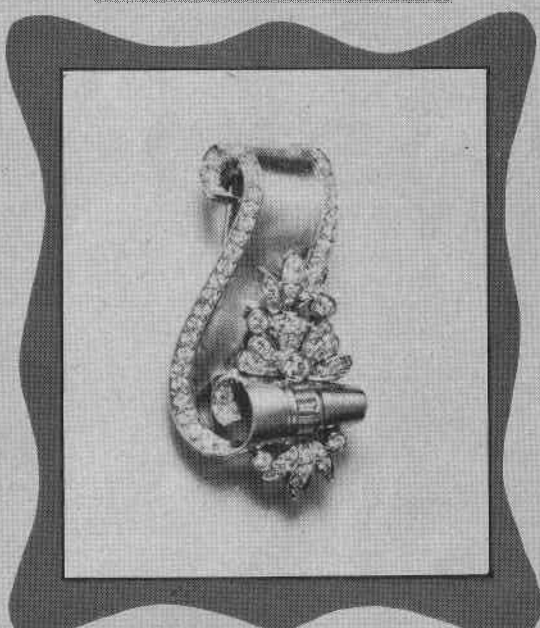
Gems and Gemology

WINTER 1948-49



MODERN ELEGANCE

See Inside Cover

GEMS & GEMOLOGY

Volume VI WINTER 1948-49 Number 4

In This Issue

On the Cover

Diamond Brooch
Wiss Sons, Inc.
Newark, N. J.

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Gem Collection of Chicago Natural History Museum

by

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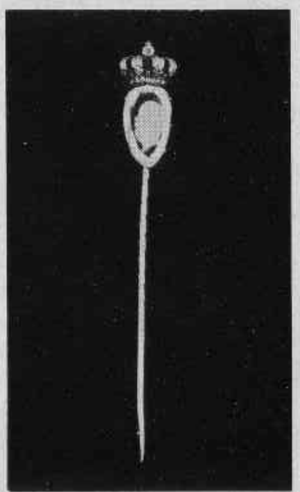
THE "Gem Collection" of Chicago Natural History Museum may also be called the "Gem and Jewelry Collection," for it contains not only gems and gem minerals, but also gold and silver jewelry from various countries. Both collections are displayed in Hall 31, known as H. N. Higinbotham Hall. The hall has been rebuilt architecturally, and the style of installation and lighting of exhibits has been modernized. It has seventeen recessed-type wall-cases and eight "island-cases." The "island-cases" have an exterior of English hardwood, matching the trim of the hall; the interiors are of bird's-eye maple; and the glass in-casings are framed in polished bronze. Concealed fluorescent lights supply the illumination. High on the wall, facing the entrance, is a Tiffany stained glass window that represents a mermaid rising from the sea. The hall was named in honor of the late Harlow N. Higinbotham, the donor of the original and major part of the present gem collection. Mr. Higinbotham, a prominent leader in Chicago civil affairs during his life time, was a Trustee of the Museum and its second President, serving the Institution with great distinction.

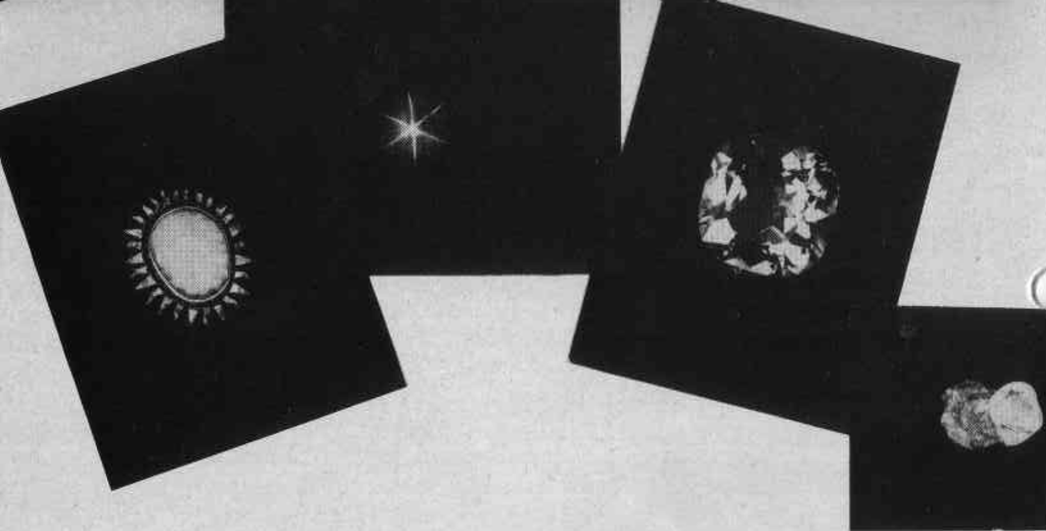
Much of the jewelry collection is in the nature of personal ornaments. Some of these are purely decorative; others are used for religious purposes and in mystic rites. The collection occupies fourteen wall cases. Of these, four are devoted to gold ornaments and fetishes made in Quimbaya, Columbia. They date back to 500 A.D. and are fine examples of work in precious metals in early America.

Bust of William II of Holland engraved in intaglio upon a ten carat pear shaped diamond.



The oldest and historically the most interesting jewelry displayed is of Sumerian origin. Most of these pieces are made of lapis lazuli and gold, and are five thousand years old. They came from Early Dynastic graves excavated at Kish, an ancient city of Babylonia, by the Chicago Natural History Museum and Oxford University joint expedition.

The Egyptian gold jewelry, dating from the 20th Century B.C. to the 2nd Century A. D., varies in fineness from 17 carats to 23.5 carats. The latter grade is from the Graeco-Roman period in Egypt. The conquest of the Near



Left to right: The "Sun God Opal." Cabochon cut, 1 inch by ¾ inch, it is believed to have been kept in a Persian Temple for three centuries. Long tapering prongs of gold extend radially, resembling the rays of a miniature sun. 2) Star Sapphire from Ceylon weighing 87.9 carats. 3) Aquamarine, 137.08 carats from Stoneham, Maine. Finest found in U. S. 4) Diamond in matrix from De Beers Mine, Kimberley, South Africa.

East by the Greeks resulted in an increased use of brightly-colored semi-precious stones, and a decline in the goldsmith's workmanship. Among the stones used were bloodstone, plasma, amethyst, carnelian, jasper; onyx, and garnet. Glass imitations of these stones were also used.

The Etruscan jewelry displayed in another wall-case is the work of the goldsmiths of Etruria, Italy (7th to the 5th centuries B.C.). The esthetic qualities and extraordinary delicacy in execution of detail, and the complex patterns of these objects have rarely been equaled. The goal of the jeweler must have been quality of workmanship, not the flamboyant display of colorful stones. The technique of applying fine gold granulations and the use of looped or twisted wires reached its peak during this period.

Three cases are devoted to Kyble jewelry, most of which is massive, and, in some instances, hideously splashy. It was collected among the Kybles a hill tribe of Algeria in North Africa. Similar ornaments are worn by the women of Morocco and Tunisia. Many of the ornaments are made of silver, but there are a few in which gold is used. The background consists of green, blue and yellow enamels, inset with large red stones of paste, and smaller ones of colored glass. In gaudiness, the Kyble jewelry has few rivals. It puts in the shade the gay costume jewelry of today.

The collection of jewelry from India is relatively the most representative. It bears all the distinctive characters of Indian jewelry—a delicacy of workmanship, lavish use of pearls and rubies, and the application of enamel. The delicacy is due mainly to the exquisite filigree work, of which the goldsmiths of India are masters. Although the collection is not old in point of time, the workmanship is the same as that found in pieces made centuries ago. India is reluctant to yield place to new; so are her goldsmiths.

Apart from general human interest, the jewelry collection, as a whole, forms a major element in anthropological studies.

The gem collection proper is one of the most complete and valuable in existence. It includes nearly every important variety of precious and semi-precious stones. There are examples of the finest cut, as well as crystals, cleavages, and rolled grains. The collection also includes magnificent examples of ornamental stones, many of which are shown as found in nature. Others have been polished, and many have been carved by skilled craftsmen. Supplementary collections consist of some of the native forms of gold and platinum, the metals in which valuable jewels are usually mounted.

Diamonds are displayed as they were found in gravels, as crystals in matrix, and as cut stones. One interesting specimen has engraved upon it in intaglio a bust of William II of Holland. It is a ten carat stone, pear-shaped, and half an inch long. The engraving is so delicate that it is necessary to use a magnifying glass to appreciate fully the workmanship. It was done by De Vries, the famous diamond cutter of Amsterdam, and is believed to have consumed all his spare time for five years.

The gem varieties of corundum—sapphires and rubies—are well repesented. Most of the sapphires are from Ceylon. They exhibit a wide range of color—blue, green, yellow, and white—and vary markedly in the quality of color. There are six large blue star sapphires, three of which weigh more than 130 carats each. The rubies are from Burma, Ceylon, Russia, Brazil and North Carolina. The star rubies, of which there are two, are not as large as the star sapphires, but the chatoyant bands composing the stars are well defined. Star quartz and star garnets are shown among the semi-precious stones. Of more than usual interest are the two garnet spheres, each showing several "four-rayed stars." Each is formed by the intersection of two chatoyant bands. Two of the angles in each star are 109° 28′, and two are 70° 32′.

The collection of beryl gems—emerald, aquamarine, and golden beryl—is unusually choice. In addition to the cut emeralds, there are several uncut crystals, three of which

Exhibit of carved and polished ornamental stones. In center foreground is a bowl of rose quartz crystal. In center rear is an elaborately carved rock crystal screen representing "The Finding of Moses." A product of old Vienna, it is believed to be largest of its kind in existence.

come from Brazil. These measure from three to five inches in length, and are of rich emerald color. The largest aquamarine in the collection is the unusually perfect Crane aquamarine, which weighs 341 carats. A smaller aquamarine, weighing 137.08 carats, from Stoneham, Maine, is the finest found thus far in the United States. A 34.4 carat, step-cut golden beryl has been recently added to the collection. It is a gift of Dr. J. D. Willems of Chicago. Dr. Willems, an amateur lapidarist, cut and polished the specimen himself. The work, however, is of professional calibre.

Like the beryl gems, the collection of blue, pink, white and golden cut topazes is select and extensive. Uncut topazes, including a gigantic crystal weighing 90 pounds, are also well represented.

