended by Robert M. Shipley and Robert M. Shipley, Jr. During most of this period of the GIA's history the entire staff consisted of only six persons and the perfection of any instrument was looked upon by each individual with the same glow of satisfaction as if it had been a personal achievement. During the years, the laboratories have produced and perfected instruments for testing and grading, in addition to the principal function of gem identification—a service which is performed for both GIA students and the public.

Instruments which have been developed to assist in the accurate testing of gemstones include the GIA Eye Loupe; the Shipley Polariscope; the GIA Dichroscope; the GIA Diamond Illuminator (used in the Diamondscope and the Gemolite); the Shipley Universal Motion Immersion Stage; and X-ray gem testing equipment. The GIA Laboratories are also responsible for the Diamondscope, used to detect imperfections in diamonds, and the Colorimeter and Diamondlite, to detect slight variances in color.

During the early days of experimentation and research, and through the present time, the GIA laboratories have worked closely with British and Swiss gemological authorities with an exchange of information existing between the three which has been responsible for greater strides forward in the development of gemological science in all three countries. The Gemological Institute of America is especially indebted to the advice so freely given by both B. W. Anderson, Director of the London Gemmological Laboratory and Dr. Edward Gubelin of Lucerne, Switzerland.

Longfelt need for an absolute identification means led to the development and perfection in the Los Angeles GIA Lab of the X-ray Diffraction Unit by Dr. George Switzer, presently Associate Curator of Minerals at the Smithsonian Institution but at that time GIA's Director



Universal Motion Immersion Stage on a polarizing microscope in use above. At the right a microscope is shown with photomicrographic attachment.

The Diamondscope at the left and at the top the Diamondlite with yardstick for color grading of diamonds in the GIA Laboratory. At the bottom of the page is shown the X-ray Diffraction Unit.

of Research. Assisted by Dr. Ralph J. Holmes of Columbia University. Dr. Switzer with this revolutionary new instrument made possible the positive identification of gemstones.

As a consequence of the early research in pearl identification by Robert M. Shipley, Jr. resulting in the gifts of equipment which were the nuclei for the present laboratories, an improved endoscope has been used by the GIA since that time and was last year developed by Shipley, Jr. into an improved model which, like all GIA instruments except the Diamondscope, is available to any purchaser.

Special credit is owing Robert M. Shipley, Jr. also for the development and perfection of the Shipley Polariscope, the Diamond Imperfection Illuminator, and the Shipley Universal Motion Immersion Stage.

Great was the feeling of reward in the spring of 1938 in disproving claims that diamonds could be produced synthetically by an American in sufficient quantity to

be considered a menace in the trade. When such reports were circulated, the GIA immediately secured specimens and after many tests, and much investigation, determined that the claims were false. Thus was the "synthetic diamond" story exploded and diamond merchants of the country could again breathe a sigh of relief.

Another period of tension was experienced with the advent of synthetic emeralds, produced by an American chemist. These proved to be of the same chemical composition and the same atomic arrangement as the natural gemstones and were being produced in sufficient size and quantity, with good color, to confuse the uninformed jeweler. The fine cooperation of the manufacturer of the stones helped make it possible for the GIA staff to establish a manner of identification in the laboratories. With this information available to jewelers, the public was again protected from what might have been an unscrupulous substitution of the synthetic—though beautiful—stone for a valuable gemstone.

At one time the scientific color grading of diamonds seemed to be just a dream of GIA's founder, Robert M. Shipley. But after years of careful research and development, the Colorimeter was constructed. Today, it is the only instrument of its kind and exact color grading of diamonds is accomplished to a very fine point of precision.

A diamond balance with specific gravity attachments.

There were many discouragements in those early days, but the perseverance, the

(Continued to page 58)

The Diamond Colorimeter above and at the right the Erb & Gray Refractometer.

Topaz . . .

(From page 49)

in such a manner as to allow some of the liquid to touch the eyeball lightly. It is recorded that a Fifteenth Century Roman physician was most successful in curing The Plague by touching sores with a stone which belonged to two popes, Clement VI and Gregory II.

The best-known romance of topaz leaves the reader to write his own ending as he wishes. A Benedictine monk, "the most greedy creature that ever went on two legs," once stole a topaz from his monastery. This gem was given them by Lady Hildegarde of Holland, and was so brilliant that it gave a light one could read by. As he was fleeing, the monk became so frightened by the glow of the stone that he threw it into the sea near Egmund to escape detection. We are uninformed to the subsequent outcome.

