Gems & Gemology

A bi-monthly periodical, without paid advertising, supported by subscriptions from Gemologists and other gem enthusiasts, aims to increase the gem merchant's knowledge and ability in order that he may protect more thoroughly his customers' best interests.

VOLUME I — JULY-AUGUST, 1934 — NUMBER 4

In This Issue:

Published by

THE GEMOLOGICAL INSTITUTE OF AMERICA

3511 W. Sixth Street — Los Angeles, Calif.

EDITORIAL FORUM

We were surprised when the Code Committee for the Retail Jewelry Trade adopted resolutions fixing the physical properties of several gems. Especially absurd seemed the statement that the hardness of sapphire was to be considered 8.8. Every mineralogical text gives sapphire the hardness of 9—indeed, the degree of hardness represented by 9 on Mohs scale is determined by sapphire. After all, corundum is a mineral made by the Great Maker, and not General Johnson. Or perhaps the statement of the hardness 8.8 for sapphire was a bit of dry humor on the part of the Committee who drew the code.

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However, we have just read the report of the B.I.B.O.A. Conference at The Hague, Holland. After studying the advance reports of the resolutions adopted by this conference, we find that the work of our Code Committee was really excellent by comparison. The Hague Conference, which met on May 13 and 14, was called "The Fourth International Conference of the Association of Manufacturers, Wholesalers, and Retailers of Jewelry and Gold and Silverware." The title is imposing; the resolutions, as far as gems are concerned, are amazing. However, great progress has been made since the meeting of the Rome Congress a year ago.

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The Conference met with the purpose of making recommendations to be acted upon at the International Congress which is to meet next year in Berlin. Evidently expert opinion has to a certain extent prevailed and several of the absurd resolutions adopted at the Rome Congress are to be rectified. The proposed "Safranite" or "Topaz Safranite" for brown quartz promises to give way to the correct term—*Citrine* or *Topaz Quartz*. "Hyacinth," recommended at Rome as a name for the Hessonite Garnet, is to be replaced by the term *Hyacinth Garnet*. These are part of a system of nomenclature first proposed in Shipley's *Gemology* in 1931. Subsequently, as a result of answers to questions submitted to 100 international authorities, the adoption of this system by the G. I. A. was approved. The adoption by the Berlin Congress will make truly international terms like *Ruby Spinel*, *Ruby Garnet*, *Topaz Quartz*, to explain that the gem is ruby-colored spinel, ruby-colored garnet, topaz-colored quartz, etc. The suggestion to use the term *Olivine Garnet* for the Demantoid indicates that the recommendations published in the prospectus issue of this magazine were adopted as far as using the name of one species to describe the color of another is concerned. However, in this case, it seems too bad to drop as fine a name as "Demantoid" in favor of the prosaic *Olivine Garnet*.

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Probably much of this very necessary revision which has been done may be credited to two expert members of the Conference—Prof. Dr. Schlossmacher of the University of Konigsberg, and M. Gobel of the gemo-

Gems and Gemology is the official organ of the American Gem Society and with it is included the Bi-Monthly Confidential Service of the Gemological Institute of America. It is published as a part of the educational gem and jewelry program of the American Gem Society by the Gemological Institute. The Gemological Institute of America is a non-profit educational institution directed by voluntary boards consisting of international gem authorities and appointees of American jewelry trade associations. It confines its activities to the furnishing of education, books, instruments and educational publicity material of a gemological or jewelry nature. In harmony with its policy of maintaining an unbiased and uninfluenced position in the gem and jewelry trade, no advertising is accepted in this or any other of its publications. *Gems and Gemology* will not overlap the field of any other periodical in America or England.

logical laboratory of Paris. Dr. Spencer's criticism of the Rome Congress recommendations in the English journals must also have carried weight.

Not a little of the credit is due, we believe, to the American jeweler-students of gemology, who, through the Gemological Institute, protested vigorously against the garbling of correct gemological terms in an effort to satisfy all the factions of the Rome Congress.

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Several new points developed at the Conference. Evidently the French representatives are of the opinion that fresh and salt water pearls should be carefully distinguished and that none except the Burma Ruby should be called "Ruby." Other red corundums should be called "Ceylon Ruby," "Siam Ruby," etc. Even if it were possible to determine the source of a particular pearl or ruby—as frequently it is not—the spirit of the resolution is opposed to the principle of that school of ethics, championed by the G. I. A., which holds that gemological nomenclature should, above everything, protect the purchaser and, though of lesser importance, harmonize with the nomenclature of related sciences. Moreover, a fine Siam ruby is undoubtedly more desirable and valuable than a poor quality of ruby from Burma. Any differentiation according to the locality where a gem was found puts a false value upon it, a value determined not by the quality of the stone in question, but by the source from which it came.

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The Hague Conference, probably taking a leaf from the page of our Retail Jewelers' Code, has asked that the findings of the various research laboratories on the hardness, physical properties, and refractive indices of gem species be submitted for approval by the Congress next year. This sounds an ominous note; it forecasts that the Congress plans to pass resolutions arbitrarily fixing the properties of gems. Mineralogists will protest any such action. The results of scientific experiment can never be changed by man-made laws.

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The Conference plans to use "Germany's Figures" in the first edition of the proposed publication, "International Nomenclature of Precious Stones." We suppose that "Germany's Figures" refers to Bauer's *Edelsteinkunde*, as revised by Prof. Dr. Schlossmacher, who is a member of the Conference. No better source could be found. *Edelsteinkunde* is a carefully compiled and authentic work, as sympathetic toward trade terms and usage as could be the work of any college professor. However, the Congress should not make the mistake of accepting the figures from this or any other source as final. To do so would be to make absurd "resolutions" of what might otherwise be valuable material for distribution to the jewelry trade throughout the world.

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The International Congress has done some fine work, and will undoubtedly do more. It can, by suggesting that correct gemological classifications—which have already been revised to correspond almost exactly with correct mineralogical classifications—be generally adopted, render an invaluable service to the entire gem trade. If, on the other hand, the representatives attempt to make new and arbitrary classifications not based upon both mineralogy (or biology in the case of pearls), and protection to the purchaser, only harm to the trade can result. Confusing and arbitrary classifications which are now used should be dropped, rather than new ones added with increased confusion as a result.

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And one last suggestion: America was not represented at all at The Hague Conference, and only ineffectively at Rome. No ruling made by a conference lacking authentic representatives from the American jewelry trade can be regarded as "International."

NEW GEM SUBSTITUTES ON AMERICAN MARKET*

Two stones among dealer's paper of pink tourmaline were found to be glass. They had a refractive index of 1.67—very close to that of kunzite, which is 1.660-1.675. It is thought, from their color and refractive index, that these stones were made to be used as an imitation of kunzite. They are easily distinguished, however, as they are less than 5½ in hardness and are 3.6 in specific gravity. These imitations sink rapidly in pure methylene iodide whereas kunzite floats.

A blue glass has been unwittingly sold by an old and experienced colored stone dealer (who depends upon only a refractometer test and his experienced eye) as a blue topaz. It has the proper refractive index of topaz, 1.62, and its specific gravity is 3.45, just below that of 3.53 for topaz. The imitation is easily detected by its inferior hardness of approximately 5, compared to the hardness of 8 for genuine topaz.

Gemologists are warned to be on the lookout for these glasses. They are very natural in appearance—the "topaz" particularly so—and might easily be passed as genuine stones if tests were not applied.

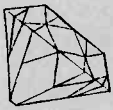
EMPRESS EUGENIE DIAMOND IN SCANDAL?

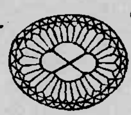
A dispatch appearing in national newspapers a short while ago, which hinted that the $100,000 engagement ring which is featuring in the scandal surrounding Miss Gillespie, ex-fiancee of John Jacob Astor III, contains the famous Empress Eugenie Diamond, is evidently entirely without foundation. So far as is known, there has never been a report that the Empress Eugenie was in the possession of the Astor family. The gem is reputedly owned by the Gaekwar of Baroda; the latter did not remember the famous diamond as being in his treasury when he was interviewed last fall in Santa Barbara by Robert M. Shipley. His Highness, the Gaekwar, however, did not state that the diamond was not still in his treasury, as are the famous Star of the South and the English Dresden. After looking at the model of the 51 carat Eugenie, he stated that there were so many gems of similar size in the Baroda Treasury that it might easily have escaped his notice.

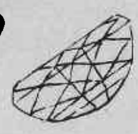
Dr. Kunz reported that the Sancy Diamond had been bought by Lady Astor. It is evidently from this report that some enthusiastic reporter attempted to build a story. Probably the newspapers intended to report the diamond in the Astor-Gillespie engagement ring as being the Sancy, but confused it with the Empress Eugenie. It is even doubtful that the Sancy is in the possession of Lady Astor. Some time after Dr. Kunz's report, the Maharajah of Pattiala—who was stated to have sold the stone—advised the late Dr. Farrington that he was wearing in his turban the Sancy, purchased by his predecessor.

*A. G. S. Research Service.

