Gems & Gemology

GEMS & GEMOLOGY is the quarterly official organ 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. Subscription price: $3.50 a year.

Robert M. Shipley, Editor

VOLUME V SPRING, 1946 NUMBER 5

●

In This Issue: *Page*

●

Published by

THE GEMOLOGICAL INSTITUTE OF AMERICA
(UNITED STATES AND CANADA)

541 South Alexandria Ave. Los Angeles 5, California

Gemstone Inclusions

Photomicrographs presented as an aid to the identification of gem species and of the differences between genuine and synthetic sapphires, or imitations of topaz and tourmaline. All illustrations on these pages reproduced from Kodachrome transparencies by Dr. Edward Gübelin, Certified Gemologist, of Lucerne, Switzerland, Research Member of the G.I.A.

With this fascinating group of photomicrographic illustrations of inclusions in gemstones we resume reproduction of Dr. Edward Gübelin's Kodachrome studies from his invaluable Kodachrome-and-lecture gift to the Institute, which we interrupted following Spring 1945 issue to bring you one of his latest studies stressing inclusions typical of certain gemstones.

Beginning in the Summer 1945 issue, this latter series carried through Winter 1945-'46 issue. Our current illustrations continue, then, from Figure 48, page 210, of the Spring 1945 issue.

Dr. Gübelin's studies draw him more and more toward the conclusion that gemologists will sooner or later abandon the present-day orthodox method of first examining gemstones for genuineness by tests for specific gravity, refraction and dichroism in favor of an approach through study of their inclusions.

The remarkable studies reproduced in this issue illustrate inclusions in genuine sapphire, topaz, and tourmaline.

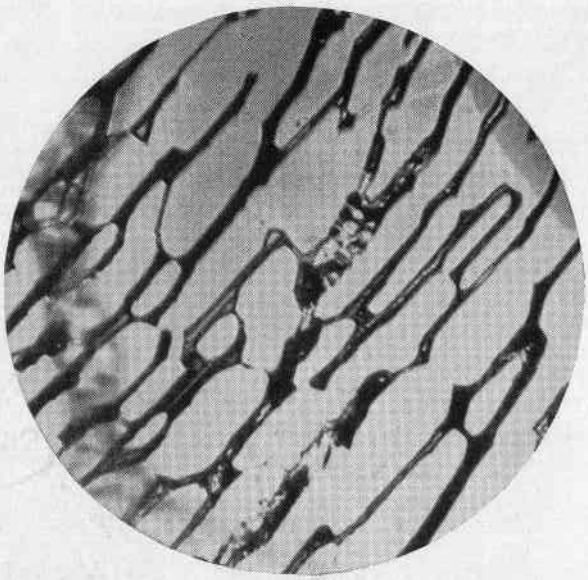


Figure 49
Mesh-like channels filled with differently colored liquids, in a ***Ceylon sapphire.***

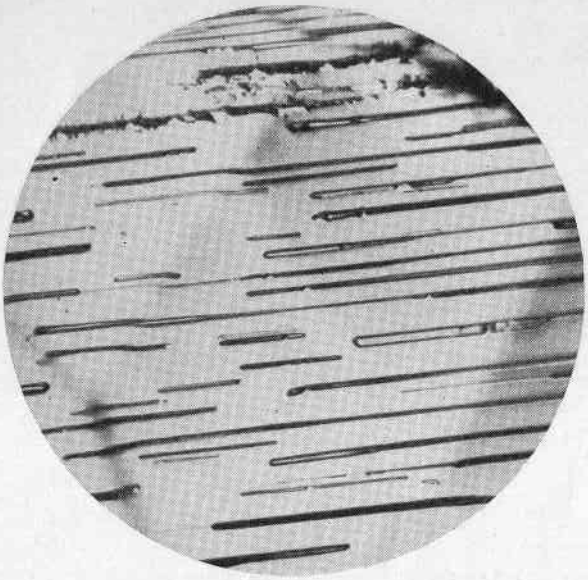
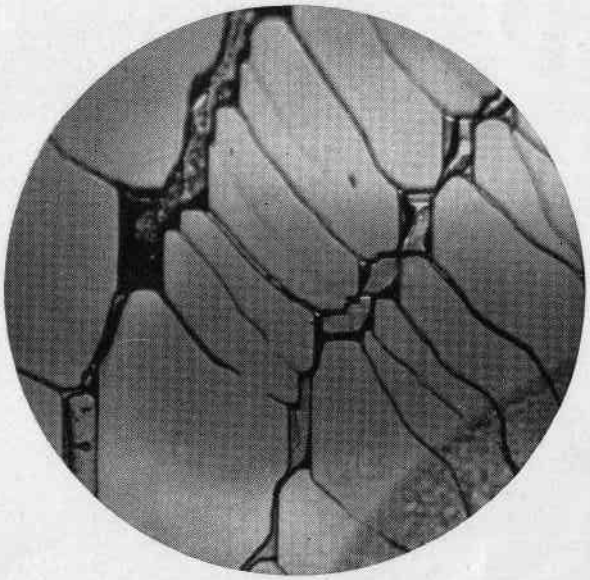


Figure 50
Straight, rod-like channels filled with liquid, in a ***Ceylon sapphire.***

Figure 51
Enlarged section of wonderful "feather" formation in a ***blue sapphire,*** *first shown in reduced size in Figure 5, Summer, 1944, issue. "Feather" consists not only of single drops but also of a large system of the finest liquid-filled channels connected by still finer capillary tubes.*



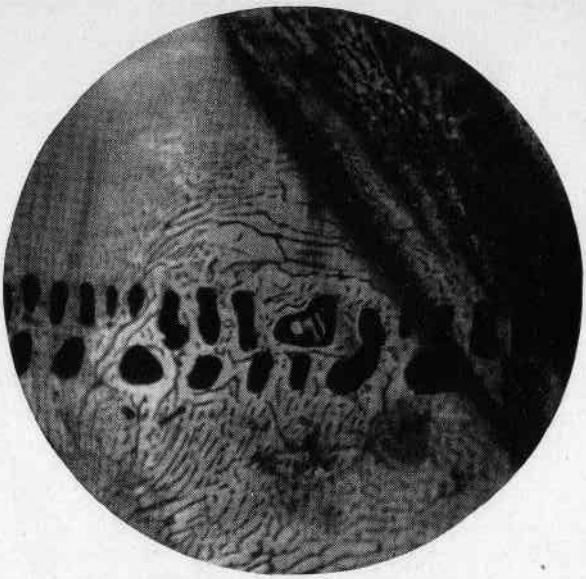


Figure 52
A straight double line of gas-filled negative crystals, with one liquid-filled cavity in the center, shown in ***blue Ceylon sapphire.***

