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and

PROCEEDINGS OF THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

THE GEMMOLOGICAL ASSOCIATION
OF GREAT BRITAIN
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THE FINE CUT OF SYNTHETIC RUTILE

by

W. F. Eppler, Ph.D.

IN more than one way the announcement of the synthetic rutile was a great surprise to all gemmologists. Although this synthesis concerns a long-known mineral, which, moreover, has for some time been produced synthetically for technical purposes (in small and tiny crystals), it was so far unknown in a size and quality suitable for jewellery, and it therefore constitutes a great novelty. Moreover, this new synthetic stone is a material which by its optical properties far surpasses all known synthetic and natural stones and which by its extremely strong refraction in its effect excels even diamond. Lastly, the wealth of coloration in which synthetic rutile can be produced is an additional and very remarkable innovation in synthetic stones. Undoubtedly the manufacturers, the Linde Air Products Company, of Chicago, U.S.A., have opened up new paths and have thus added further ornamental possibilities, but at the same time have increased the difficulty of identifying and testing stones. The importance which synthetic rutile is able to attain as a precious stone is subject to certain restrictions owing to its relatively low hardness.

Without in any way examining the commercial or aesthetic value of this new synthesis, it should be stated that synthetic rutile is a material with remarkable optical properties. These necessitate a suitable cut to yield the optimum effect. It is unlikely that a cut which is usual and effective in other stones can be applied to rutile without modification of the dimensions and angles. On the contrary, it appears indispensable in view of its abnormally high refraction to work out a special cut for synthetic rutile. In doing so, one will have to start from experience with diamond, which has shown the brilliant shape to be the most suitable one, and to adapt its proportions to the refractive indices of rutile.

At first the calculation so successfully carried out by Tolkowsky* for the brilliant cut of diamond was tentatively applied to rutile. First of all, in every research on cutting of precious stones it must be postulated that all the light entering the cut stone from above shall be totally reflected by the facets of the base and shall leave the stone through the crown in an effective direction. Therefore the angle of inclination γ of the pavilion facets towards the plane of the girdle is the most important angle and at the same time is the angle determining any shape.

Tolkowsky calculates this angle by the equation

$$\gamma = (180° - x)/4$$

the auxiliary angle x being obtained from the formula

$$\sin x = \sin 45°/n,$$

where n stands for the refractive index, which (least and greatest value) is 2.62 and 2.90 for rutile. For these two values the following angles of inclination are obtained:—

$$\gamma\,(2.62) = 41.1°, \ \gamma\,(2.90) = 41.5°,$$

from which the height of the base hb can be found from the equation

$$hb = 50 \times \tan \gamma,$$

the diameter of the girdle of the brilliant shape being assumed to be 100. For the two refractive indices of rutile the heights of the base are obtained:—

hb (2.62) = 43.6, hb (2.90) = 44.2 per cent. of the diameter of the girdle.

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* Tolkowsky, M. "Diamond Design." E. & F. Spon, Ltd., London, 1919.

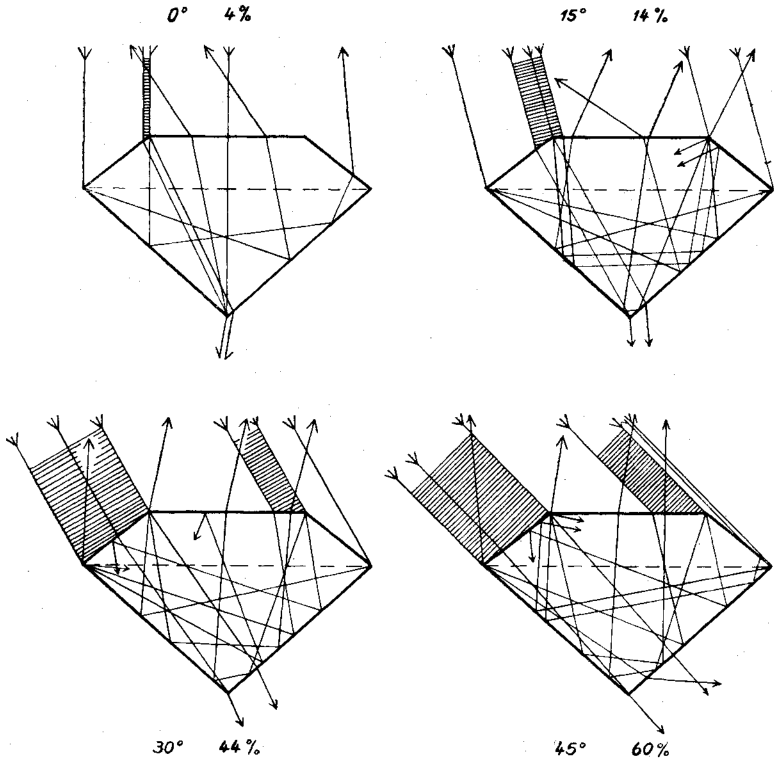

FIG. 1.—Cross-section showing path of rays for synthetic rutile (n = 2.90) in Tolkowsky cut for various inclinations of the entering light. The shaded parts indicate the regions of light losses.