Important Diamonds of the World







Robert M. Shipley

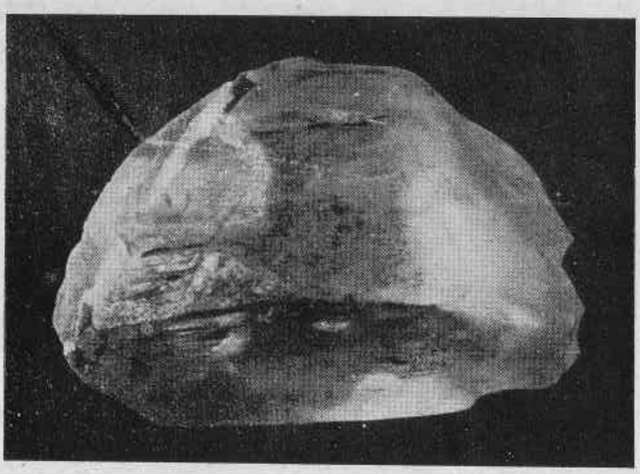
THE JONKER

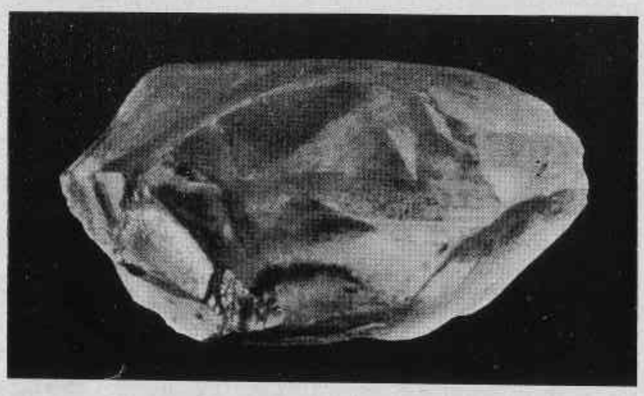
Of fine quality gem diamonds, the Jonker may rank as high as fourth in size in the world, perhaps as low as sixth. The Cullinan, of 3025¾ carats, was undisputably first. A table of Bauer's *Edelsteinkunde*, as revised by Prof. Dr. Schlossmacher lists the find of a 1500-carat blue-white fragment in the Premier Mine in 1919. The table is credited in part to L. J. Spencer and P. A. Wagner; probably the report is Wagner's, since Dr. Spencer's report was published in 1912, before the stone was reputed to have been found. However, A. F. Williams, in his very complete tables of the production of large South African diamonds, does not mention this stone. Direct information from Africa is being secured, and further details will be published in *Gems & Gemology*, as soon as they are received. If we accept the report as true, the stone is the second largest. The third largest diamond, then, is the Excelsior, with its weight of 969½ carats. If we are to accept Tavernier's record, written in the seventeenth century, as to the size of the mythical Great Mogul, 787½ carats—the Jonker diamond falls to fifth place. But Fersman and a few authorities doubt Tavernier's accuracy. If we accept the possibility suggested by Kunz, in 1929, that the Portuguese Braganza is not a topaz, but a gem diamond of about 1680 carats, as originally claimed, then the Jonker falls to sixth place. If these three doubtful stones are disregarded, the Jonker could take the rank of third in the list of great gem diamonds of the world, as has been reported. However, we prefer not to assume the responsibility of discrediting either the existence or the reported weight of the Mogul in the rough and, therefore, class the Jonker as fourth largest of the Important Diamonds of the World, and third largest of those from Africa.

From the standpoint of all diamonds found, the Jonker must take a much lower rank. No less than three industrial carbonadoes of over 2000 carats have been found in Brazil. The Premier Mine in 1912 yielded a 1640-carat diamond and, in 1924, one of 1195½ carats. The former is recorded as having been largely bort and the latter may also be considered to have been bort, since there is no record of a stone of that size ever having been cut. In a list of all the above-mentioned diamonds, both gem and bort, the Jonker ranks eighth.

It is, however, foolish to class the Jonker against diamonds technically of the gem variety but containing large amounts of industrial bort. The newly-mined Jonker is flawless and blue-white in color; if cut into one large stone, it will rank as one of the most important diamond gems in the world.

THE MOST RECENT ADDITION TO THE IMPORTANT DIAMONDS OF THE WORLD





Two Views of the Jonker Diamond

Found Near Pretoria, South Africa, in January, 1934.
Weight, 726 carats.

The diamond was found on January 17, 1934, on the Elandsfontein farm, the same tract in which the Premier Mine is situated. The claim was that of Jacobus Jonker, from whom the stone took its name. Jonker is a "digger," a man sixty-two years old, the father of seven children. For eighteen years he has worked in various diggings, usually barely managing to survive. It is an interesting sidelight on the character of Jonker that the newspaperman who went to interview him after the phenomenal discovery, found the bearded old man still working his claim.

The Jonker Diamond was then sold to Sir Ernest Oppenheimer for £63,000, about $315,000. The entire sum was not retained by Jonker, however. £27,600—$138,000—went to the State in the form of poll and super taxes. Sir Ernest Oppenheimer, according to an exclusive report from London to *Gems & Gemology,* purchased the diamond on behalf of the newly-formed Diamond Producers' Association. It has been reported that another syndicate offered £75,000 for the Jonker Diamond, but the offer had to be refused since Oppenheimer had previously secured an option on the stone. Jacobus Jonker retains $177,000 of the sale price; with it he plans to buy a ranch in the Transvaal and raise sheep.

It would be incorrect to refer to this 726-carat gem as a "new" diamond or as "young"; it was formed millions of years ago, perhaps in the Premier pipe which in 1905 yielded the magnificent Cullinan. It has lain in the alluvial deposit where it was found for perhaps longer than the years the race of man has inhabited this planet.

The Jonker is a flawless blue-white gem of 726 carats. It is, according to word from South Africa, of a quality very similar to that of the Cullinan. Likewise the shape of the Jonker, as the illustrations show, is comparable to the Cullinan. As Dr. J. R. Sutton remarked in his letter published in the May-June issue of *Gems & Gemology,* "if the latter (Jonker) were four times its actual size, the two would almost be twin brothers." Dr. Sutton is emphatic in his belief that the Jonker is not a missing portion of the Cullinan, that both it and the Cullinan are complete stones and, with but minor injuries, exactly as Nature made them.

The Pohl Diamond, which was found near the spot which yielded the Jonker, is a 287-carat stone and is also of fine quality and blue-white in color. The majority of reports have erroneously placed the Pohl at 500 carats or more. The smaller gem has been sent to London.

The Jonker Diamond is now in London, in the possession of the Diamond Producers' Association. The report that the stone has been sold to Prince George, younger brother of the Prince of Wales, is unfounded. So also is a report that the gem is to be cut in the famous Asscher plant in Amsterdam. The authoritative report received by *Gems & Gemology* states that as yet no decision has been made as to the disposal of the stone. The Diamond Producers' Association may decide to have it cut to produce one large stone, or perhaps to form several smaller and more readily salable gems. The Jonker may be sold to an individual or a group of men, in whose hands its fate will rest. Perhaps the report of its purchase by Prince George of England is not entirely without foundation and the gem will pass into the possession of a member of the British Royal Family, to whom the Cullinan was presented.

Gems & Gemology is following the developments in connection with the Jonker Diamond and hopes to add to the information concerning this Important Diamond.

Note: Other reports concerning the Jonker will be found on pages 26, 79, and 99 of Vol. I of *Gems & Gemology*.

NATURALLY-OCCURRING VS. SYNTHETIC GEMS

DR. THOMAS CLEMENTS,
Chairman, Department of Geology,
University of Southern California

Chemically there is perhaps not the slightest difference between a naturally-occurring ruby and a synthetic ruby; both are aluminum oxide with a trace of impurity to give the red color. Nor is there any particular difference in crystal structure; both are definitely crystallized in the hexagonal system, and both give the same optical reactions. In the finest synthetics of today even the bubbles, those tell-tale marks of the artificial, have become almost invisible, and the accretion lines are apparent only under high magnification.

If all this is true, then why should not one be as easily satisfied with a synthetic as with a genuine stone, and at but a fraction of the amount the latter would cost? If they are identical chemically, physically, and in every other way, why do not synthetics entirely replace the naturally occurring stones in the markets of the world?

The synthetic stone was made yesterday; the day before it was but a bit of white powder on a chemist's shelf. But what of the genuine? Yesterday it lay in the dusty treasury of a democracy—the day before it glowed like a coal of eternal fire amid the royal jewels of a king's bride. Before that it graced the forehead of an idol unto which teeming millions bowed themselves to earth. It was a rajah's prior to that, taken with fire and sword from a neighbor princeling who had received it as tribute from the ruler of the land where it was found by a weary slave sweltering in a rice field.

So the genuine stone has background—history. But even this history of a few hundreds of years fades into insignificance when compared with the almost infinitely longer period of its geologic history.

The stone was carried to the place of its finding by those forces of erosion, weathering, and running water, that have been changing the face of the earth since time first began. It was taken by these gnawing agents from the place where it had rested in a great dike of material that once seethed and bubbled as it forced its way into a narrow crack between huge blocks of limestone, and once gaining an entrance, urged on by resistless force from below, forced those blocks farther and farther apart until somewhere something had to give and great earthquakes shook a land in which man not only had not yet appeared, but would not appear for millions of years.