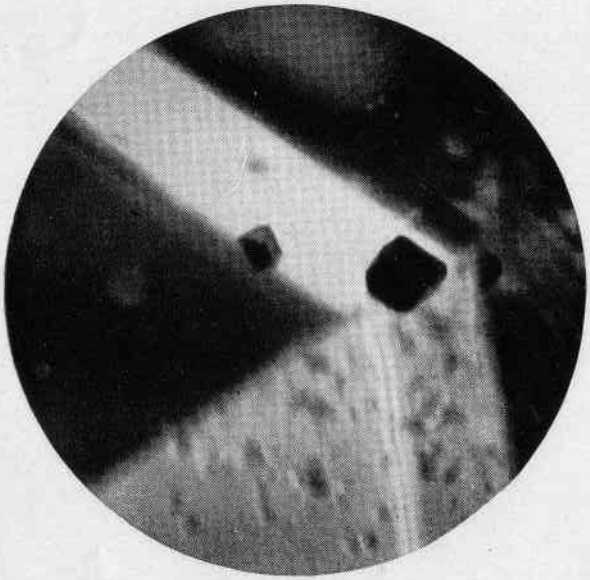


Figure 53
Octahedral crystals of dark red ruby spinels in a ***blue Ceylon sapphire.***

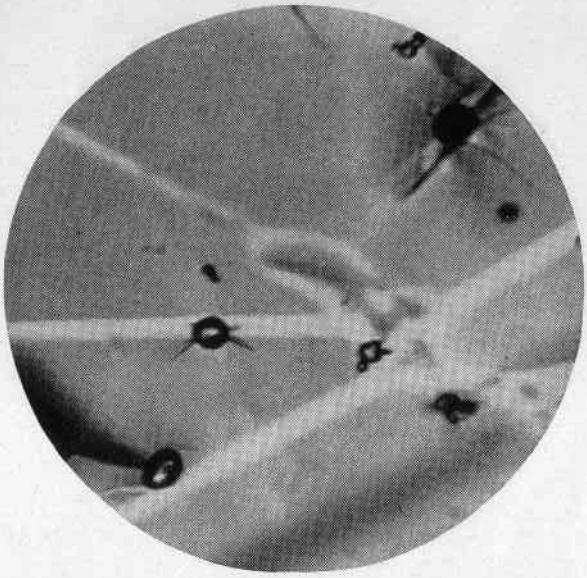
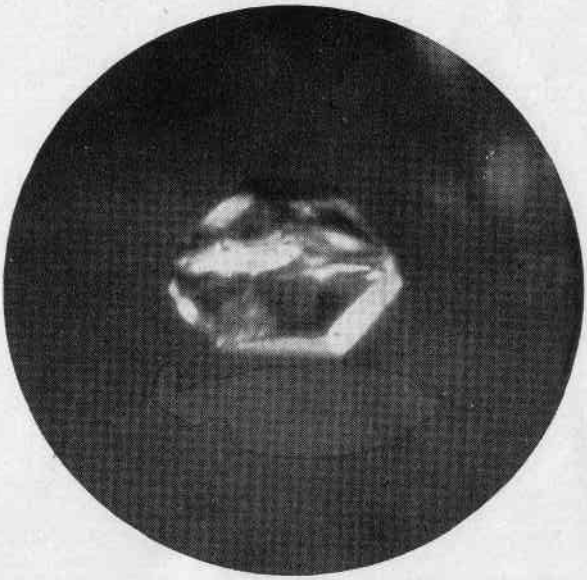


Figure 54
Loosely scattered brown zircon crystals, with brown pleochroic radiohalos, in a ***yellow sapphire from Ceylon.***

Figure 55
An exceptionally well formed corundum crystal in a ***blue Ceylon sapphire.***



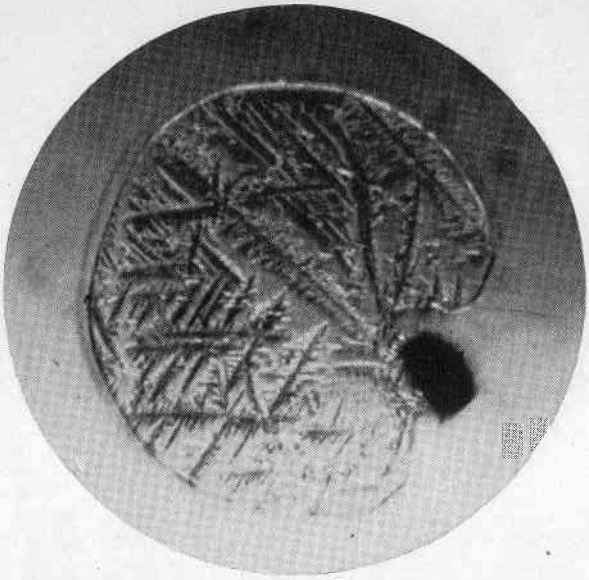


Figure 56
Liquid inclusion in a ***Siam sapphire,*** *showing formation of tiny crystals in an unusual and beautiful pattern.*

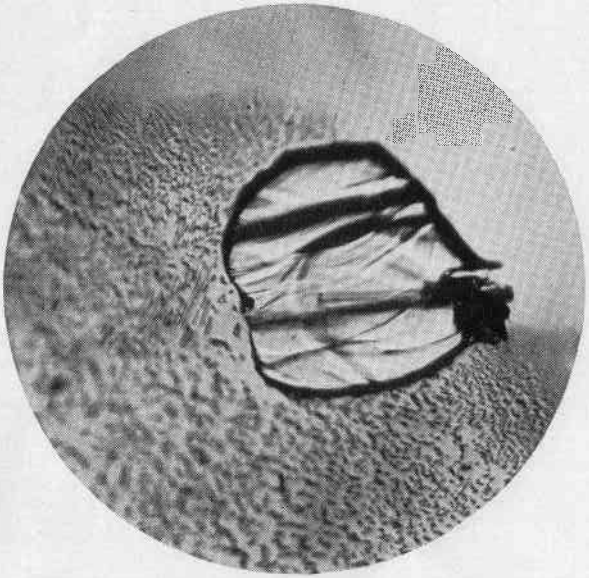


Figure 57
Thick plate of muscovite of the hexagonal outline of the host mineral, in ***light blue Ceylon sapphire.***

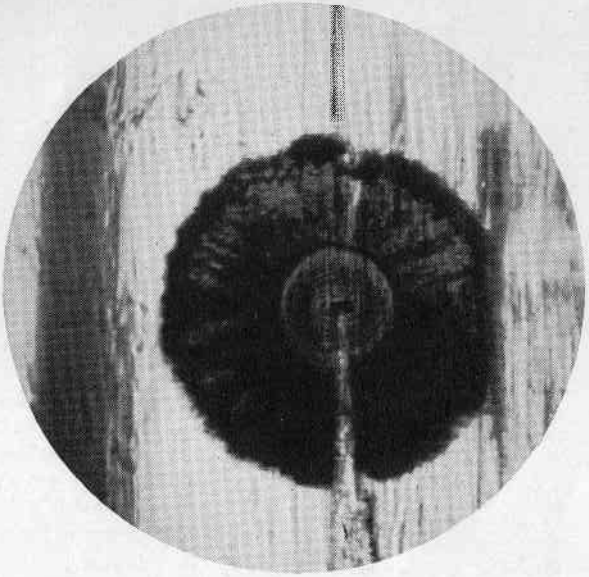


Figure 58
Disc-like inclusion, of concentric "year-rings" as seen in pearls and tree trunks, frequently seen in ***yellow and brownish-yellow topazes.***