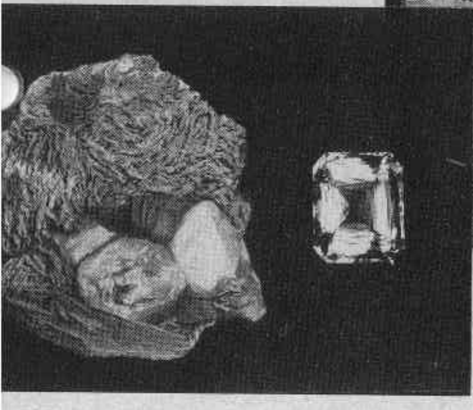
There is also an excellent assortment of the gem varieties of quartz, crystalline and cryptocrystalline. Noteworthy among the crystalline variety is a rock crystal screen showing "The Finding of Moses" elaborately and exquisitely carved on a thin section of quartz. It is a masterpiece, but like many medieval masterpieces it presents a gross anachronism. Pharaoh's daughters are dressed in costumes of medieval princesses, and in the background there appear a number of castles of types found in the artist's rather than Moses' time.

Other semi-precious stones—tourmaline, zircon, garnet, sphene, turquoise, lapis lazuli, jade, rhodonite and a host of others—are present in great variety and color. Many of these display such brilliancy that one may wonder why they are classed as semi-precious. "Gems," such as pearls, amber, jet and coral are also exhibited. The collection of these objects from organic sources is also an excellent one.

The high-grade ornamental stones, such as selenite, alabaster, and agate, used more for decoration than personal ornament, are represented both in the rough, and in cut polished and carved form. Among the agates, the moss agates are illuminated by transmitted light, which brings out clearly their "landscapes" and other imitative patterns.

A final interesting feature of the gem exhibits is the several varieties of opal. From a historic standpoint, the most noteworthy among them is the Sun-God Opal from the collection of Philip Hope. This opal was kept in a Persian temple for three centuries. The manner of its mounting and its traditional name strongly indicate that it may have been used in rites connected with the worship of the sun. The followers of the prophet Zoroaster are sunworshippers and Zoroastrianism was the religion of Persia previous to the conversion of the Persians to Mohammedanism. I was told that,

Some of the filigree jewelry of India. The stones used to lend color and beauty on these objects are chiefly pearls and rubies.



At left, Topaz from Alabashka, Ural Mts., U.S.S.R. Cut stone weighs 166.85 carats. Above, view of the central portion of Gem Room, Higinbotham Hall.

of late, a Chinese gentleman visited the gem room on successive days for nearly three weeks and stood before the Sun-God Opal for two hours each day, in deep meditation. Apparently, the Chinese gentleman is an adherent of Buddhism. His devotion conflicts with my notion that the opal might have been worshipped by the Zoroastrians. The opal is cabachon cut, one inch long, and three quarters of an inch wide. It is carved to represent a human figure which is difficult to see because of the "fire." The gem is mounted in an oval-shaped cup of gold inscribed with black figures, presumably of Near Eastern design. Long, tapering prongs of gold extend radially from it. The resemblance to a miniature sun is striking.

It has been mentioned before that the original gem collection was presented to the Museum by the late Harlow N. Higinbotham. This collection had been assembled through the efforts of the noted gemologist, the late Dr. George F. Kunz, and had been exhibited by Tiffany and Company at the World's Columbian Exposition in 1893. The history of the gem collection is thus the history of the Museum itself, for the Institution was founded upon the various natural history specimens exhibited at the Exposition. The gem collection was but a part of the whole, and, as is to be expected, it has since then grown, keeping pace with the overall progress and growth of the Museum. From time to time, pieces of gems and jewelry of high value, obtained by purchase, by Museum expeditions, or as gifts from benefactors, have been added to the original collection. The most notable gifts in recent years were made by Mrs. Richard T. Crane Jr., of Chicago and by Prince M. Sali of India. The most notable addition resulting from an expedition came from the Marshall Field Brazilian Expedition, which was led by the late Dr. Oliver Cummings Farrington, the author of "Gems and Gem Minerals," and the first head of the Department of Geology in the Museum. His lifelong interest in gems and gem minerals was a potent factor in the steady growth of the collection, which is now one of the world's most comprehensive assemblages of gems and jewels.

Fundamental Problems of Light

PART II

by

DAVID H. HOWELL, C.G.

INTERFERENCE

RETURNING our thoughts to the concept of "elastic solids" for the propagation of light, we may visualize what will happen when two elastic particles strike each other, their masses being different.* If the lighter particle strikes the heavier particle it will drive the heavier particle forward, but it will itself rebound so that its own motion will be suddenly reversed. Since a sudden reversal of a moving particle's motion corresponds to a change of PHASE of ½ Wave-length, or 180°, we can conceive that when a light wave moving in air strikes a denser medium such as glass, the refracted ray will be in the same phase as the incident ray, BUT the reflected ray will undergo a sudden change in phase, equivalent to the loss of half a wave length at the moment of reflection.

If a heavier particle strikes a lighter, then the lighter particle is driven forward, but the motion of the heavier particle continues in its original direction. So that, in the case of a wave of light traveling in a denser medium and meeting a surface separating this medium from a less dense one, there will be no change in phase in either the refracted or reflected wave. This is shown in Figure 5. At the extreme left a vertical ray AO strikes the glass surface at MN, instantly part of the light is reflected back to A and its phase is changed 180°. (Broken line is reflected phase). That refracted and passing into the glass begins a new set of vibrations which then proceed through the glass with the same phase as they had in air. This ray again re-enters air and since it is passing from a denser into a lighter medium there is no alteration in phase relationship.

In the right hand portion of Figure 5, at the bounding surface MM, we see illustrated an advancing ray AO incident at M, refracted at the point O and traveling thence to O′ where part is reflected back within the glass towards O″ and part re-entering the air at O′ and proceeding on to C. The curved line along this path of travel represents the *Phase* of the vibrations in this ray AOO′C. It will be noted that there is no alteration in the phase of the vibration when the ray is reflected into the glass nor when it is reflected at the point O′. This follows the law of phase behavior.

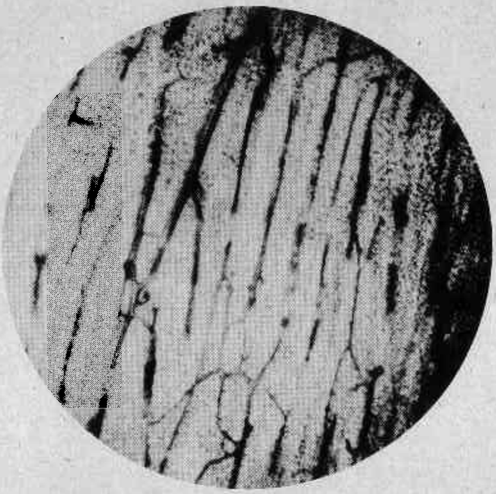
Now let another ray A′O″, with the same phase as ray AO, be incident upon MN at O″ and strike with the same angle as AO. Part of this ray will be reflected at O″ and travel towards B′ and part will enter the glass (not shown for clarity of drawing). The reflected ray O″B′ will suffer a phase reversal of 180°. This is illus-

(Continued to page 114)

**A Textbook of Physics*—W. Watson, Longmans, Green and Co., London, 8th Edition, P. 543.

IVORY. . . OR BONE?

—their distinctive characteristics



by

ROBERT WEBSTER, F.G.A.

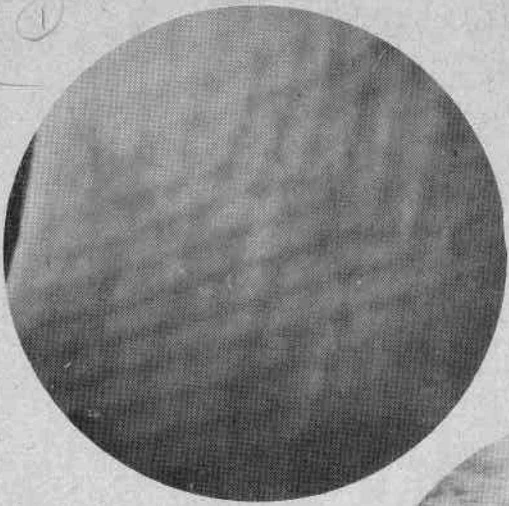
Longitudinal section of bone. X25.

IVORY has served man from the very dawn of his existence; from ages past to present day a prime medium of the glyptic art; a material whose loveliness mere words fail to convey but which tempts lesser things to emulate its beauty. To most people ivory is inevitably connected with the elephant, but how many know all the varied sources of this prized material? How many would be prepared to explain its origin? And how many would be able by indisputable means to confirm the genuineness of an "ivory" specimen?

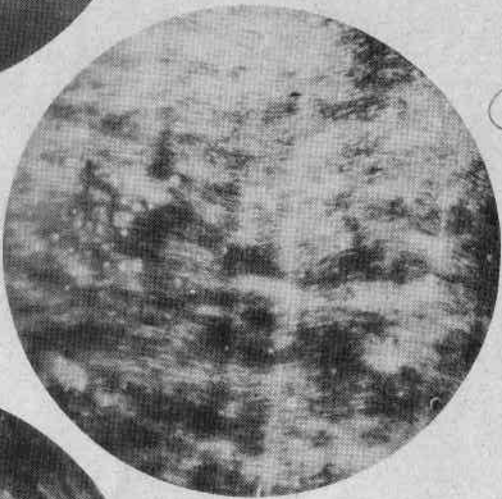
It is remarkable that ivory, a material so often used by jewelers for jewelry, has never received attention by the gemologist—maybe the mineralogist, to whom all students of gems refer, has never conceived an understanding for so truly organic a substance. Also true is the fact that the only books on ivory mainly treat with the artistic and antiquarian side, referring only to the properties and to other simulating materials by name and scant description. May this short article, therefore, tell something of the means which may be used to differentiate between ivory itself and the more common bone.

Ivory, or more correctly *dentine,* forms the body mass of the teeth of all mammals. On the wearing face the dentine is covered by a layer of the harder enamel, and at the fang end, by the *crusta petrosa* or cement, neither of which have an importance in this work, for in general these layers are removed before the ivory, which requires no further preparation, is fabricated into worked pieces. It is obvious that only those mammals which have teeth large enough to supply dentine in pieces of sufficient size

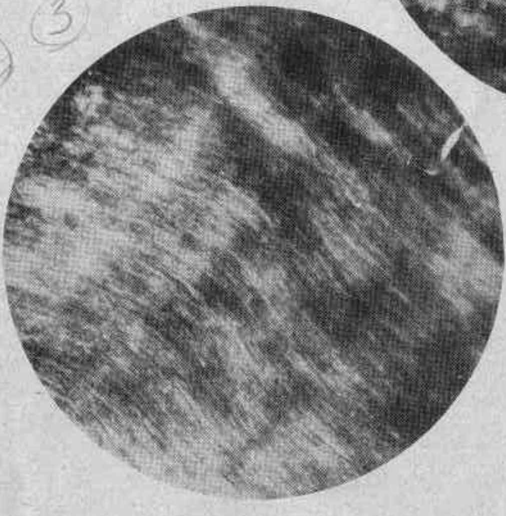
Ivory . . .