Thus the history of the naturally occurring stones goes back not merely hundreds or thousands, but millions of years. It has background. It has a pedigree. It is the thoroughbred horse, the blooded dog, the man of ancient and honorable lineage. It is genuine.

The synthetic serves its purpose; it does almost as well for the jewel of a fine watch as a genuine stone; it makes as good polishing material as the genuine; it is a good ornamental stone; it has its place in jewelry. But it can never supplant the naturally-occurring—the genuine stone.

CARVINGS OF GEM STONES IN THE ART INSTITUTE OF CHICAGO

HELEN C. GUNSAULUS

Members and students of the Gemological Institute and of the A. G. S. who plan to visit Chicago this summer will find much to interest them in the Art Institute which is to house the official Art Exhibit for the Century of Progress Exposition.

Particularly will they enjoy the exhibition of Chinese carvings made from jade, coral, turquoise, lapis-lazuli, malachite, crystal, amber and agate, shown in the Oriental Galleries in the East Wing of the museum. This collection consists of ceremonial objects, ornamental pieces, and objects of use and convenience, such as small censers, brush-washers and boxes and a variety of bottles used for snuff. The larger part of the collection bears the name of Lucy Maud Buckingham; other examples come from the collections of Mr. and Mrs. S. N. Nickerson, Mr. and Mrs. Potter Palmer and Mr. and Mrs. Edward Sonnenschein.

The earliest objects are of jade and were found mainly in tombs of the Han Dynasty (206 B.C.-22 A.D.). They are generally in the form of amulets or ornaments used in burial ceremonies.

Jade, coral and turquoise have been used for some very interesting figures and objects made purely for ornamental use. They were particularly popular during the late Ching Dynasty which lasted up until 1911. Most of the better examples date from the reign of the Emperor Chien (1736-1796)

The jade objects range in color from white through green to "spinach jade," a lovely flecked stone of sombre tone. Some are carved in intricate open-work patterns, or in low, flat relief with designs recalling those used on the old bronze vessels. The forms are also often reminiscent of bronzes. Certain jades, such as a small screen and a brush-washer are carved in high relief, showing sages roaming through mountainous landscapes, and peonies growing in profusion with rich, heavy leaves.

The coral and turquoise carvings generally represent favorite legendary characters, such as the Goddess Lan Ts'ai ho, one of the Eight Immortals who carries a basket of flowers and a hoe. Another charming subject in coral is that of two tall female figures whose long bodies form the trunk of a tree and whose flowing sleeves blossom into pink flowers. Malachite and lapis have been used by the carvers of small sail boats on which little men and women seem to be enjoying themselves, and amber has been cleverly carved into both figure pieces and floral sprays or branches of luscious fruit.

The collection of snuff-bottles includes all of the foregoing materials as well as rose-quartz, agate, crystal and aqua-marine. The range of design is unending and each piece is worthy of study and fascinating in subject of decoration. One beautiful green jade snuff-bottle with tiny rose-quartz stopper and another entirely carved from delicate blue aqua-marine must have been the property of very exquisite and wealthy aesthetes who enjoyed "the filthy weed" in powdered form. Great ingenuity is shown in the use of the agates in these little bottles. The differing layers of colors are used to great advantage and any apparent imperfection is incorporated into the design in a most clever manner. Certain of the snuff-bottles are made of moss-agate with the natural patternings beautifully exposed. Venus hair-stone seems also to have found favor with the makers of these little luxuries and some of the most choice examples are to be seen in ivory, lacquer inlaid with mother-of-pearl, and in the porcelains for which China is so famous.

CULTIVATED PEARLS NOT GENUINE

The contention of a number of scientists, as set out in the March-April issue of GEMS & GEMOLOGY, that cultivated pearls are equal in every respect to genuine natural pearls, is an argument which seems not to be based upon *all* the facts.

The other side of this question has been ably set forth by several well-known pearl dealers—men who themselves have made a comprehensive, practical study of the qualities and value of cultivated and natural pearls.

Mr. Emil W. Kohn, president of the Jewelers' Association of New York, writes:

"It seems to me that a definition should be accurate and clear. In my opinion, the use of the word 'genuine,' as applied to stones or pearls, should only be used in relation to the natural product.

"To illustrate, a synthetic ruby is 100% ruby but it should never be offered or regarded as a genuine ruby. To do so, would be destructive in every respect. Genuine ruby is the natural ruby, similarly in the case of cultured or cultivated pearls.

"We appreciate the fact that cultivated pearls are a scientific achievement of which the producers may justly be proud. It is, however, produced or provoked by inserting a small mother-of-pearl ball, or other foreign substance within the mussel shell. It is, therefore, insofar not natural and not genuine.

"It is in no sense a disparagement of synthetic rubies or cultivated pearls, to insist that they must never be offered or regarded as 'genuine'."

The longest reply to the statements made in the former article is that of Mr. P. Irving Grinberg, of the Gem & Pearl Dealers Association of New York, and representative on the pearl section of the Advisory Board of the GEMOLOGICAL INSTITUTE OF AMERICA. He says:

"When visiting any of the art museums in which famous pictures are displayed, one frequently finds artists copying celebrated canvases. Oftimes the effect compares favorably with the original and biologically speaking, the materials used are the same but certainly there can be no comparison as to value or touch of master. To the untrained individual, the fine points are lost which are so apparent to the expert. We know that there are but very few who have the knowledge and judgment, developed by study, which make them capable of giving a valued opinion when discussing works of art. Everything that has been said above applies to the genuine natural pearl. One often hears the question, 'Why should one pearl be worth so much more than another?' Some professors seem to think that because biologically speaking they are the same, the value likewise should be the same, but experts who have dealt in pearls for many years agree that there are certain characteristics which very definitely tend to fix values. It is well known that producers and dealers of cultured pearls have repeatedly quoted statements from scientists. However, regardless of Mr. Boutan, a professor of zoology, the French courts have decided that there is a difference and the cultured pearl must be designated as such in distinction to the natural pearl which is called a 'perle fine'. Both in England and America there are provisions which demand that the cultured pearl be so designated when sold. The statement of the late Dr. David Starr Jordan, a great authority on fishes, 'As they are of exactly the same substance and color as the natural or "uncultured" pearl, there is no real reason why they should not have the same value', must be recognized as one made without a knowledge of intrinsic value by anyone familiar with gems of any sort as there are many reasons why they should not have the same value. All will agree that every individual gem is unique as to quality and value though biologically they may be in exactly the same group. It would be impossible to point out the differences in an article such as this. The ability to judge gems and pearls comes after much study and handling, certain characteristics, while easily recognized by the expert, can not be described by mere words. Although cultured pearls have merit as cultured pearls, they are definitely and distinctly different from the natural fine pearl. Besides the trained eye of the expert, there are perfected lamps and X-ray machines which definitely show the difference between the natural and cultivated pearl."

In the article printed some time ago in *Gems & Gemology*, the Encyclopaedia Britannica was liberally quoted. Mr. Grinberg comments:

"Frequently in quoting various articles from magazines and encyclopaedias, sufficient effort is not made to secure the latest information. Scientists are aware that changes are continuously being made. The Encyclopaedia Britannica, as everyone who is interested in research knows, is always revising its material according to the latest information.

"The following is an excerpt from a letter written and signed by F. H. Hooper, American editor of Encyclopaedia Britannica written on August

30th, 1933. 'In reply to your favor of yesterday that some short time ago my attention was drawn to the last paragraph of the text of the article PEARL, CULTIVATED, the question being, was the information given there up to date. After a thorough investigation, it seemed to me that it was not and I had the plates of the Britannica altered. This change does not appear in any of the printed copies of the Britannica yet on the market but the printer has completed a reprint which will appear shortly. I take pleasure in enclosing herein a slip showing how the section referred to will appear in future issues.

"PEARL, CULTIVATED *(COPY)*—

" 'Cultured' pearls are 'natural' only as regards an outer skin averaging in thickness about three-tenths to four-tenths of a millimetre. Examination of a section of 'natural' pearl shows, generally, a nucleus surrounded by a series * * *

" '*Distinction between Cultured and Natural Pearls*

" 'The ordinary cultured pearl, because of its external appearance, can readily be distinguished by the expert from the natural. In the case of the finer grades, distinction was not at first easy except by cutting a cross-section, thus disclosing the interior of the pearl. Two French scientists, Chilowsky and Perrin, invented an instrument called the endoscope, which introduces into the holes of the drilled pearls a powerful light so that the origin (whether cultivated or natural) of the pearl can be determined and the thickness of the pearly covering of the cultivated pearl measured. A skillful and experienced operator can examine over 150 pearls in an hour. X-ray photography is now also employed successfully for the same purpose, but the process is rather slow. An instrument of German origin which makes use of the powerful electric-magnets has proved successful in discovering the nature of pearls which have not been drilled. Many other types of instrument have also been employed, but not so successfully.'