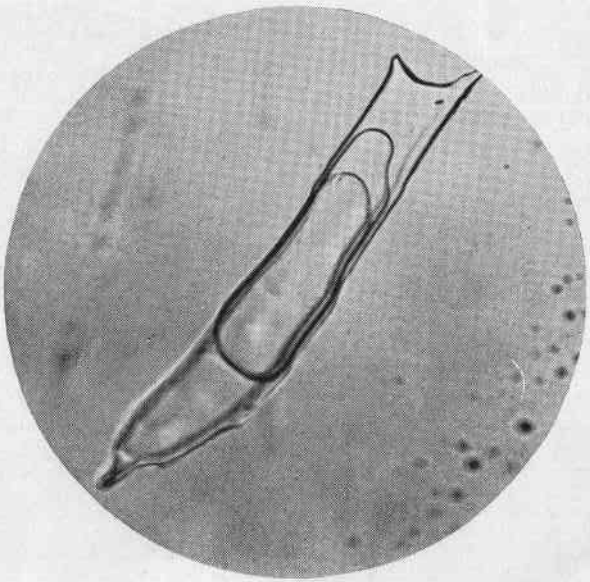


Figure 59
Several non-miscible liquids, in one inclusion, in a ***light blue topaz*** *from Brazil.*

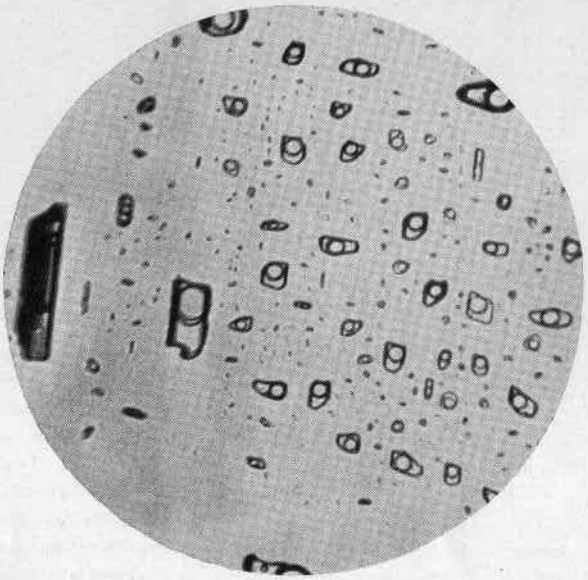


Figure 60
Irregular liquid inclusions containing movable gas bubbles typical of the topaz species, shown in ***light blue topaz*** *from Brazil.*

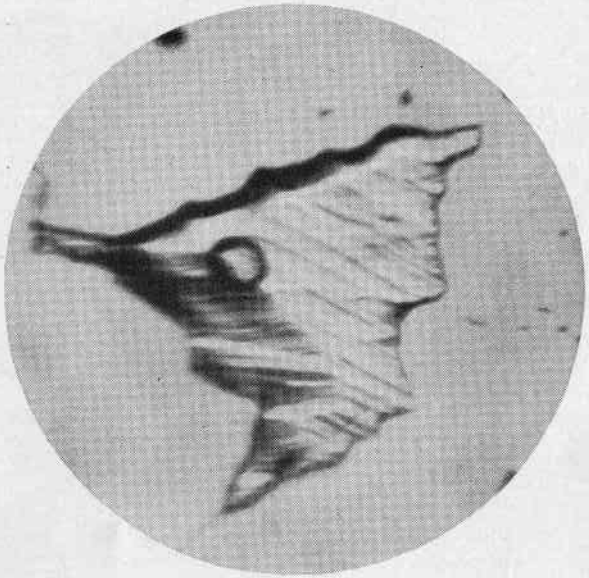


Figure 61
A large liquid-filled cavity with a small round gas bubble floating in it, included in a green tourmaline.

Distinction Between Pyrope Garnet and Red Spinel

by

B. W. ANDERSON, B.Sc., F.G.A.

In the preceding article in this series I showed how pyrope garnet may be distinguished from red spinel by means of a small spectroscope. The matter was discussed at some length because distinction between these two isotropic red minerals is not always easy by orthodox means, and their absorption spectra may thus be of considerable value as an independent and decisive accessory test.

Before proceeding to a description of further chromium spectra, however, I should like to try and clear up some widespread misconceptions concerning the physical constants of pyrope and spinel which have blurred the distinction between them to an unnecessary extent.

In 1915, W. E. Ford published a classic paper on the relation between the chemical composition and properties of the various garnets, in which he calculated the probable density and refractive index figures for "pure" pyrope, almandine, etc. The figures given were not those of any specimens found in nature, and those for pyrope (density 3.51, R.I. 1.705) were particularly far removed from those for any actual specimen, since pyrope has never been found without a considerable admixture of the almandine and other garnet molecules.

These figures were of great interest and value for the purpose in hand, but they have since been widely quoted in textbooks without reference to their context, and with the implication that they represent the values to be expected in actual practice.

In the case of spinel, the trouble has been that mineralogists, knowing that considerable variations are possible due to isomorphous replacement, have played safe by giving uncritical figures with a wide margin, e.g., "3.5-4.1" for the density. This is all very well, but hardly helpful when one wants reliable data for discriminative purposes.

So far as the distinction between these two minerals is concerned, it is the **lower** limits for the garnet and the **upper** limits for the spinel which are important, and I have for years sought diligently for unusually "low" pyropes and "high" spinels. The results for the "closest approach" I can so far record are tabulated in Table 1.

TABLE 1

SPECIMEN	SP.GR.	R.I.
Pyrope, Arizona	3.643	1.7323
Pyrope, Australia	3.670	1.7333
Spinel, Burma	3.611	1.734
Spinel, Burma	3.610	1.730
Spinel, Burma	3.604	1.730

It is important to realize that these figures refer to decidedly out-

of-the-ordinary specimens. The garnets mentioned were a strangely unrepresentative specimen from Fort Defiance, Arizona, and one of a small parcel of Australian specimens (exact locality unknown) which were given to me some years ago. The spinels were unusually chrome-rich crystals from the Mogok district.

The gap between the more normal pyropes and spinels is far more marked, as can be seen from the following table:

TABLE 2

SPECIMEN	SP. GR.	R.I.
Pyrope, Kimberley	3.68-3.85	1.738-1.751
Pyrope, Arizona	3.70-3.75	1.741-1.745
Pyrope, Bohemia	3.68-3.71	1.743-1.747
Pyrope, Ceylon	3.78-3.83	1.748-1.753
Spinel, Burma or Ceylon	3.58-3.61	1.715-1.725

The Ceylon type of pyrope included here is not colored with chromic oxide as are the others, and clearly shows the three main bands of the almandine absorption spectrum. To sum up: the constants of pyrope garnet and red spinel can admittedly overlap in theory. In practice only one spinel has been found in which the refractive index was higher than the lowest figures found for pyrope garnet. Even here, a distinct density gap remains, and it is true to say that if a tube containing Clerici solution diluted to density 3.625 (using synthetic spinel as indicator) were prepared, that all the known red spinels would float in this liquid and all the known pyropes would sink.

