Gems and Gemology

FALL 1952

See Inside Cover

Gems & Gemology

VOLUME VII FALL 1952 NUMBER 7

IN THIS ISSUE

On the Cover

An emerald and diamond necklace of exquisite new design and incomparable workmanship from Cartier, Inc., Fifth Avenue, New York City.

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INCLUSIONS IN GEMSTONES REVEALED as IMPORTANT IN IDENTIFICATION

As early as the 1st century of the Christian era Pliny the Elder, great Roman historian, recognized the value of inclusions within gemstones as a means of identification. In the latter part of Book XXXVII of his *Natural History of the World,* is an excellent summary of the methods of testing gems before and during his lifetime. Here he points out that glass imitations of precious stones—widely used in Rome—contain more gas inclusions than the genuine and may serve in identifying the false from the real.

Of the *carbunculi* (garnet, ruby, spinel, and other transparent red gems) he says, "One sees in false carbunculi certain small inclusions — that is, blisters and vesicules, which look like silver.

"Smaragdi (principally emerald) have blemishes, but like humans each has its own particular flaw, varying with the country from which it is derived." He tells how if one shakes the *enhygros* (our enhydros—a nodule of chalcedony containing water) "a liquid is heard to move within, as when the yolk within an egg is shaken."

Pliny's description of flaws, liquid and other inclusions, and iron-stained fractures in rock crystal is accurate when he says, "In the rough it contains iron rust spots or clouds, or is full of specks. In other instances there is within it, so to speak, a hidden diseased ulcer; or there may be in it a hard knot which is brittle and apt to break into small fragments. Again, it may contain grains of salt."

Remarkable conclusions these for one living in an age when all natural occurrences were attributed, for the most part, to the caprice of the gods.

For more than 1600 years after his death (79 A.D.) books on precious stones were little more than copies of his work. In the dark Middle Ages, Pliny's *Natural History of the World* was the foundation of all science.

It was during the 19th century that mineralogists began to realize that the internal arrangement of a gemstone bore some relation to its identity. As early as 1823 an article was published in Edinburgh by Sir David Brewster, English physicist, describing cavities and fluids found within certain gemstones. Although a few other scientists believed inclusions to have some importance in the identification of gem minerals, it was

much later before the diagnostic importance of these characteristic features was given much serious consideration by mineralogists.

Among contemporary gemologists, Prof. Dr. H. Michel of Vienna was one of the earliest to appreciate the value of these identifying features from a gemological viewpoint. Other eminent gemologists and mineralogists of this century who have acknowledged the importance of inclusions not only to establish the stone's identity, but also as an indication of its source of origin, include such well-known authorities as Anderson, Andrews, Eppler, Schlossmacher, Smith, Spencer, Webster, Wild, and many others.

The development and introduction of dark-field illumination for microscopic examination of gemstones by the Gemological Institute of America in 1937 was another step forward in this science since the new instrument enabled gemologists to examine internal characteristics with greater accuracy.

Although many scientists had written occasional articles revealing their investigations into this new science, Dr. Edward J. Gubelin was the first to make an exhaustive study over a period of years and to present the results in book form. His *Inclusions as a Means of Gemstone Identification*, published by the Gemological Institute of America, will be on the book market January 1, 1953.

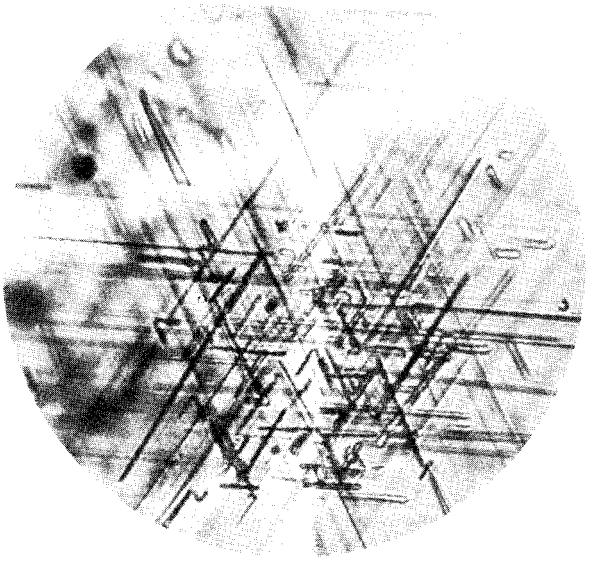
As the son of a jeweler family in Lucerne, Switzerland, he began his first gemological research as a youth when his father equipped a gemological laboratory for his use. After obtaining his doctorate in his native country —as well as studying under the well-known gemologists, Prof. Dr. K. Schlossmacher of Koenigsberg and Prof. Dr. H. Michel of Vienna—Dr. Gubelin came to the United States to spend some time in the firm's New York branch. While in this country he completed the courses of the Gemological Institute and spent additional time in the Los Angeles laboratory of the Institute to obtain supervised laboratory practice and later did research in the identification of gemstones. During his stay in California his enthusiasm for the study of inclusions and the photomicrography of gemstones was encouraged by GIA founder Robert M. Shipley with the thought that the results of such research could eventually be incorporated in a book for the benefit of all gemologists.

In acknowledgement of his contribution to the advancement of gemological science, Dr. Gubelin, in 1939, was named the first Research Member of the Institute. In the spring of the following year his first article on the subject of gemstone inclusions appeared in *Gems & Gemology*. In this article he described the differences existing between Burma and Siam rubies beyond the generally accepted color variations as recognized in the trade.

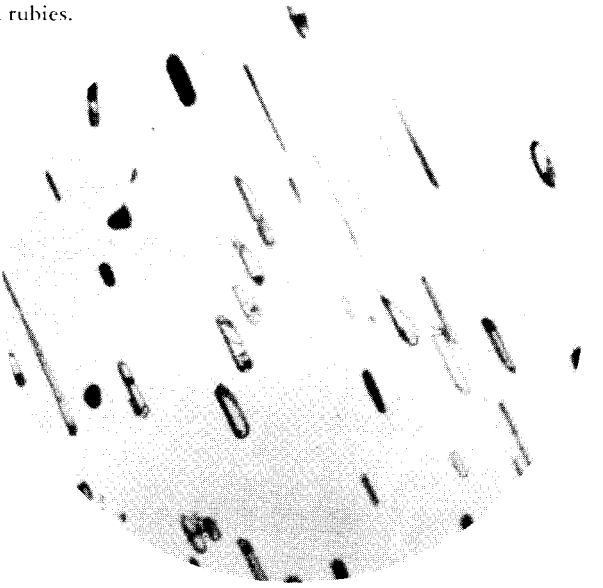
In the next issue of this publication he discussed the means of accurate discrimination between emeralds from the Ural Mountains and emeralds originating in Colombia. Although it was common knowledge that a difference in color existed between emeralds from the two sources, he observed that these color variations are at times difficult to recognize with the unaided eye, and present even greater problems to a beginner in the trade. During the period of his research in the photomicrography of gemstones, Dr. Gubelin endeavored to establish positive proof that internal markings could be used to prove their identity.

In analyzing a great number of emeralds—the sources of which he already knew—he found what he described as "an absolutely incontestable way to discriminate objectively between Russian and Colombian emeralds."

It was his observation that it is not the great mass of very visible inclusions or cracks within emeralds, but rather the subtle and most minute kind of liquid inclusions, which hold the secret of their source of origin. Colombian emeralds were found to contain scattered and irregular groups of almost invisible liquid inclusions showing a remarkable tail-like form. These inclusions, many of which contain the three phases of matter—i.e., liquid, solid and gas



• Patch of hexagonally arranged fine rutile needles characteristic of Burma rubies.