"Since the above article, the X-ray machines have been perfected so that pictures properly taken show conclusively whether a pearl is cultivated or natural."

And a sentence from the pen of Mr. Julius Kaufman, president of Goodfriend Brothers of New York, is a terse summary:

"The liberties that the naturalists and the authorities on fish matters take in stating that the values of cultured pearls approach or compare in any way with the values of natural pears are on the face of it so ridiculous that anyone with any common sense would be able to judge how foolish some of these articles are."

BIOGRAPHICAL SKETCHES

DEAN EDWARD H. KRAUS

HORATIA J. CORBIN

Dean Edward H. Kraus

Edward H. Kraus, mineralogist and educator, was born in Syracuse, N. Y., on the first day of December, 1875, the son of John Erhardt and Rosa Knobel Kraus. His early education was received in Syracuse, and in 1896 he was graduated from Syracuse University with the degree of Bachelor of Science. He was immediately appointed to the staff of Syracuse University and for three years acted as instructor in German and mineralogy. In 1897 the degree of Master of Science was conferred. Going to Germany in 1899, he studied crystallography, mineralogy, geology, and chemistry, and in 1901, at the University of Munich, he received the degree of Doctor of Philosophy. He returned to Syracuse, was instructor in German and mineralogy for one year, and in 1902 was made associate professor. At the same time, however, he was offered a position as head of the Science Department of the Syracuse Central High School. He left university teaching and held this position for two years. In 1904 he was called to the University of Michigan as assistant professor of mineralogy, became junior professor in 1906, junior professor of mineralogy and petrography in 1907, and full professor of mineralogy and petrography in 1908. Since 1918 he has held the chair of crystallography and mineralogy.

In addition to his teaching duties, Dr. Kraus has held a number of administrative positions. From 1908 to 1933, he was Director of the Mineralogical Laboratory. From 1908 to 1912, he was Secretary of the Graduate School. From 1908 to 1910, he was Secretary of the Summer Session. In 1911, he was appointed Acting Dean of the Summer Session, and from 1915 to 1933, he was Dean of the Summer Session. In 1920, he was made Acting Dean of the College of Pharmacy, and from 1923 to 1933, he was Dean of the College of Pharmacy. In August, 1933, he was appointed Dean of the College of Literature, Science and the Arts, University of Michigan.

Dr. Kraus is a Fellow of the Geological Society of America, Fellow of the American Association for the Advancement of Science, honorary member of the Deutsche Mineralogische Gesellschaft, and a member of the Committee of Revision of the U. S. Pharmacopeia. He is also a member of Phi Beta Kappa, Sigma Xi and other learned societies.

In addition to his earned degrees, Dr. Kraus has been the recipient of the honorary degrees of Doctor of Science, 1920, Syracuse University, and LL.D., 1934, Syracuse University.

Dr. Kraus is author of a number of important works on crystallography and mineralogy. In 1906 was published his *Essentials of Crystallography,* and in 1911, *Descriptive Mineralogy.* The first edition of *Tables for the Determination of Minerals,* compiled jointly with W. F. Hunt, was published in 1911, and the second edition in 1930. *Mineralogy,* with Hunt, appeared in 1920, with a second edition in 1928, and *Gems and Gem Materials,* with E. F. Holden, first appeared in 1925, with a second edition in 1931. Dr. Kraus is also the author of some 60 monographs and articles in German and English in his fields of scientific study, and also on educational problems.

He is the inventor of modifications of Jolly's recording spiral-spring balance for the determination of specific gravity. In 1925 he improved the device by an attachment that enabled the specific gravity to be read directly from the graduated scale. A smaller addition of the balance is used in the determination of cut gems.

Dr. Kraus' work with gem stones is almost too well known to be mentioned. The textbook, *Gems and Gem Materials,* is known to every progressive gem-dealer in America. The gem courses of the University of Michigan are but slightly less famous; a description of them will be found elsewhere in this issue. Because of Dr. Kraus' efforts to advance the knowledge of gemology he has been selected as a member of the Examinations Standards Committee of the Gemological Institute.

GEMS AND GEM MATERIALS AT THE UNIVERSITY OF MICHIGAN

DR. CHESTER B. SLAWSON

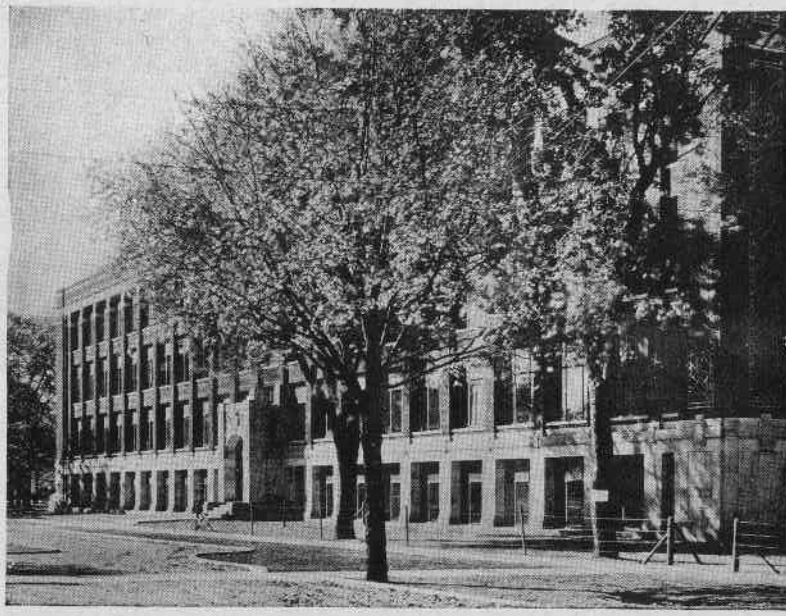
Director of Mineralogical Laboratory, University of Michigan; and Member of Students' Advisory Board, G. I. A.

Classroom instruction in *Gems and Gem Materials* as a distinct and separate course was first offered at the University of Michigan in the spring of 1916. Prior to that time certain phases of this subject such as, gem cutting incident to the consideration of the diamond, and the manufacture of synthetic rubies and sapphires as part of the general subject of corundum, had been discussed in the other general courses in mineralogy. By this method there was gradually developed illustrative material and equipment which furnished the foundation for the special course in *Gems and Gem Materials* which was offered for the first time in 1916 by Professor Edward H. Kraus, then Director of the Mineralogical Laboratory.

As originally given this course consisted of two lectures each week with laboratory work available to every student. At that time there was no adequate textbook available so the instruction was confined to lectures and demonstrations. No attempt was made to give the student a practical working knowledge of the subject which would lead him to a professional career in this field but the instruction was designed to furnish him with a better understanding and appreciation of gem materials. Nor has it since seemed advisable to give a professional trend to our class work because of the general character of our students, although a few of them, especially sons and daughters of jewelers, have been aided in a business way.

During the first few years a number of changes were introduced including the dropping of the laboratory work for the class as a whole and confining it to a small group selected for their scholastic ability and special interest in the subject. Those not allowed to do the laboratory work are required to submit a thesis upon some subject pertaining to gem stones. This change in laboratory work was made because of the large enrollment and the necessity for close personal supervision while in the laboratory. Because of the demand for such a course in the Summer Session it has been given each summer for the past three years. Finally, in 1925, the lectures with additional material were incorporated into a textbook "Gems and Gem Materials" under the co-authorship of Professor Kraus and Dr. E. F. Holden. Subsequently this widely-used textbook has furnished the basis about which the lectures and demonstrations are given although only thirty of the most important gem materials are discussed.

One of the most important steps in the development of the course was the acquisition in 1926 of the gem collection of the late Frederick Stearns of Detroit. Even prior to this time the laboratory was very well equipped with all types of apparatus for the determination of the physical and opti-



The Natural Science Building at the University of Michigan. Here the Courses in Gems Are Presented.

cal properties of not only gem stones, but of all other types of material that fall within the domain of mineralogical study. The laboratory had gradually acquired representative material covering all of the gem minerals and glass models illustrating the famous diamonds, the various types of cutting, and also of the different steps and stages of the cutting process. It was especially well fortified with material showing the development of the manufacture of synthetic sapphires and rubies. But with the addition of the Stearns collection we are now able to illustrate abundantly every known gem mineral. An idea of the size and character of the collection may be obtained from the fact that it contains 29 cut beryls including a 3.72 carat emerald, 30 cut corundums including a 55 carat star sapphire, and 36 cut topazes.

As stated above, we have not endeavored to develop a course of study preparing the student to step into the business field, but rather to develop in the general student a proper appreciation of gem stones and an understanding of the accurate scientific facts upon which that appreciation is built. At the present time we have no intention of going further and we feel that the commercial and merchandising side of this subject should be developed by the technical schools and trade associations.

Those students who have successfully completed the gem course at the University of Michigan are eligible as non-commercial Graduate Members of the American Gem Society upon application to its headquarters.