The gemmologist, however, most frequently has to deal with mounted stones, and thus has to rely mainly on optical tests. When a red isotropic stone, therefore, shows a refractometer reading unusually high for spinel or unusually low for pyrope it is wise to examine its absorption spectrum to insure a certain distinction between the two possibilities, as already described.

The nature of the inclusions as seen under the microscope also provides a valuable criterion. Spinel commonly contains octahedral inclusions either as fairly large isolated crystals or as numerous very small crystals arranged more or less regularly in one plane forming an extensive "feather." The inclusions in pyrope vary with locality, but are never, in my experience, octahedral. Typical pyrope inclusions were excellently described and illustrated by Dr. Gübelin in the Fall 1945 number of *Gems & Gemology*, and the reader is referred to his article.

Of the other accessory tests for discriminating between pyrope and spinel only one more need be mentioned here—the fluorescence under ultra-violet light. Spinels of clear red type show a distinct red fluorescence under the rays, while garnet remains inert. The duller red spinels containing iron show little or no

(Continued on Page 304)

New Fluorescence Test for Doublets and Triplets

by

RICHARD T. LIDDICOAT, C.G.
Director, Education and Research
Gemological Institute of America

The Research Staff of the G.I.A. has just discovered a new fluorescent means for the identification of doublets and triplets. There are many tests which identify these materials, but the new method is of importance because of the rapidity with which it can be used on a large number of gems at one time. Considerable work has been done in the past on fluorescence by a number of investigators, but to our knowledge no information has been presented on this phase of the subject.

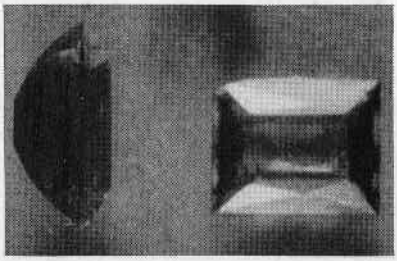


Photo by G.I.A.

Figure 1
Two triplets under ordinary light. 2x

Seventy-five doublets, triplets and glass imitations were tested under ultra-violet radiation of a wave length of approximately 2500 Ångstrom units. The lamp used is a hand flashlight type in an easily detachable mounting, on a 6"x3" transformer. Its light source is 2" square.

In every case garnet and glass doublets were immediately distinguishable by the fact that the glass backs fluoresced greenish yellow, while the garnet tops failed completely to fluoresce. The garnet tops stood out as a dark area above the strong greenish yellow color observed in the glass base, no matter what its color in ordinary light. Thus, garnet and glass false doub-

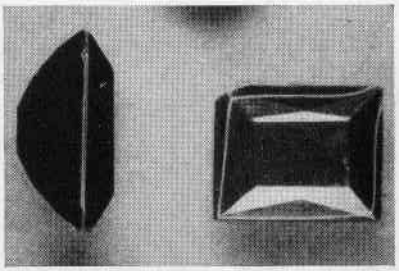


Photo by G.I.A.

Figure 2
The same gems under 2500 Å. wave length radiation. Notice the bright line around the crown of the triplet at right. The triplet at the left shows a bright line of fluorescent cement along the girdle. 2x

(Continued on Page 307)

Appointments and Additions to G.I.A. Educational Advisory Board

Dr. Edward H. Kraus, new president of the Gemological Institute of America, has reappointed Robert M. Shipley, founder and Executive Director of the Institute, to the position of Chairman of the Educational Advisory Board.

Two new offices, those of Vice-Chairman and Secretary, have been created for the Board.

Professor Paul F. Kerr, Executive Officer of the Geology Department, Columbia University, and President of the Mineralogical Society of America, has been elected to the first-named office.

The Board has elected as Secretary Professor Frederick K. Morris, Professor of Geology at Massachusetts Institute of Technology, leader of the Boston Study Guild of the A.G.S.

In addition to those just named, the members of the Board are: B. W. Anderson, B.Sc., F.G.A., Director of the London Gemmological Laboratory; Sydney H. Ball, Ph.D., eminent international diamond authority; Thomas Clements, Ph.D., Head of the Department of Geology, University of Southern California; George Engelhard, Publisher, *National Jeweler;* P. M. Fahrendorf, President, *Jewelers' Circular-Keystone;* W. F. Foshag, Ph.D., Curator of Minerals, Smithsonian Institution; Samuel G. Gordon, Associate Curator, Academy of Natural Sciences, Philadelphia.

R.P.D. Graham, D.Sc., Professor of Mineralogy, McGill University, Montreal; Paul Grodzinski, Technical Advisor, The Diamond Trading Company, Ltd., London; John W. Gruner, Ph.D., Associate Professor, Geology and Mineralogy, University of Minnesota; Harry H. Hess, Ph.D., Asst. Professor, Geology and Mineralogy, Princeton University; David H. Howell, C.G., Pomona College.

Richard T. Liddicoat, C.G., G.I.A. Director of Education and Research; G. H. Niemeyer, Chairman, Jewelers' Vigilance Committee, New York; Robert M. Shipley, Jr., Major, A.U.S., retired; W. D. Shipton, Associate Professor, Geology, Washington University; Chester B. Slawson, Ph.D., Professor of Mineralogy, University of Michigan; G.F.H. Smith, British Museum (Natural History), London; L. J. Spencer, Sc.D., Editor, *Mineralogical Magazine,* London; Frank Spies, Handy & Harman, New York; and Alpheus F. Williams, Author and Mining Engineer, Cape Town, South Africa.

Distinctions, Garnet and Spinel

(Continued from Page 302)

fluorescence, so that a negative result cannot be considered conclusive.

It is hoped that the above brief notes may serve to show that these two admittedly similar minerals can be distinguished without recourse to chemical or X-ray methods. Fuller details will be given in a paper now being prepared for publication in the *Mineralogical Magazine.*

Improvements in Quality in Synthetic Emerald

by

GEORGE SWITZER, Ph.D.
Asst. Director, Education and Research
Gemological Institute of America

Introduction: Synthetic emerald was first reported as having been successfully manufactured in France in 1884. The I. G. Farbenindustrie of Germany in 1931 succeeded in making synthetic emerald crystals ("Igmerald") from which gems were cut measuring five millimeters in length. A few years later synthetic emerald was made in the United States by Mr. Carroll F. Chatham of San Francisco, California.

The American-made synthetic, known as *Chatham Synthetic Emerald,* has recently been somewhat improved in size, strength of color and quality and, therefore, its differentiation from genuine emerald is becoming increasingly difficult. The laboratory of the Gemological Institute of America has examined a large lot of the recently manufactured material through the courtesy of Mr. George H. Marcher, C.G., of Los Angeles. Because of the improved quality of this synthetic emerald, it is thought desirable at this time to summarize its properties and to outline the most reliable methods for its identification.

