Gems & Gemology

GEMS & GEMOLOGY is the quarterly official organ of the American Gem Society, and in it appear the Confidential Services of the Gemological Institute of America. In harmony with its position of maintaining an unbiased and uninfluenced position in the jewelry trade, no advertising is accepted. Any opinions expressed in signed articles are understood to be the views of the author and not of the publishers.

VOLUME II | FALL, 1936 | NUMBER 3

In This Issue:

Published by

THE AMERICAN GEM SOCIETY

555 South Alexandria | Los Angeles, California

YEARLY EXAMINATIONS SENT

The first annual examinations for Registered Jewelers, A.G.S., and Practicing Certified Gemologists, G.I.A., are now in the hands of holders of these titles. Those who have not already done so are urged to answer their questionnaires immediately. This is required for 1937 re-registration of title-holders. If you are a title-holder and have not yet received the examination, be sure to advise the American Gem Society immediately.

THE DIAMOND MARKET*

The strong tone of the diamond market which has been reported in each issue continues, with prices gradually rising. Fine stones in large sizes become increasingly scarce and it is said that it is now almost impossible to secure selected material of over 5 carats.

The imports of rough diamonds into the United States are increasing and American cutters are resuming operations, suspended since 1932.

In the foreign markets the demand continues to be firm though the Belgian cutters still bewail their lack of profits. The increased armaments of almost every country are causing a greatly increased demand for industrial stones and prices on these are rising steadily. Only bort continues variable. When it is offered at low prices it is used for cheap goods. Stabilization of the price of bort, as the foreign cutters point out, will tend to further stabilize the price of all cut material, particularly of the cheaper qualities.

The Diamond Corporation maintains its policy of selling limited amounts of rough at continuously increasing prices, and this, of course, reflects beneficially on the diamond trade as a whole. The gradually increasing price of cut stones in addition to the sensational rise of platinum to double its price at the first of the year has increased the price of jewelry in the United States and has raised the value of almost every jeweler's stock. The removal of the 10% tax on jewelry has also been beneficial to the trade and has allowed reliable firms to "push" their finer merchandise without fear of competition from unscrupulous dealers who were in the habit of "dodging" the tax.

The stabilization of the currencies of France, Great Britain, and the United States has caused a momentary lull in the market, especially in Amsterdam, where cutters are apparently awaiting the reaction of American buyers to the stabilization. It is doubtful, however, that stabilization will lead to lower prices, except possibly in the case of melee.

*A.G.S. Research Service.

Construction of a Polarizing Microscope

For those who cannot afford to purchase a microscope, Mr. Hoover gives practical instructions for making one which will perform as satisfactorily as many factory-built instruments.

by R. C. HOOVER
Registered Jeweler and Junior Gemologist, Akron, Ohio

One of the most useful instruments in all branches of scientific investigation is the microscope. In gemology, as in mineralogy, it affords a means of determination through a number of applications. A variety of microscopes are made, with features designed for special types of work, and among these specialized instruments the one which most closely approximates that needed for aid in determination and study of gems is the standard petrographic microscope. This instrument is provided with adjustments and accessories for the study of thin sections of rock, crystals and minerals. Its main features are a revolving stage for the rotation of the object and some means of polarizing the beam of light used for illumination. Also a polarizing device for analyzing the light after it passes through the specimen. The standard petrographic microscope is further equipped with cross hairs in the eyepiece; a graduated circle on the eyepiece for measuring crystal angles with the cross hairs; a graduated rotary stage, various crystal plates and screens and many other accessories which are needed for making exact measurements and highly accurate determinations of great importance to the mineralogist in dealing with raw materials, but for simple determinations and the application of polarized light only the revolving stage and polarizing apparatus are needed. It is the construction of such a simpler form of instrument, with the additional feature of a means of changing from polarized light to ordinary light for observation of imperfections, inclusions, striæ, etc., in gem stones which the writer will attempt to describe.

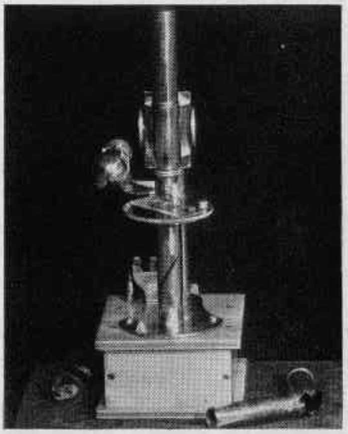

Fig. 1
Front View of the Microscope Made by Mr. R. C. Hoover.