G. I. A. Registered Loupe Ready

After ten months of careful experimental work, the G. I. A. registered loupe is now ready to be presented to the trade. This is a ten-power eye loupe, which uses a triple aplanatic lens, corrected for chromic and spherical aberration. No make of triplet has been permanently adopted as a standard. The stock numbers of two makes of triple aplanats have proved superior to the lens system of any other manufacturers, and thus far, lenses of but one of these have been used exclusively, although each individual glass is carefully and individually tested in the G. I. A. Laboratory before it is accepted for mounting.

The eye cup of the registered loupe is made of duraluminum—the metal used in the manufacture of aircraft—and the whole instrument is but a few grams heavier than any diamond eye loupe previously made, in spite of the fact that its entire lens system, without the mounting, weighs more than many of the black rubber eye cups and their inferior lenses. The aplanatic lens is mounted in an individual cell. This cell can be moved in a sleeve in the eye cup so as to be focused at the will of the user. The G.I.A. registry number is engraved upon the side of the eye cup. A window in the opposite side of the cup permits inspection of an object without magnification and without removing the loupe from the eye.

The G. I. A. registered loupe is enamelled black, and the cell which houses the lens is left unfinished. The contrast of the jet black eye cup with the platinum-like sheen of both the lens cell and the large letters "G.I.A. No. —" upon the eye cup makes the instrument a very attractive one; it has been proved to have a great appeal for customers and several diamond sales have been attributed to its possession by students of gemology now using it.

NEW BOOKS

***Minerals and the Microscope*, by H. G. Smith. Thos. Murby & Co., London.**

***Minerals and How They Occur*, by W. G. Miller. Revised by A. L. Parsons. Copp Clark Company, Toronto, Canada.**

The above two volumes have been received for reviewing purposes. The reviews will appear in *Gems & Gemology* as soon as space permits.

A GEMOLOGICAL ENCYCLOPEDIA

(Continued from last issue)

HENRY E. BRIGGS, Ph.D.

Partly Transparent under X-rays	Slightly Transparent under X-rays	Partly Opaque under X-rays
Quartz	Spinel	Gypsum
Adularia (feldspar)	Fluorspar	Calcite
Topaz (crystalline)	Garnet (essonite)	Tourmaline
Labradorite		Turquoise

Minerals which are opaque under X-rays are: Beryl, Garnet (almandite), Epidote, Hematite, Magnetite, Pyrite, Rutile, Zircon, etc.

I have not here tried to give a complete list, as few of my readers will have an X-ray machine at their disposal, and still fewer will be versed in handling such a machine. However, the list can be quickly completed if such a machine is at your disposal. It will be necessary to use the machine on those gems mentioned in order to get a clear mental picture of just how each one will look under the fluoroscope.

It is quite obvious how this method is used to tell one gem from another or from a paste. If a ring is set with what on first sight appears to be a diamond, it can be quickly slipped under the fluoroscope, and if it is completely transparent it is without doubt a diamond. If it is entirely opaque, it may be only a lead glass paste or it may be a zircon; other tests will have to be applied to determine this. If it is partly transparent, it may be a colorless topaz.

Some minerals will glow brightly when under the excitation of X-rays. This is particularly true of Kunzite, and also true of some diamonds. However, I have experimented on some diamonds which would no more fluoresce than would a piece of common glass. Yet the diamonds were genuine and of very high quality. Colored diamonds fluoresce more often under X-rays than do the colorless ones.

Electrical Charges

Certain minerals possess the property of taking on an electrical charge by rubbing. Such gems as tourmaline, diamond, topaz, amber, copal, etc., will take on a charge and will pick up bits of paper, as a magnet will pick up bits of steel, if they are rubbed vigorously with a cloth or some such material.

Other minerals will often develop an electrical charge by mere heating, as the heat from the sun, etc.; such minerals are said to be "Thermoelectric." If the gem or crystal develops polarity (positive and negative charges on opposite ends) it is said to be "Pyroelectric."

Pyroelectricity may be detected in a gem very easily by the Kundt method. The crystal is first gently heated and allowed to cool on an insulated support. Put a small quantity of red lead and sulphur into a small bellows, such as is used for spraying insecticides, and cover the nozzle with a very fine screen which will just allow the powder to be blown through it. Now spray the gem or crystal which has been prepared with this mixture. The red lead, in passing through the fine screen, is positively charged, and will hence collect at the negative pole of the gem or crystal, while the sulphur in passing through the screen is negatively charged and will collect at the positive pole of the gem or crystal. Remember, in electricity unlike charges attract each other, while like charges will repel each other.

Pyroelectricity will be found only in gems which are differently terminated (crystals) as one terminating on one end in a pyramid and on the other end in a basal pinacoid. Tourmaline is very often pyroelectric.

CHAPTER 2

OPTICS

Light

It will possibly be best for us to here review a little on that natural force which makes possible vision—Light.

Light is the undulatory disturbance of luminiferous ether, which, when it impinges upon the retina of the eye, causes in the brain that sensation which we call vision. The etheral vibrations which make up visible light are in the forty-ninth octave, and the vibrations per second amount to about five hundred and sixty-three trillions.

Comparatively little is known of light itself. However, we do know considerable of what it will do and how it will act under certain conditions. We know that ordinary white light is made up of seven colors, which we call "spectrum." The seven colors of the spectrum are: violet, indigo, blue, green, yellow, orange, and red.

Black and white are often spoken of as colors, but this is erroneous, for black is rather the entire absorption of light and hence the entire lack of color, while white is a combination of certain colors, or of all the entire spectrum. Violet has the highest frequency of all visible vibrations and is refracted most, while red has the longest wave-length of all visible light and is refracted the least.

Light travels in air of the clearest kind at a rate of about 186,000 miles per second. When it enters a medium of greater density its speed is somewhat retarded, due to the resistance offered by the greater density of the second medium. The resistance offered by the second medium will also largely depend upon its index of refraction. It will be noted that density and index of refraction are entirely different things, although the word density is often used in optics to denote the refraction of a certain medium. Density is a physical property, while refraction is an optical property. While we feel that density is the proper word to use in optics in this way, yet it often confuses the beginner, and it should be remembered that when this word is used in connection with the optical properties of a gem, that there is absolutely no reference to the specific gravity of it.

When light impinges upon the surface of a denser medium (optically speaking), part of it will be reflected according to the laws of reflection, part of it will be absorbed and the balance will be refracted, dispersed and transmitted.

(To be continued)

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BOOK REVIEWS

***The Pocket Book for Jewelers,* by Dr. Hermann Michel. Published by Gustave L. Herz, Vienna, 1929. Present price in United States, $8.50. May be secured from G. I. A. Book Department, or from Jewelers' Circular.**

The *Pocket Book* consists of 200 pages of printed material and 28 full-page illustrations in a loose-leaf binder. There is a terse introduction to crystallography and mineralogy. Forty-six pages are devoted to the methods of detecting cultivated pearls and 24 pages to distinguishing between colored stones and their reproductions. There is no systematic description of the individual gem stones, but comprehensive tables and instructions for testing make the book an excellent reference guide for use in determinations.

In the pearl section minutely detailed instructions, profusely illustrated with actual photographs, are given for testing, especially with the microscope. The pages on detection of synthetics, doublets, and glass—even more fully illustrated and supplemented by 19 pages of photos—should prove valuable to the gemologist who wishes to have a reliable guide for determination of these reproductions. Although the *Pocket Book* was written before some new improvements in synthetic manufacture, these illustrations are still of the greatest value.

One very important criticism of the book must be made: Much of its material which should be of value is worthless because it applies to special instruments. These instruments were formerly furnished solely by the publisher of the *Pocket Book.* Today, many of them cannot be secured at all.

Four pages in full color show the differences between genuine and cultivated pearls in more detail. Two color pages are devoted to actual representations of dichroism shown by the more important colored gems. The value of the latter, however, is impaired by the fact that many of the dichroic colors represented are those seen only when a stone is viewed over special color filters.

The Pocket Book for Jewelers is highly recommended to gemologists who plan to put their knowledge into practice and desire a competent reference book to help them interpret their results. —*R. S., Jr.*

***A Textbook of Geology.* Part I—Physical Geology, by Chester R. Longwell, Adolph Knopf, and Richard F. Flint, New York, 1932. John Wiley & Sons, Inc. May be secured from the G. I. A. Book Department.**

The old and trusted geology of Pirsson is the predecessor of this work. However, the *Textbook of Geology* is capable of making its own way without depending upon its well-known forerunner for support. In its 493 well-written pages, the subject of physical geology is clearly outlined. There is no conscious attempt made to popularize the subject by weaving it into a story; but the authors never forget for a moment that geological processes are constantly in motion, and their awareness of this concept gives movement and life to what might otherwise be merely another geology book.

The *Textbook of Geology* is another evidence of the enlightened trend toward accepting—even stressing—the fact that both student and author can work together toward a conclusion, rather than the author arbitrarily and dogmatically stating *his* beliefs to be true. The book gives the facts which might disprove a conclusion as well as those which support it. Especially in this manner is the chapter on the earth's interior, credited to Longwell. The facts concerning that inaccessible region, gleaned from manifestations at the surface, particularly the paths taken by earthquake waves, are set forth, and a conclusion hinted. Then the reader is left to a great extent to put his own interpretation upon the facts, guided gently by the author.