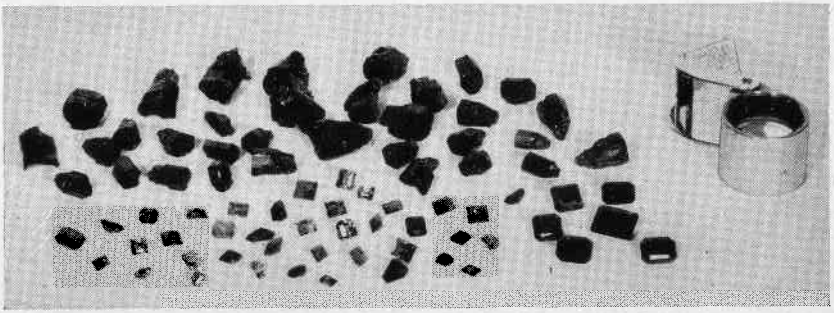


Figure 1 *Photo by G.I.A.*
Rough and cut ***Chatham Synthetic Emerald.***

Physical and Optical Properties: The refractive indices and birefringence of synthetic emeralds are in general lower than genuine emerald. Gübelin and Shipley (1941) give values of $\omega = 1.562$, $\varepsilon = 1.559$ for both American- and European-made synthetic. Rogers and Sperisen (1942) give the Chatham material $\omega = 1.573$, $\varepsilon = 1.578$, while measurements in G.I.A. Laboratory on the most recently manufactured material were essentially the same as those of Gübelin and Shipley (1941). The pleochroism is weak, ω = blue green, ε = yellow green. These val-

ues (and the resultant birefringence) are generally lower than the refractive indices for genuine emerald, although there may be some overlap, so that index of refraction is not a reliable diagnostic test.

Specific gravity of Igmerald and Chatham Synthetic Emerald is reported by Gübelin and Shipley (1941) to vary from 2.50-2.70. Rogers (1942) gives the value 2.667 for the Chatham material and Wigglesworth (1944) gives an average value of 2.66 for similar material. Thus the specific gravity of synthetic emerald is slightly lower than that of genuine emerald. Here also the difference is too small to be a reliable test for identification.

Fluorescence: Presence of fluorescence in synthetic emerald (both European and American) and the lack of it in genuine emerald has been reported by: reports from the laboratory of the Gemological Institute of America: *Gems and Gemology*, July-August 1935, P. 282; Winter 1937, P. 131; Summer 1938, P. 166; and by Eppler (1936), and Gübelin, E., and Shipley, R. M., Jr. (1941).

Further work on the present material substantiates these previous findings. The material shown in the photograph (Figure 1) fluoresces a strong deep red color under ultraviolet light having wave lengths of both 3600 Ångstrom units (G.I.A. fluorescent unit), and 2500 Å. (Minerolight). An additional ten samples of genuine emerald from various localities were tested for fluorescence with negative results. Fluorescence alone, therefore, appears to be a reliable test for the distinction between synthetic and genuine emerald.

Inclusions: Inclusions have been reported in synthetic emerald as being of three types (Gübelin and Shipley, 1941): (1) Solid particles spread swarm-like throughout the synthetic emerald. These are probably inclusions of the green coloring agent (Shipley, 1942). (2) Groups of liquid inclusions shaped as feathers, making up wisp-like, veil-shaped formations in the synthetic. (3) Systems of almost parallel rod-like inclusions.

The material recently examined in the G.I.A. Laboratory contains, in addition to the three types of inclusions mentioned above, sharp, well-formed crystal inclusions, indicated by their low relief and hexagonal outline to be beryl. These crystal inclusions are illustrated in the photomicrograph, Figure 2.

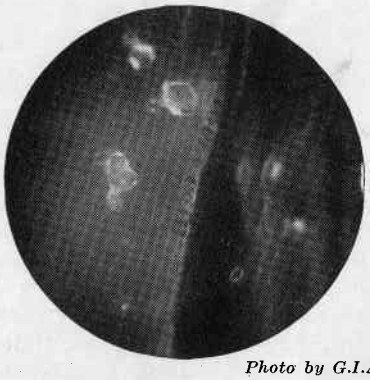


Photo by G.I.A.

Figure 2
Crystal inclusions in American-made synthetic emerald. 50x

A decided improvement in the quality of some of the cut stones examined is a matter of considerable importance. A few of the better quality synthetic emeralds had very few inclusions of any type and were especially free of the wisp-like inclusions that were described as being

diagnostic of synthetic emerald in earlier articles on this subject.

Conclusions: The quality of synthetic emerald is being improved and the distinction between synthetic and genuine emerald on appearance alone is becoming increasingly difficult. The poorer-quality material can still be identified by the presence of wisp-like inclusions but stones are now being produced which are almost entirely free of inclusions.

Present indications are that the most reliable test for differentiation between synthetic and genuine emerald is fluorescence. All specimens of synthetic emerald so far tested, of both European and American manufacture, fluoresce a strong dark red color under ultra-violet light (3600 Å wave length). Numerous genuine emerald specimens from several different localities have been subjected to ultra-violet radiation with negative results.

Synthetics still fail to show the tiny crystals within liquid inclusions so often shown in Colombian and Uralian emeralds.

References

Eppler, W. Fr. (1936): *Deutsche Goldschmiede Zeitung*, May 23.

Gübelin, E., and Shipley, R. M., Jr. (1941): *Gems and Gemology*, Summer 1941, pp. 146-150.

Rogers, A. F., and Sperisen, F. J. (1942): *American Mineralogist*, Vol. 27, pp. 752-768.

Shipley, R. M. (1942): *Gems and Gemology*, p. 40.

Wigglesworth, E.: *Gems and Gemology*, Spring 1944, p. 133.

Fluorescence Test

(Continued from Page 303)

lets were easily distinguished by the difference in appearance between the non-fluorescent garnet crown and the glass base.

It was found that in a large majority of cases triplets will be immediately revealed by the fact that the colored cement layer will fluoresce strongly, giving a very light greenish yellow color that shows up as a bright line encircling the stone. The only case in which triplets failed to fluoresce was in the case of quartz-topped and quartz-backed triplets with a green cement to imitate emerald. Apparently, the cement in this case is of the type which is not excited to visible light emission by ultra-violet radiation. This material was subjected to radiation of several other wave lengths, under which it continued to give negative results.

The speed with which this test can be conducted on a large number of gems simultaneously makes it a test that most Certified Gemologists will want to be able to conduct in their laboratories.

This new means of testing doublets is especially helpful, not only because of the rapidity with which the gems can be tested, but because of the other gem-testing applications to which ultra-violet light of this frequency range can be applied. Further research is being conducted along these lines and will be reported upon its completion.

On the Great Diamond in the Possession of the Nizam[1]

by

HENRY PIDDINGTON[2]

At the November meeting of the Asiatic Society, Captain Fitzgerald, B.A., presented for the inspection of the Society a model in lead of this remarkable stone, and gave a brief note of its history, which will be found in my report for that month. He has since favoured me with a more detailed one, which is as follows:

Note by Captain Fitzgerald, Bengal Artillery, attached to the Nizam's Service, on the Nizam's Diamond—1st December, 1847.