It will be assumed that the prospective builder will, in most cases, be a jeweler or have had some experience with metal working and equipped with the necessary tools and skill for making the various parts and putting them together, so no definite instructions or measurements other than those which apply to proper operation of the instrument will be given, the builder thus being left free to make it as simple and plain or as complicated and highly finished as fancy or necessity dictate.

Now as to cost and materials. The microscope illustrated was made by the writer at a total cost for all parts and materials of just under \$15.00. The lens equipment consists of a 5X Huygenian eyepiece at \$3.00 and a 32 mm. 0.10 objective at \$7.00 both obtainable from Bausch & Lomb or any optical house. The rack and pinion, if used for focusing, may also be obtained from B. & L. for \$1.25, more about this later, however, as it may be eliminated if preferable. The other parts bought are an automobile dash light socket and 21 candlepower headlight bulb and a transformer for delivering 6 volts reduced from 110. A toy transformer will serve, but heats up badly if used for long periods and it is preferable, if possible, to persuade a radio repair man to rewind a burned-out miniature radio power supply transformer to deliver exactly 6 volts when in use, as this runs fairly cool and costs little. Brass plates ⅛ or $\frac{3}{16}$ inches thick for the base and stage can be obtained from any large hardware store, and the 20-gauge brass tubing, 1 inch outside diameter, for the draw-tube, etc., is most easily obtained from a plumber in about 12-inch lengths, it being a necessary part of an essential bathroom fixture. The "backbone" or column which supports the stage and draw-tube support in the instrument illustrated was made from half of a brass wash-bowl trap sawed off at the center of the curve.

These parts and some thin brass plate, to be used for making brackets to hold the light, some brass screws and an extension cord complete the parts, with the exception of a condensing lens and plate glass for the polarizing mirrors which will be described later.

The wooden base under the microscope has a hinged door in the back and contains the transformer and extension cord and this, as well as the wooden box to contain the entire outfit, is optional. If no special emphasis is placed on appearance by the builder, the parts may be soft-soldered together, but brazing will produce a much stronger and neater job and one which will stand buffing and polishing and permit electroplating if desired. "Ezy-Flo" brazing wire, used with the flux which is furnished with it, was found to work very nicely used with a torch capable of heating the parts to redness. "Ezy-Flo" flows at 1100 degrees, thus leaving plenty of margin between it and the melting point of the brass, whereas silver solder is so close to the melting point of the material that there is danger of melting laboriously made parts and so should not be used.

Of the several means of producing polarized light, this instrument utilizes the polarizing angle of ordinary glass as being the most economical and suitable for self-manufacture. Fig. 1 shows the entire outfit with the regular or ordinary light straight tube on the microscope and the analyzing draw-tube lying beside it, and gives a good idea of the general layout. Fig. 2 (in next issue) gives a side view, with the analyzing tube in place. This tube, together with the polarizing mirror below the stage, being the most important and necessarily accurate parts they will be described first.

(To be continued)

A GEMOLOGICAL ENCYCLOPEDIA

(Continued from last issue)

HENRY E. BRIGGS, Ph.D.

Synthetic corundum is very brittle and the boules often are rent by the extreme internal strain caused by rapid cooling. For this reason the boules are split lengthwise or along the optic axis in order to relieve this stress. The boules split readily in this direction, and by being so split the stress is most effectively overcome. However, it results in pieces of such a shape that it is difficult to properly orient the crystals for cutting. Natural ruby and sapphire are usually cut perpendicular to the optic axis; by this orientation the best color is obtained. However, in the synthetic it is not practical to so orient the crystals for the reason that they could not be economically cut, and also for the reason that such a method would entail a careful examination of each crystal before its cutting. This would consume a great deal more time, and consequently the price would be much higher. Then, too, the lapidaries of some of the foreign countries where synthetics are cut, do the work in their own homes and are not equipped with the necessary optical instruments to make such examinations. They are paid such low wages that they can scarcely live as it is, and cannot afford to waste time with proper orientation of crystals. The lapidary to whom is entrusted the cutting of a rare natural gem, is better paid and has more time to spend upon each job. For this reason the dichroscope can be used to detect synthetic, as a rule. The synthetic will be dichroic when viewed through the table, while the natural will not be because the table is perpendicular to the optic axis, and in that particular direction the mineral is isotropic.