• Small single liquid drops composed of several nonmiscible liquids in a yellow Ceylon sapphire.

—also revealed by the microscope, he found to be typical of emeralds from Colombia.

Although it was noted that the three-phase inclusion was also a characteristic in Russian emeralds, the distribution, kind and shape of the solid inclusions in the latter group were entirely different.

In the winter of 1940 he described results of additional research with Ceylon rubies, and outlined more fully their characteristic and distinguishing inclusions. He told of his discoveries that rubies from Ceylon contain solid, liquid, and gaseous inclusions which differentiate them markedly from other rubies. Not only did he examine many stones in order to substantiate his original belief concerning the significance of inclusions, but each of these important discoveries was photographed under the microscope to provide a record of his findings.

One of Dr. Gubelin's main objectives was to make available to other gemologists these illustrations of his findings particularly in reference to synthetic materials. Because chemical and physical properties of both genuine and synthetic gemstones are identical, the logical means of distinguishing between them is by examination of inclusions.

In the Summer 1942 issue of *Gems & Gemology* he reported his findings on European synthetics. The long study and examination of synthetic corundum had resulted in numerous photomicrographs of typical inclusions which do not appear in the genuine. Results of his study of synthetic spinel were given at the same time.

"The problem of classification of gemstones in accordance with their sources of origin has always challenged my special interest and has prompted me to carry on extensive research in this matter," he stated later that year. "In spite of the fact that opinions have been expressed to the effect that the differences in gemological properties were insufficient and that, therefore, no accurate and convincing method could be achieved; I would like to attempt to prove in this paper," he continued, "the existence of such distinctly discriminating properties which permit a definite identification."

As in a previous article on rubies, he described and pictured characteristics and typical inclusions in sapphires which revealed not only their identity but also would assist the gemologist in determining the origin of a given sapphire. In the winter of the same year, and again in the spring of 1943, he continued to write on the subject and to give evidence of the accuracy of his findings by using photomicrographs.

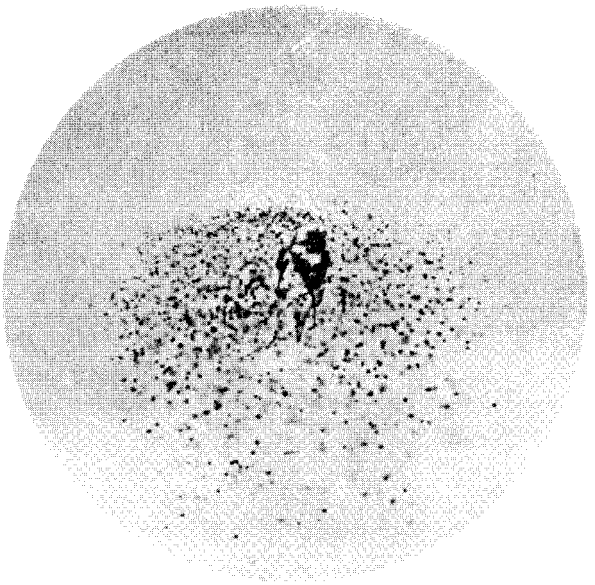
As more and more stones were scrupulously tested, this method was regarded as more efficient and reliable, and of sound value in identifying gemstones and proving their source of origin.

Beginning in the summer of 1944, and continuing through the spring of the following year, a number of papers were prepared by Dr. Gubelin on "Gemstone Inclusions" which were largely a summary of important facts he had established during his years of research, although, at this time, he also revealed important new developments and corroborated observations made in the past.

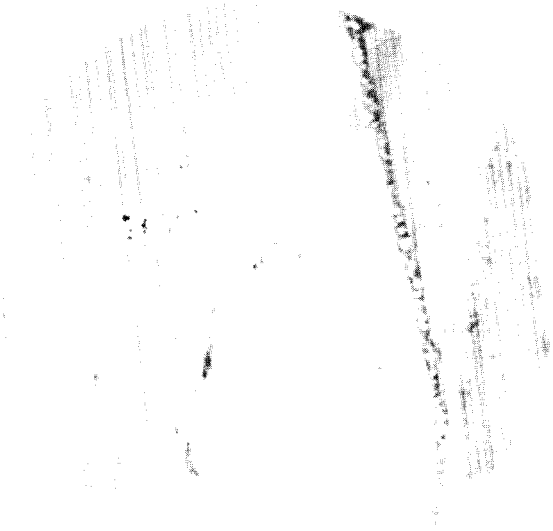
In an article appearing in 1945 he discussed characteristic inclusions found in garnets. He called attention to the numerous errors made in identifying green demantoid and explained that absolutely typical and ever-recurring inclusions had consistently been observed. A knowledge of this means of identification would have precluded the many errors previously made in such identifications. He pointed out how hessonite, by a study of its inclusions, can be readily distinguished from gems of similar appearance and color such as zircon, tourmaline, citrine, or brown imitations. In this series of articles on garnets he also showed how source of origin can be confirmed through the presence of typical inclusions.

All of this work has been compiled in the new text *Inclusions as a Means of Gemstone Identification.* Unlike the average text which has but a few illustrations, *Inclusions as a Means of Gemstone Identification* contains 258 photomicrographs of characteristic inclusions carefully selected from Dr. Gube-

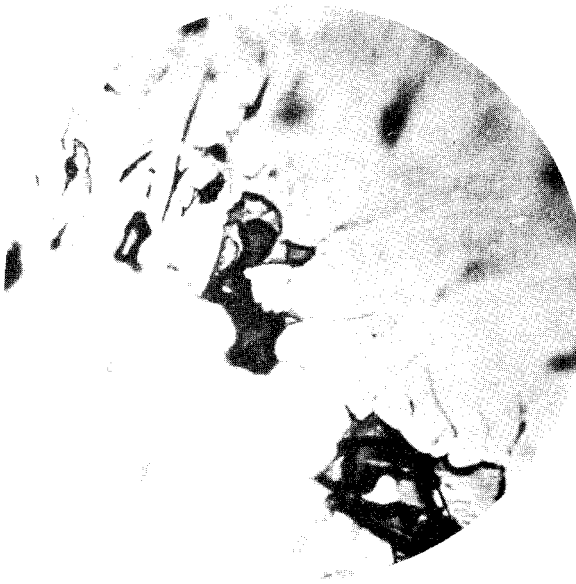
• Genuinelike gas inclusions in a synthetic ruby. 40x



• Synthetic ruby with cloud of very fine bubbles, some of which have combined into irregular, threadlike formations.