"About 12 or 14 years ago a large diamond was found in the Nizam's country under circumstances of rather a curious nature. The model now shown is the model of a part only, a piece having been chipped off, which after passing through many hands, was purchased by a native Banker for 70,000 rupees.

"The larger piece, as represented by the model, is in the possession of his highness the Nizam, and at the time of discovery was exhibited to many European gentlemen.

"The manner in which this Diamond was originally found, may be considered interesting. It was first seen in the hands of a native child, who was playing with it, of course ignorant of its value. On eight annas being offered for what the poor people considered as a mere stone, their suspicion was excited, which led ultimately to the discovery of the bright stone being a real diamond.

"Its form and size is shown below. This stone, hitherto unknown, may now be classed among the larger description of Diamonds which we read of, but seldom see."

The size of the stone exactly taken by calipers, from the leaden model, is as follows:

Length	2.48 Inches
Greatest breadth	1.35 Inches
Average thickness	0.92 Inches

I have had now exact models cast in glass from the leaden one exhibited at the meeting, and I find that

	Grains
Their absolute weight is	1164.50
Their specific gravity	3.70

Now according to various authorities we have for the specific gravity of the Diamond

Ure	3.53
Brewster, colourless	3.52
orange	3.55
Jameson, twelve authorities, mean	3.52
Mean	3.52

And hence assuming our model to be exact (and it is very nearly so), we have by a simple proportion not

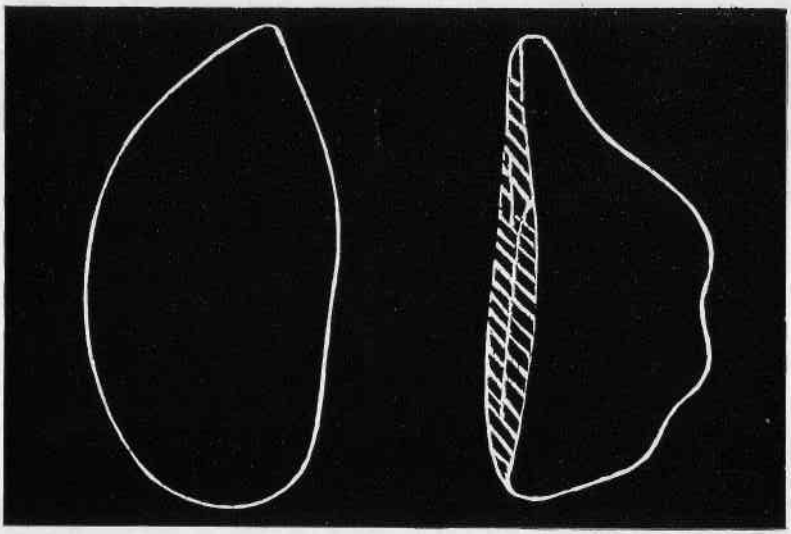
[1]Reprinted from the February, 1848, issue of the *Journal of the Asiatic Society*, Bengal Branch.

[2]Henry Piddington (1707-1858), meteorologist, bred in the mercantile marine, for some time commanded a ship, evidently in the East India and China trade. Appointed Curator of the Museum of Economic Geology, Calcutta, he retired from the sea in about 1830. Several of his geological and mineralogical notes appeared in the *Journal*.

quite 1108 grains for the actual weight of the Nizam's diamond.

This is equal to 277 carats of weight of the rough diamond, and as the rough stones are usually taken to give but one-half of their weight when cut and polished, it would allow 138½ carats, or a weight between the Pitt (or Regent) diamond (136¾ carats), and that of the Grand Duke of Tuscany (139 carats), for it in its present condition; and if we take it that one-eighth of what it would be when polished was taken off with the splinter sold to the native, as related by Captain Fitzgerald, we shall then have 155¾ carats for the possible weight of it, if it had been cut and polished entire; which would then place it as to weight between the Tuscan and the great Russian Diamond of 195 carats, which last is well known to be an Indian stone.

We are not informed if this stone is considered as likely to be one of pure water, which can only be ascertained by polishing it, though we know that the natives of India, and particularly of the Deccan, are too good judges of diamonds to mistake a topaz for one, and it is stated that 70,000 Rs. have been paid for the fragment. It therefore certainly adds one extraordinary fact more to the history of this most wonderful of gems.



Base *Side View*

Figure 1
Sketch of leaden model of the Nizam Diamond exhibited by Captain Fitzgerald before the Asiatic Society, reproduced actual size of illustration in the Journal.

Editorial Note

Piddington's estimate of the weight of this diamond is difficult to harmonize with the glass models which were available for the last two decades from manufacturers of

the models of world famous diamonds. A photograph of one of these models, the Nizam, shown in Fig. 2, indicates that, unlike Piddington's estimate, the stone had not been reduced by one-half its original weight.

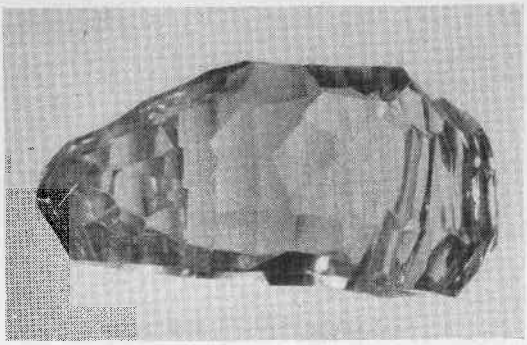


Figure 2
Glass model of the Nizam Diamond of the type available during recent years.

On the other hand, this model indicates that only a small amount of the original weight has been sacrificed, since the method of fashioning has been merely to polish the surface (except the side from which a part was probably cleaved) with the view to loss of as little weight as possible. Indeed, the original octahedral shape of the stone is still evident, indicating that these facets only removed the nyf or skin of the original stone. The fact that each of these facets is convex would also indicate that the stone might have been fashioned by the use of powdered corundum, before the use of diamond powder was known. Several polished grooves which are observable in the model are also of the type used by the earliest diamond cutters in India to remove unsightly flaws.

Perhaps the glass model was made before the stone was recut and Captain Fitzgerald's leaden model, which Piddington mentions, was taken from the stone after recutting. However, such recutting seems improbable since Piddington does not mention it in his rather complete description of the stone. It seems more probable that the glass model is fairly authentic.

Another interesting point to be gained from the Piddington-Fitzgerald material, published over a hundred years ago, is that it refutes King's[1] story of a "very ominous accident" by which the Nizam was "broken asunder in the year of the Great Indian Revolt," quoted by Streeter.[2]

Fitzgerald wrote in 1847, describing the diamond as already having had a piece chipped off. Piddington published this description, together with his own notes, in 1848—nine

(Continued on Page 314)

[1]C. W. King, *"Precious Stones and Metals."*
[2]E. W. Streeter, *"Great Diamonds of the World."*

GEMOLOGICAL DIGESTS

Dr. Pfund's Method of Gem Identification

A new and unusual supplementary method of gemstone identification has recently been proposed by Dr. A. H. Pfund, of the Department of Physics, Johns Hopkins University. The results of his work were published in the September, 1945, issue of the *Journal of the Optical Society of America.*

Dr. Pfund's method consists of measuring the intensity of infrared reflection from the facet of a gemstone. The radiation that is directed against the gemstone is generated by an alundum-covered platinum helix, raised to a yellow-white heat. The infrared radiation thus generated varies in wave length from 6,000 to 12,000 Å.