The additional values which determine the brilliant shape have been worked out graphically on the basis of the Tolkowsky values for diamond:—

Bezel facets φ (2.62) = 36.0°, φ (2.90) = 38.1°, inclination to the plane of the girdle ; Diameter of Table T(2.62) = 53.5°, T(2.90) = 54.3 per cent. of the diameter of the girdle ; Height of crown hc (2.62) = 16.9, hc (2.90) = 17.9 per cent of the diameter of the girdle.

These values determine a brilliant cut of synthetic rutile, since the remaining facets, namely star, cross and half facets, are only accessories in the cut, important though their effect may be.

It is now essential to ascertain the effect of such cutting. This question can be reliably done by studying whether, and to what extent, light rays incident upon a rutile cut according to these values are utilized for brilliancy. For convenience the path of the light rays is followed out on a cross section of the cut (which is known to be permissible in such examinations), and that cross section is chosen which runs through the greatest diameter of the table and through the middle of the main facets of crown and base. The following light-losses have been established in this way for the two refractive indices of rutile, caused partly by escape at the back, partly by undesirable internal reflections: —

TABLE 1.—Light-losses in percentage proportion of the entering quantity of light in Tolkowsky brilliant cut of synthetic rutile: —

Inclination of entering light towards the normal	Light-losses $n = 2.62$	$n = 2.90$
0°	0°/o	4°/o
15°	15	14
30°	35	44
45°	43	60
mean	23.3°/o	30.5°/o

The cross sections for refractive index, $n = 2.90$, are shown in Fig. 1 ; the path of rays which enter vertically and obliquely can be seen in them. The shaded parts indicate the regions of the entering intensities of light which are lost for the brilliancy of the cut.

The investigations by graphs for this and the ideal cut, discussed below, have shown, moreover, that the individual values of a cut, at steeply rising refractive indices, do not change as much as at low refractive indices. This becomes obvious also by comparing the values of the Tolkowsky cut for the two refractive indices, the difference of which, especially in γ and φ, is so small, that for γ at least lies within the latitude of cutting. It therefore appears warrantable to take account in the calculations not of both refractive indices but only of their mean, $n = 2.76$. This simplification has been proved by diagrammatic proof to be admissible.

The light-losses of the rutile in the Tolkowsky cut, as shown in Table 1, appear rather high. It has therefore been studied whether the ideal cut, proposed formerly by Johnsen and by Rösch* for diamond and other precious stones, can be applied to rutile. The

* See W. F. Eppler, " Die Brillianz durchsichtiger Edelsteine. Fortschritte der Mineralogie," etc., vol. xxiii, 1938, pp. 1-40 (containing references).