"Engine turning" effect seen on the surface of elephant ivory cut across the tusk. X15.



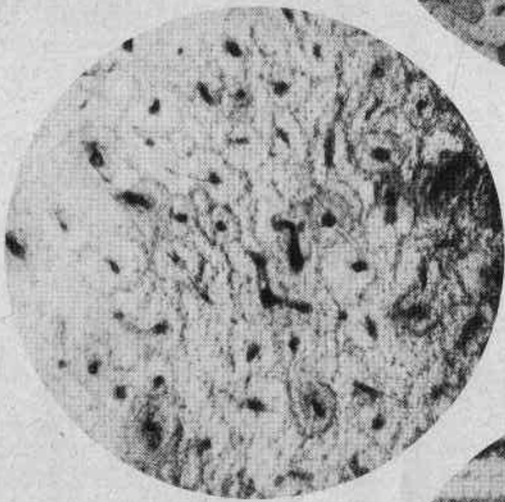
Wave-like structure of the canals in ivory. X25.



Wave-like canal structure in thin section of ivory. X50.

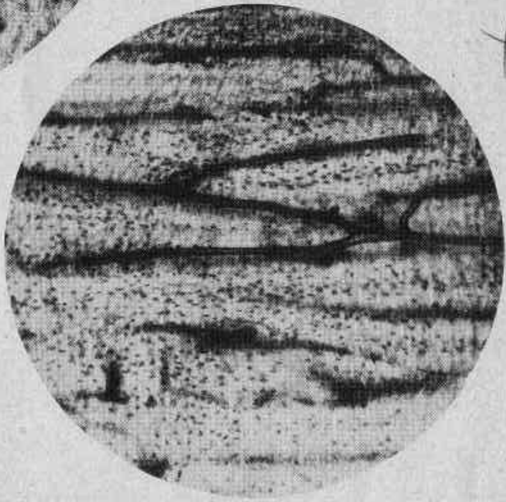
. . . Bone

Transverse section of bone. X25.



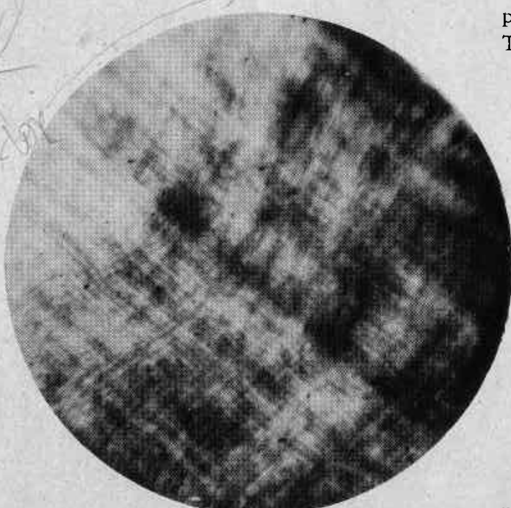
Transverse section of bone. X50.

Longitudinal section of bone. X50.



can have importance as a source of commercial ivory; these are, in general, those animals whose teeth are modified into the form of tusks.

The main source of ivory is from the two existing species of the order *Proboscidea*; the African elephant *(Elephas africanus)*, and to a lesser extent from the Asiatic elephant *(Elephas maximus)*, the so-called Indian elephant. The tusks of the elephants are not canines as tusks usually are, but the incisor teeth of the upper jaw. They are teeth which grow during the whole of the animal's life, and being subject to no habitual attrition from an opposed tooth, being worn only by the occasional use in digging roots, arrive at an extraordinary length and follow the curve originally impressed upon it by the form of the socket. The tusks consist of ivory only, though there may be a patch of enamel at the tip in young "teeth" —the term used throughout the ivory trade for the tusks.



Microphotograph of thin section of ivory showing grain band and wave-like canal structure. X25.

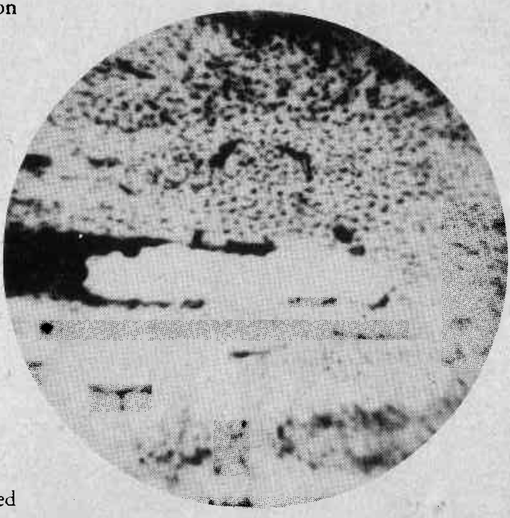
A further member of the proboscidea remains to be mentioned—one that excites awe and imagination—the woolly mammoth *(Elephas primigenius)*, a prehistoric elephant which lived and roamed Europe, Asia and North America before the great ice ages. Well may the reader wonder how such a creature can have an application in an article on modern ivory, for surely the tusks of these warrior animals of the past would, after the countless years, be blackened and destroyed. The fact is that many of these great beasts, with their inordinately long and curved tusks, were overwhelmed by the ice flow which descended from the north during the periods of glaciation. This fossil ivory has been literally kept in refrigeration and has been found in some quantity in the icy arctic wastes about Siberia's Lena river, and, except for perhaps a slight brittleness, differs little from recent ivory.

The large thick-skinned aquatic animal, often termed "sea or river horse", which inhabits the rivers of Central Africa, the hippopotamus *(Hippopotamus amphibius)* produces ivory from its large canine teeth. The tusks, weighing one to six or more pounds and covered by a particularly hard variety of enamel, consists of an ivory whiter and of finer grain than that of the elephant, but of less commercial importance today. Two denizens of the deep supply an ivory which had, and to some extent still has, particularly in Scandinavian countries, a commercial significance. The first of these is the walrus *(Odobaenus rosmarus)*, an amphibious animal of the seal family characterized by the enormous development of the canine teeth of the upper jaw. The other is the narwhal *(Monodon monoceros)*, a species of arctic whale whose spirally twisted "horn" is an incisor tooth projecting straight out from the animal's head on the left side, being one of the only two teeth possessed by the creature, the other being the right incisor which is generally only rudimentary, although occasionally narwhals are found with two "horns". Both walrus and narwhal ivory are coarser in texture than either ivory from the hippopotamus or elephant. Small articles have at times been fashioned from the tusks of the boar and from the conical teeth of the cacholot (sperm) whale, but such material has scant importance.

Bone is the hard material of the skeleton or framework of mammalia, reptiles, birds and certain fishes. It is a substance near to ivory in composition; they both consist essentially of calcium phosphate and an organic material which may be keratin or albumen. For purposes of the arts only the solid part of bone, termed the *compact* tissue, is used; the more cellular center portion, the *cancelleous* tissue, and the gelatinous bones of fishes have no application. The long bones of the ox are those most used, and bone, unlike ivory, requires preparation by degreasing before being worked into the required shape. The production of worked bone is chiefly in the Central European countries and in France.

In attacking the question of the distinction between ivory and bone the gemologist naturally considers first those methods with which he is most familiar. The use of a lens to examine the external structure will often reveal features which tend to indicate, if not to satisfy, what the material is. Elephant ivory may show a typical graining, straight in the direction of the length of the tusk, and in sections cut across the tusk a characteristic "engine turning" effect may be observed. This "engine turning" if seen, proves conclusively that the material is ivory, and ivory from one of the elephants, for it is never seen in the ivory from the other animals, nor in bone. The surface of worked bone generally shows small dark colored dots or short lines, the significance of which will be discussed later, but it is wise to consider this effect as an indication only and not treat it as conclusive proof.

The hardness is about 2½ (Moh's scale) and the refractive index about 1.55 in both bone and ivory and thus give no assistance in identification. The density of ivory was found by the writer experimentally to be



Longitudinal section of bone showing large haversian canal. X50.

lower than for bone and to have a much wider range. Elephant (and mammoth) ivory has a density of between 1.70 and 1.90; hippopotamus ivory between 1.80 and 1.85, and the coarser walrus and narwhal material, and that from the teeth of the boar and the whale, ranges 1.90 to 2.00. Bone, as used in the arts, was found to have a range of 1.95 to 2.20; most of the specimens tested, however, gave a density value of $2.05 \pm .04$.

Probably the simplest and most efficient method to distinguish ivory from bone is by examination of the internal structure. This may be conveniently done by removing a small peeling with a sharp knife from an inconspicuous part of the specimen; pressing flat on a 3 x 1 glass microscope slip and adding a drop of oil (clove oil; R.I.=1.54, or oc-monobromo-naphthalene; R.I.=1.66) and observing the structure with a low-power microscope. Ivory shows a series of alternating light and dark bands corresponding to the grain (especially apparent if the peeling be rather thick), and a close-grained regular texture of brownish hair-like markings which undulate wave-like across, and at right angles to, the grain lines. These fine canals, usually filled with a brownish gelatinous solution to which ivory owes its beautiful polish, in life conduct the sensitive nerve fibrils which radiate outwards from the central canal in the tusk. It is by the observation of these wave-like canals that ivory is completely distinguished, but some care is necessary for there are directional differences. Should the peeling be a longitudinal section which is parallel to the radius of the tusk the wave-form is most pronounced, but if still longitudinal but at right angles to the first direction, i.e. tangential to the length of the tusk, the section cuts off the canals across the tubes and a series of dots are seen, which do, however, appear to show a tendency to produce a wave-like picture. Transverse sections show the fibres in length but with a less pronounced undulatory form. It is thus best to try for peelings in two different directions.

A peeling of bone, similarly treated, exhibits a totally different picture. A section cut across the bone shows a pattern consisting of a number of circular or oval spaces surrounded by a concentric structure which contains a number of small seed-like spaces or *lacunae*. Numbers of these spaces are dispersed throughout the whole of the tissue which is transversed by many fine meandering canals. The larger circular spaces with their attendant concentric structure are the canals which in life pipe the vital fluids through the bone structure, the system being called the *haversian system* after an 18th Century English anatomist, Clopton Havers. In longitudinal sections the haversian systems are cut parallel, or at an oblique angle, to their length, hence the open spaces are oval, long and parallel, or may be branched and appear like twigs. In such sections there is no sign of concentric structure but the main mass of bone contains myriads of lacunae. The cross section when viewed between crossed-nicols shows the cut-across haversian systems to be built of radial crystallites, for each system shows an 'extinction cross', and either section, if of suitable thickness, shows strong polarisation colors.