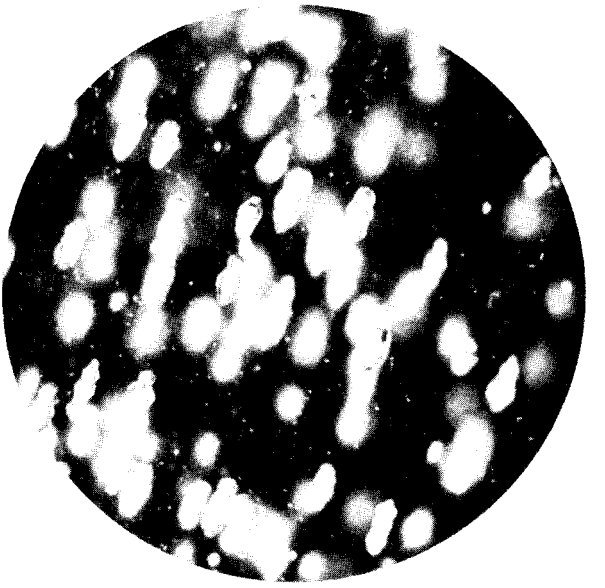


• Synthetic ruby showing a few gas bubbles and almost perfectly straight growth striae. 75x



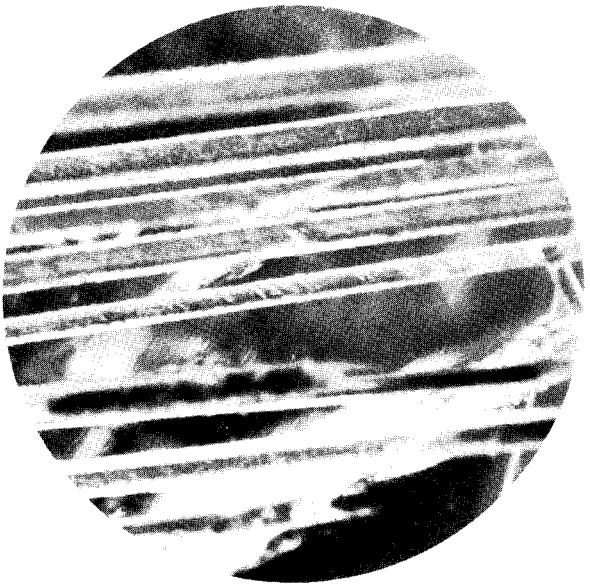
• Large irregular cavities in genuine beryl, filled almost half and half with liquid and gas.

• Wisplike liquid feather in synthetic emerald. 100x

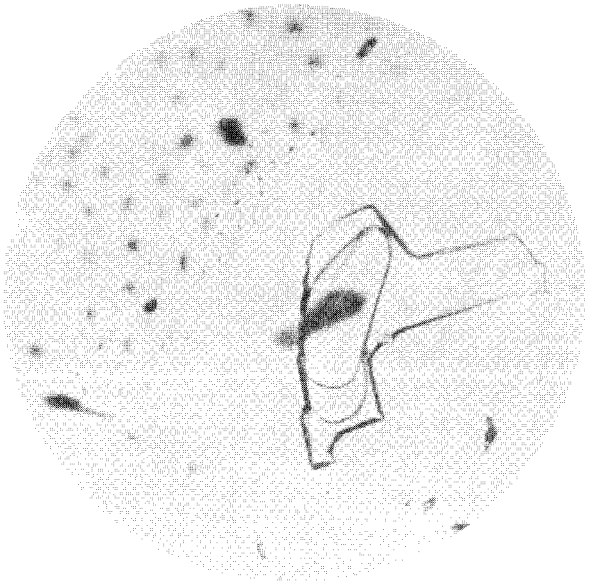


• Typical picture of masses of elongated, profile gas bubbles in synthetic spinel. 20x

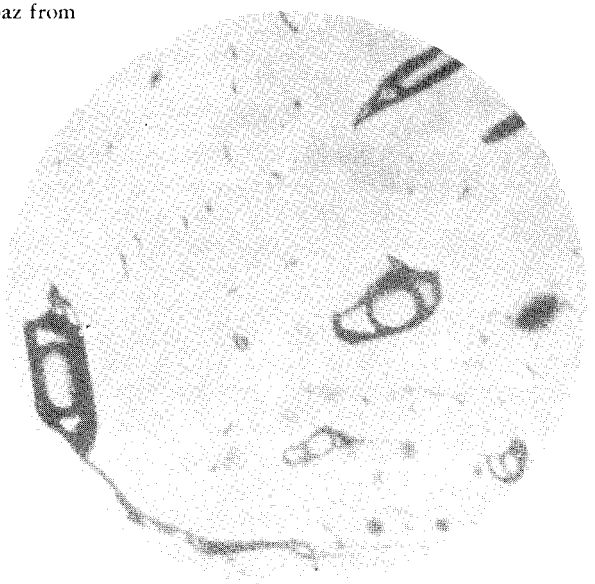
• Swarm of negative crystals in smoky quartz, rigorously oriented and all exhibiting the quartz habit. 50x



• Long stalked crystals of actinolite in quartz.



• Three nonmiscible liquids in a strangely shaped cavity in a light blue topaz from Brazil.



• Typical irregular liquid inclusions with rounded or compressed libella in brown topaz.

lin's extensive file of inclusion slides produced over the long years of his research.

The importance of this contribution to the jewelry industry can be comprehended only when one realizes that today the jeweler is confronted with an increasing problem in gem identification—resulting from new or improved methods of gemstone synthesis and treatment, and that the easiest, and in some cases the only, methods of detecting a synthetic stone is by analyzing the inclusions within the stone since there is a distinct relationship between the type of inclusion and the method by which the stone is formed.

The excellent illustrations in this new book show the common characteristic inclusions of the various natural stones and synthetics, as well as the more unusual inclusions in synthetics which closely resemble those in the natural stone.

No attempt has been made to include all of the inclusions and patterns of arrangement that are to be encountered in all gems since no two gems are exactly alike in this respect. Instead, Dr. Gubelin has devoted several chapters of the book to the basic types of inclusions that result from the different methods of formation. Coupling this information with the types of deposits in which the different gem species are found, enables one to better evaluate the numerous inclusions that may be encountered but which are not specifically illustrated in the book.

Gemological students have often requested information concerning sources of photographs of gemstones and procedures for photomicrography of inclusions. Unfortunately, some of the problems encountered in microscopy such as the required depth of focus, working distance and illumination necessary to photograph inclusions are not only quite different from that required for photographing thin sections, but every stone —depending upon the degree of transparency, size, style of cut and polish— requires a slightly different technique. Even when these problems are overcome, the task of acquiring a suitable cross section of the type of inclusions to be expected is, in itself, a tremendous task. By overcoming these numerous obstacles, Dr. Gubelin has made possible one of the most valuable text books to date in the ever-expanding science of gemstones.

The book has been prepared with general text in each chapter accompanied by a series of photomicrographs similar to those shown in the illustrations accompanying this article. Aside from the instructional value of this new book, what better means could be employed by a jeweler to overcome the layman's aversion to so-called imperfections in gems than by displaying a text which stresses the importance of inclusions?

ENGRAVED GEMS Through 6,000 Years of Popularity

Part II

by

KAY SWINDLER

With the decline of the once mighty Roman Empire, and its practice of wearing jewelry to the point of ostentation, the art of gem engraving gradually deteriorated. When the Empire was divided early in the 5th century, commerce in engraved gems flourished to some extent in the eastern capitol. Any work appearing there was lacking in creative impulse, however, —a condition which continued until the fall of Constantinople in 1453.

During these centuries some interest was shown in gem engraving in the East but subject matter was largely of religious inspiration and inscriptions generally replaced the former artistic and imaginative carvings. The Mohammedan sect, whose teachings forbid the use or possession of any graven image, may have influenced the adoption of this new type seal.

In Medieval Europe, original inhabitants of the provinces had been subjugated by barbaric tribes whose history included little evidence of artistic accomplishments. It is possible, however, that they treasured to some degree any objects which had been valued by the more cultured natives, and that many engraved gemstones were worn, or kept, by them.