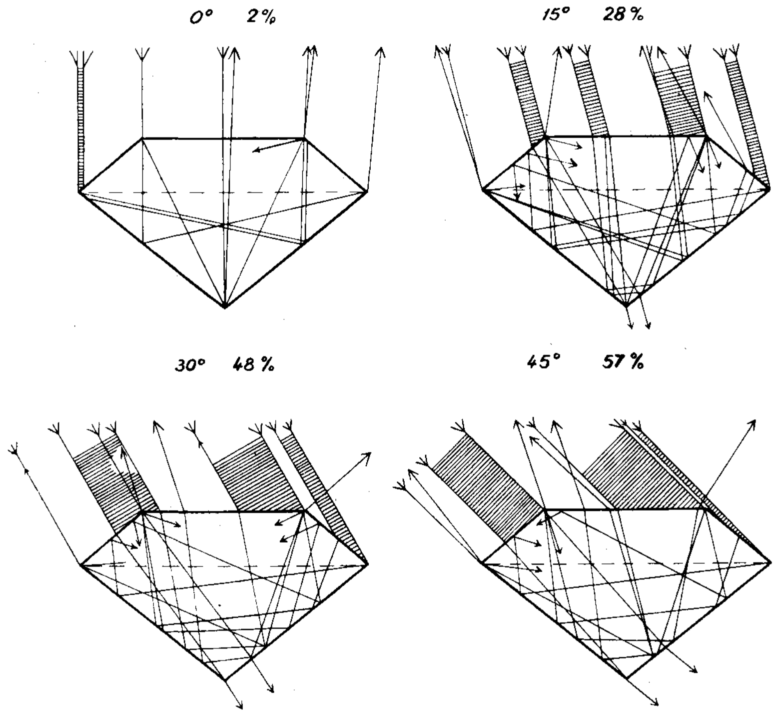

FIG. 2.—Cross-sections showing path of rays for synthetic rutile (mean, $n = 2.76$) in the ideal cut for various inclinations of the entering light. The shaded parts indicate the regions of light losses.

required values for the high average refraction of rutile have been established sufficiently exactly by graphs ; they are set out in Table 2.

TABLE 2.—Values of dimensions and angles of the ideal cut for $n = 2.76$:—

Pavilion facets	$\gamma = 38.5°$	inclination towards plane of girdle
Bezel facets	$\varphi = 40.1°$	
Height of base	$hb = 39.8$	per cent. of diameter of girdle
Height of crown	$hc = 18.5$	
Diameter of table	$T = 56.1$	

Fig 2 shows the method of examining the extent to which light rays entering vertically and obliquely are used, while Table 3 contains the light losses as compared with those of the Tolkowsky cut for $n = 2.90$.

Table 3 as well as Fig. 2 show very clearly that the loss of light in the ideal cut is even greater than that in the Tolkowsky cut. Neither form therefore appears to be advantageous, and the question arises whether one has to put up with such high, at least high for this type of refraction, losses of light. To answer this question the following method was used:—

TABLE 3.—Light-losses in percentage proportion of the entering quantity of light in synthetic rutile in the Tolkowsky ($n = 2.90$) and ideal cuts ($n = 2.76$):—

Inclination of the entering light towards the normal	Light-losses Tolkowsky cut	Ideal-cut
0°	4%	2%
15°	14	28
30°	44	48
45°	60	57
mean	30.5%	33.75%

In the Tolkowsky and ideal cuts the angles of inclination of the pavilion facets have been calculated by the authors under different assumptions. Tolkowsky based his calculations on oblique incidence of the light, whilst the ideal cut takes account of light only which enters vertically i.e. at right angles to the table and therefore to the plane of the girdle. With regard to the use of cut stones Tolkowsky's version is preferable. By his method of calculation and by using the formulae given above one obtains for $n = 2.76$ an angle of inclination, $\gamma = 41.3°$, to which angle a height of the base, *hb* = 43.9 per cent., is correlated. These two values determine the base, but there are difficulties in the case of the crown. Those angles of inclination of the bezel facets which are obtained by graphs cause either losses of light by escape through the pavilion facets or no less undesirable internal reflexions in the crown. Critical deliberations lead to the result that because of the high refraction a very small range of angles only is available for the exit of the light-rays in the crown. At the most, as can be proved by drawing and calculation, this is not more than the critical angle t of total reflexion. According to the equation, $\sin t = 1/n$, a critical angle of $t = 21.25°$ corresponds to the refractive index $n = 2.76$. The light, coming from the interior, must fall on the main bezel facets within this range of angles, if it is to leave the stone at all.

As a second requirement which must be satisfied, light which emerges from the crown must leave the stone in directions which