The bluish white fluorescence color exhibited by both ivory and bone when irradiated by long-wave ultra-violet light (approx. 3650A°) did not convince the writer that fluorescence is a quick and easy test to distinguish ivory from bone. Whether the short wave-length ultra-violet light lamp (approx. 2650A°), so much used in America, would give a better distinction can only be found by experiment. We in England do not have this lamp so cannot give the answer.

"Summing up", the examination of the internal structure will clearly show the difference between ivory and bone. It is a method applicable to a specimen whether it be mounted or embellished with gems or other materials, or be alone but of such a size that a density test, itself unreliable owing to the present use of certain plastics, cannot easily be carried out. The objection that a peeling might damage the specimen is rarely valid, for in most worked ivory there is some part or raw place where the knife can be dexterously employed without apparent damage.

Review of Diamond Industry

by

DR. SYDNEY H. BALL

As digested by *Kay Swindler*

In his 23rd *Annual Review of the Diamond Industry,* as written for, and published by, the JEWELERS CIRCULAR-KEYSTONE, Dr. Sydney H. Ball, mining engineer, diamond consultant, and G.I.A. Educational Advisory Board member, brings a clear, comprehensive and authoritative picture of interest to every retailer and wholesaler in this country and abroad.

The report, which covers all phases of the diamond industry for the year 1947, should be read by all interested in any phase of the industry. As usual, in addition to thorough coverage of domestic and foreign markets, cutting, production, imports, research, government dealings, identifications, attempted diamond synthesis, fashions in jewels, it also gives detailed information on investments, smuggling, thefts, war loot, demand, government regulations and many other significant reports.

Although figures regarding diamond production are not available from all countries, Dr. Ball believes a fair degree of accuracy can be accredited to the estimates showing 1947 production about 95 percent of the previous year, according to weight. The loss shown was in industrials. According to value, 1947 production was approximately 92.5 percent of 1946.

The Belgian Congo was the principal producer of diamonds during 1947, yielding by weight 56 percent of all mined. Although the British Commonwealth shows only 31.1 percent of the weight for the year, the value of diamonds from this source represented 68 percent of all produced during the year. The Belgian Congo, the Union of South Africa, and Tanganyika produced less than in the previous year while the Gold Coast, Sierra Leone, South West Africa, and Venezuela produced more.

Since in Tanganyika only 20 percent of the yield is industrial, it becomes one of the important diamond fields of the world due to the quality of its production.

INDUSTRIAL DIAMONDS

About 6,907,000 carats of industrials of which 4,500,000 carats were crushing bort, were produced in 1947. Imports of this country in 1947 were between 4,000,000 and 4,500,000 carats which compares with the previous year's consumption of industrials. Dr. Ball warns that the supply of bort is still light and in certain grades short and that it should be considered a precious material by all and be utilized carefully. He further points out that there is no satisfactory substitute for the industrial diamond. Prices of industrials are steadier than those of gemstones.

CUTTING

According to Dr. Ball, it will be still some time before more gem rough is available. He further predicts, due to the over-

(Continued to page 113)

The Triclinic System and Feldspars

The triclinic crystal system is the sixth and last to be illustrated in our series of color plates. This system is interesting because it is at the same time the simplest and most complex. To the mathematical crystallographer it is the simplest because it is the general case, there being no special conditions such as right angles or axes of equal length. In actual practice it is the most complex since any calculations made on triclinic crystals are difficult and tedious.

The triclinic system is the least symmetrical of the six, some crystals having only a center of symmetry and others no symmetry whatever. Triclinic crystals are always described by referring them to three axes of reference. These axes are all of different length and all of the angles between them are oblique.

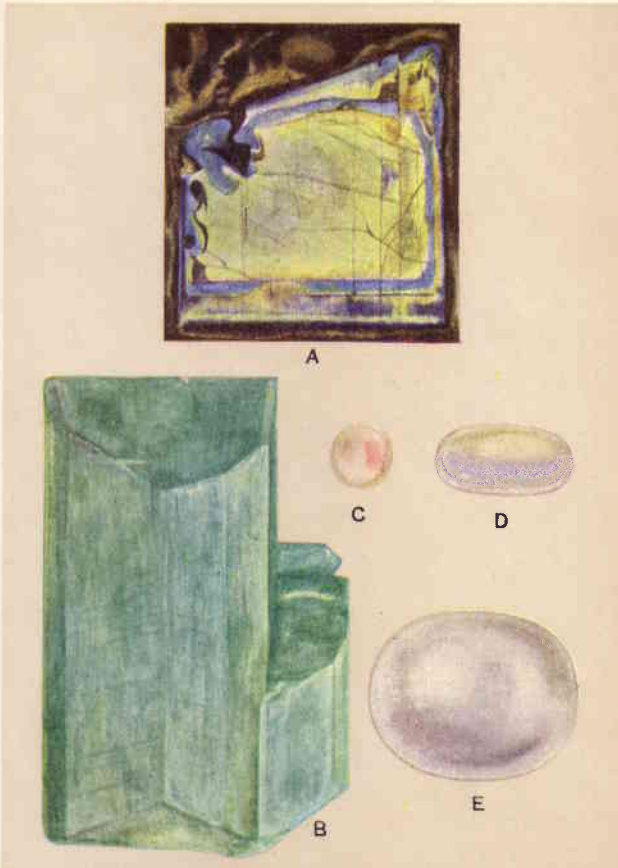
Only six gem minerals crystallize in the triclinic system. These are turquoise, labradorite feldspar, microcline feldspar, axinite, rhodonite, and kyanite. Of these turquoise is by far the most important, labradorite and microcline are fairly common, but axinite, rhodonite and kyanite are rarely seen as gems.

Turquoise is only very rarely found in crystals, but is usually massive and fine-grained. Labradorite is usually found in large cleavage masses and rarely in good individual crystals. It is noted especially for its flashes of color, caused by interference of light in intricately twinned crystals. Labradorite is a member of a continuously variable member of the feldspar group known as plagioclase. Another member of the plagioclase series is albite, a crystal of which is shown in figure B of the color plate. Microcline, another member of the feldspar group, is sometimes used as a gem, especially the green variety known as amazonite or amazonstone. Axinite is a complex silicate not common as a mineral and still less so in gem quality. It is rarely found in pale yellow or brown crystals having sufficient transparency to be cut as gems, but is never seen in the jewelry trade. A crystal of axinite is shown in A of the color plate. Rhodonite, a silicate of manganese, is red in color and nearly opaque. It is used occasionally as an ornamental stone, very rarely in jewelry. A crystal of rhodonite is shown in C of the color plate. Kyanite, silicate of aluminum, is a rather common mineral but very rarely found in gem quality. When of gem quality, however, it is a beautiful stone since it has a fine sapphire blue color. It is never seen except in collections.

Feldspars

The feldspars form one of the most important mineral groups. They are silicates of aluminum with potassium, sodium and calcium. The feldspar group is very complex and is made up of several members. Some crystallize in the monoclinic system, some are triclinic. All have good cleavage in two directions, hardness about six and specific gravity ranges from 2.55 to 2.75.

The important members of the feldspar group are orthoclase, microcline and plagioclase. Orthoclase is the monoclinic form of potassium feldspar, while microcline has the same chemical composition but is triclinic. Plagioclase is the name applied to a continuously variable series of feldspars rang-

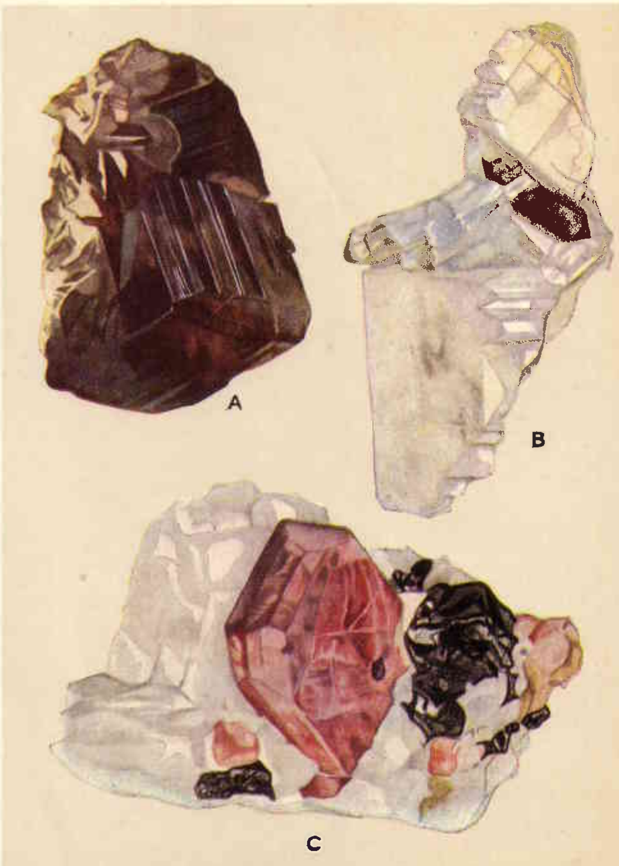


FELDSPARS

Labradorite, showing the broad display of colors common to it, is shown at (A). Aside from occasional use as gem material, it is widely used as an ornamental stone. Figure (B) shows a crystal of Amazonite from Pike's Peak, Colorado. This is a common jade substitute. The illustration of sunstone at (C) does not reveal the identifying characteristics, namely the reddish or yellowish cast, a result of the reflections from metallic inclusions. A moonstone cat's eye is shown at (D) and a large precious moonstone at (E). Specimens from the collection of British (Natural History) Museum, London.

PLATE XVI

Printed in England.



CRYSTALS: TRICLINIC SYSTEM

The mineral axinite (A) takes its name from its wedge or axe shaped crystals. Gems occur in clove brown, honey yellow and rarely in blue. Principal locality is Bourg d'Oisans, France. Albite (B) is the soda feldspar. The crystals are triclinic and frequently twinned. Its name, due to its unusually white appearance is derived from the Latin albus (white). Rhodonite (C) at its best finds wide use as an ornamental stone. This fine crystal is from Franklin Furnace, New Jersey. Specimens from the collection of British (Natural History) Museum, London.

PLATE XVII

Printed in England.

ing from albite, the pure sodium member to anorthite, the pure calcium member. Intermediate members of this plagioclase series are termed oligoclase, andesine, labradorite and bytownite.