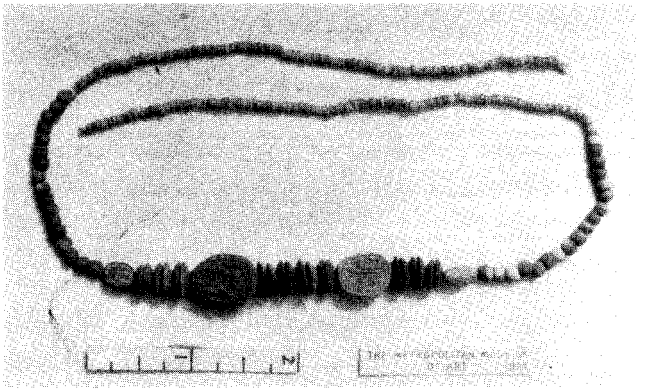
AMULETS AND TALISMANS

The use of amulets and talismanic objects was a natural outgrowth of an age and people filled with superstitious and supernatural beliefs and engraved gemstones were in demand.

Although as far back as the 1st century, Pliny scoffed at the belief in benefits to be derived from wearing certain gems, yet similar beliefs have existed through the centuries—as the good luck attributed to the wearing of a birthstone even today. No doubt even Hippocrates — father of medicine—was speaking with pure sarcasm when he remarked that he found the use of amulets for the cure of disease much more effective when used in combination with regular prescribed remedies.

However, during the growth of the early Church and the gradual overrunning of the more advanced civilizations by barbaric tribes, belief in the powers of gemstones grew rather than diminished. Since most of these interpretations concerned engraved gems, it can be surmised that they were more in demand than any other type.

The following are just a few of the magic working powers attributed to cer-



• Egyptian bead and disc necklace with scarabs. 18th dynasty. *Metropolitan Museum.*

tain engraved stones which our readers may find interesting—or amusing:

If one possessed a jasper which showed the portrait of a man with serpents under his feet; a spear in one hand; and a shield in the other hand, or about his neck; he would have powers over his enemies.

Power in business dealings would always come to the man who wore a stone showing a man with wings. The same benefits could be had if the man wore a chrysolite on which was engraved a woman holding a bird in one hand, and a fish in the other.

Loss of any possession was impossible if one owned a white stone engraved with the figure of a mermaid holding a mirror and an olive branch, mounted in gold. If one wished to become invisible at times, this same engraving was useful if cut on hyacinth.

Peace was assured the person who owned a stone depicting a struggle between a serpent and an archer. Conversely, if one wished to incite a quarrel, all one had to do was touch the chosen individual with a wax effigy of a scorpion and Sagittarius in combat, engraved on any kind of stone. If, instead, a reconciliation was desired, it was necessary to own a ring of any kind of stone, mounted in silver, on which was the figure of a combination ram and ox.

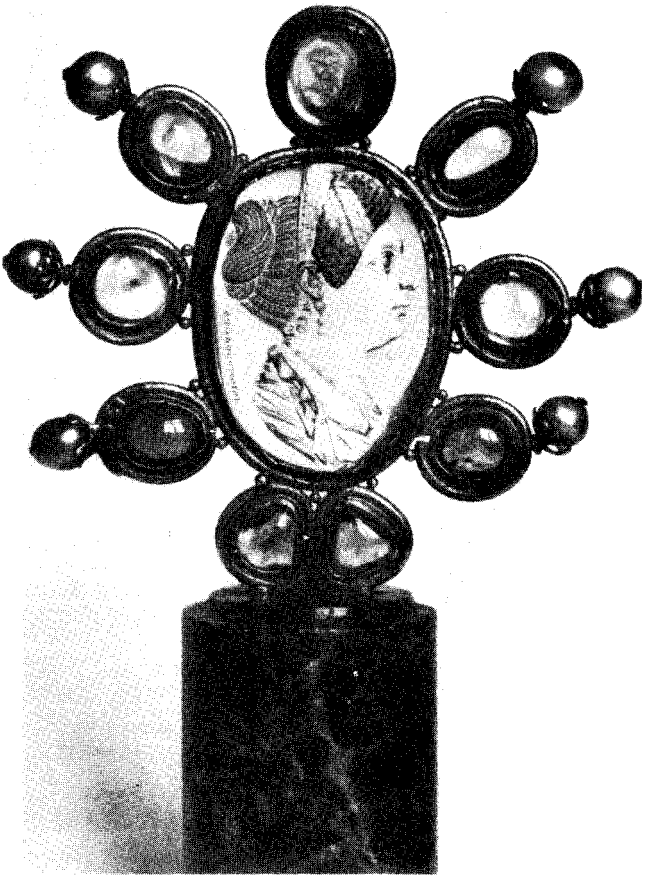
Perhaps one of the very best amulets of all was the figure of Capricorn engraved on carnelian, set in a ring of silver. Such a prized possession protected its owner against loss of money, harm to the person, any judgment against him by officers of the law, success in business, honor, friendships of many, defeat of any enemy in combat, and could break any spell which an evil wisher might cast upon the owner.

GEMS OF THE MIDDLE AGES IN MEDIEVAL EUROPE

We have seen how, since the days when engraved gems had reached their apex of popularity, they continued to be used for other purposes. Although the less durable mountings may have disappeared, it is possible that many of the ancient stones existed through the intervening centuries.

During the Middle Ages in Europe, original intaglios were most frequently used in signets. To list only a few of these, Charlemagne is said to have used an ancient head of Marcus Aurelius as a

• Onyx cameo of Proserpine set in gold fibula. 6th to 8th Century. *Metropolitan Museum, New York.*



• Evodos' portrait of Julie, daughter of Titus, engraved on emerald. Greek-Roman. Mounting from period of Charlemagne. *Bibliotheque Nationale, Paris.*

signet; Pepin duc d'Aquitaine, a portrait of Caligula; and Carloman (754 A.D.) a female bust with hair in a knot, which was probably a Diana.

How the deeply religious leaders of the Church interpreted the pagan symbols engraved on their signets is an interesting conjecture. It is intimated by some writers that they claimed winged figures were angels; any veiled female figure they regarded as the Madonna; while an engraving of the Egyptian Horus and Isis was considered the likenesses of Mary and the Infant Jesus.

Although most engraved pieces used during this period were antiques set in new mountings, there is some evidence that the glyptic art was practiced to a limited extent. Most designs, however, were truly religious subjects such as one of 9th century workmanship now in the British Museum.

Medieval writers also describe some of the gem minerals used for engraving but it is questionable if they are correctly named due to the lack of mineralogical knowledge. There were a few pieces created at this time that are still in existence, however, giving a clue to the gemstones used. One of these is a signet from the beginning of the 14th century, found in the tomb of Bitton, Bishop of Exeter, which has a hand with thumb and two fingers extended—as if in episcopal benediction—engraved on sapphire.

The few examples, together with chronicles of the period, prove that the art of engraving did not entirely disappear during the dark days of more than a thousand years dating from the fall of Rome.