Anyone interested in topaz should certainly read "A Trip to the Interior of Brazil," written by John Maw in 1727.

—*Mark C. Bandy*

GIA Officers . . .

(From page 51)

Jewelers Association, has been active in the work of the Institute since its inception and has served most of those years as a member of its Board of Governors.

Other officers elected at the April meeting to guide the future destinies of the Gemological Institute are: H. Paul Juergens, C. G., Juergens & Andersen, Chicago, Chairman of the Board; J. Lovell Baker, C. G., Henry Birks & Sons, Ltd., Montreal, Vice-Chairman; and Dorothy M. Jasper, Executive Secretary of the G.I.A., Secretary to the Board of Governors.

Geo. Carter Jessop, C. G., J. Jessop & Sons, San Diego, California, was appointed by the Board Chairman to act as Chairman of the Operating Committee which is responsible for supervision of activities of the G.I.A. Headquarters in Los Angeles.

Present members of the Board of Governors in addition to those named are: Charles H. Church, Church & Company, Newark; Myron Everts, A. A. Everts Company, Dallas; Paul S. Hardy, Hardy & Hayes Company, Pittsburgh; Edward F. Herschede, Frank Herschede Company, Cincinnati; Oscar C. Homann, C. B. Brown Company, Omaha; Burton Joseph, S. Joseph & Sons, Des Moines; Lazare Kaplan, New York City; John S. Kennard, Kennard & Company, Boston; E. A. Kiger, C. A. Kiger & Company, Kansas City; P. K. Loud, Wright, Kay & Company, Detroit; Charles D. Peacock III, Chicago; Fred B. Thurber, Tilden-Thurber Corporation, Providence; Leo J. Vogt, Hess & Culbertson Jewelry Company, St. Louis; and Jerome B. Wiss, Wiss Sons, Newark.

Commendation is expressed to the retiring officers Leo J. Vogt, Chairman; Paul S. Hardy, Vice-Chairman; and P. K. Loud, Secretary-Treasurer.

First president of the Gemological Institute of America was its founder, Robert M. Shipley, who served in that capacity for ten years, until 1941.

In that year the office was filled by Dr. Edward Wigglesworth who had for 21 years served as a director of the New England Museum of Natural History. During his presidency, he was also director of the Eastern Headquarters and Laboratory of the G. I. A. in Boston until his death in the spring of 1945. Dr. Kraus, the current president, was elected to office at that time.

Gemological Digests

Recently Found Large Black Star Sapphire Now on Display Tour

Appearing for the first time in March, 1948. what is said to be the largest black star sapphire in the world is now being displayed at some of the larger jewelry stores of the country.

Found in an alluvial deposit at Rubyville, a small placer mine in Queensland, Australia, the stone, which weighed 1156 carats in the rough, was purchased by Kazanjian Brothers, importers and cutters of precious stones, Los Angeles, and fashioned in two months' time by James Kazanjian into the present stone of 733 carats shown in the picture.

As can be seen in the illustration the sapphire has a six-pointed star against what is said to be a velvety black background. Measurements are given as 2 3/16 by 1 27/32 by 1 1/32 inches.

Although not for sale, the owners place the retail valuation of the Black Star Sapphire of Queensland at $300,000.

GIA Director Agrees To Remain Until 1951

At its annual meeting in Chicago, April 30, the Board of Governors of the Gemological Institute of America, obtained from Robert M. Shipley a contract to remain as executive head of the G.I.A. until December, 1951. This contract was accepted by the Executive Director with the understanding he be permitted to retire at that time.

In the three years which remain before his intended retirement from the organization which he founded and has guided for the past 17 years, it is planned to provide a permanent home for the Institute, to explore and perfect possible changes in policies, and to complete the integration of its various activities.

Original founder of the G.I.A., Robert Shipley was retained as active director when it became a corporation in 1942. At all times the Institute has been a non-profit organization, governed by a board consisting of outstanding jewelers in the United States and Canada.

Industrial Diamonds . . .

(From page 47)

In closing, let me quote a sermon from a Buddhist source, the Hindoo poem known as "The Questioning of King Melinda," dating from about the beginning of our era.

"O King, as the diamond is pure throughout, so O King should the sincere man of virtue, constant in right endeavor, be ever pure in his manner of living. This, O King, is the first quality of the diamond he ought to have. Again, O King, as the diamond cannot be alloyed with inferior substance, so O King should the sincere man of virtue, constant in right endeavor, never mix in friendship with wicked men. This, O King, is the second quality of the diamond he ought to have. Again, O King, as the diamond is only set about with the most costly jewels, so O King should the sincere man of virtue, constant in right endeavor, only associate with men of high excellence. This, O King, is the third quality of the diamond he ought to have."