The most important gem varieties of feldspar are moonstone, sunstone, amazonite and labradorite. Moonstone, shown in D and E of the color plate, is a variety of orthoclase which exhibits the property of adularescence. Sunstone may be either orthoclase, or a member of the plagioclase series such as oligoclase, which shows reddish flashes due to reflection from inclusions of a foreign mineral such as hematite. Amazonite, shown in B of the color plate, is a green variety of microcline. It is used widely as a gemstone, especially as a substitute for jade. Labradorite, shown in A of the color plate, is used as a gem when it shows vivid flashes of color due to interference of light by twinned crystals.

Diamond Review

(From page 112)

amount of rough for cutting and the resulting lowering of wages for such work, that a number of cutting centers will disappear or languish. Among the centers to cut larger stones Dr. Ball believes Holland, America, and South Africa are most likely to survive. Belgium and possibly Palestine are selected as the two centers most likely to continue among the cutters of small stones.

At the end of 1947, 15,500 cutters were employed. At the beginning of that year there were from 3,000 to 3,500 in the United States. However, both America and Palestine, Dr. Ball reports, are feeling the competition exerted by Belgium since early in 1946 when that country regained its place as the world's premier diamond cutting center.

Palestine during 1947 lost much of the phenomenal ground it had gained during 1946. At the beginning of that year 4,500 cutters were employed. This number was reduced to 500 during 1947. Wages were also lowered. Smuggling and black markets, as well as the increased political unrest in the Holy Land, have been responsible for the retardation of diamond cutting in that center.

In Holland a shortage of labor is not deterring the country from making a brave attempt to regain its former position in the cutting industry. The Netherlands has not however, as yet, regained the position as a dealer in industrial diamonds which it held in prewar days.

In South Africa about 48 employers and some 600 artisans are engaged in this important and exacting work. That country and the United States have the highest wage scale of all cutting centers although in April of 1947 cutters in South Africa accepted a wage cut of 25 percent.

During the war years from 3,000 to 3,500 artisans were employed in Brazil where the diamond cutting industry has been functioning for more than a hundred years. At that time the principal source of cutters was from Belgium and The Netherlands. Now that many of these Belgian and Dutch refugees have returned to their homelands, it is believed in the immediate future the total number of cutters in Brazil will be nearer a few hundred.

Although rumors persist that cutting has been resumed at Idar-Oberstein, no authenticated reports are given. One report denies that diamonds are being cut at the German gem center and claims that all the 3,500 prewar diamond cutters are polishing synthetic stones.*

In Cuba, at one time during the war, 3,000 cutters were employed. This number had dwindled to 1,000 by the end of 1946 and greater reductions are believed to have taken place more recently. The 600 cutters

(Continued to page 126)

***In the next issue of *Gems & Gemology* we hope to have an article on the present activities at Idar-Oberstein which is now being prepared by Prof. Dr. Schlossmacher, director of the Gemological Institute of that city.**

Light

(From page 104)

trated by the broken line for phase relationship along the reflected path O″B′. Following the relationship of phase in the former ray, we note the difference in phases and find that interference of light will occur at O″ when the reflected and refracted rays meet. In fact the point O″ would appear to be dark when viewed at the angle shown for the path of the rays B′O″ (reflected) and B′O″O′ (the refracted).

Thus we see that if the path difference in a substance such as glass is such that the distance traveled is equal to a whole wavelength (λ) or any whole multiple of this distance, total interference will occur and a dark area or band will be produced. In Figure 5 we see that the path O to O′ to O″ is equal to two wave lengths.

If this distance, however, is a half wavelength $1/2\lambda$ or an odd multiple of half waves, the light will be intensified over the normal reflected light.

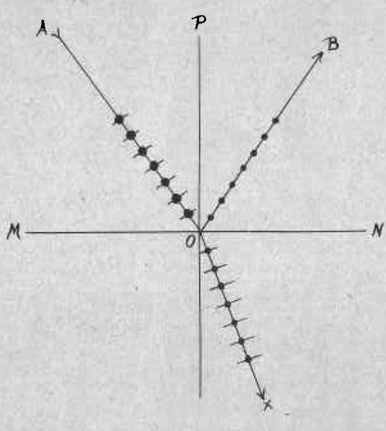


Figure 4. **Unpolarized ray AO in striking surface of glass MN will be reflected (OB) and refracted (OX) with same amount of partial polarization. However, since only a small percentage of total ray is reflected, ray OX will have more polarized light than ray OB.**

Maximum Illumination $= 1/2\lambda, 3/2\lambda, 5/2\lambda$, etc.

Maximum Interference Darkness $= n\lambda, 2\lambda, 3\lambda$, etc.

POLARIZATION

In the following portion of this article we shall take up the underlying principles of the polarization of light. Heretofore, we have been dealing with light in its simplest form and, for the most part, we have ignored the vibrational directions of wave motion. Now we shall be required to think in a more complex manner. Polarization is the process of resolving the extremely complex vibrations of ordinary light into vibrations taking place in definite directions or in definite planes.

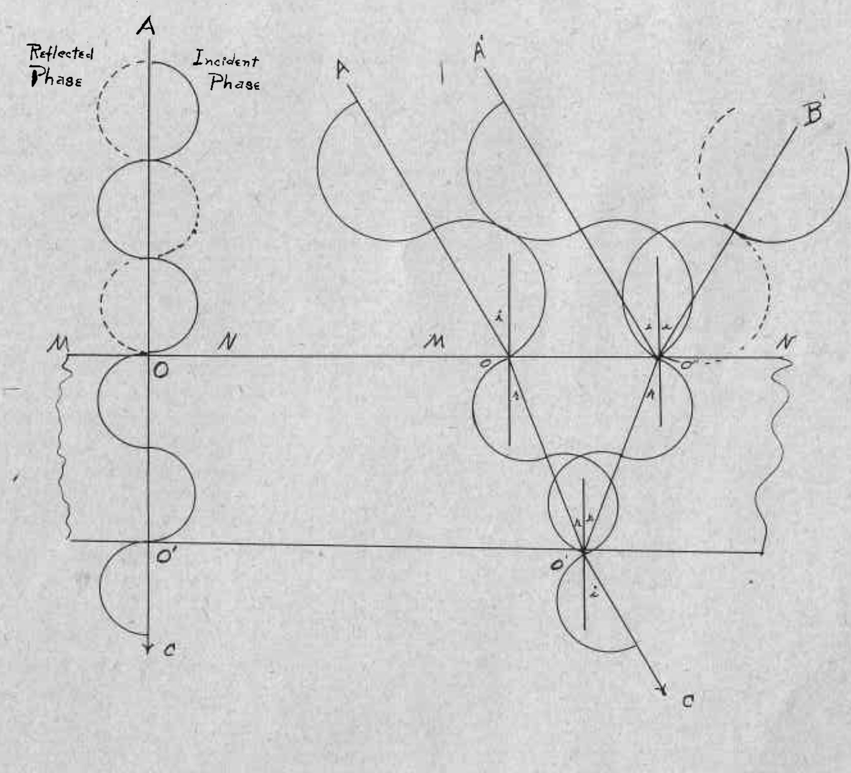
A classic example used to show motion progressing forward and a particle moving in a transverse plane also is the action seen in a simple coil spring when it is expanded and contracted. If we expand a simple coil spring, having one end securely fastened, and which we may regard as the origin of motion, our first and most obvious motion is that along the direction of stretching whereby the coils are moved apart. However, in order to produce this effect, motion had to be conveyed along each part of the whole. The progress of this motion followed the coils from side to side, front to back and then repeated this all over again. This circular advance is similar to the transverse motion of light. The total forward motion which is that seen as the separating of the coils, is analogous to longitudinal motion. Now, as said before, polarization is the mechanics whereby this type of compound transverse, longitudinal motion is reduced to a forward motion and one single transverse vibration.

Figure 4 shows at A an incident ray of unpolarized light which strikes the surface of a piece of glass. The reflected ray OB is partially polarized as is the refracted ray OX. The amount of *polarized* light in rays OB–OX is exactly the same. However, since only a small percentage of the total ray AO is reflected, the ray OB has a much higher percentage of polarized light than ray OX.

At this point it should be pointed out that two terms are used in describing and illustrating the direction of polarization. Older books on optics refer to plane of polarization, whereas newer books refer to plane of vibration. Before polarization was well understood, light reflected from a surface was said to be polarized in the plane of *incidence* or reflection. Now, however, it is definitely known that the plane of vibration is parallel to the reflecting surface, or perpendicular to the plane of incidence. Hence, the older term plane of polarization is at right angles to the actual plane of vibration. The term plane of vibration will be used uniformly in this discussion.

In Figure 4, let AO be the incident beam at the point O upon glass surface MN. Light is vibrating in all directions concentric around ray AO, but by resolution of vectors may be considered to be vibrating in but two planes, that of the page represented by lines, that at right angles to the page, i.e., emerging from the page, by dots. The vibration represented by lines is in plane of incidence, the vibration represented by dots being in parallel plane to surface of glass. Now the majority of those

Figure 5. When a light wave strikes a denser medium, the refracted ray will continue on in same phase as the incident ray, but the reflected ray will undergo a change in phase equivalent to one half wave length. When passing from the dense medium to a less dense medium, neither the refracted nor reflected ray will change phase.



vibrations parallel to the surface of the glass at the point of reflection are reflected towards B and thus the reflected ray OB is a polarized ray, vibrating in plane parallel to the surface of the glass, but said to be plane polarized in the plane of incidence. To prove this point experimentally, one need only examine light reflected from such a surface through a Nicol prism or similar analyser. Rotation of the Nicol will cause this reflected ray to darken and lighten depending upon its orientation. Polarization from a single reflecting surface, however, is seldom complete and the amount or degree to which the reflected ray is polarized is controlled by the refractive index of the substance and the angle of the incident light.

A physicist by the name of Sir David Brewster in studying the behavior of plane surface reflections and polarization found there was an angle at which polarization became maximum. Also the intensity of the polarized reflected ray varied in a similar manner with changes of incidence and reflection.