Because of the extreme brittleness of synthetics, they are apt to check at the angles of the facets. Any slight blow or pressure during use will cause these checks, and frequently they are present as the stones come from the cutters, having occurred during the cutting and polishing. Especially if the polishing lap is slightly out of true, or if it is run at too high a speed, these checks will appear. The natural stone, on the other hand, is one of the toughest of stones, and it requires a terrific blow to cause a fracture in it. When such a blow does occur, a conchoidal piece will usually be broken out of one of the angles, instead of a check forming.

Regarding the composition of the synthetic corundum: In the colorless synthetic the stone is pure alumina, while in the natural it would indeed be exceptional to find a stone which was entirely pure. In the Blue, the synthetic contains a certain amount of titanium oxide, while the natural does not. Also, in the ruby the percentage of iron in the natural is rather high, while in the synthetic it is either absent or present only as a trace. The spectroscope will be found rather invaluable in determining the synthetic corundums and the natural.

Spinel is also produced synthetically by the same process as described in the making of the corundums. The only difference being the addition of a small amount of magnesium oxide, which changes the product to magnesium aluminate or spinel.

Spinel crystalizes in the cubic system, and in the boules of the synthetic the square outlines and large faces clearly point to this system of crystallization. It is singly refractive, the same as the natural, and the specific gravity and index of refraction will be found near to that of the natural. However, the test of microscopic bubbles, as outlined for the corundums, will hold true here also, and will serve as a means to distinguish between the synthetic and the natural, as will also the structure lines.

The gems sold as synthetic zircon, rozircon, aquamarine, and alexanderite all may be synthetic spinel colored to imitate these gems. However, in every case mentioned the natural gems are all anisotropic, while the synthetic spinel is isotropic. This will afford an easy method of detection.

Synthetic spinel is exceedingly brittle and often chips while being set in mountings. The natural stone is a very durable gem.

Synthetic beryls and emeralds have never been produced in a commercial way. All gems offered as "synthetic emeralds" are merely spinel of corundum which is colored to imitate these gems as outlined before, or are doublets or triplets, or imitations.

Synthetic diamonds have been a bugbear to many in the form of wild imaginations. Large sums of money have been squandered in an effort to produce diamonds artificially. However, despite the fact that different men from time to time have laid claim to having produced crystallized carbon, it still remains to be done, at least in a way so as to produce crystals of a size visible to the naked eye. Moissan, Noble and Crookes all claimed to have a process to produce diamonds artificially. However, despite their claims they were only able to show the most minute microscopic grains. So tiny were these grains that very grave doubt clouds their actual identity. Such is the success attained along this line. The author feels that since the diamonds (so-called) which were produced were worthless, the processes are hardly worth spending time on.

From the foregoing it will be obvious that despite the claims of makers of synthetic and others, there has not yet been produced a laboratory gem which was in every sense of the word identical to the natural. It is true that moldavite or natural glass can be so skillfully imitated as to defy detection by the methods ordinarily at our disposal. However, in the case of the higher types of crystallized gems we will see, from a very little observation, that there exist many points, such as the structure lines, wherein the synthetic is not identical to the genuine.

Synthetic gems fill a useful place in cheap jewelry and as jewels for delicate instruments. Due to their superior hardness they are a very welcome substitute for the old doublets, and because of their low cost they are appreciated by those who cannot afford the genuine. Synthetic gems are manufactured chiefly in Switzerland, France, Italy, and Germany.

(To be continued)

SPECTROGRAPHIC CHEMICAL ANALYSIS OF SIAMESE ZIRCONS*

The Zircon presents more baffling problems than any other gem species. Mr. Howell contributes the results of preliminary work on the gem.

by

DAVID H. HOWELL
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The following spectrographic investigation of Siamese zircons conducted at Pomona College, Claremont, California, with the aid of Dr. T. G. Kennard, Research Fellow in Chemistry and appearing soon in the "American Mineralogist," is herewith rewritten in part for *Gems & Gemology.*

The gem-stone zircon, a silicate of zirconium, is generally classified into three types according to its density and refractive index. Those with a refractive index of approximately 1.93-1.99 and density of 4.7 are the b- zircon according to the modifications given by Smith and Spencer, and is the *alpha* type of Schlossmacher and the G.I.A. The second or unstable variety, refractive index about 1.92-1.97, density 4.3, are said to increase these properties and become the normal type upon heating, and are the G.I.A. *beta* zircons. The third type, generally seen in the green variety which are exported from Ceylon, have an index of refraction of 1.81 and a density averaging 4.0. The material used in this investigation was the normal, or *alpha*, modification and were very kindly donated by C. A. Allen of Cranbury, New Jersey, a graduate member of the A.G.S. and a junior gemologist.