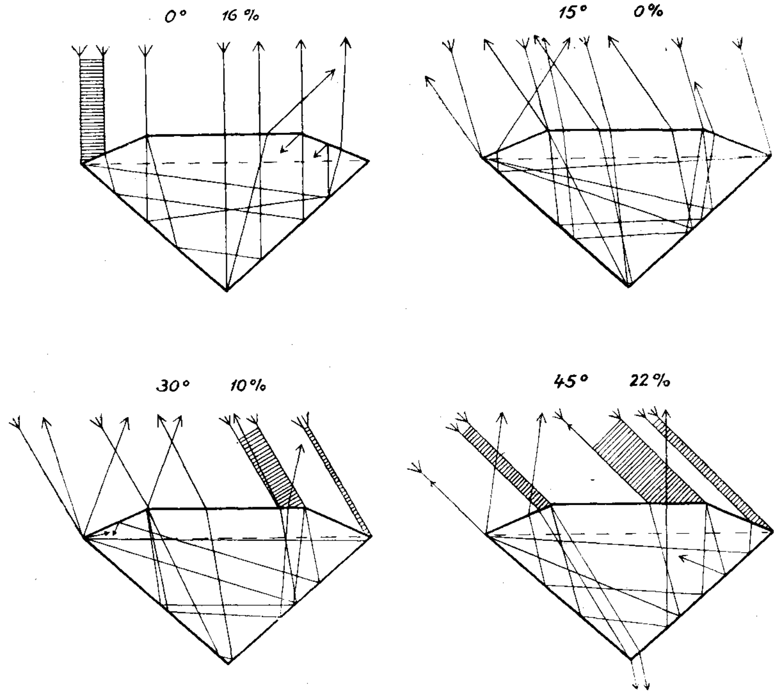

FIG. 3.—Cross-sections with path of rays for synthetic rutile (mean, $n = 2.76$) in fine cut for various inclinations of the entering light. The shaded parts indicate the regions of light losses.

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are still effective. The angle of the emergent light with the normal (i.e. a line at right angles to the table) should therefore not be too large and should after an approximate estimation not exceed about 50°.

These two requirements for the angle of inclination φ of the bezel facets depend, as can easily be understood, on the refractive index n and the angle of inclination γ. From them we obtain by means of trigonometrical calculations, upon which we need not enlarge, the following formulae for a suitable angle of inclination φ:

$\varphi = \alpha + \beta$, where $\cot \alpha = (n - \cos \beta)/\sin \beta$, and $\beta = 180° - 4\gamma$.
For refractive index $n = 2.76$ and for $\gamma = 41.3°$ the required angle of inclination can be worked out as $\varphi \doteq 23.0°$. The height of the

crown hc depends, if φ is known, on the diameter T of the table. The very low value of the angle φ requires a low crown ; the table should then be as small as possible. On the other hand, a small diameter of the table is not particularly favourable for the path of the rays, as it might bring about additional losses of light. At any rate, the somewhat complicated calculations, which are beyond the scope of this paper, give us a diameter of the table T = 31.1 per cent., and thus a height of the crown hc = 14.5 per cent. of the diameter of the girdle. It appeared useful nevertheless to plan the table somewhat larger than as calculated, and in analogy with the accepted ideas about the brilliant cut a diameter of the table, T = 54.0 per cent., was chosen. The height of the crown thus has the extraordinarily low value hc = 9.8 per cent. of the diameter of the girdle, a value which otherwise can be justified with stones of very low refractive properties only, such as opal and fluorspar. As an additional precaution the path of the rays in a cross section has been followed out in both forms, that with the calculated smaller table and greater height of the crown as well as the more conventional cut with larger table and specially low crown. The light-losses thus found as a criterion are shown in Table 4.

TABLE 4.—Light-losses in percentage proportion of the entering light quantity in the fine cut for n = 2.76:—

Inclination of the entering light towards the normal	Light losses at cross section with a small table	a large table
0°	35°/。	16°/。
15°	13	0
30°	17	10
45°	37	22
mean	25.5°/。	12°/。

It can clearly be seen that the conventional cut with a large table is definitely to be preferred because of the reduction of the light losses to about half the amount. As can be seen also in Fig. 3, the light losses in this form are so extraordinarily small and *vice versa* the light yield is so surprisingly large that this cut must be expected to be especially effective in rutile. It is suggested therefore to give it the designation " fine cut."

To give an overall idea, the values for a Tolkowsky cut, for an ideal cut (from Table 2) and for the suggested fine cut of rutile are compared in Table 5. Table 6 enables a comparison of the light yields of these three forms to be made, a comparison which underlines by graphical means the specially favourable conditions of the fine cut.

TABLE 5.—Values of lengths and angles for three cuts of synthetic rutile:—

		Tolkowsky cut	Ideal cut	Fine cut	
Pavilion facets	γ	41.5°	38.5	41.3°	inclination towards plane of girdle.
Bezel facets	φ	38.1°	40.1°	23.0°	
Height of base	*hb*	44.2	39.8	43.9	per cent of diameter of girdle.
Height of crown	*hc*	17.9	18.5	9.8	
Total height	*h*	62.1	58.3	53.7	
Diameter of table	T	54.3	56.1	54.0	