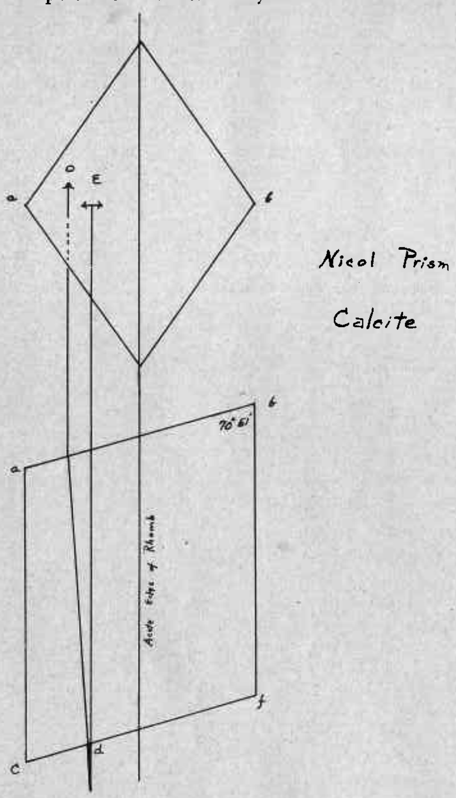
Brewster's Law says the angle of incidence for maximum polarization is that angle whose tangent is the index of refraction of the reflecting substance.

In formula form then:

$$\frac{\sin i}{\sin r} = N \text{ or } \frac{\sin i}{\cos i} = \tan i = N$$

This relationship is such that the angle between the reflected ray and the refracted ray is 90°.

But what of the refracted ray? This brings before us a very interesting phenomenon. The refracted ray is partially polarized and the same absolute amount of plane polarized light is present in it as there is in the reflected ray. There is another interesting fact which should be pointed out. Those rays which are transmitted and which are not perpendicular to the reflecting surface have their planes of polarization shifted. A light ray which passes through a succession of glass plates becomes thereby more



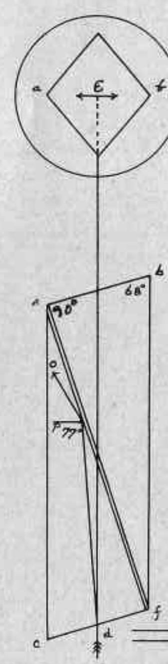


Figure 6. In general when a beam of light passes through a doubly refractive material it is broken into two beams (ordinary, o, and extraordinary, e), each having different characteristics and different planes of polarization. Right hand figure is a cross sectional view of a Calcite Prism or Nicol Prism wherein one component of the two rays in the former Calcite crystal is eliminated and a single resultant plane polarized ray evolved.

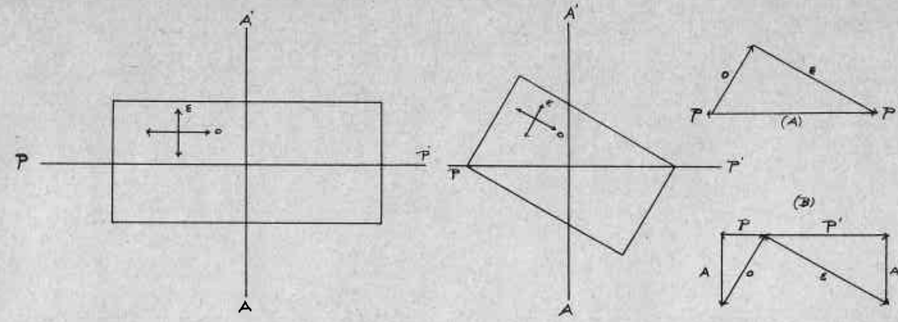


Figure 7. **Examination of anisotropic material between crossed polaroids. (See article for complete explanation.)**

and more completely polarized. Each succeeding plate causes surface reflection and consequent weakening of vibrations in this direction which causes thereby more deviation in the resultant polarized planes. Ultimately the shift (or resolution) will become quite complete and the emergent light will be completely polarized in the plane of the light perpendicular to the original surface of the plates. Experimentally seven or eight glass plates are sufficient to produce light which is quite completely polarized by reflection. It is interesting to note that polarization always takes place in two mutually perpendicular planes, never at any angle other than 90°, and the absolute amount of polarized light is always the same in each of the two planes.

ANISOTROPIC MATERIALS

Polarization may also be produced by substances which have a proper crystalline structure. It occurs in anisotropic materials whenever light enters the specimen in a direction which is not parallel to an optic axis. In such substances the light not only suffers polarization but it is decomposed into two components which travel through the crystal with different velocities and are polarized in mutually perpendicular planes. This phenomenon of beam splitting is called double refraction. One of the refracted beams is called the ordinary ray for, in its refraction, it obeys the ordinary laws of refraction. The other, however, behaves in an eccentric fashion for it is bent out of the plane of incidence. This abnormal behavior occurs even at perpendicular incidence and the ray has been called the extraordinary ray (Symbols w & e, omega and epsilon).

In Figure 6 at the left hand side is pictured a Rhomb of Calcite looking sidewise at the crystal and parallel to its long axis (crystallographic) or optic axis. A ray of light incident upon the under side or basal section a d, will upon entering the Calcite break into two rays. One will follow the ordinary laws of refraction and is bent (deflected) from its original path according to the previous relationships of incident angles to refracted angles. This ray is called the Ordinary Ray and has been given the designatory symbol o to identify it.

This ray o will have its vibrations polarized, i.e., the plane of polarization will have a definite position to the crystallography of the Calcite crystal structure. The direction of the vibrations in the ordinary ray are shown in the upper portion or projection of the basal section.

The other or extraordinary ray, symbolized by e does not follow the regular refraction laws; however, the vibrations in this ray are plane polarized. This plane is perpendicular to the plane of vibrations in the ordinary ray. This plane is shown in the upper projection of the rhomb at e.

At the right hand side of Figure 6 is drawn a cross sectional view of a Calcite Prism or Nicol Prism wherein one component of the two rays in the former Calcite crystal may be eliminated from consideration and a single resultant plane polarized ray evolved. Two crystals of Calcite are usually cut with the angles and faces as shown and cemented together along the long diagonal direction af with balsam. The incident ray of light, incident at d, breaks into the two components as before the ordinary and the extraordinary rays. The ordinary ray in its progress meets the bounding edge of the crystal and balsam at the diagonal in such an angle that it is totally reflected (greater than the critical angle for the calcite and balsam combination —which is in this case 77° to the normal) and travels towards O and thus does not enter into the upper crystal of Calcite of the compound Nicol.

The second ray e (the extraordinary) however passes through the prism with almost no deviation from its original course. Its index of refraction and that of the Canada Balsam are nearly the same, hence the ray suffers almost no deflection at this point and passes out of the upper face of the prism. The light enters the upper prism and upon emergence at the top of the combination belongs wholly to one ray and is all vibrating parallel to the shorter diagonal of the rhomb and surface.

Combining two such Nicols one may observe the effects upon minerals when subjected to plane polarized light. Such a combination of two Nicols may be known as a Polariscope, Polarizer and Analyzer depending whether one speaks of the components separately or the combination as a whole.

When sections of double refracting minerals are examined in polarized light certain interference effects are commonly obtained that are of great importance. As shown above with calcite when an anisotropic substance is placed in a ray or beam of ordinary light, two rays are produced which have different characteristics and different planes of polarization. This is true of sections of all double refracting minerals, in general. Let us consider what might take place when a general section of an anisotropic mineral is placed in a polariscope between polarizer and analyzer, the planes of vibrations of which are at right angles to each other. That is to say the passage of light is extinguished and the Nicols are said to be crossed.

In Figure 7, let the outline represent such a section. The double arrows marked o and e show the two possible directions of vibration of light in the section. The direction P-P′ represents the plane of vibration of light which emerges from the polarizer, below and A-A′ shows the direction in which light must vibrate when it emerges from the analyzer above, in order to be seen.

In the first case to be considered, at the left in the figure, the directions o and e are taken as parallel to P-P′ and A-A′ respectively. The light that enters the section from below must all vibrate parallel to the direction P-P′. It enters the mineral and must vibrate there as the ordinary (o) ray. There will be no extraordinary ray vibrating in the direction of e, as a vibration parallel to the ordinary ray (o) cannot be resolved into another at right angles to it. The light will leave the section, therefore still vibrating parallel to P-P′ and enter the analyzer above it. It will be entirely lost in the analyzer (at the balsam layer) since the Nicols are crossed and only rays vibrating in the direction A-A′ can be passed through the analyzer. Thus the section in this position will appear dark through the polariscope.

The same reasoning may be used if the section is turned 90° from its present position. Thus it may be seen that there are or will be four positions in one revolution of the section about an axis perpendicular to A-A′ and P-P′ when the section will appear dark and no light will pass through the polarizer system. At each of these four positions the section is said to be extinguished.

In the central portion of the figure we show an oblique section. The directions A-A′ and P-P′ are the analyzer and polarizer directions as before. Also, o and e show the vibration directions in the section. To

(Continued to page 126)

Pink Diamond Gift to H. R. H. Princess Elizabeth

Comparative size of rough stone shown by thumb and forefinger.

As a wedding gift, Dr. J. T. Williamson presented Her Royal Highness The Princess Elizabeth with a rough 54 carat diamond of a deep pink color which had been found in his Tanganyika mine.

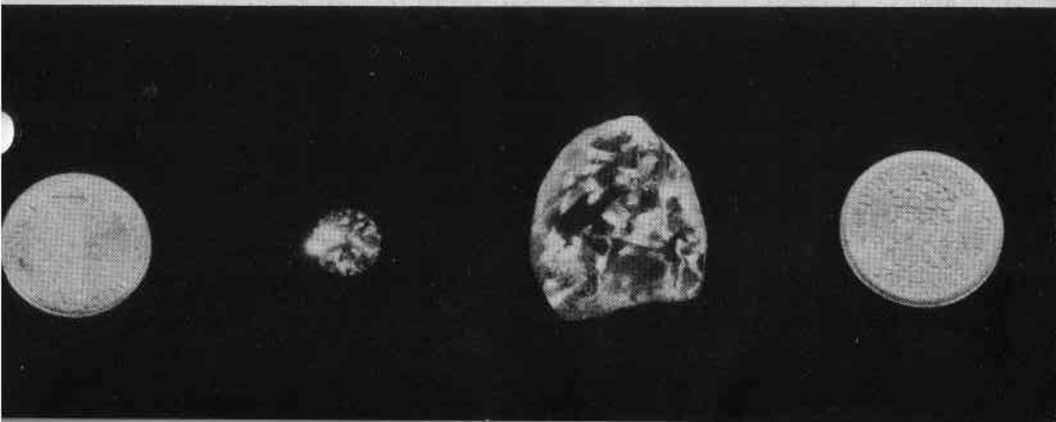
Gems & Gemology is informed by the Diamond Trading Company, Ltd., that in February, 1948, after very careful examination of the crystal, its cutting and polishing was entrusted to the firm of Briefel & Lemer of London. Upon examination of the diamond, the cutter recommended a brilliant cut and estimated a total recovery of approximately 15 carats.