Refractive Indices . . .

(From page 37)

This system of determining refractive indices may be used with both the stationary and rotating models of the Erb & Gray refractometer and thus greatly increase their value as a gem testing instrument. In making experiments in the Los Angeles laboratory with the various refractometers on the market, it was learned that with the Tully, by removing the eyepiece, readings on stones falling between 1.50 and 1.65 could also be taken. Beyond these limits, however, the image became too distorted to obtain accurate results. Because of the intermediate lens utilized in the other standard refractometers on the market today, this system cannot as yet be applied to them.

GIA Laboratories . . .

(From page 55)

courage, and the untiring efforts of the GIA staff under the guidance of Robert M. Shipley—plus the confidence, support, and recommendations of so many leaders in the industry—were rewarded in the satisfaction of accomplishment and present-day prominence. The work conducted through the years has been responsible in a large measure in building gemstone identification into a true science, and has contributed largely toward lifting the jewelry industry's agelong hope of recognition as a profession.

Since its founding, the laboratory has inspired the establishment of scores of laboratories in North America's leading retail jewelry stores and today some of these are almost as complete as laboratories of the Gemological Institute of America.

The Gemological Institute of America maintains its laboratories as a service to its students, for the protection of the public, and as a gemological contribution to the entire industry.

One of the interesting points brought out by Dr. Foshag in his review of Kraft's *Adventures in Jade* (page 62) is the classification of tuxtlite as one variety of Mexican Jade. Another is his comment regarding the presence of true jadeite in the state of California.

Gemological Digests

Carborundum as Gem Mineral Regarded as Doubtful by GIA

For many years, silicon carbide has been made commercially as an abrasive. The commercial varieties of the abrasive occur in a nearly opaque form which has a metallic luster. Although material has been made in colorless transparent form, it is only recently that it has been cut as a gemstone.

At present time, it would seem that the commercial possibilities of the material were rather unimportant since it has been produced only on an experimental scale and in sizes from which gemstones of less than one-tenth of a carat have been cut. If commercially feasible processes of producing silicon carbide in larger crystals are developed, then this could become an important gemstone.

The properties of the artificial material will convey to the gemologist its potentialities. The refractive index of the material, both in its common hexagonal form and rare cubic form are above 2.6 compared to the 2.42 of diamonds. The dispersion or fire is slightly more than double that of diamond. In contrast to synthetic rutile, which has even higher optical property values, silicon carbide is hard. The hardness of the material is usually given as 9¼ on the Moh scale, since it is measurably harder than corundum. The specific gravity of silicon carbide in both its hexagonal and cubic forms is considerably lower than that of diamond, being slightly less than 3.2.

While carborundum produced in good size and in commercial quantities in a colorless transparent form would immediately become significant in the jewelry industry, there is no indication that such a development will take place in the near future.

Founders of Swedish Association Meet

In June of this year members of the Gemological Association of Sweden met for the third successive year for an intensive course of study under Dr. Edward Gubelin of Lucerne, Switzerland.

At the invitation of leading jewelers of Sweden Dr. Gubelin, GIA graduate and only research member of the Institute, first traveled to Sweden in November, 1946, and helped charter members with their plans of organization for a Swedish association. At that time they outlined their intention to make gemological studies available to jewelers in that country. Sven Carlman, as President and Ake Stromdahl, as Secretary were elected to guide the group in carrying out these plans.

Again in May, 1947, Dr. Gubelin spent three days in Stockholm lecturing to the ten charter members of the new association and instructing them in the use of gemological instruments.

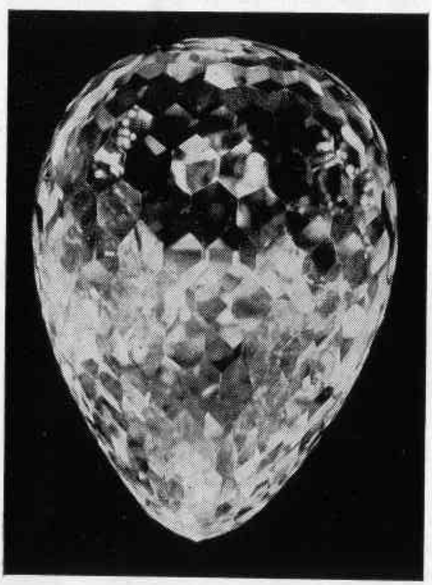
Plans of the original founders include the introduction in that country of a course of gemological classes as soon as the present members feel they have advanced far enough in their own understanding of the subject to make such courses possible.