The examination was made with a large quartz spectrograph of the Littrow type manufactured by Gaertner. The samples were crushed in an agate mortar and examined under a microscope using a magnification of 35X. Only material free from inclusions and color spots, visible under a magnification of 35X was selected. This material is designated as "clear" or "inclusion-free." Sample No. 10 was found to be coated with a grayish white glaze, presumably due to the chemicals used in heat treating. This glaze was removed and spectrographically examined as sample No. 10a, the included black spots and zones of black material composed sample No. 10b. The inclusions removed from samples Nos. 1, 2, and 3 (brown mine-rough) were red in color, and in No. 2 black spots were also found. The red spots corresponded with those of the clear water-white samples.

In all the zircons, distinct spots or zones, or both, appeared as inclusions when examined under a magnification of 35X. Separation of clear portions for samples, in the crushed material, was comparatively simple except in the case of the blue variety. Here the inclusions consisted of a relatively small number of black spots distributed throughout the entire sample. No separation was made since the material as a whole was practically inclusion-free.

*G.I.A. Research Service.

Chemical Elements Found in Siamese Zircons

Sample No.	Color	Large	Medium	Small	Very Small	Trace	Minute Trace
1.	Brown (clear)	Zr Si	......	......	Hf	Ca	Mg Ba
1a.	Red (inclusions)	Zr Si	......	......	......	Fe Ca	Mg Ba
2.	Brown (clear)	Zr Si	......	......	Hf	Ca	Mg Ba
2a.	Red (inclusions) Black (inclusions)	Zr Si	......	......	......	Fe Ca	Mg Ba
3.	Brown (clear)	Zr Si	......	......	Hf	Ca	Mg Ba
3a.	Red (inclusions)	Zr Si	......	......	......	Fe Ca	Mg Ba
4.	Blue	Zr Si	......	......	Hf	Ca	Mg Ba
5.	Blue	Zr Si	......	......	Hf	Mg Ca	Ba
6.	Blue	Zr Si	......	......	Hf	Mg Ca	Ba Ti
7.	Blue	Zr Si	......	......	Hf	Mg Ca	Ba
8.	Straw-yellow	Zr Si	......	......	Hf Ag	Mg Ca Na	Ba
9.	Water-white	Zr Si	......	......	Hf	Mg Ca	Ba
10.	Water-white	Zr Si	......	......	Hf	Mg Ca	Ba
10a.	Glaze	Zr Si Na	Ag	......	Al Fe Mg Ca	Ag Li V	Ba
10b.	Black (inclusions)	Zr Si Fe	Al	......	Hf Ag	Mg Ca Na	Ba
11.	Water-white	Zr Si	......	......	Hf	Ca	Ba
11a.	Red (inclusions)	Zr Si Fe	......	......	......	Ca	Ba
12.	Water-white	Zr Si	......	......	Hf	Ca	Ba
12a.	Red (inclusions)	Zr Si	......	Fe	Hf	Ca Ti	Ba
13.	Water-white	Zr Si	......	......	Hf	Ca	Mg Ba
13a.	Red (inclusions)	Zr Si	......	Fe	Hf	Ca Mg Cu	Ba

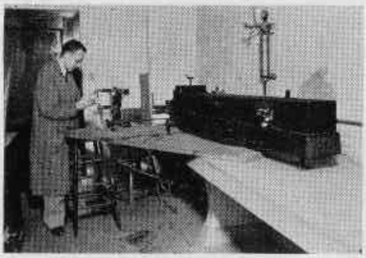
Ag—silver; Al—aluminum; Ba—barium; Ca—calcium; Cu—copper; Fe—iron; Hf—hafnium; Li—lithium; Mg—magnesium; Na—sodium; Si—silicon; Ti—titanium; Zr—zirconium.