After reflection from a facet of a gemstone the infrared rays are passed through an infrared spectrometer (having a rock salt prism) and the intensity of each wave length measured with a vacuum thermopile. The resultant data were plotted against wave length, and for each mineral tested a different curve was obtained.

Curves were plotted for seven gem minerals, and each has a very characteristic shape, so that by having a set of master curves for each mineral, it would be possible to identify most gemstones by this method alone. In doubtful cases a combination of the infrared reflection data with some other optical or physical property would make the determination certain.

While this method is of considerable interest it seems doubtful that it will ever become widely used due to the high cost of the equipment required.

Following are digests of comments on Dr. Pfund's method by Dr. Edward Henry Kraus, President of the G.I.A., Professor Paul F. Kerr, Executive Officer, Department of Geology, Columbia University, and Samuel G. Gordon, Associate Curator, Academy of Natural Sciences, Philadelphia. Their comments appeared in full in *Guilds*, March, 1946, issue.

Digest of Dr. Kraus' comments: Dr. Kraus points out that Dr. Pfund's method must be restricted to laboratories having the required equipment and personnel trained in its use; that gemologists will not resort to the method until an infrared spectrometer can be obtained at moderate cost. He believes that the new method will not replace the petrographic microscope, refractometer and dichroscope, with which determinations can be made more quickly and accurately.

Digest of comments by Professor Kerr: Professor Kerr compliments Dr. Pfund on having done an interesting piece of scientific research thereby adding to our technical knowledge of gems. He also remarks that all materials Dr. Pfund mentions may be identified by ordinary optical methods, and that the infrared reflection method may never be of great practical importance.

Digest of comments by Samuel G.

Gordon: Mr. Gordon points out that Dr. Pfund is a foremost authority in the field of physical optics, and his contribution to the field of gemology is welcome. When reflectance curves are obtained for all of the gem minerals the data will be of still greater value. Mr. Gordon also points out that the method is too difficult and expensive to be used by the average jeweler.

The Wegener Theory and Diamonds

In the February and March issues of *The Gemmologist,* Mr. Paul C. Herz, of New York, has published an interesting article entitled "Diamond Characteristics and the Wegener Theory." In his article Mr. Herz reviews the Wegener theory, well known to all geologists, and discusses the supporting evidence given this theory by the geographical occurrence of diamonds.

In 1924, Alfred Lothar Wegener, a German geologist, impressed with the fact that the eastern outline of South America fitted closely the western outline of Africa, proposed his theory of Continental Drift.

This theory supposes that prior to Cretaceous time North and South America were connected to Europe and Africa, and that during the Eocene period they started to drift apart, gradually assuming their present positions.

Wegener's theory is disputed by many bits of geologic evidence, and supported by others. One of the most interesting supporting evidences is the geographical distribution of diamonds. Ninety-nine per cent of all the diamonds in the world are found in Venezuela, the Guianas and northeastern Brazil, and along the west coast and across the southern tip of Africa. According to the Wegener Theory, these two areas were at one time connected, and this striking present-day geographical distribution of diamonds is strong evidence in favor of the theory of Continental Drift.

The Nature of the Polished Surface of a Gemstone

In the January, 1946, issue of *The Gemmologist,* Mr. Frank B. Wade, of Indianapolis, Indiana, has outlined his views *"On the True Nature of the Polished Surface of a Gemstone."* The evidence cited is in support of the existence of the Beilby layer, the fused surface layer on the facets of polished gemstones, first postulated by Sir George Thomas Beilby in about 1900.

As further evidence of the existence of the fused surface layer, Mr. Wade points out: (1) Polishing is often done with a powder softer than the material being polished, but that all polishing agents have a very high melting point. (2) Before attempting to repolish scratched surfaces, most old-time lapidaries prefer to grind a new surface. (3) It is best to shape and rough-grind a stone before attempting to dye it, because polishing seems to develop a surface layer impervious to staining solutions.

In the February, 1946, issue of *The Gemmologist,* Mr. B. W. Anderson makes some interesting comments on Mr. Wade's article. Mr. Anderson tells of some experiments performed by Professor G. I. Finch, who, by means of X-ray examination of the surface layers of polished gems, was able to add further supporting evidence to the existence of the "Beilby layer."

Use of the Diamondscope

by

JEROME B. WISS, C.G.

(Continued from Page 288 of last issue)

A separate examination should now be made of any imperfections which may have been noticed inside the body of the stone, in addition to cracks or cleavage separations. Imperfections should be viewed from various angles from the top as well as from the bottom, to determine exact location and seriousness. An imperfection appearing small from one angle may appear much larger and more serious from another. Considerable adjustment of position of the stone in the holder, and of the focusing wheels may be necessary for best results. Only practice in the instrument's use can answer "How are the best results obtained?"

If no interior flaws or surface blemishes have been discovered in scrutiny from both top and back, a minute facet-by-facet examination is in order.

Starting with the diamond in the table-up position, an inspection should be made, using each of the 32 top facets as a corridor through which to look towards the culet. The stone holder must be tilted slightly so that the facet being examined is on a plane approximately 90° to the objective of the microscope. Here again, practice brings the best results.

The top break facets do not lend themselves readily to an examination of this sort as the metal of the tweezer points interferes with a clear view through these facets in either the 12- or 9-o'clock position. The more experienced observer may substitute a pair of fine-point diamond tweezers for the stone holder.

Each back facet is now examined in turn. Considerable illumination will be reflected into the observer's eyes during examination through the back. A slight dimming of the light source may be necessary to avoid too bright a glare. Minute inclusions, "feathers," invisible from the top examination are frequently discovered in the diamond during back-facet examination. When a minute flaw, either of the surface or internal variety, is believed to have been discovered, its actual existence *must be proved.* Particular care must be taken not to confuse true flaws with reflections of minute dust particles cast into the stone from other facets.

One way of testing this is to thoroughly blow off the diamond with the ear syringe, and to re-examine the stone. Do not remove the diamond from the tweezers while this is being done. The exact location of the supposed flaw may be lost if the position of the diamond is changed.

When an imperfection has been located, carefully adjust the stone holder so that the imperfection is in the approximate center of the field of vision (lest the imperfection fail to appear in the smaller field of vision of higher magnification), then change magnification to the higher 30 power by swinging the 2x objective in line with the eyepieces.

The change to the higher magnification should afford a clearer picture of the imperfection, although this

will not always follow. Cloudy texture, and certain types of faulty structure, may be very difficult to see under 30x. A slight adjustment upward of the light value may also be necessary.