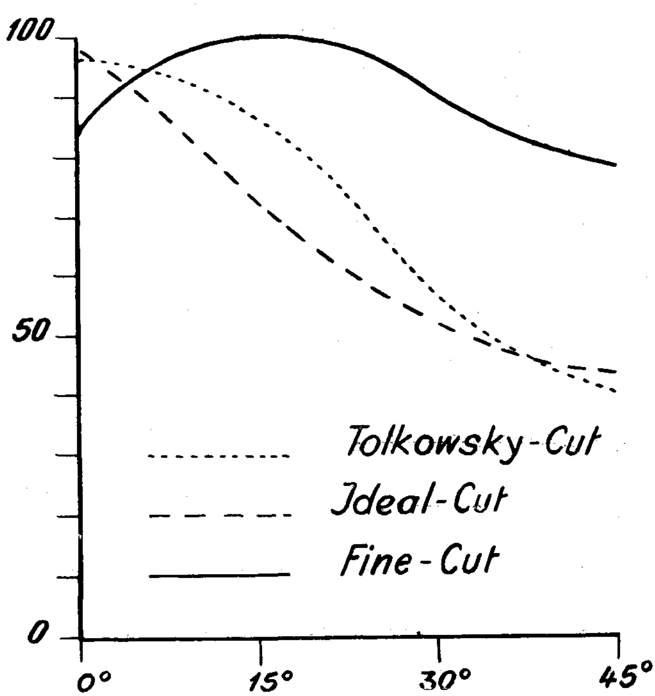


FIG. 4.—Graphical representation of the light yields for synthetic rutile in the Talkowsky cut, ideal cut and fine cut, according to the inclination of the entering light.

TABLE 6.—Light yields in percentage proportion of the entering light quantity for three cuts of synthetic rutile:—

Inclination of the entering light towards the normal	Tolkowsky cut	Ideal cut	Fine cut
0°	96	98	84
15°	86	72	100
30°	56	52	90
45°	40	43	78
mean	69.5	66	88

There remains the calculation of the small facets, i.e. of the angles of inclination of the star facets and of the cross and lower half facets. For the time being it was not considered necessary to work out their values, as they cannot influence the basic form of the fine cut. Moreover, in practice, the unusually low crown may make different values appear more suitable than those usual in the brilliant cut. If they are arranged as customary in the brilliant cut, the following values may be proposed:—

Star facets ...	8°-10°	inclination towards plane of girdle
Cross facets ...	25°-27°	
Half facets ...	43°	

In working out these values, it has been taken into account that the length of the star facets should be about a third of the distance from the table to the girdle and the edge between each two cross facets about two-thirds of that distance. For the length of the half facets half the distance from the culet to the roundist has been used. It will be interesting to see to what extent these values will be proved satisfactory in practice.

The preceding calculations are based upon the assumption that the girdle has no thickness, which, however, even in well-cut brilliants amounts to about 1.5 to 2 per cent. of the diameter of the girdle. With regard to the thickness of the girdle it can only be recommended to keep it as small as possible, as it exerts, like a culet in the brilliant cut, an unfavourable influence upon the brilliancy by causing additional losses of light.

The measurements and dimensions supplied above are applicable not only to the brilliant cut of rutile but also to every other form of it In these cases they apply to the smallest cross-section of the cut in question.

A. E. ALEXANDER, Ph.D.,
Director, Gem Trade Laboratory Inc., New York, discusses

A Remarkable Inclusion in a Burma Ruby

RECENTLY a Burma ruby was brought to my attention in which was so unusual an inclusion as to warrant special comment. This ruby contains an aggregate of rutile needles which—in my mind—form, in profile, something of the likeness of the head and headdress of an " Egyptian Deity," and illustrates the vagaries of nature showing to what extent crystallization can deviate from the theoretical or ideal.

The story of this ruby goes back to 1938, when Mr. Charles Murray, well-known New York pearl and stone dealer (with whom I went to the Middle East in 1947), was on an extensive trip to the Far East. Among other places, he had been at Mogok visiting the ruby and sapphire mines and taking motion pictures of the natives at work. Leaving there, he had returned to the Irrawaddy River, to the boat on which he was soon to leave.

The boat was scheduled to leave at dawn and Mr. Murray was awakened at 2 a.m. by someone loudly calling his name. The pilot of the craft, also aroused by the commotion, went on deck to ascertain the nature of the disturbance. There was a native demanding to see Mr. Murray, who by that time was also on deck and recognized the man as a worker from one of the mines at Mogok. He was permitted on the boat, and excitedly told his story: Shortly after Mr. Murray had left Mogok, this native found the remarkable ruby shown in Fig. 1. Elated with his find and believing the figure in the stone to be a good omen, he wanted the American to have it. So he set out at once on the two-day trip from the mines to Mr. Murray's boat.