GEMS OF THE RENAISSANCE

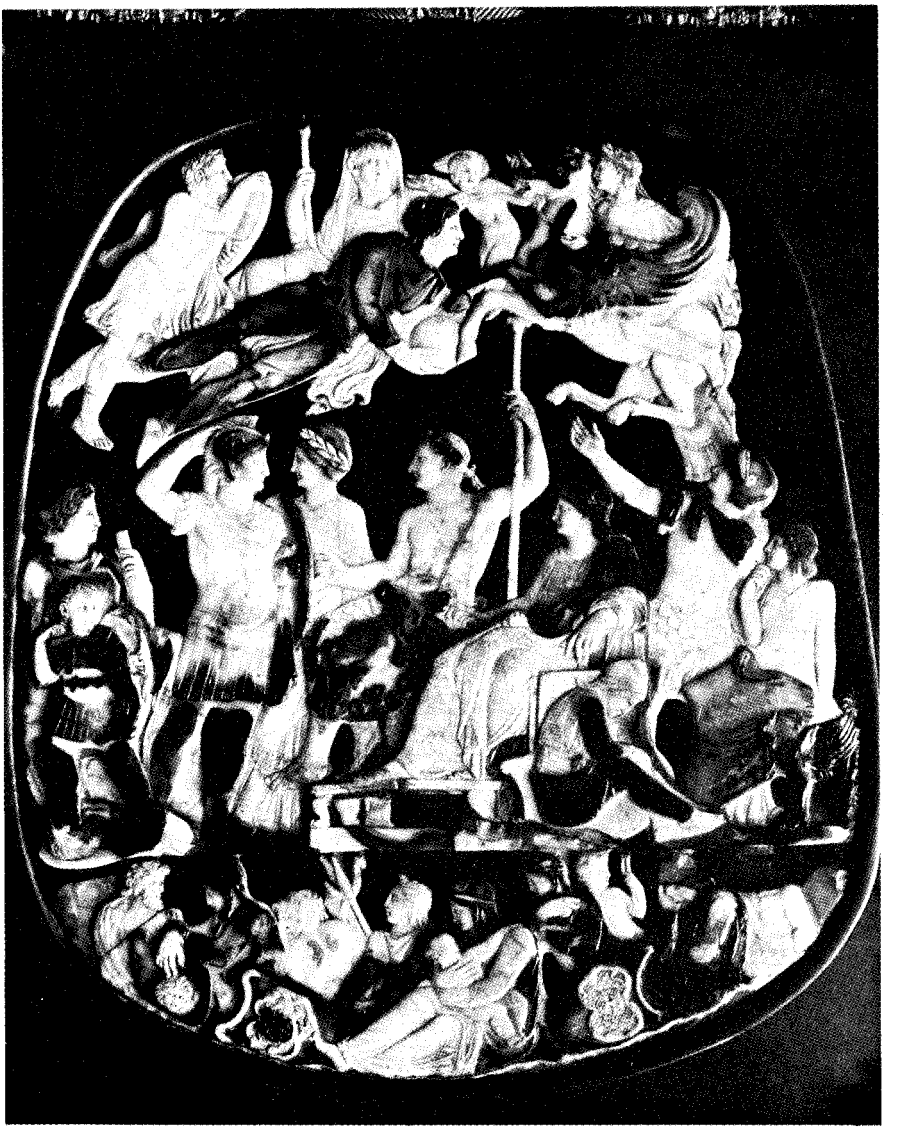
With the 15th century's lessening of strict church discipline and a change in cultural centers, came a new intellectual curiosity and a rebirth of love for all things beautiful, which was expressed in all forms of art during the period we call the Renaissance.

• Shell cameo mounted in gold and enamel badge of the Order of St. Michael. 17th century. French. *Metropolitan Museum.*

Since the use of engraved gems had never entirely lost its popularity even in the Dark Ages, it is not unusual that this form of artistic expression should have been revived. First attempts to produce engraved gemstones resulted largely in rather stiff forms reflecting the lack of imagination present in the passing period. Later, artisans developed a sense of personal pride in their designs, but their ideas were generally borrowed from the classical ages.

The cameo form was the most popular type of engraving and a greater variety of stones was used by engravers. They were especially interested in those stones which offered new color combinations. Some intaglios were produced for signets —many of them engraved on lapis lazuli— during the late Renaissance.

With the beginning of the 17th century, there was a decline in the popularity



• Famous agate cameo, Apotheosis of Germanicus, which measures 30 cm by 26 cm. *Bibliotheque Nationale, Paris.*

of gem engraving. Several writers claim the art had reached its apex of perfection by the time of Lorenzo the Magnificent (1149-1492) who inherited many valuable antique gems from his father, which were added to a fine collection left by Paul II.

Writers of the period named, among others, a Leonardo da Milano as a pre-eminent cutter of intaglios. One writer believes this artist was the versatile Leonardo da Vinci who, it is definitely known, worked in gold and enamel.

During the 18th century gem collecting became a mania with the rich. Catherine of Russia was one of the well-known collectors, and even George III purchased a large collection to prove his appreciation of art. Josephine Boneparte was among the many who indulged in the vogue of covering themselves with gems.

Artists of the 18th and 19th centuries did little more than imitate previous artists' works and many fraudulent practices were perpetrated to keep up with the demand for antiques by the collectors. Greater care was taken to give a genuine antique look to the forged gemstones. Gem cutters signed their work with Greek or Roman letters; some even signed the names of ancient artists in their efforts to capitalize on the demand for collector's items. Some of the imitations and forgeries originating during this period are still confusing today's collectors of antique engraved gemstones.

The uncovering of some of these frauds —notably the Poniatowski Collection—resulted in a loss of interest in engraved gemstones and even those admittedly made by contemporary artists were no longer in demand.

ENGRAVED GEMSTONES TODAY

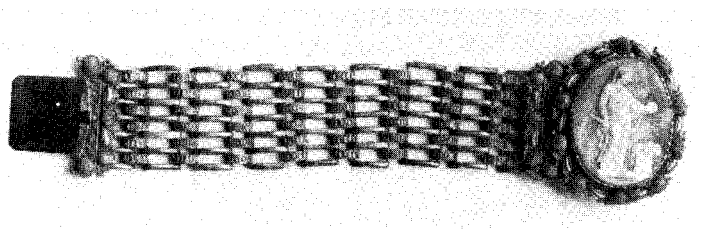
Although the intaglio was developed first and has had, through many centuries, much greater popularity, the cameo is in greater demand today. In recent years engraved gemstones have usually been sold mounted in men's rings. However, jewelry manufacturers have recently offered a new line of scarab jewelry for women which, with encouragement from the retail jeweler, may result in another spurt of popularity for this type of gemstone.

In the trade today carved and engraved gems are usually distinguished by such terms as stone cameo, shell cameo, coral cameo, etc., depending upon the materials from which they are fashioned.

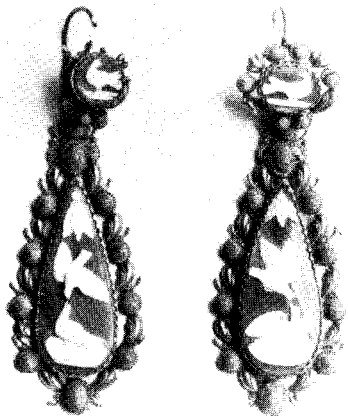
For instance, a stone cameo refers to one engraved on any naturally occurring mineral or rock. The ethical jeweler or gem dealer applies the term "imitation" to all engraved materials such as wax, glass, plastic, etc., and the term "synthetic" to those fashioned from synthetic materials.

Still another type of engraved gemstone, not previously described in this article, is known as the *assembled cameo.* This is not

• Italian bracelet of the mid-19th century with a shell cameo set in gold. *Metropolitan Museum.*



• Center badge of this gold and enamel necklace, containing pearls and rubies, believed to be Mariede Medici. French. 16th century. *Metropolitan Museum of Art.*



• Pair of cameo earrings mounted in gold. Italy. 19th century. *Metropolitan Museum of Art.*

carved from one piece but consists of two or more cemented layers of genuine materials, or a combination of genuine and imitation materials. Such stones are seen infrequently and were, perhaps, produced in order to salvage worth-while layers of broken cameos.