In making examination through back facets, better results will be obtained if the diamond is viewed with the culet down, pointing towards the observer. When the stone is at the proper angle the under side of the table will be in view. By slowly revolving the stone holder toward him, the observer will have brought into view all of the internal material of the diamond from the table to the surface of the facet through which he is peering.

In examining colored stones, particularly very dark ones, and translucent specimens, it is sometimes necessary to throw more light into the stone—readily accomplished by placing the bluish frosted glass end of the baffle or background slide into position.

Examination of colored stones should follow the pattern outlined above for diamonds. In most genuine colored stones imperfections are larger and more prominent than in diamonds, but as a rule play a less important part in the valuation of a stone. The exception to this general rule is in synthetic corundum and spinel. In being able to detect the tell-tale air bubbles and sometimes curved striations of the synthetic, the reputation of the jeweler may well be at stake.

Here for the first time it may be necessary to use higher power (60 or sometimes the 112½) magnification. Upon slightest suspicion of seeing a tiny internal flaw, the observer should center the flaw and turn to the 30-power magnification. If sufficient evidence of the type of flaw is not discovered under 30 power, the flaw should be very carefully centered and the 7½-power objective then thrown into line. A considerable darkening of the field of vision will occur when this is done. Either by turning up the rheostat or control switch (if your accessories include these) or by changing the opaque end of the background plate, sufficient light will be obtained to finish the test.

Nizam Diamond

(Continued from Page 310)

years before the Indian Mutiny, which broke out in 1857.

It seems likely that the Indian Mutiny and the Nizam Diamond's damage became linked for either of these reasons: when Piddington wrote, times were troublous in Hyderabad, and England had gone in to preserve order and to extend protection to the young Nizam; in addition, during the Mutiny, later, extensive looting was the rule in the region. However, our research has disclosed neither any reference to anything of great importance being carried off, nor any statements which indicate the Nizam Diamond's being involved.

DIAMOND GLOSSARY

(Continued from Page 291 of last issue)

pink diamond. A term often used loosely in the trade to describe any diamond of pale reddish, purplish-red, purplish or violetish hue. Diamonds of colors other than pale red are sometimes described as rose-pink, rose-colored, peach blossom, heliotrope and mauve diamonds, or similar terms. The *Condé Diamond* is the most famous pink diamond.

pipe. (1) Common name for: (a) vertical cylindrical or column-like masses of **kimberlite** believed to have solidified in the necks of extinct volcanos which, when active, had penetrated older, usually sedimentary, rock masses; (b) similar rock masses occupying volcanic fissures. These pipes usually contain diamonds. They occur in South Africa, Arkansas and Kentucky, and have been reported in South America and Australia. Their diameters are from 100 feet to a half mile; their area from about one to eighty acres. (2) A geological term for: (a) the eruptive channel opening into the crater of a volcano or the filling of such a channel (Webster); (b) columns of ore, hollow tube-like spaces in lava, calcareous rocks, sand, etc., and for narrow portions of rich ore in a lode, fossil trees in coal beds, etc.

piqué. French word for *pricked;* formerly used in North America and still used elsewhere as a diamond-grading trade term meaning touched with tiny **inclusions** or unimportant surface blemishes observable only under a diamond loupe. *First piqué* meant almost flawless, but revealing tiny inclusions other than carbon pin points or unimportant surface blemishes when examined by an excellently trained eye under 10x magnification and scientific lighting (as in the Diamondscope or Gemolite), but unobservable with lower magnification, such as 2x. *Second piqué,* very, very slightly imperfect (V.V.S.I.), meant slightly inferior to *first piqué,* and often with carbon pin points or more noticeable surface blemishes or both, with all defects easily observable under 10x magnification. *Third piqué* (term rarely used except in U.S.A.), very slightly imperfect (V.S.I.), contained more prominent imperfections seen easily under any magnification; only a shade better than *slightly imperfect.* The term *piqué,* or *first piqué,* later was debased by many dealers to mean a grade inferior to V.V.S.I.; *second piqué* to mean V.S.I. When further debased, the terms were largely discontinued. See **imperfect; perfect; slightly imperfect.**

pit. A term infrequently applied to polished surfaces of diamonds; more properly applied to small natural fractures on polished gem surfaces.

Pitt Diamond. Same as **Regent Diamond.**

P.K. Abbreviation often used to mean *piqué.*

Pliny the Elder. Roman naturalist and one of earliest authors to describe the diamond (77 A.D.) . . .

"a gem known only to kings". He described the crystal form of the Indian variety as like "two whiptops placed base to base." Ball believes that most other varieties mentioned by Pliny were not diamonds.

plunger. Alternate name for a **jig**, used in winning diamonds.

plutonic. Term applied to cooled or crystallized igneous rocks, usually granite-like in texture, below the earth's surface; opposed to volcanic.

Pniel. South African alluvial diamond diggings on the Vaal River, located between the Vaal and Orange Rivers, originally granted by a Koranna tribal chief to the Berlin Missionary Society. After the discovery of diamonds on the land in 1870, the Society paid monthly lease fees of ten shillings a claim. The finds were phenomenal. (Beet). Consecutive prospecting began in June, 1870. Many claims yielded down to bedrock, 25 feet below surface. (G. F. Williams).

Poçãol (Brazilian). Pits in river beds in which diamond-bearing gravel is found (Halse).

Pohl Diamond. A 287-carat alluvial diamond of fine color found by Johannes Jonker (who found the **Jonker Diamond** at about the same time and place), in January, 1934, in Elandsfontein diggings, 20 miles north of Pretoria, South Africa. The theory that both stones were from the original Cullinan is questionable.

point. (1) *In weighing diamonds,* a jewelry trade term meaning one hundredth part of a carat, each one hundredth being called a point; e.g., 32 hundredths (.32) of a carat is called 32 points, and a diamond weighing .32 carat is said to be a 32-point diamond, or a thirty-two **pointer.** (2) *In cutting diamonds,* a term applied to the rough diamond during the early operations of fashioning it, and referring to the relation of the table to the **possible crystal faces** of a **cube,** an **octahedron,** or a **dodecahedron.** It is said to be *four-point* if the table is cut parallel to the face of the cube, e.g., across a corner of the octahedron so that the resulting section is a square; *three-point* if the table is parallel to an octahedral face; and *two-point* if the table is parallel to a face of the rhombic dodecahedron and therefore to an edge of the octahedron, while equally inclined to its two faces meeting in that edge. (3) Term used for a minute fragment of diamond, used for etching, carving or cutting various substances.

point cut. Earliest form of fashioning diamonds, consisting simply of polishing the natural faces of an **octahedron.** Differed from the **table cut** or German *Dickstein* in which a table and usually a culet were ground upon opposite points of the octahedron.

pointer. Word used in jewelry trade to describe weight of a stone, e.g., twenty *pointer,* meaning either a rough or cut stone weighing twenty points. See **point.**

point naive. (French, *natural point).* Term used by Tavernier to indicate a natural diamond **octahedron** and also apparently any diamond having easily distinguishable crystal faces. However, the term *natural point* is now used in the industrial diamond industry to mean an elongated diamond crystal, especially with sharp points.

(To Be Continued)