Two of the chapters—"Igneous Rocks" and "Volcanoes and Volcanism"—should be of especial interest to students of gemology. The mighty subterranean processes which have caused the crystallization of the majority of the gem minerals are here described in an interesting and intelligent manner.

A book to be especially recommended for the library of every certified gemologist. —*R. M. S.*

Crystals and the Fine Structure of Matter, **by Friedrich Rinne. New York. E. P. Dutton and Co. May be secured from the G. I. A. Book Department.**

As in the case of Bragg's "Universe of Light," we have here the record of a series of experiments written by one of the experimenters. Dr. Rinne, whose death in 1932 ended long years of outstanding prominence in the scientific world, was the Professor of Mineralogy in the University of Leipzig and everywhere known for his research in the ultimate structure of matter. He explains the experiments made both by himself and by others, and from them draws his conclusions.

The form and behavior of atoms, as indicated by various manifestations, are first described. Dr. Rinne then explains the combination of atoms into molecules. The study of fine structure from the standpoint of physics is likewise detailed. From this discussion, the author leads into the process of formation and the structure of crystals. During the explanations of crystal behavior, the diamond is frequently used as an illustration, and sometimes as a particular isolated case.

"Crystals and the Fine Structure of Matter" is no book for a beginner. However, it is a book which not only clarifies crystal structure for many students of gemology in which subject only the elements of fine structure are included, but it opens wider the door to the fascinating experiments now being feverishly pursued in the race between nations to further subdivide the atom, to transmute elements, and possibly to release unimagined power.

—*R. M. S.*

GEMOLOGICAL GLOSSARY

(Continued from last issue)

(The key to pronunciation will be found in the January issue.)

Burnt. Term applied as a prefix, i. e., Burnt Topaz) to refer to gems such as topaz, amethyst, etc., the color of which has been changed by burning or heating.

Button Pearl. Dome-shaped pearls with one surface almost plane.

Byon. Alluvial gravels in which rubies are found in Burma, locally known as byon.

Byssus (bis'sus). The threads secreted by glands in the foot of certain shell-fish, for attachment to hard bodies or to one another.

Bywaters (bei'wa"ter). Decidedly yellowish diamonds.

Cabochon (ka"boe"shon'). A stone of convex form, highly polished but not faceted; also the style itself. Such stones are said to be cut "en cabochon", or simply cabochon.

Cachalong (kash'oe-long). A milky-white opaque (or feebly translucent), porcelain-like variety of common opal.

Cairngorm (karn'gorm). Smoky quartz. "Scotch Topaz". A variety of crystalline quartz which is smoky-yellow to dark-brown or black in color.

Calamine (kal'a-mine or min). See Smithsonite.

Calcite (kal'site). Calcium carbonate. (Carbonate of lime). Hardness, 3; R. I., 1.49-1.66; Specific gravity, 2.71; birefringence very strong. When pure is white or colorless. When colorless is known as Iceland spar, a variety used to illustrate birefringence and to polarize light. When banded is correctly called onyx marble and incorrectly as "Oriental alabaster", "Mexican Onyx," "California Onyx," etc.

Calibre Cut Stone (kal'i-ber). Small stones which are cut to exactly fit a space in a mounting; such spaces are usually lines in which are set many stones side by side.

"California Cat's-eye" (kal"i-for'-ni-a). Compact serpentine, sufficiently fibrous to show a silky luster and to produce a cat's eye effect when cut cabochon.

"California Iris". Kunzite (spodumene).

"California Jade". Californite.

"California Lapis". An incorrect name for blue dumortierite or dumortierite quartz resembling lapis lazuli in appearance.

"California Moonstone". White or gray chalcedony.

"California Onyx". Dark-brown aragonite.

"California Ruby". Garnet.

"California Tiger-eye". California cat's-eye.

Californite (kal"i-for'nite). Compact variety of vesuvianite or idocrase. Incorrectly known as "California Jade".

Cameo (kam'ee-oe). Generally a carved gem of two differently colored layers, the lower layer forms a background for a raised figure cut out of the other layer. When cut from onyx, or less commonly used gem minerals, are known as stone cameos. When cut from shells are known as shell cameos. Cameos are molded from a kind of semi-porcelain called Wedgwood. They are also molded from lava.

"Canary". Diamond with pronounced yellow color.

Canary Beryl. Greenish-yellow beryl.

Cancrinite (kan'kri-nite). A mineral occurring only in igneous rocks of the nephelite, syenite and related groups. Sometimes used as a gem stone. Hardness, 5-6; specific gravity, 2.42 to 2.50. Luster, sub-vitreous or a little pearly or greasy, strongly translucent. Bright orange yellow to pale yellow, gray, green, blue, reddish and white.

Cannel Coal (kan'el). A substitute for jet.

Canutillos. Term used in Columbia for fine emeralds suitable for gems.

Canton (kan-ton'). A city in China. The world's most important jade market.

"Cape". A jewelry trade term for a white diamond, which to the experienced diamond grader exhibits a noticeable yellowish tinge.

"Cape Chrysolite". Green prehnite from South Africa.

Cape Garnet. Bright red-yellow garnet.

"Cape May Diamond". Colorless and clear rock crystal from Cape May, New Jersey.

"Cape Ruby". Blood-red pyrope garnet from South Africa.

Capillary (kap'i-la-ri). Hair-like. Very thin and greatly elongated prismatic crystals.

Capillary Attraction. Refers to the tendency of the surface of a liquid, as water to slightly resist an object which is passing through it.

Carat (kar'at). A unit of weight for diamonds, other gems and pearls. The carat formerly varied somewhat in different countries, but the metric carat of 0.200 grams or 200 milligrams was adopted in the United States in 1913, and is now standard in the principal countries of the world.

Carbon (kar'bon). An element. A jewelry trade term used to refer to any black inclusion or imperfection in diamonds; also a term used in industry to refer to the carbonado variety of diamond.

Carbonado (kar"bo-na'doe). Black diamond. A massive, impure, slightly cellular aggregate of small diamond crystals, forming a rock of granular to compact texture. Opaque, black, brown or dark grey. An industrial diamond. "Carbon" and "Carbonate" are trade terms for Carbonado.

"Carbonate" (kar'bon-ate). An industrial trade term for Carbonado. The word carbonate as used in chemistry and other sciences, has other definitions. See dictionary.

Carbonatization (kar-bon"a-ti-zae'-shun). Formation of carbonates.

Carbon Dioxide. Carbonic acid gas; a colorless gas 1.524 times as heavy as air and 22 times as heavy as hydrogen.

"Carbon Pin-points". A jewelry trade term referring to small black inclusions in diamonds or other gems, which are usually extremely small crystals of other minerals.

(To be continued)

UNUSUAL GARNETS

Most gemologists are well acquainted with the pyrope and almandine garnets. These gems, in their finer qualities, have always been in demand. Lately the desire of the public for garnets seems to be increasing. As a result, species of the garnet group which were once considered unimportant as items in jewelers' stocks, are beginning to find popularity with the public. The decision of dress designers to use brown as the predominant hue in fall styles may be used by the intelligent jeweler to further increase the interest in the many types of garnet. The brown gems may be sold on the strength of the harmony of their colors with brown dress material. The more unusual green garnets—especially demantoid—as accessories, furnish an excellent contrasting color to any brown shade.

Some interesting gem stones have been received recently at the G. I. A. laboratory, most of them from Ceylon. Among them were several oriental-cut stones of a very attractive bright violet red. These stones were not of the violet color usually encountered in almandine garnet, but were lighter, somewhat more pink in hue. Sent by an Oriental dealer, the stones were listed as "Ruby Garnets." Instrument tests determined the following properties: Single refraction; refractive index, 1.75; hardness 7¼; and specific gravity 3.80. These all proved the stones to be pyropes, despite their almandine-like appearance. Almandite has a refractive index of about 1.79, hardness 7½ and specific gravity 4.05.

Another violet-red garnet gave the laboratory a stiff battle before it was determined. This gem exhibited single refraction, a refractive index of 1.76, and specific gravity 3.89. The difficulty in the determination was encountered when the stone proved to be over 8 in hardness; it scratched topaz and topaz would not scratch it. The spectroscope was resorted to, and the gem showed the absorption bands characteristic of almandite. Upon the strength of this test in conjunction with the refractive index and specific gravity, and in the absence of a description of a mineral possessing such properties and a hardness of over 8, the gem was classified as a rhodolite garnet. Rhodolite is generally considered to be a garnet composed of two molecules of pyrope to one of almandite. Due to the content of almandite molecules, rhodolite shows the same absorption bands as almandite. Pyrope shows no such bands. The other gems with which the stones tested might be confused—notably spinel—show either no absorption bands at all or bands of a very different character. The rhodolite was of a very beautiful red-violet and showed only microscopic flaws. As yet the only reported source of this material is North Carolina; it is to be supposed that the stone tested by the G. I. A. was from this source. The owner of the gems tested has no record of the source from which he had purchased them.