The accompanying table lists the various zircons analyzed, together with their colors and chemical elements—even the most minute traces—found to be present. Oxygen—though not listed in the table—is an integral element in the composition (Zr Si04) of zircon.

The cause of color in zircons has generally been attributed by various authors to impurities, particularly iron, copper, titanium, chromium, vanadium, uranium, thorium, hafnium and magnesium. With the exception of traces of magnesium, sodium and silver, this spectrographic examination did not show any marked differences in chemical composition between the blue, brown and colorless "inclusion-free" samples. Hafnium, barium and calcium appear in all "clear" samples and no correlation between color and composition is shown. The presence of sodium and silver in samples 8, 9, 10 may be accounted for by the chemicals used in heat treating. C. A. Allen, in his article in *Gems & Gemology*, November-December, 1935, says that the colorless zircons are often produced from the brown mine-rough by the use of chemicals and heat and that sometimes silver nitrate, arsenous acid and sodium hypophosphite is the chemical employed.

Since no difference in composition between the three color varieties was observed it was concluded that the color was not due to any specific element in the zircon as an impurity, but that the color may be due to variations in crystal structure or colloids (impurities in a finely divided state).

This examination is the first of a series of investigation which I have planned to carry on in an effort to solve some of the mysteries of this little known and fascinating gem, zircon. No definite conclusions can be drawn from the data now available and given herewith.



The Large Spectrograph with which the Results in the Above Article Were Obtained. Dr. T. G. Kennard is the Operator.

BIOGRAPHICAL SKETCHES

SYDNEY H. BALL

Sydney H. Ball was born in Chicago in 1877. His geological training was taken at the University of Wisconsin, where he received his A.B. in 1901 and his Ph.D. in 1910. Mr. Ball began practical work in geology in 1901 as geologist for the Missouri Bureau of Mines. From 1902 to 1903 he taught geology at the University of Wisconsin and from 1903 to 1907 was assistant geologist for the United States Geological Survey. From 1907 to 1909 he accompanied an expedition in the Belgian Congo as Chief Geologist for the "Societe Interiore Forestiere et Miniere du Congo" (an organization more commonly known as "Forminiere"). This expedition resulted in the opening up of the vast alluvial diamond mines of the Congo, which are an extremely important factor in the world diamond production today.

Since 1909 he has practiced generally as a consulting geologist in Europe, Asia, Africa, America, and Greenland. Mr. Ball is a member of the American Institute of Mining and Metallurgical Engineers of which organization he was a director from 1924 to 1927; a fellow of the Geological Society of America; and of the American Society of Economic Geologists, of which he was president in 1930; and of the Mining and Metallurgical Society. He is also a member of a number of other scientific organizations, including the Belgian Geology Society. In 1919 the Belgian Royal Order of the Lion, Grade of Officer, was conferred upon him.

Sydney Ball has always been interested in the source and production of gem-stones and he has prepared many papers on this subject; at the present time he prepares the official reports on gem production appearing in the *Minerals Yearbook* of the United States' Bureau of Mines. Mr. Ball has been extremely helpful to the Gemological Institute of America and has served as a member of the Students' Advisory Board and of the Examination Standards Board. By the latter body he was elected as one of the three members of the Examinations Board. Readers of *Gems & Gemology* are familiar with Mr. Ball's writings, which have appeared from time to time in this journal.

His particular interest is with diamonds, and his annual report on the diamond market is known to all jewelers. However, he is also interested in the history, valuation, and production of colored stones.

GEMOLOGICAL GLOSSARY

(Continued from last issue)

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

Terms in quotation marks are considered incorrect.

Hematite (hem′a-tite). A gem mineral; hardness 6, opaque, black, translucent and red in thin sections. Incorrectly called "bloodstone," which was the ancient name for hematite, "black diamond," "brown limonite." Blackest material with metallic luster is most desirable.

Hemihedral (hem″i-hee′dral). Having but half the planes or facets which a symmetrical crystal of the type to which it belongs would possess.

Hemimorphic (hem″i-more′fik). Having the opposite ends (of crystals) terminated differently.

"Herkimer Diamond." (hur′ki-mer). Clear quartz crystal, from Herkimer County, New York.

Hessonite (hes′oe-nite). A variety of grossularite (garnet), known also as cinnamon stone, hyacinth garnet, "hyacinth," "jacinth," "California hyacinth," "American hyacinth," "Ceylonese hyacinth," "false hyacinth," "Montana ruby," "California ruby." Transparent, yellow to red-orange, also yellow-brown and orange-brown.