The majority of scarab-type engravings are produced in Germany today, using the many varieties of cryptocrystalline quartz. The jeweler should never accept any which are crudely carved, or inferior in any other way. The finer examples he can sell on their own merits of beauty and durability at a cost considerably less than must be paid for many genuine gemstones. Persons with little or no appreciation for diamonds or other precious stones -- as well as those financially unable to own them -- may buy an exquisitely worked cameo or intaglio when it is presented by the jeweler as a miniature work of art.

Although a large portion of valuable antique carved gems are in museums or private collections, there are undoubtedly many still in circulation. Some may have been kept as family heirlooms and, perhaps, regarded as worthless other than for their sentimental value. Still others have been removed from mountings in order to salvage gold in the jewelry. There is a distinct possibility that if a sufficient number of retail jewelers could be interested in accumulating a stock of these old carved and engraved gems, the desire for collecting them might be revived.

HOW TO JUDGE ENGRAVED GEMS

In examining an engraved gem of contemporary manufacture, the jeweler should consider both craftsmanship and design. Finely cut stones will reveal, even under magnification, exacting detail in cutting. In the case of portrait styles, even the features and hair will show this careful attention to detail. On inferior gems, the opposite will be true and faulty modeling of objects may even be visible to the unaided eye.

Since an engraved or carved gemstone of an early period is more esteemed than those now produced, it is also necessary for the jeweler to be able to recognize characteristics which may prove, or disprove, its antiquity.

Unfortunately, there is no sure method of recognizing the true antique from the modern forgery cut by an expert, but there are a few distinguishing features which give some assistance. In judging such stones, little dependence can be placed on the amount of wear shown. Those ancient carvings still in existence were cut on the more durable materials and should have worn well despite their age.

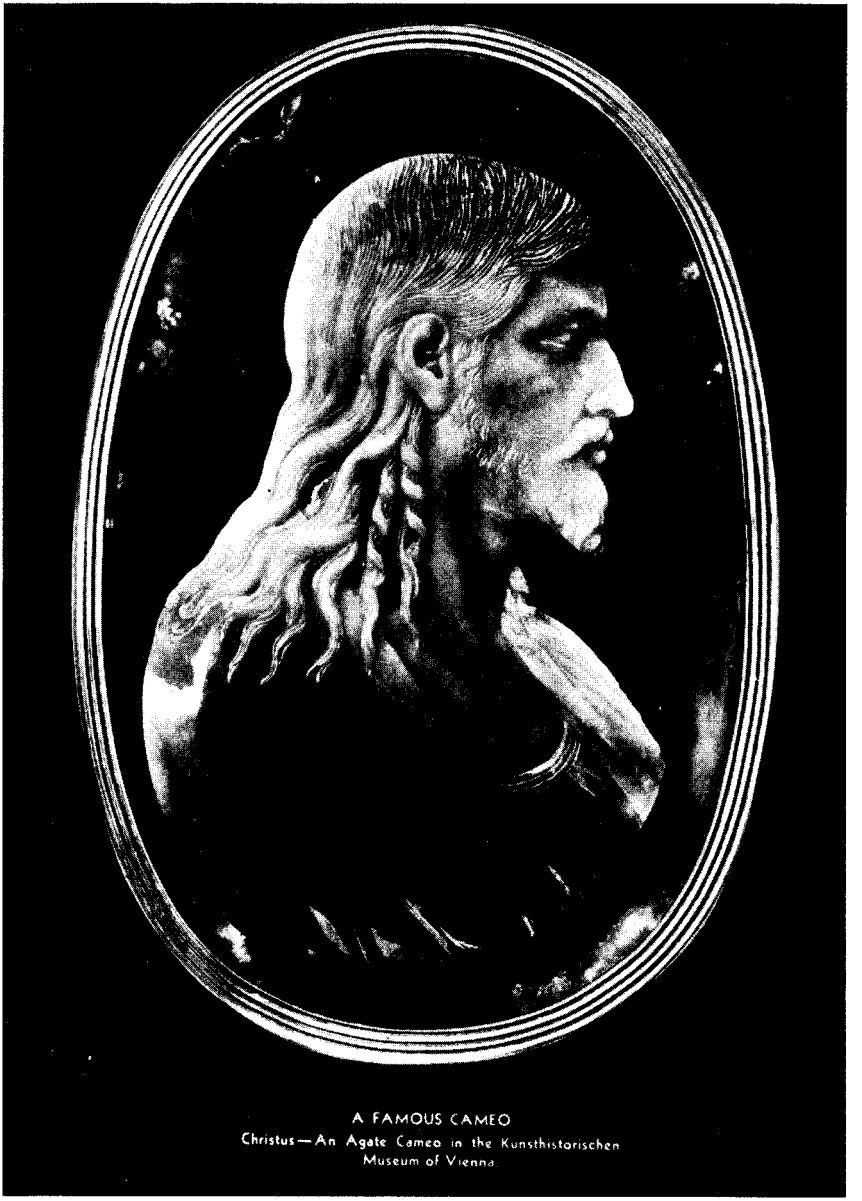
It is only rarely that a mounting will furnish a clue to the age of an engraved gem either since there are many fine specimens which have been placed in modern settings. It is possible that a genuine 19th century mounting could contain the work of a Roman or Greek artisan. Too, it could be one of the many forgeries appearing during that century.

Ancient seals were thicker than our modern intaglios and—with the exception of cylinders -- only a limited number of figures were used. Designs were sunk deeply into the stone by the engravers.

There was little uniformity of shape in the gemstones engraved in classical periods. The ancients hated angles and the face on an engraved gem was usually convex, with irregularities appearing on the back. Any uniform scratches should be regarded with suspicion, however.

The style and spirit of the ancients is often missed even by the most clever imitator and some detail will be lacking in costume, hairdress, or symbolic objects. The symbols of the gods, and portraits of their deities, were uniform to the ancients whereas the forger may try to dramatize these forms.

In judging its antiquity, beware of the signed gemstone. It was rare for the artist to sign his handiwork since most early intaglios were used as signets and the owner



A FAMOUS CAMEO
Christus—An Agate Cameo in the Kunsthistorischen Museum of Vienna.

• Famous cameo of head of Christ carved in agate. Formerly in *Kunsthistorischen Museum, Vienna.*

did not wish another's name on his personal seal. In the rare instances when a gem carried the signature of the artist, or his identifying mark, it was cut in a spot where it would not be seen when the stone was mounted.

There is no patina acquired by ancient gems other than the dulling of the internal polish in the deeper cuts. Even this can be duplicated by the clever forger.

It is not necessary to pay high prices for engraved gems even if they are genuine antiques. There are far too many fine antique gems, scarabs, and cylinders to have them classified as extremely rare. High prices only encourage forgery. When originals may be purchased for less than most people realize, it makes the task of producing a fine copy too time-consuming and costly for the forger.

The more you know of the past, its art, its history, its belief and its spirit, the less chance will the expert, willful forger have to deceive the jeweler or collector. Several comprehensive books have been written on the subject. If it is not possible to visit museums owning ancient engraved gemstones, catalogs showing reproductions of these gems may sometimes be obtained. Some of the very fine collections in this country are in the Museum of Fine Arts, Boston, and the Metropolitan Museum, New York.