Gemological Digests

Largest Blue Topaz In American Museum Of Natural History

Believed to be the largest faceted blue topaz in existence, the gemstone pictured weighs 1463 carats and is the star of the topaz suite in the American Museum of Natural History in New York City.

This remarkable stone was presented to the Museum in October, 1920 by M. L. Morgenthau who was then president of the Mirror Candy Company. It was cut by Anthony Espositer at the time he was associated with Varni, from a water-worn blue Brazilian boulder for which he paid $20.00. It was then sold to a wealthy Buffalo collector named Parker and after his death was purchased from his estate by Morgenthau who presented it to the Museum.



Another noteworthy topaz in the series at the American Museum of Natural History is a six carat deep rose stone. So far as is known, this is the largest such stone in natural color in this country. Found in Russia, it is not to be confused with the pink color developed by the heating of brown topaz.

Clerici Solution Found Useful in Laboratory

Recently a shipment of Clerici solution was received from England and experiments have been conducted with it in the Los Angeles laboratory of the Gemological Institute of America.

This transparent solution has a specific gravity of 4.33 which makes it extremely useful in testing stones with a specific gravity higher than 3.32. Its use makes possible the ready separation of deeply colored zircons from corundum. When diluted with water, intermediate specific gravities are obtained; liquids with densities of 3.99, 3.73, and 3.52 (corundum, chrysoberyl, and diamond) being particularly useful. Unlike other solutions of this type, this one is unusually clear and stable and more fluid than is usually the case.

Book Reviews

GEMS AND GEM MATERIALS, by Edward H. Kraus and Chester B. Slawson, McGraw-Hill, New York, Fifth edition. Price $4.00.

The latest edition of *GEMS & GEM MATERIALS* contains a number of important changes and additions. Long a standard gemological text the improvements in the fifth edition make it a must for the library of the gemologist.

Many sections have been expanded, namely those on crystal forms, physical properties, optical properties, fashioning, and manufactured gems. The most important changes are in the section on cutting of diamonds. From the first the authors have interpreted long established practices of the diamond cutting industry on the basis of the structure of the diamond. The expanded section on cutting represents the clearest, most concise explanation of diamond cutting in relation to the crystal structure of the diamond. Excellent new diagrams clarify this important chapter.

A valuable new chapter, "Crystal Structure and X-ray Methods" has been added to clarify identification by X-ray for the jeweler-gemologist. A number of photographs and drawings simplify the presentation. The description of gemstones has been revised and five gem species have been added.

The practicing gemologist will consider changes in the tables the most important improvement in the fifth edition. In the general property tables, values are now given for Epsilon and Omega for the uniaxial and Alpha, Beta, and Gamma for the biaxial gemstones. Earlier editions confined refractive index figures to a mean value, with a birefringence value given in addition. No variation was shown. Now the refractive index table shows both highest and lowest values for gemstones with an indicative arrow. Thus, pyrope garnet, shown in an earlier edition at n 1.705, the index for the pure material which is almost never found in nature, now is shown to vary from n 1.705 to 1.749. The figures are given to only a single decimal place in the specific gravity tables. While this is satisfactory for gemstones for which the specific gravity values are given with a wide variation, i.e. almandite 3.9-4.2, it often implies a wider variation than is likely to be encountered, i.e. corundum 3.9-4.1, topaz 3.4-3.6. Although quartz is listed in the general tables at 2.66, it is given a 2.7 value in the specific gravity table. No indication is found in either table of the considerably lower value to be expected in chalcedony.

—*Richard T. Liddicoat.*

POPULAR GEMOLOGY, by Richard M. Pearl, John Wiley & Sons, Inc., New York. XII, 316 pages, 1948, $4.00.

A comprehensive and well written book for the layman and amateur gemologist. Technical data are in tables and held to a minimum. The scope of the contents is indicated by the 29 pages devoted to diamond, ruby, and sapphire and 27 pages given to quartz, chalcedony, and opal. The illustrations are well chosen and adequate. The publishers and the author, who was the second person to receive the title of Certified Gemologist of the Ameri-Gem Society; who is a Fellow of the Gemmological Association of Great Britain, co-founder of the American Federation of Mineralogical Societies, and currently Assistant Professor of Geology at Colorado College, are to be congratulated upon the excellence of this publication. —*Mark C. Bandy.*

Book Reviews

ADVENTURES IN JADE, by James Lewis Kraft, Henry Holt and Company, New York , 1947, 81 pages, 1 color plate, $3.50.