Hexagon (hek′sa-gon). A six-sided style of cutting.

Hexagonal System (hek-sag′oe-nal). A system in crystallography, a division of which is known as the rhombohedral system; has four axes, three in one plane inclined to each other at 60 degrees, the fourth perpendicular to this plane. Corundum, beryl, tourmaline, and quartz are important gems in this system.

Hiddenite (hid′n′ite). Green spodumene, known also incorrectly as "lithia emerald." Intense yellowish-green to yellow-green. See also Spodumene.

High Gate Resin. See Copaline.

Hinge Pearls. Pearls of elongated shapes from the hinge of the fresh water mussel.

Hololith Ring (hoe′loe″lith). An entire ring made from a single piece of gem material.

"Honan-Jade" (hoe-nan′). Same as "Soochow jade."

"Hope Sapphire." Term originally applied to a blue synthetic spinel, in fanciful allusion to the blue Hope Diamond.

Hope Stone. A trade name now applied by an American importer to any synthetic corundum or spinel. See Hope Sapphire.

"Horatio Diamond" (hoe-rae′shi-oe or shoe). Colorless quartz from Arkansas.

Hornblende (horn′blend″). Dark green-brown mineral. See also Amphibole.

"Hot Springs Diamond." Rock crystal.

Hue. The principal attribute by which a color is distinguished from black, white or neutral gray. The attribute by which colors, when they are arranged in orderly sequence around the circumference of a color circle, are perceived as differing from one another. Red, yellow, blue, etc., are different hues, while pink (light red), maroon (dark red) and red-brown are colors which have the same hue but which differ in other attributes.

Hulls. The very thin outer coatings or nacreous layers of pearl.

"Hungarian Cat's-Eye" (hun-gae'ri-an). An inferior yellowish green variety of quartz cat's-eye from Bavaria.

Hungarian Opal. A white opal with a fine play of color, found in the country which was formerly Hungary—now part of Czechoslovakia.

Hyacinth (hye'a-sinth). A variety of zircon. The term is by some writers applied only to the red and orange variety. Others use it interchangeably with jacinth to mean yellow-orange or red or brown zircon. It is sometimes loosely used to mean any zircon. Hyacinth is also often used in the U.S.A. for the reddish, orangy, or brownish hessonite garnet.

"Hyacinth of Compostela" (kome-poe-stae'la). Quartz, with red metatie inclusions; also applied to a reddish variety of gypsum.

Hyacinthozontes (hye'a-sinth"oe-zone-is). Sapphire-blue beryl.

Hyalite (hye'a-lite). Colorless opal; also called water opal, "water stone," "Muller's glass."

Hydration (hye-drae'shun). Combining chemically with water.

Hydrogen (hye'droe-jen). A chemical element, a constituent of many gem-stones.

Hydrophane (hye'droe-fane). A variety of common opal. Must be immersed in water to produce play of color. Sometimes immersed or boiled in oil. See Floating Opal.

Hydrous (hye'drus). Containing hydrogen or water, and therefore, yielding water on heating.

Hypersthene (hye'per-sthene). A gem mineral in the orthorhombic system, closely related to enstatite and bronzite. Hardness 5-6, refractive index 1.71, translucent to opaque, dark green, brown to black, luster nearly metallic. See also Enstatite.

"Iceland Agate" (ice'land). A brownish or grayish iridescent variety of obsidian.

Iceland Spar. Calcite. Hardness 3, refraction 1.49-1.66, transparent or translucent, colorless and light tones of all hues.

Icy Flakes. A seldom used trade name for small cracks along cleavage planes sometimes caused by overheating stones during polishing.

I.D.B. Act. A South African law which makes the buying of diamonds from native laborers and others not entitled to their possession, a criminal offense.

Idiochromatic (id'i-oe-kroe-mat"ik). Stones in which the substance producing the color is an inherent constituent of the mineral and is limited to such stones as chrysocolla, malachite, diopside, and azurite.

Idocrase (eye'doe-krase). A gem mineral. A silicate of calcium and aluminum. Translucent, light blue to dark yellowish-green. Refractive index 1.72, hardness, 6½, specific gravity 3.4.