Grossularite, the green, semi-transparent gem which was formerly used as a substitute for jade, is finding favor on its own merit. This stone, like jade, is extremely tough and durable. It has a hardness of 7¼, and will therefore hold its polish longer than either jadeite or nephrite, both of which are slightly below 7 in hardness. The specific gravity is 3.61, and the refractive index 1.745. This material is found in fairly large deposits in South Africa in fine qualities and at several points along the west coast of the United States in paler and therefore less valuable qualities. It is to be expected that grossularite will appear more and more frequently in the trade.

A variety of the grossularite species is hessonite. It has the same physical and optical properties as has grossularite except that it is brown and transparent. Hessonite especially should find favor with the inauguration of fall styles. The rich orange-brown of this stone makes it the appropriate accessory gem for the promised new dress styles. The best qualities of hessonite are found in Ceylon; however, the Southern California mines near the Mexican border have also furnished gems.

Spessartite is another brown garnet; it ranges from orange-red to brownish-red, sometimes tinged with violet. It is 7¼ hard, 4.15 in specific gravity, and has a refractive index of 1.81. Although spessartite is found in many localities, very little of the material discovered is fit for cutting. The vicinity of Amelia Court House, Virginia, has yielded some fine gems, but no other source has become a producer. For this reason, and also because it is very similar to hessonite, spessartite has never won great favor as a gem.

Perhaps the most beautiful of all the garnets is demantoid, a variety of andradite. Demantoid is lower in hardness and higher in dispersion than any other garnet. Whereas the other garnets range between .024 and .028 in dispersion, demantoid possesses the figure of .057—greater even than diamond. A well-cut demantoid shows many rainbow colors. Flashing from the cool green depths of the gem, the spectra have a strangely beautiful effect. Demantoids are found usually in very small sizes; large gems are rare and valuable. The green of these gems sometimes approaches that of emerald, but the great difference in physical and optical properties easily distinguishes the two stones. Demantoid has a refractive index of 1.85, specific gravity 3.84, and hardness 6½. The Ural Mountain district of Russia has so far proven the only important source of demantoids. There they are found in and around the stream Bobrowska; the gems are sometimes called Bobrowska garnets. Demantoid is also called "Uralian Emerald," although true emeralds are found in the Urals. Even though the source of the demantoid seems limited, specimens appear rather frequently in the trade, especially in calibre work. Several have come from Ceylon, along with other gems cut on that island. There is, of course, the possibility that the rough material is imported from the Urals. However, since the Uralian deposits have proven to be very similar to those of Ceylon from the standpoint of gems yielded, demantoid may have been discovered in Ceylon. Germany, Hungary, and Italy are less important sources.

GEMOLOGICAL MICROSCOPY

I. DETECTION OF REPRODUCTIONS

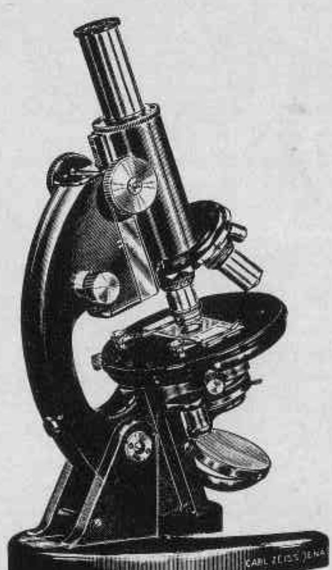
The importance of the microscope in gem-testing is second to that of no other instrument. This statement, of course, does not apply to the small and inefficient beginners' microscopes now being featured by several optical houses, but to more important equipment which includes aplanatic lenses and attachments for polarized light. The larger instruments, which have been referred to in G. I. A. literature as *polarizing microscopes*, have a great deal of practical value in testing gem stones. No less than four separate tests, each of considerable value, may be applied with such apparatus.

Although limited largely to distinguishing between genuine stones and their manufactured reproductions, the smaller beginners' microscopes have a place in the laboratory of the gemologist who does not plan later to equip his instrument for use in determination between the various gem species.

The first and most important application of any microscope in gem testing is its use simply as a magnifier. This includes principally the determination of synthetic and imitation gems through a study of their inclusions. A large number of the newer synthetics require a magnification of 200 times (200X) for identification. In a few cases in the Institute laboratory, over 400X has been found necessary. These latter stones, of course, were exceptional.

In order to secure 200X, a 20X objective (lower lens) and 10X eyepiece are required. The use of a 10X objective and a 20X eyepiece would not give the same result; beyond a certain point raising the power of the eyepiece, while theoretically increasing the magnification, does not increase the power of resolution. The 200 magnifications secured by the use of a 10X objective and a 20X eyepiece enable no closer study of inclusions than would 100 magnifications secured by a 10X objective and a 10X eyepiece.

The working distance of the objective also limits the magnifying power it is possible to secure. A high power objective has a very short working distance, and focuses less than a millimeter from the object. This short working distance makes it impossible



The Zeiss Microscope.
Recommended by the G. I. A.
for Gem-Testing.

to study the inside of a stone with an objective of more than about 40X. In fact, a 20X objective cannot be focused, through the table, on the culet of a cut stone of more than about five carats.

For general use in testing gems, objectives of approximately 10X and 20X and eyepieces of 5X and 10X are recommended. The magnification furnished by any pair composed of objective and eyepiece is determined by multiplying the power of the former by that of the latter. Thus, with the lenses recommended, magnifications of 50X, 100X and 200X may be secured. This range is sufficient for any but the most difficult determinations.

The placing of the stone upon the stage of the microscope should be done carefully. Often a gem has a culet sufficiently large to permit examination through it. In this case, the gem may simply be placed table down on a glass slide and centered on the stage. However, very few gems have culets large enough for this purpose. Then the stone must be mounted in such a manner that it may be studied through the table or one of the larger facets. The best material to hold a stone in any desired position has been found in the Institute laboratory to be ordinary beeswax. Beeswax may be shaped in the fingers to any desired form; it adheres to a gem pressed lightly against it. A rod of wax about one-fourth of an inch or less in diameter and an inch long may be rolled out between the fingers. Press one end of this rod against the stage and bend the wax in a right angle at the center of its length and adjust it until the free end is almost under the objective lens of the microscope. The gem to be studied may now be pressed against the free end of the wax rod in any desired position under the objective. In most cases, it is advisable to mount the stone with the girdle pressed against the wax and the table up.

It will often be found advantageous to mount the stone and wax upon a thin glass microscope slide, rather than directly upon the stage. The glass slide may be moved about to center the stone in the field of focus without moving the gem in its wax mounting.

Light is thrown upon the lower side of the object on the stage by a small mirror mounted at the base of the instrument. (See illustration.) A good source is an ordinary desk lamp, the sort with a flexible neck about a foot long. Special microscope lights are an unnecessary expense. The light from the mirror is passed through the substage condenser, in case the microscope is equipped with that accessory, and then to the gem. It passes through the gem, into the objective, and finally through the eyepiece to the observer. In case the gem is cut in such a manner that light can in no way be sent through it, or if the stone is opaque, the desk lamp may be raised to throw its light upon the top of the stage rather than on the mirror below. For most uses, however, it is preferable that light be sent through the stone from below. A fine microscope is usually equipped with a sub-stage condenser. This consists of a series of lenses which condense or concentrate the light upon the object on the stage. In most cases, a condenser is a very great aid in examining a transparent or translucent stone. It is, of course, impossible to use to illuminate an opaque gem. Sometimes the cutting of a stone will destroy the value of the condenser by deflecting the concentrated beam of light in a direction other than into the objective lens. In such an event the condenser should be removed from the body of the microscope and light directed from the substage mirror alone. As this mirror is movable, it may be adjusted in the position which throws the maximum amount of light into the stone. This procedure also is followed in case the microscope is not equipped with a condenser.

When the gem is mounted on the stage and the light is satisfactorily arranged, the microscope may be focused. And at this point we reach the first rule which must *always* be observed when using a fine microscope. *Never focus downward.* With your eyes at a level with the stage, and watching the position of the objective lens, turn the coarse adjustment—the pair of large knobs on the microscope in the illustration—until the exposed lens of the objective is almost resting upon the gem stone on the stage. Never let the objective touch the stone, however lightly. Each time the soft glass of the lens comes in contact with the hard gem, a scratch is made. Several such scratches can destroy the value of a fine lens.

Now the eye may be applied to the eyepiece and the microscope focused by turning the coarse adjustment. As the tube is thus raised, the stone will come into focus. In order to bring any point into the sharpest possible focus, the fine adjustment—the smaller knob set into the body of the microscope below the coarse adjustment in the illustration—is used. If a focus is not secured as the tube is raised, do not turn the coarse adjustment in the opposite direction without again removing the eye from the eyepiece and watching the objective approach the gem below.

Once an approximate focus is secured, the mirror or the lamp should be moved about until the maximum possible amount of light is sent through the stone. If the 'scope is equipped with a sub-stage condenser, this should also be focused, by turning its adjustment screw, until the light passing through the stone to the microscope is at its maximum brightness. Also, the stone itself should be moved by gently pushing it with the fingers or tweezers or by shifting the slide upon which it is mounted until that portion of the gem which it is desired to study is in the center of the field of vision. The fine adjustment is again used to sharpen the focus after the light and gem have been moved.