ANCIENT TOOLS SIMILAR TO MODERN

Careful study of the many gems found in various stages of completion by trained archaeological students gives a clear picture of methods used by ancient engravers.

In prehistoric times a hand drill, and later a bow-driven point of soft metal such as copper impregnated with abrasive, was used. Mesopotamian lapidaries in the 4th millenium B. C. used tools which were, in principle, very like the tools of today. Both Theophrastus and Pliny describe methods used to engrave gemstones which are surprisingly modern.

The earliest lapidary tool was any sharp, hard stone like quartz, corundum, and later white sapphire. Pliny also describes diamond splinters, set in iron, as a tool of the engravers.

An abrasive paste was made of emery or corundum dust mixed with oil or water and soft copper — or even wood — to rub away the stone. Pliny states that most of the abrasives came from the Isle of Naxos. Frequently, the roughing out was done by an apprentice or assistant, while the master artist completed the work requiring skill, individuality, and experience.

Polishing was done as today, with metallic oxides and soft wood or — for flat surfaces — by a cloth dusted with ochreous earth or hematite. Glass cameo work in two colors was done by dipping cobalt blue glass into molten white glass which fused on a thin white coating. This was then worked away and the figures cut, leaving a blue background.

Today the electric drill is the most important tool used in engraving gems. These drills are fabricated of a high quality steel. After being charged with diamond dust or carborundum powder, the drill is placed in the collet chuck of a tool similar to a lathe. The material to be worked is either held in the hand or cemented to a short dop stick and the engraving accomplished by manipulating the stone against the rapidly revolving drill.

In order to insure accuracy in the finished product, it is usually customary to sketch the outline of the proposed design or figure upon the surface of the gem with a diamond stylus or other suitable instrument. Work done by the drill is characterized by rounded grooves or lines and especially by "hole" where the drill has stopped momentarily.

REFERENCES

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Oriented Lines in Synthetic Corundum

by

DR. W. PLATO, Frankfurt, Germany

Dr. W. Plato, Frankfurt, Germany, studied and specialized in inorganic chemistry. He was a student of the renowned German chemist, Prof. Dr. Ruff, and received his doctorate in 1904. He is a member of the Organization of German Chemists, and was for many years associated with the I. G. Farbenindustries. He is well known on the continent for his private work and research on the mineral analysis of gemstones. The article which follows is a translation from one which originally appeared in the German publication, EDELSTEINE UND SCHMUCK.

In order to distinguish between natural and synthetic corundum, we use — besides other characteristics—the color bands often present in the gem mineral.[1]

Bands which are straight in one direction, or which meet at certain angles, have been said to be especially characteristic of *natural corundum* observed under the microscope. In synthetic corundum these bands are more or less curved, often not very pronounced, occurring as striae curved, but not intersecting. The bands correspond to the zonal layers which develop during the process of accumulation of the boule influenced by external conditions.

In natural corundum the color bands lie in certain crystallographic directions, either perpendicular to the optic axis (parallel to the base (0001), or parallel to the optic axis parallel to the prism (1010), or at certain angles inclined to the optic axis parallel to the rhombohedral planes). Most frequent of these are the planes (1011), (2242), and 4483)[2].

In synthetic stones the color bands are parallel to the top of the boule. They are not in a definite crystallographic direction, since the optic axis in the boule is independent from the layers of accumulation. It may be perpendicular, horizontal, or inclined. In natural stones, bands may be caused by twins. Often repeated twinning lines lie parallel to one rhombohedral plane. In synthetic stones, twinning lines can be found too, but they are rare.[3]

Synthetic corundum, however, shows other lines which do have a definite crystallographic direction, about which nothing can be found in the literature to date.

When examining the stone under the microscope, these lines can be seen only at a certain limited orientation of the stone. It is not easy to detect them. These lines in synthetics resemble closely the color bands of natural stones. Consequently, a stone being examined may be erroneously regarded as natural corundum. The bands may provide, however, a key to the detection of synthetic stones, especially if other means (inclusions, etc.) for distinguishing natural and synthetic corundum cannot be found. The zonal layers corresponding to the above mentioned lines are parallel to the optic

axis. To find them, the direction of the optic axis is first determined in convergent polarized light. The stone should then be turned so that the optic axis lies in the optic axis of the polarizing microscope, i.e., the black cross of the optic axis is centered in the field of vision. The use of parallel polarized light will reveal the lines at a certain position of rotation of the stage. Single, double or triple systems of straight lines can be seen, the second or third systems of which are at angles of 60° or 120° to the first. These lines are shadows of irregular form (similar to the striped effect seen in glass bent by pressing) and result from the "tabby extinction" caused by tension.

At points of intersection of these lines rays which are similar to those around inclusions of garnets may be visible. Using unpolarized light, the straight lines can be seen at every position of rotation. Using the polarizer (or analyzer) alone, the lines are sharp if the plane of vibration of the polarizer is parallel to the lines; at a right angle they are not visible. The lines have no fixed position in relation to the color bands of accumulation of the boule. The latter can be parallel or inclined to them, often at angles of 90° or 60°. The described lines and the color bands are absolutely without regular relationship.

Shadows of the lines seem to be caused by tension existing in synthetic stones, so they are most noticeable where tension is greatest. Since tension or strain affects the interference figure, areas of strain may be located by observing the change of the cross of the optic axis. In the center of the boule there is a neutral zone with a normal interference figure. At the edges the cross opens more or less according to the direction of pressure inside of the stone which is also related to the zonal layers of accumulation. Of the many stones examined, nearly all showed one or more systems of lines, or at least single lines. They were seen equally well in all varieties of synthetic corundum, rubies, sapphires, blue and otherwise colored, and in white sapphires.

Besides these lines, the white sapphires showed fine straight lines in a direction perpendicular to the optic axis. These lines are similar to the bands of accumulation of the boules. They appear in ordinary light, when deeply screened by a cylindrical diaphragm of 1 mm. While they are sometimes very distinct, usually they are only slightly visible. They disappear completely with a slight rotation of the stone. Therefore, they can be found only by systematically adjusting the stone.

The lines of natural corundum, caused by the layers in the direction of the optic axis, may be distinguished easily from the lines in synthetic stones. In natural stones, the lines are normally dark between "crossed Nicols"; can be seen when looking through one Nicol only, or in unpolarized light; and they do not show the characteristic signs of the synthetic stones (shadows, etc.). Consequently, the "oriented lines" are useful in determining synthetic corundum. This is particularly true with yellow, or lightly colored stones in those instances where the color bands of accumulation (curved striae) cannot be found.

[1] Bauer-Schlossmacher, *Edelsteinkunde*, 1932. p. 780; Eppler, *Edelsteine und Schmucksteine*, 2 Auflage, 1934. p. 337; Michel, *Die kunstlichen Edelstein*, 1926. p. 212; Schlossmacher, *Praxis der Edelsteinbestimmung*, 1937. p. 80.

[2] The position of the layers here described had been determined by use of the great three-circular rotating apparatus of Klein (S.B.A. 5,94, 1895) referring to the optic axis.

[3] Bauer-Schlossmacher, 1, c. Page 781; Michel, l.c. p. 224.

Gemological Digests

AUSTRALIAN ASSOCIATION BECOMES CORPORATION

On the first day of May, 1952 the Gemmological Association of Australia was incorporated as an association "not for gain," and limited by guarantee.

Functions and purposes as outlined conform to the original intention of the founders of the Australian Association in 1945.