Now, according to Burmese religious beliefs, the person finding a large, rare, or an unusual gem is grateful to Buddha for his discovery. To express his gratitude he erects at the site of the " find " a pagoda, which may be small or large, simple or ornate, inexpensive or very costly, according to his financial ability. So

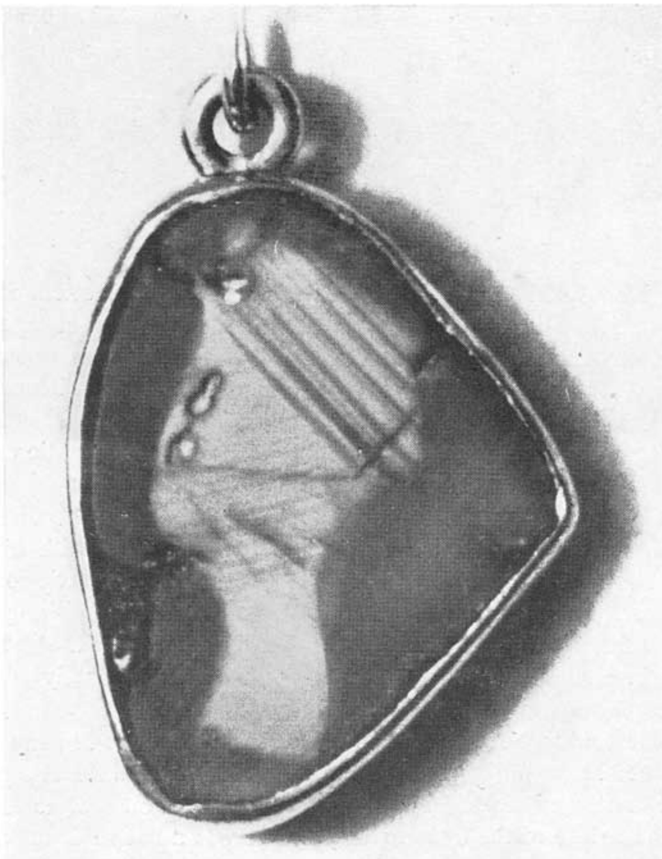


Photo: *Courtesy of Cartier, Inc.*

to-day, should you visit Mogok, you would undoubtedly find a Buddhist pagoda built in honour of this ruby, its discoverer, and its present owner.

Perhaps because, to his mind, he would be displeasing Buddha and would bring misfortune and grief upon himself and his family, the Burma native would under no circumstances sell the stone. It was a gift for Mr. Murray—a gift that would bring him, or anyone thereafter who possessed the gem, good fortune.

As for the ruby, it weighs approximately five carats. The colour is good. The photograph reproduces the outline of the head and headdress exceptionally well. This figure consists of a dense mass of rutile needles, in addition to several growth or colour bands

Photo: Courtesy of Katherine Cornell Productions Inc.

which help to accentuate the " design " in the headdress. The stone has never been polished or otherwise fashioned.

I have included a picture in this story of Katherine Cornell and Godfrey Tearle as they appeared in Shakespeare's " Anthony and Cleopatra " (Fig. 2). With a little imagination, the similarity between the figure in the ruby and the Egyptian headdress in the photograph is apparent.

In conclusion, I wish to thank Messrs. Cartier, Inc., for kindly taking the photograph of the ruby, the Katherine Cornell Productions, Inc., for their interest and co-operation, and Helen DeVore Alexander for her advice and constructive criticism.

"GEMSTONES"

by Dr. G. F. Herbert Smith goes to Tenth Edition

THE tenth edition of "Gemstones," by Dr. G. F. Herbert Smith, is expected to appear very shortly, after a long delay that originated from the coal crisis. The previous edition, which was published in May, 1940, became exhausted soon after the end of the war Its scope had been expanded to a considerable extent, because students of gemmology, for whom from its beginning in 1912 the book has been primarily intended, wished to delve ever deeper into the subject. Even then their thirst for knowledge was not assuaged, and in the new edition the opportunity has been taken to enlarge certain parts and to introduce additional matter. For instance, the chapter on crystals has been lengthened until it has become almost a treatise on crystal morphology in itself, and the discussion on the crystal form of diamond has been widened so as to include its intimate structure. Despite the limitation which the titie of the book might logically be supposed to impose upon its contents, pearl has always found a place in it, but a new chapter on ivory and tortoise-shell has now been added ; with the inclusion of pearl there is no logical reason for the omission of ivory. Tortoise-shell is, however, another matter, and the justification for its inclusion is that for many purposes it is allied to ivory. Another new chapter is on resins. The artificial resin known as celluloid has long been used in imitation of ivory, but the great development of what are now known as plastics is increasingly leading to their use in place of glass imitations of gemstones. This chapter may appear unnecessarily comprehensive, but it would have been difficult and perhaps even undesirable to draw a line. Dr. Herbert Smith's book has for long been recognized as the standard work on gemmology in the English language, and the new and revised edition, with its wealth of information, will undoubtedly make it the best text-book available.