(To be continued)

BOOK REVIEWS

***The Book of Minerals*, by Alfred C. Hawkins. New York. Wiley & Sons. 1935. $1.50.**

This is a handbook for the amateur mineralogist. It offers hints as to where to find and how to collect and preserve minerals. Unfortunately, specific localities are seldom listed under the sources. Except for this omission the book will serve excellently as a guide to the beginner in the collecting of mineral specimens. Many minerals are described, and although discussed but briefly almost every one is presented in an interesting fashion. Dr. Hawkins has served for several years as a member of the Students' Advisory Board of the Gemological Institute of America, and for the last two years as leader of the New Jersey Group of the American Gem Society. He has had long experience in practical mineralogy and in adult education, so his "tips" are of undoubted value to anyone who wishes to build a mineral collection either through searching for specimens himself or by purchasing or trading for them.

The Book of Minerals is written in a popular fashion, for reading by the untrained amateur, and is definitely not a textbook. Technical discussion is altogether omitted, and the reader is referred to a bibliography if he desires more detailed information on any subject in the book. His book is written especially to create an interest in mineral wealth in general on the part of persons who are interested only in the more valuable minerals simply because these are the only ones which they know about. He states in his foreword that the minerals which he describes are mainly those "which furnish products which we use daily, or which give us gem stones, or something else that we know about."

***Minerals and How They Occur*, by Willet G. Miller, revised by A. L. Parsons. Copp Clark, Toronto. 1928.**

This text was prepared for study in Canadian schools and is written along rather unusual lines. The book refers especially to the minerals from Canada, and the discussion of sources is limited largely to those of the Dominion. *Minerals and How They Occur* presumes some knowledge of physics and chemistry on the part of the reader. It gives almost equal importance to mineralogy and geology, even discussing fossils and economic geology. The text is not much concerned with gems; moonstone, for instance, is not even mentioned as one of the varieties of feldspar, and the discussion of the diamond is limited to six lines.

In that the text discusses rocks as well as minerals, describing not only the minerals themselves, but also tying them in with the deposits in which they occur or in which they have formed, it has a very definite value for the reader who wishes to correlate the sciences of geology and mineralogy.

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(To be continued)

A New Gemological Refractometer*

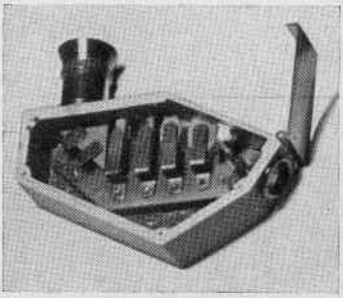
Every student of gemology knows the great importance of a refractometer in the identification of unknown gems. Only testing for specific gravity rivals determination of the refractive index of a gem as a means of determining its species. Unfortunately, many gemologists are prevented from owning a refractometer by the high cost of this instrument. Due to the complex construction required if the instrument is to perform even reasonably well, it is extremely difficult to simplify methods of manufacture and thereby reduce production costs; much of the work of assembly and aligning, indeed, must be done entirely by hand.

Therefore, Rayner of London is especially to be complimented on their recent achievement — the production of a truly satisfactory gemological refractometer which is priced at considerably less than any similar instrument on the market.

A principal item in the cost of the average gemological refractometer is the hemisphere, or portion of hemisphere, of expensive dense optical glass which is the "soul" of the instrument. By employing a very small prism of this glass, backed up with a large specially shaped lens of ordinary optical glass, Rayner has cleverly overcome the problem. Moreover, every lens in the instrument is a segment employing only the minimum necessary area and thereby a saving in optical glass is effected throughout.

Another defect of the average refractometer is that it is very difficult to refocus if one or more lenses should become displaced. This difficulty also has been neatly overcome in the new Rayner instrument. Removal of the side plate renders every adjustable part easily accessible and adjustments can be made while observing results through the eyepiece.

The only principal criticisms which can be made of the instrument are relatively unimportant. It would be desirable to have a rotating hemisphere instead of the fixed glass prism, but this, of course, is made impossible by the very design we have commended above. Also, it would probably increase the value of the instrument if the light shield, which prevents unwanted reflection from entering the stone being tested, could be attached in such a manner that grazing illumination could be used. Such grazing light is often valuable when a clear reading is not possible by the usual method of illumination.



The Rayner Refractometer, with Side Plate Removed to Show Lens and Prism Assembly.

*G.I.A. Confidential Service. For price of new Rayner refractometer, see next page.