The rare colored stone is described by the Diamond Trading Company as pure and of an original vague heart shape with one concave side. There was some risk that this cavity would not disappear when it was polished to its estimated dimensions, with the result that any recutting would greatly reduce its weight. The diamond was considered of such rarity and beauty that Mr. Breifel determined to polish it to shape and so avoid any risks in sawing or cleaving.

At the "cross-work" stage the pink diamond weighed 38.5 carats and still retained its rare pink color which was constant through the stone. Hopes were raised that the diamond might, when finished, weigh considerably more than the minimum guaranteed by the firm.

The polishing was completed April 14, 1948 and the result was a perfect brilliant of a deep pink color weighing 23.6 carats. The future of the unique pink diamond is not at present known as Her Royal Highness has not yet decided on the manner in which the stone will be mounted.

Below the 54 carat crystal is shown with a two carat brilliant, an English sixpence and a dime. Rough crystal cut to 23.6 carats when completed.



New Classification of Rough Diamonds

in Use by De Beers Company

DE BEERS CONSOLIDATED MINES, LTD., have recently supplied the Gemological Institute of America with the following classifications now in use by that company in grading rough diamonds at the Dutoitspan, Wesselton and Bultfontein mines (De Beers and Kimberley closed). Graduates and advanced students of the Institute will notice that the new classifications differ somewhat in terminology from the older classifications contained in the Institute's diamond course. This new classification will now replace the old one in that course.

a) **Close Goods.**

b) **Irregulars and Shapes** as in "a" but not necessarily symmetrical or octahedral.

c) **Spotted Stones.**

d) **Cape and Yellow Spotteds** as in "c" but of a progressively deepening yellow color.

e) **Browns.** Stones of a progressively deepening brown color.

f) **Greens.** Stones of a progressively deepening green color.

g) **Melee** "a" to "f" in sizes under one carat and larger than "l."

h) **Cleavage.** Broken pieces of a reasonable thickness, and not "twinned" (Macled or Naated).

i) **Chips** as in "h" but under one carat in weight.

j) **Macles.** Twinned crystals of a reasonable thickness.

k) **Flats.** Thin pieces, whole or broken, including thin macles.

l) **Sand.** All qualities in a very small size, passing through a .070 inch sieve.

m) **Industrials.** Diamonds not suitable for cutting, and allocated to industrial uses, including bort, which is only suitable for crushing into diamond powder.

The percentages of each classification as of 1948 was estimated by the Sorting Room of De Beers Consolidated Mines, Ltd., as a comparison.

	Description	*Bultfontein*	*Wesselton*	*Dutoitspan*
a)	Close Goods	.40	1.91	3.44
b)	Irregulars and Shapes	.19	.73	5.56
c)	Spotteds	15.78	6.30	8.05
d)	Cape and Yellow Spotted	.43	.54	9.54
e)	Browns	.50	.94	2.38
f)	Greens	1.44	----	1.50
g)	Melee	15.39	10.67	5.79
h)	Cleavage	6.10	6.38	17.83
i)	Chips	4.76	5.04	4.17
j)	Macles	5.25	3.71	7.39
k)	Flats	5.63	11.21	9.05
l)	Sand	2.04	2.80	.82
m)	Industrials	42.09	49.77	24.48

A study of these figures reveals that only half of the production of Wesselton is suitable for cutting; that in Bultfontein this figure is less than 66%; and in Dutoitspan less than 75%. Since flawless stones of fine color are cut from the first two classifications (a) Close Goods and (b) Irregulars and Shapes, it can be seen that only about 2% of the average total production of the three mines is of this quality.

Here is again evidence of the few diamonds of fine color and purity in comparison to the proportionate number of diamonds sold as blue white and perfect. A comparison of this table with the older and similar tables in the Institute's diamond course shows that the percentage of fine stones is decreasing, especially in the Bultfontein mine. It is the Dutoitspan which shows improvement in percentage of all the better qualities.

It is believed that the following statistics, also prepared by De Beers Consolidated Mines, Ltd., should likewise be of interest to our readers.

TOTAL PRODUCTION OF DIAMONDS

From 1888 to 30th June, 1948

Mine	*Metric Carats*
De Beers Mine	23,201,719¼
Kimberley Mine	14,624,822
Wesselton Mine	16,096,230
Bultfontein Mine	17,412,795½
Dutoitspan Mine	8,831,712½
Total	80,167,281¼
Tailings (30th June, 1901 to 30th June, 1915)	3,350,111¾
Grand Total	83,517,393

Research Laboratory Erected in South Africa

Recently erected in Johannesburg, South Africa, is a Diamond Research Laboratory which is devoted exclusively to investigations on all phases of the diamond.

Sponsored and maintained by Industrial Distributors Limited, research is concerned with immediate practical problems on methods of recovery and extraction, improvements in diamond tools and the extension of their uses, the application of scientific control and instrumentation to the diamond cutting and polishing industry. Long term theoretical investigations on the relationships between the structure and properties of the diamond, how and why stones differ in physical properties, and functional characteristics are also a part of the research conducted.

All types of diamonds are examined by X-ray procedures. There is also a Microscopical Room and a Spectrographic Room. In the Cutting and Polishing Room experienced diamond cutters are employed. Not only do they endeavor to affect possible improvements in their own art, but they also provide cut stones for other research workers in both industrial and gemstone investigations made at the Laboratory.

The staff of the Laboratory is composed of experienced chemists, physicists and engineers from Europe and South Africa. Its director, Dr. R. S. Young, was previously associated with large research organizations in Northern Rhodesia and Canada.

Industrial Distributors Limited, sponsors of the Research Laboratory, includes the following primary producers: Anglo American Corporation of South Africa Limited, De

(Continued to page 124)

Gemological Digests

Topaz Colored By Radium

A step cut seven carat brown topaz has recently been presented to the U. S. National Museum by Nicola G. D'Ascenzo of Philadelphia, Pennsylvania. This stone is of unusual interest because its original pale blue color was changed to a deep rich brown by exposure to radium radiation.

The following information regarding the topaz was very kindly supplied by Mr. D'Ascenzo: The stone was irradiated by three grams of radium contained in 30 glass tubes, which in turn were placed inside of thin-walled brass tubes. These tubes were stacked to a depth of two inches in a lead container and the stone, in a paper envelope, was laid on top of them.

At intervals, the topaz was examined for color and induced radioactivity. At the end of one week it had turned light amber, at the end of a second deeper amber, at the end of a third no further change and at the end of four weeks still no further change. At no time was any induced radioactivity detected. The experiment was carried out during the period of September 17 to October 18, 1948. No indication of fading or change of color has been observed since that time, during which the stone has been kept on a gem paper, but examined numerous times in strong daylight.

Further experiments were also carried out on other gems with interesting results. A yellowish white sapphire crystal turned dark amber in two weeks with no further change in four weeks. A purplish white sapphire turned olive in one week with no further change in four weeks. A blue-gray star sapphire changed to a more pronounced gray in a week, to gray with an olive tint in two weeks and no further change in four weeks. A blue sapphire and a brown star sapphire showed no change after four weeks.

By George Switzer, Associate Curator, Division Mineralogy and Petrology, U. S. National Museum. Published by permission of the Secretary, Smithsonian Institution, Washington, D. C.

GIA Educational Boards Meet

One of the most important recommendations made by the GIA Educational Boards during their meeting November 13 at the Hotel Pennsylvania in New York City, was the consolidation of the Educational Advisory Board and the Examination Standards Board of the Institute. Presented as a recommendation by the committee, headed by GIA's president Dean Edward H. Kraus, the proposal will go to the GIA Board of Governors for final approval.

Further recommendation was that foreign members or those unable to attend meetings be known as Honorary Members of the Educational Advisory Board. It was also suggested that active members be selected for periods of one, two, and three years with no limitations on reelection. An increase in trade representation was also felt desirable in order to secure a better balance of trade and educational membership.

Those Board Members in attendance at the New York meeting in addition to Chairman Dean Edward H. Kraus were Dr. Sydney H. Ball, Dr. William F. Foshag, Dr. Harry H. Hess, Dr. Ralph J. Holmes, Dr.

Cornelius Hurlbut, Dr. George Switzer, Lloyd Lassner, Richard T. Liddicoat. Charles H. Church, Eastern Member of the GIA Operating Committee, and G. Robert Crowningshield, GIA Director of Education at its Eastern Headquarters, were guests.

Other members of the GIA Educational Advisory Board who were unable to attend the November 13 meeting included: Robert M. Shipley, GIA Director and Chairman of the Board; Dr. Paul F. Kerr, Columbia University; B. W. Anderson, London; George Engelhard, Chicago; P. M. Fahrendorf, New York; Dr. R. P. D. Graham, Montreal; Paul Grodzinski, London; Dr. John W. Gruner, Minneapolis; David H. Howell, Claremont, California; Dr. Frederick K. Morris, Boston; Gus H. Niemeyer, New York; Robert M. Shipley, Jr., Los Angeles; Prof. W. D. Shipton, St. Louis; Dr. Chester B. Slawson, Ann Arbor, Michigan; G. F. H. Smith, London; Dr. L. J. Spencer, London; and Alpheus F. Williams, Capetown, South Africa.

Diamond Find in Canada Doubted

Several months ago a northern prospector, John J. Johnson, reported the discovery of five rough diamonds in a wall of blue ground approximately 100 miles from Flin Flon, Saskatchewan. He claimed that one of the stones was as large as a marble and had been valued in the rough at $300 by a jeweler.

Although Johnson made application for exclusive prospecting rights, the Saskatchewan Department of Natural Resources and Industrial Development advises the Gemological Institute that no diamonds have been passed to anyone in the Saskatchewan Department of Mineral Resources for examination or identification. Actually, according to the Senior Geologist of the Saskatchewan Department of Natural Resources, no qualified person has ever seen one of the diamonds reported found in the province.

It would seem with these facts at hand that the possibility of Canada's becoming a second South Africa in the immediate future is rather doubtful. Should these five stones have proved genuine it would have marked the first time that diamonds have been found in kimberlite in Canada although geologists believe that the discovery of a pipe at some spot adjacent to the Hudson Bay region is not improbable since alluvial diamonds have been found in Indiana, Ohio, Michigan, and Wisconsin. Study of the regions in which they have been discovered indicates that they have been carried down by a retreat of ice in the Pleistocene period from an original source believed to be located somewhere in Central Canada. Whether this deposit exists at this time cannot be stated with certainty, since it could have been completely eroded during the glacial movements.

Gemologist Titles Awarded by A.G.S.

Since last reported in this publication twelve Certified Gemologist titles have been awarded by the American Gem Society to former GIA graduates.