Application for articles of incorporation were signed by Jack C. Taylor, Arthur A. Wirth, Rudolph V. Marks, all of Sydney; Reginald M. Tiley, Mossman; Malcolm J. O'Hara, Kings Cross; and Geoffrey A. Tombs, Randwick.

The number of members with which the association proposes to be registered is 200 but provision is made in the articles to permit the Federal Secretary to register an increase of members from time to time. All members of the original association may retain classifications previously held if they become members of the corporation within a stipulated time.

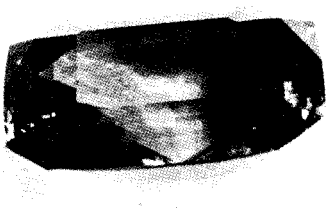
Six classes of membership are outlined. These include the title of Fellow which requires the successful completion of theoretical and practical examinations in gemology. Other classes of membership established are Honorary Fellow, Ordinary Member, Life Member, Honorary Member, and Honorary Life Member. Provision is made in the articles for state branches in New South Wales, Victoria, Queensland, South Australia, and Western Australia. Others may be added at a later date if desired.

The Gemmological Association of Australia was established October 25, 1945 and when the results of 1951 examinations were announced, 261 of its members had earned the title of Fellow.

LOS ANGELES COLLECTOR OWNS LARGE SPECIMEN OF NEW GEM MINERAL

The 158 carat sinhalite pictured here was recently examined in the Los Angeles Laboratory of the Gemological Institute of America. This light yellowish brown gem —flawless and beautifully cut—is part of the well-known collection of Wm. E. Phillips, Los Angeles.

Properties of the stone were found to be as follow: *Color:* light brownish yellow; *R. I.:* 1.661-1.695-1.700 (biaxial negative); *Birefringence:* .039; *S.G.:* 3.48; *Pleochroism:* strong, very light greenish yellow and brownish orange. (Close examination of the photograph will show the pronounced doubling of facets resulting from the strong birefringence.)



The stone was originally purchased as a tourmaline but was singled out as a new mineral about two years ago by Dr. George Switzer of the Smithsonian Institution. Complete analysis, however, and subsequent naming of the new mineral was completed in London only this year.

For those readers unfamiliar with the report of the discovery of sinhalite as well as that of another new mineral, Taaffeite attention is called to B. W. Anderson's article in the Summer 1952 issue of *Gems and Gemology.*

Lester B. Benson

Gemological Digests

GERMAN SCIENTISTS TRY TO SYNTHETIZE DIAMONDS

In recent months many publications have carried the exciting announcement that a group of German scientists have been able to synthetize diamonds. No verification from an authoritative source has, however, been received by the Gemological Institute. We believe the following account by Prof. Dr. Schlossmacher, head of the Gemological Institute of Idar-Oberstein, which recently appeared in *Zeitschrift der Deutschengesellschaft* reveals as much as is, at least at the present, being released to the public.

"Through the German press a short time ago, a report was made of a press conference in the Commerce Department of Germany, in which the production of synthetic diamonds in Germany was discussed. From this report it is seen that the Minister of Commerce is very much interested in this project and that a number of German financiers made this research possible through their financial aid.

"The leader of this organization is Herr Dr. H. Meincke, in Bonn. Fantastic figures of the production possibilities were named, and it was said that they were only interested in the production of industrial diamonds. Further developments were to wait. If this is to be taken seriously it is only because a forceful, influential group is behind it.

"There were charges and countercharges of sensational reports in illustrated magazines which gave this research a very doubtful aspect as to the probability of this production of synthetic diamonds. Therefore, the people responsible for this research requested an official and authoritative examination of the method of production. The results will have to wait, as it is too early to get a clear picture of this through the reports of the uncontrolled press."

FINE 160 CARAT DIAMOND FOUND NEAR ORANGE RIVER IN SOUTH-WEST AFRICA

Recently the G.I.A.'s Gem Trade Laboratory in New York was asked to examine a nearly-completed large pear-shaped pendeloque diamond cut from the famous 160 carat "La Belle Helene." After examination, the diamond was described by the staff as containing no flaws which could not be removed during the finishing process.

Of exceptionally fine color, the crystal was found in March, 1952, near the mouth of the Orange River in South-West Africa. The rough crystal was purchased by Rome Goldmuntz, noted diamond dealer of Antwerp, Belgium, for 80,000 pounds sterling. Named for Goldmuntz' wife, the stone was brought by his brother to R. & L. Goldmuntz, Inc., the firm's New York branch.

In the accompanying photograph the "La Belle Helene" is shown in rough crystal form beside an engagement ring with a brilliant cut diamond of slightly less than one and one quarter carats.

• **The "La Belle Helene" in rough crystal form.**

Gemological Digests

DE BEERS ANNOUNCE THE REOPENING OF BULTFONTEIN MINE

According to a report in the *Diamond News*, directors of De Beers Consolidated Mines, Ltd., have announced that Bultfontein Mine in Kimberley will be reopened December 1, 1952. Throughout 1950 and 1951 development work was carried out in preparation for lowering the hoisting level from the 1600-foot level to the 2200-foot level.

Bultfontein was closed July 1, 1949. The mine has always been a producer of predominately medium size stones and statistics show that out of every 100,000 carats recovered only 11 are large crystals, these averaging 134.2 carats. From 1888 until its closing in 1949, it produced a total of 17,412,795½ carats.

In accordance with the company's policy of maintaining production from two mines in Kimberley, and with reference to the needs of the diamond market, Dutoitspan—which reopened July 1, 1949—will close simultaneously with the reopening of Bultfontein.

Dutoitspan has long been a good producer of fine white cleavages, large yellows, and large silver capes, although total carats recovered has been considerably less than from Bultfontein during a similar period. Dutoitspan has produced many large stones, notably three large bye-water octahedrons weighing 300, 234¾, and 126 carats recovered in February 1944. In the past, the mine has shown an average of 61 large stones of 137.9 carats average for every 100,000 mined.

In addition to the Bultfontein Mine, the Wesselton and Jagersfontein Mines will now be in operation in the Kimberley area by De Beers Consolidated Mines, Ltd.

THOUSAND YEAR OLD PEARL DISCOVERED IN YUCATAN EXCAVATION

In a communication from Alberto L. Ruz, Merida, Yucatan, a description is given of a pearl found in a Mayan pyramid during recent excavations in Yucatan.

Recovered during the exploration of the inner staircase of the Temple of Inscriptions in Palenque, the pearl, according to Sr. Ruz, is in the shape of a teardrop, drilled at the end for suspension. It measures 13 mm long by 8 mm in diameter with its state of preservation good as far as luster is concerned, since it still presents an appearance of mother-of-pearl. It has, however, been cracked and separated into two pieces at the point of its greatest diameter, making it possible to estimate the nucleus of its original formation.

"I cannot say," Sr. Ruz says, "if it came from salt water or not since an X-ray examination has not been made. I believe that the relatively good state of preservation is due to the pearl's having been protected from air and dampness inside the powdered painting in which it was found inside a shell."

Regarding the date of deposit, Sr. Ruz estimates that it was concealed approximately 1,000 years ago, assuming that it must have been done at the end of the 9th or beginning of the 10th century.

The pearl is now on display at the Exposition of Objects from Palenque in the National Museum of Anthropology (Calle de la Moneda No. 13, Mexico, D. F.) and will be preserved later in the same museum.

More recent announcements tell of additional recoveries at the scene of excavation in Yucatan which include beautiful pieces of jade and a pearl even larger than the one here reported.