If one power of a microscope is being used—let us say 50X, it is sometimes necessary to go to a higher magnification—100X or 200X, to obtain a more distinct view of the inclusion or feature which is under observation. First be sure that the object which is to be studied is as nearly as possible in the field of vision. Then use the coarse adjustment to raise the tube of the 'scope well up out of the way. Change the objective lens, either by removing it and fastening a higher power in its place, or in case the microscope has a revolving nosepiece, merely by rotating the latter; then turn the coarse adjustment to lower the tube and focus as before.

Often when high magnification is used, it is very difficult to find inclusions in a light-colored gem. In this case, a rotating stage is of great value. The microscope may be set in such a position that it is known to be focusing inside the gem. Then the stage may be rotated. As moving objects are easily seen, the inclusions in the stone, which move in a circle as the stage is turned, may be located with more facility. Moreover, the rotating stage is an important aid in securing the maximum possible light through a facetted stone.

Using a microscope throws a strain on the eyes. However, an experienced microscopist can work with his instrument for several hours without fatigue. The secret lies in using each eye alternately. Most people, of course, have one eye which they prefer to use for close work. Therefore, it is necessary to start from the very first to use both eyes. In the beginning this will be rather difficult but as the trick is learned, it becomes second nature to shift from one eye to the other. Teachers advise changing eyes each time the microscope is re-focused. If this is followed as a rule, it will soon be found that one eye is equally as valuable as the other during a working period of reasonable length.

Moreover, both eyes should always be kept open. That is, the eye which is not being used should not be closed in order to see into the microscope tube more clearly. This throws a large amount of unnecessary strain upon the eye which is being used. As the eyes become trained in the use of the microscope, it will be found that the eye in use, upon which the microscopist's attention is fixed, is doing all the work; the resting eye will not register its impressions.

When working with gems, a number of difficulties are met which are not encountered in other microscopic determinations. Almost without exception these difficulties may be traced to the facets of the cut stones. The facets refract light at angles which prevent its passing through the stone and into the lens system of the microscope. Sometimes two facets, inclined steeply to one another, will break up the light passing through them into brilliant dispersion colors, thus preventing a focus. Most of these "facet effects" may be overcome by immersing the gem in a liquid of refractive index approximating its own. There is then no appreciable effect as the light enters and leaves the facets, and the light behaves, in reality, as though it were passing through a flat plate. The method of immersing the specimen has its drawbacks; the liquid used is often spilled on the stage and sub-stage parts of the microscope. Moreover it is difficult to shift the position of the stone while it is immersed in the fluid.

It is, of course, impossible to forecast all of the problems which the beginner may encounter. However, if the three definite rules which we have stated: (1) Never focus downwards; (2) Use both eyes alternately, and (3) Keep both eyes open—are always faithfully observed, one will lay the foundations for true expertness in microscopy. Ease and rapidity of determinations will come with practice.

MICROSCOPES FOR GEMOLOGICAL USE*

The following microscopes have been chosen from among the apparatus offered by each of the listed optical manufacturers. The microscopes listed here are those which, of each company, are the most useful for testing gems. Two instruments, as noted below, were found to have value in the testing of synthetics alone; that is, they fulfill the requirements under I, but not those of II. The following requirements were used as a basis of testing the various instruments:

I. Imperative features:
   A. Sufficient power to distinguish the most carefully made synthetics, such as those recently appearing in the trade.
   B. Great enough focal length to allow examination of a fairly thick stone.

II. Desirable features:
   A. Microscope stage must permit attachment of polarizing equipment.
   B. Calibrated fine adjustment screw.
   C. Stage of sufficient size that examination of gems is not unreasonably difficult.

The following microscopes were tested:

Bausch & Lomb. Stand equipped with rotating stage and double nosepiece for objectives. 10X and 20X objectives—10X divisible to produce 4X. 10X eyepiece. This is a good, manageable instrument. The rotating

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*G. I. A. Confidential Service.

stage is a very desirable feature. May be equipped with polarized light. Fine adjustment, but not calibrated. Price, $105.75. Polarizing equipment, $79.00, including substage condenser. *Recommended.*

The *Little Gem* or *New Gem,* much advertised product of Bausch & Lomb, is a beginner's instrument, although quite good of its type. It may be used to a limited extent for determination of synthetics. Magnifies to 300X. No fine adjustment; cannot be equipped with polarized light; cannot be increased above 300X magnification. Price, $17.00. *Not recommended, except for limited work with the determination of synthetics.*

E. Leitz. Standard microscope with objectives and eyepieces to give 100X to 500X. May be equipped with polarized light. Double nosepiece. Fine adjustment, uncalibrated. This instrument is of the usual fine quality of Leitz apparatus. Price, $83.00. Polarizing equipment, $79.00. *Recommended.*

Spi is the designation given to the Leitz beginner's microscope. Magnifies 100X to 500X. No fine adjustment. No provision for polarizing equipment. Price, $37.50. *Recommended, but only for determination of* synthetics.

Leitz also makes a small folding microscope of some merit. It may be equipped with stock lenses to give magnifications up to about 600X. It may be equipped with special polarizing attachments and rotating stage. The instrument is, however, extremely difficult to operate, especially when used with gems. Price, $50.00. Polarizing equipment, $59.00. *Not recommended.*

Spencer Lens Co. No. 64D. 10X and 4X divisible and 20X objectives. 6X and 10X eyepieces. Excellently calibrated fine adjustment. May be equipped with polarizing attachments. The lenses in the instrument submitted for tests were of very inferior quality. Price, $84.25. Polarizing equipment, $79.00. *Not recommended.*

No. 74Z. 4X and 10X divisible, and 36X objectives. 6X and 10X eyepieces. This is essentially the same instrument as the 64D, save that it has even poorer lenses and no fine adjustment. Price, $61.50. Polarizing equipment, $79.00. *Not recommended.*

Carl Zeiss. Standard microscope. 8X and 20X objectives; 5X and 10X eyepieces. Calibrated fine adjustment. Rotating stage. May be fitted with polarizing equipment. For any sort of work with gems, this is by far the most satisfactory instrument tested. Bubbles which other microscopes showed as little more than black patches, were resolved so that they could be studied closely by this apparatus. Price, $105.25. Polarizing equipment, including sub-stage condenser, $43.00. *Recommended.*

(These prices are those given by Pacific Coast representatives of the firms. Although every effort has been made to obtain accurate quotations, the Institute does not guarantee the prices to be absolutely correct.)

GEMOLOGICAL TITLES AWARDED

Since the publication of the May-June issue of *Gems & Gemology*, the following have passed the *Qualifying Certified Gemologist* Examination:

Justin DeVylder, Jeweler, Springfield, Massachusetts.

Karl G. Johnson, S. Jacobs & Company, Minneapolis, Minnesota.

Earl McBath, Jeweler, Chicago, Illinois.

Wm. H. Meyer, S. Jacobs & Company, Minneapolis, Minnesota.

Capt. Ted Syman, Syman Bros. Jewelry Co., Denver, Colorado.

Burt Umstead, C. C. Lewis Jewelry Company, Glendale, California.

Samuel R. Zickerman, Zickerman Bros., Jewelers, Woodside, L. I., New York.

The following persons have qualified as *Graduate Members* of the *American Gem Society* since the publication of the May-June issue of *Gems & Gemology*:

CALIFORNIA
Earle B. Hall, *Pasadena*
Joe Handcock, *Compton*
E. I. Hunt, *Alameda*
Harold B. Ross, *Hollywood*
William Stedman, *Fullerton*
J. W. Ware, *San Diego*

ILLINOIS
Hans J. Bagge, *Chicago*
Joseph Galowitsh, *Chicago*

INDIANA
Guy Swartzlander, *Kendallville*

IOWA
Earl George, *Des Moines*

MASSACHUSETTS
H. D. Feuer, *Worcester*

MISSOURI
Leo J. Vogt, *St. Louis*

OHIO
Clayton G. Allbery, *Cleveland*
Louis J. Binder, *Cleveland*
C. J. Cornell, *Cleveland*
H. A. Erickson, *Cleveland*
H. B. McCague, *Cleveland*
W. A. Ritzi, *Parma*

VIRGINIA
Geo. C. Barclay, *Newport News*

WASHINGTON
Harry F. Arold, *Seattle*

WISCONSIN
Ervin A. Christianson, *Port Washington*
Alvin F. Loose, *Milwaukee*

The new *Graduate Members* of the *American Gem Society* are now displaying this registration card:

THIS CERTIFIES THAT

WILLIAM H. ROBINSON

HAS SATISFACTORILY COMPLETED THE GRADUATE REQUIREMENTS OF THIS SOCIETY AND ALSO ITS ANNUAL CUSTOMER-PROTECTION EXAMINATION FOR THE YEAR 1934.

AMERICAN GEM SOCIETY.

Registered Diamond and Gem Merchant No. 327

Robert M. Shipley
Secretary, Examining Board

— Obtainable from *American Gem Society*.