"Gemstones," by G. F. Herbert Smith, D.Sc., M.A. (Tenth edition, revised), 1949. Published by Methuen at 35s. (postage and packing 1s.). Copies may be ordered from the Gemmological Association of Great Britain, 93-94, Hatton Garden, London, E.C.1.

ATOMIC PHYSICS

ON Monday, January 24th, the Gaumont-British film on Atomic Physics was shown to members of the Association at the British Council Cinema. The film dealt with the story of a remarkable scientific achievement based on the work of scientists of many nations, but owing most of all to the work of Lord Rutherford and the school of Nuclear Physics which he developed. The final achievement of the release of nuclear energy for war was due largely to the scientists and engineers of the United States stimulated and helped by British Physics.

The film recalled the emergence in 1826, when John Dalton propounded the Atomic Theory of Chemistry, of a scientific theory of an idea of matter which had existed for over two thousand years as a belief unsupported by experimental proof.

Scientists have now the task of using the immense power of nuclear energy for peaceful purposes—for the production of radioactive materials for medical and biological research, and for the generation of heat and power. With their present knowledge it is possible to design nuclear power stations, which will produce power at a moderate efficiency. Until operating experience of these plants is acquired it will not be known how economical they will be, nor will scientists be sure of overcoming all the technical difficulties which will occur in large scale development of nuclear power.

Nevertheless, there is a real promise that over the next few decades world power resources can be greatly increased and that the very great benefits to be obtained will do much to increase standards of living. It is the hope of every scientist that this will lead to the establishment of a work organization for the effective control of all weapons of mass destruction and through this to the abolition of war.

From Dalton's theory of 1826 to atomic power is a long road but the landmarks are clear.

With the Atomic theory as a basis a pretty complete picture of the elements of our material world was fitted together during the 19th century.

The discovery of electrons, the realization of the nature of positive rays, the strange powers of X-rays revolutionized conceptions of the nature of matter and of the atom itself.

The study of radioactivity, investigated by Becquerel and the Curies, led Lord Rutherford to make the greatest single advance in atomic theory. He pictured a small heavy nucleus in the atom, round which the electrons revolved.

In 1919 Rutherford discovered how to change one element to another by bombardment with alpha-particles.

He suggested that the nucleus of the atom might contain protons and uncharged particles of about the same mass.

In 1932 scientists could say with certainty that the atom contained electrons, carrying unit negative charges—and a nucleus, built up of protons, carrying unit positive charges and of neutrons, uncharged particles equal in mass to protons, whose existence was proved by Sir James Chadwick. In 1932 also Cockcroft and Walton split the lithium atom by bombardment with protons and found that mass could actually be translated into energy in perfect accord with Einstein's Theory of Relativity.

Atomic disintegrations provoked by great machines became a commonplace of well-equipped physics laboratories.

In 1939 Uranium fission was first noted and the possibility of a self-sustaining chain reaction suggested the wholesale release of energy. Controlled chain reactions were achieved in the atomic pile.

The imagination of the world has been stirred by the prospect of adapting such piles to use as sources of heat energy, and as sources of radioactive materials for use in medicine.

In research laboratories the scientists are even now writing fresh pages in this unfinished story.

But over all, the smoke of the atomic bomb hangs like a pall. If we are to reach the future that promises so bravely, the peoples of the world must see that this new power is wisely used.

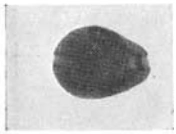
By ROBERT WEBSTER, F.G.A.

STAINED PEARLS and X-RAYS

RECENTLY during the routine testing of pearls by the direct radiographic method (skiagrams), the writer was interested to notice a " reversal " effect in a photo of a necklet of black pearls which under test was found to be cultured. The effect was considered to be due to the pearls having a black colour induced by staining, probably by silver nitrate ; and to obtain further confirmation that this might be the case an experimental coloration was carried out.