These twelve men are Gilbert B. Oakes, E. J. Scheer, Inc., Rochester, N. Y.; Richard N. Talcott, Talcott Brothers, Olympia, Washington; Lester B. Benson, Gemological Institute, Los Angeles; Edward H. Schewe, Louis Esser Company, Milwaukee; David Widess, I. Widess & Sons, Los Angeles; Thornton J. Manry, The Green Jewelry

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Company, Kansas City; Dr. George Switzer, Smithsonian Institution; Herbert E. Reid, Henry C. Reid & Son, Bridgeport, Connecticut; George Robert Crowningshield, Gemological Institute, New York City; Franz F. Pulver, Bronx, New York; T. C. Brown, Lemon & Son, Louisville; and Wesley Savage, Wm. H. Gilchrist, Santa Barbara, California.

A.G.S. Names Three To New Exam Board

James G. Donavan Jr., Donavan and Seamans, Los Angeles, and president of the American Gem Society, has named three Certified Gemologists and Registered Jewelers to serve as members of the Society's new Examinations Board. The three are Kenneth G. Mappin, C.G., R.J., F.G.A., of Mappin's Limited, Montreal; Samuel J. Tyack, C.G., R.J., of Shreve, Crump and Low Company, Boston; and John F. Vondey, C.G., R.J., of Vondey Jewelry and Gem Shop, San Bernardino, California. Each of these men is a graduate of the Gemological Institute of America.

The Board, which was ordered by a vote of the Society's members, provides a highly qualified governing body to administer and control its educational standards and qualifications. Members of the Board are appointed by the president and may include educators and authorities in the field of gemology who are not necessarily associated with the Society.

Duties of the new Board will be to institute gemological examinations and offer them to Society membership in order to provide a direct manner of meeting the educational requirements for its various titles and classifications of membership.

The examinations, when accepted, may be taken by any member who, by virtue of experience and gemological knowledge, is deemed qualified. No formal study courses or graduation from gemological schools or universities offering gemological degrees, is necessary under these provisions. The Society also recognizes the courses of the Gemological Institute of America and the Gemmological Association of Great Britain as providing the educational requirements for its titles. Final decision as to educational qualifications of any candidate now rests with the Board, which is also responsible for the annual examinations required of all title holders of the Society.

Research Laboratory

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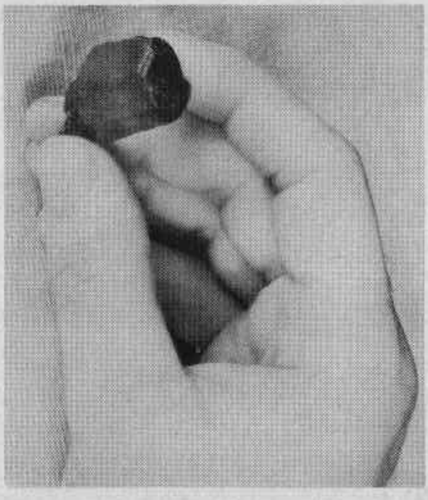
Beers Consolidated Mines Limited, Consolidated Diamond Mines of South West Africa Limited, Consolidated African Selection Trust Limited, Sierra Leone Selection Trust Limited, Societe Miniere du Beceka, Societe Internationale Forestiere et Miniere du Congo, and Companhia de Diamantes de Angola.

Andalusite Crystal Weighs 85 Carats

What is believed to be one of the finest known andalusite crystals in the world was obtained by Allan Caplan, New York importer, in Minas Geraes during the summer of 1948. Weighing 85 carats in the rough, it is estimated that the crystal will cut to approximately 50 carats. This would make the stone exceed in size any known gem andalusite.

In describing the crystal, shown in the accompanying photograph on page 125, its owner states: "Its dimensions are 32 x 21 x 18 millimeters. It is crystallized in the orthorhombic system and has a hardness of 7.5. The pleochroism is very strong, changing from yellow-green to red when viewed parallel to the long axis of the crystal."



Report Kimberlite Pipe In Belgian Congo

Evidence of a kimberlite pipe in the Belgian Congo has been established for the first time since alluvial diamonds were discovered in the gravels of Sasatchie River, in the Kasai region, by George Young 30 years before. A report of this find was made by Dr. Ivan De Magnee of the University of Brussels at the International Geological Congress in London last year. A portion of the abstract presented, as published in the *Diamond News,* follows.

"At the end of 1946, a geophysical prospecting mission (Belgian centre for geophysical prospecting studies) had the good fortune to verify the existence of kimberlite, "yellow ground," hidden under a thick sandy covering.

"The decomposed kimberlite is enclosed between horizontal limestones of the Bushimaie (Precambrian) system. Electric borings indicated that the limestones were distinguished by an electrical resistivity higher than that of the yellow ground.

"A series of sections of resistivity in diverse directions show an oval zone of low resistivity, covering about 15 hectares.* This zone was considered to represent the extent of a pipe of kimberlite.

"Eventually shafts were dug one way and the other for verification of the limits assigned to the kimberlite."

The pipe is said to be approximately 400 meters in diameter. Altered to yellow ground, it contains characteristic crushing bort. Further work indicates the existence of other pipes.

For the past 15 years the Belgian Congo has been the largest producer of diamonds in the world. It currently produces about 75% of the world's crushing bort, while of the 5,474,469 carats produced by the district in 1947 only 7.1% were diamonds of gem quality. Since the discovery of alluvial diamonds in 1916 there has been an all time production in the colony of 109,068,500 carats although the major portion has been industrials.

Gift to the Institute

Recently Dr. Edward J. Gubelin of Lucerne, Switzerland presented the Gemological Institute of America with 32 additional Photomicrograph Color Slides showing inclusions in gemstones. This new collection from Dr. Gubelin includes Siam Sapphire, Fluorspar, Moss Agate, Diamond, Ceylon Ruby, Aquamarine, Adventurine quartz,

*Corresponding to 37½ acres.

Rock Crystal, Opal Glas, Moonstone, Almandine, and four of Reconstructied Rubies. This increases his contribution of excellent colored photomicrograph slides in the Institute's library to approximately 250.

Dr. Gubelin, who is a member of the editorial board of this publication and the only research member of the Institute, is now completing a book concerning the recognition of characteristic gemstone inclusions as a means of identifiation. This book will be published by the G.I.A. and released early this spring.

Diamond Review

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in Puerto Rico experienced difficulties during 1947 due to a shortage of rough.

During the past two years Great Britain has increased its cutting industry from 500 to approximately 650. In France there are some 580 cutters and 120 apprentices. Canada's infant diamond industry is said to employ some 600 men cutting and setting diamonds.

Of negligible importance in the cutting industry are India, Borneo, Mexico, Venezuela, British Guiana, and Egypt.

INDUSTRY FUTURE

In 1947, for the first time in several years, a new use was introduced for the consumption of diamonds commercially. Being sensitive to radioactivity, colorless crystals are being used as counters for alpha, beta, and gamma rays, replacing the Geiger-Muller counter. The practical indestructibility of the diamond as compared to the ordinary counter, plus its small size, doubles its usefulness both for use in the human body and in industrial equipment. It is a new alarm instrument to protect lives of atomic workers.

According to Dr. Ball, 1947 was a good year for the diamond industry although not as prosperous a one as 1946. He optimizes: "The industry is in an enviable position, its stocks are low, and the operating units are in a strong financial position. The world today seems capable of absorbing all the gemstones the mines can produce and government stockpiles would welcome an oversupply of industrials."

Light

(From page 118)

better understand the resolution of the vibrations and their amplitudes let us construct at the right side, Figure 5 A a line P-P′ which we will say represents the amplitude of vibrations in plane or direction P-P′ which enters the section from below having passed through the polarizer. Now the vibration P-P′ will be resolved into two vibrations at right angles to each other and which will be parallel respectively to o and e of the section. In the figures o and e graphically represent the direction and amplitudes of such vibrations by application of the principles of the parallelogram of forces. The two rays emerge from the analyzer above. Since the planes of vibration in the analyzer are parallel to A-A′ and P-P′, these two rays o and e will resolve each into two new rays which will vibrate now parallel to A-A′ and P-P′. The two rays designated and shown as P and P′ in Figure 5B, will be absorbed by the analyzer but the rays marked A and A′ will emerge and meet the eye. These are developed graphically as previously stated. The section, therefore, will be illuminated. It follows that the section will be illuminated in all positions in which the directions of vibrations of the polarizer and analyzer are inclined to the vibrating directions within the section proper. Maximum transmission through the whole will be when the vibration directions in the section are at an angle of 45° as referred to the polarizer system.

In addition to being illuminated, the section, if thin, will also be colored. This color is due to interference and is known as the Interference Color of a (or the) thin section.

(to be continued)

The name of ROBERT WEBSTER has long been synonymous with gemology in England. His present association with B. W. Anderson and the London Gemmological Laboratory is the logical culmination of years of training and experience dating back to 1914 when he was first employed as a jewelers and pawnbrokers assistant. Students of gemology in this country know him well for his *Gemmologists Compendium.*

Born at the turning of the century, Robert Webster was educated at St. Marks College, Chelsea, London, S.W. and South Western Polytechnic. After serving in the overseas army from March 1918 to 1920 (he was awarded the Military Medal September 1918), he returned to the jewelry trade and a course in gemology at Chelsea Polytechnic from 1932 to 1934, receiving his Fellowship Diploma of the Gemmological Association of Great Britain the latter year.

Robert Webster, a member of the Mineralogical Society since 1943, is one of only two to date who have been awarded the Research Diploma of the Gemmological Association of Great Britain. This was a result of his thesis "An investigation into the properties of ivory and of materials used in its simulation and into methods whereby they may be severally distinguished."—1946.

DR. SHARAT K. ROY, Chief Curator of Geology at the Chicago Natural History Museum, was born in India late in the nineteenth century. He attended the University of Calcutta and the University of London (England) before coming to the United States, He spent one year in the department of geology at the New York State Museum in Albany and then joined the staff of Chicago Natural History Museum (then Field Museum of Natural History) as an assistant curator in the Department of Geology. He has served continuously with the museum since that time, becoming Chief Curator in 1947.

Dr. Roy, who served with the British-Indian Army in World War I and who now holds a commission as major in the United States Army Air Force reserve, received the degree of Doctor of Philosophy at the University of Chicago. He was a member of the Second Rawson-MacMillan Subarctic Expedition of Field Museum in 1927-28 and collected ores, lithological specimens and Cambrian fossils in Newfoundland the following year. In 1945, on leave from the Army, he collected economic geology specimens and Permian fossils in the eastern mine regions of India and the Salt Range of Northern India.

In recognition of his exploratory work in the Arctic the United States Geodetic Survey in 1944 honored him by designating as "Mount Sharat" one of the mountain peaks on Baffin Island.