This entertaining and well written book recounts the adventures and joys of a "rock hound" in pursuing a hobby of collecting jade.

The enthusiasm for his hobby and the pleasure it has afforded him, as well as the cultural dividends it has paid, are apparent in each chapter of the book. Included with the author's accounts of his adventures is much interesting information on jade as a mineral and as a material for the arts.

While the book contains sections devoted to Chinese jade, the author's adventures are mainly concerned with his search for American sources of this material in California, Alaska, and Wyoming. These American occurrences are of nephrite jade, no jadeite jade having yet been found in America, except as worked pieces in Mexico and Central America. The author's enthusiasm for American jades might lead one to believe that it is unsurpassed by other jades.. While American jades have desirable qualities of their own, they will hardly be generally accepted as equal to the finer oriental, or even Mexican, jades. The American jades owe their color to their iron content, which yields gray-green, sage-green or yellowish green colors, while the jadeite jades, which owe their color to chromium have more vivid and desirable colors in apple- and emerald-green.

Several jade localities in California are mentioned. Of these the only nephrite occurence mentioned in gemological literature is the region about Monterey. Nodular masses of actinolite, the minerological constituent of green nephrite, are not uncommon in the Coast Ranges of California, and it is not unlikely that an occasional nolude of nephritic actinolite will be found in that region.

The fascinating problem of Mexican jade the author passes over hurriedly. The Mexican mineral is, however, the original and true "jade." The name derived from the Spanish *piedra de hijada* or stone of the side, since the early Spanish conquerors first found the Aztecs using stones of this material in curing pains in that part of the body by application or wearing polished pieces of this highly esteemed material. This Spanish term has been transliterated by the French into "jade." Centuries later the term was applied to the mineral of oriental origin. Mexican jade is of two varieties: jadeite, similar in chemical composition to Burmese jadeite; and diopside-jadeite or "tuxtlite," a mineral intermediate between jadeite and diopside, and peculiar to Mexico. No nephrite jade is known in Mexico. All the jade from this southern region is found in the form of worked or carved pieces and the original source is now unknown. The finest pieces belong to the early Olmec culture and there is evidence that it had become very rare by Aztec time. Some of the "Olmec" jade is of the highest quality, comparable to the "imperial" jade of Burma. A search for the original source (or sources) of this Mexican jade would offer Mr. Kraft a new and probably more exciting "Adventures in Jade."—*William Foshag, Ph.D., Curator of Minerals, Smithsonian Institution.*

Contributors In This Issue

A. E. ALEXANDER, Ph.D., is a recognized authority on pearls and the pearl industry, having been Director of the Bureau of Natural Pearl Information for six years before assuming his present position in 1946 as Director of the Gem Trade Laboratory, Inc., New York City. As an industrial Fellow on pearls, he attended Mellon Institute of Industrial Research in Pittsburgh from 1938 to 1940. Dr. Alexander took graduate work in mineralogy at Harvard University and was graduate instructor in mineralogy and geology at the University of North Carolina. He earned both his bachelor degree and his doctorate in mineralogy and petrography at Cornell University.

With the exception of the founder of the Gemological Institute of America, no employee of this educational institution holds as long a record of tenancy as does DOROTHY M. JASPER. With the exception of brief intervals of leave, she has been with the G.I.A. constantly since 1932, shortly after its inception. Her recording of the achievements of the G.I.A. laboratories follows personal observation of their growth and expansion. She has worked side by side with the early founders of the gemological movement in America and has been familiar with its pioneering discouragements and more recent fulfillments. Today, as the Institute has reached its high peak of accomplishment, Mrs. Jasper holds the important post of Executive Secretary.

SYDNEY H. BALL, geologist and mining engineer, New York City, is recognized as one of the world's foremost authorities on diamonds. His conclusive annual *Review of the Diamond Industry* is known to all readers, as is his Gemstone Chapter in the Bureau of Mines Year Book, U. S. Department of the Interior. He has authored many other papers and treatises published in this country and abroad. Intensely interested in gemological education, Dr. Ball is a member of the G.I.A. Examining Board, the Examinations Standards Board, the Educational Advisory Board of the Gemological Institute of America and recently served as a member of its first Board of Visitors.