Before considering this " reversal " it will be as well to discuss the principle underlying the testing of pearls by the direct radiographic technique and the limitations of such a method. Skiagrams —the pictures obtained when an object is photographed by a wide beam of X-rays—are really shadowgrams. This was one of the earliest applications of X-rays, being immediately taken up by the medical profession, who early foresaw its value in the location of metallic foreign bodies and in the diagnosis of fractures in the skeletal framework. The method depends on the differential transparency to X-rays of the various components of the body examined, and quite soon after Röntgen's classic discovery of these radiations it was found that, in general, the higher the atomic weight of the elements composing the material the more opaque was the material to the rays ; thus aluminium (*atomic weight of 27*) is very transparent, and lead (*atomic weight of 205*) very opaque ; and similarly flesh, consisting mainly of the light elements carbon, hydrogen and oxygen, are more transparent than the bones which contain the heavier calcium and phosphorus atoms.

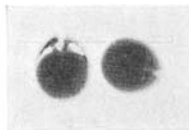
As the operative value of a skiagram depends upon the differential transmission (or absorpton) of the incident X-rays, in theory,



Direct radiograph of a cultured pearl.
Positive print about twice natural size.

" A," before staining.

" B," after staining with $AgNO_3$, showing the " reversal " effect.



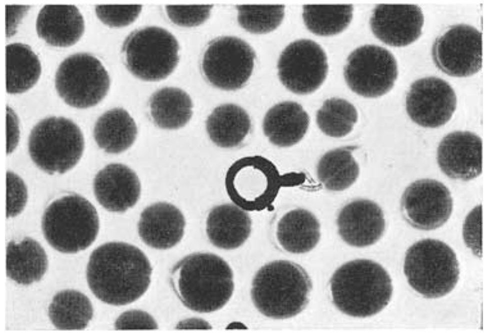
Direct radiograph of the two " rosée " cultured pearls showing the " reversal."
Positive print natural size.

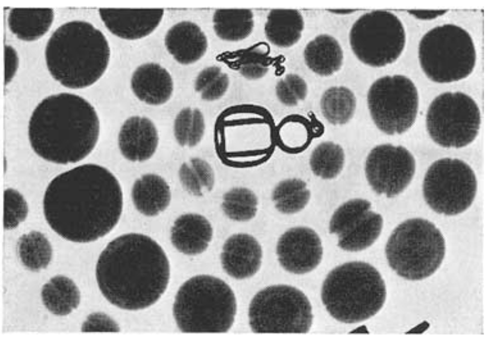
a radiograph of a pearl would be expected to show little, for the organic constituent—conchiolin ($C_{30}H_{48}N_2O_{11}$), is so intimately incorporated with the $CaCO_3$ crystallites that the structure would not show. In practice, however, pearls are often found to depart from this ideal condition, particularly between the concentric layers of the structure. This being due to the oyster depositing, either in a complete concentric layer or in patches in such a layer, a variable thickness of the organic constituent ; this will show up in an X-ray negative as lines of deeper density (due to the greater transmission of the X-rays through the organic layers affecting the photographic emulsion to a greater extent than those rays which have been partially stopped by the mineral crystallites). In the case of cultured pearls the skiagram method may give adequate distinction owing to a similar effect ; for the oyster very often deposits a thick layer of conchiolin round the bead nucleus. The deposit may be irregular and thus form baroque pearls, or, if concentrated in any one area will produce a drop pearl. The layers normally show up as a dark circular ring, either complete or partial, which has a sharp inner edge and possibly a diffuse outer edge ; while the central bead shows, perhaps surprisingly, no structure. This effect is diagnostic but requires considerable ability to interpret correctly.

When the radiograph of the black pearl necklet was examined it was noticed that, in the case of a few pearls, instead of the black circle on the negative. which, as has been previously mentioned, so often occurs surrounding the bead nucleus, the circle was seen to be, in part, white on the negative ; this being especially noticeable near the string canal *(the photograph of this necklet is*

Direct radiograph of cultured pearls, showing the white ring (*this is black in the negative*) surrounding the bead nucleus.

Positive print natural size.





Direct radiograph of natural pearls, showing the structure exhibited by natural pearls. Some of the pearls are seen to have the appearance of cultured pearls in this picture ; this shows the difficulty of complete diagnosis by the direct radiographic technique.

Positive print natural size.

unfortunately unsuitable for reproduction). The inference is that the white line may be due to colouring by stain containing heavy atoms.

That a black colour may be induced in pearls, both natural and cultured, by staining, has long been an accepted fact, but the methods by which this may be carried out are, perhaps for good reason, not disclosed. Experiment has shown that soaking a pearl in a strong solution of silver nitrate ($AgNO_3$) would turn it to a bronze or black colour—the silver nitrate being reduced by the organic (conchiolin) content to finely divided metallic silver which is black in colour. In order to ascertain whether such a coloration would in fact cause the " reversal " of the black line to white, a direct radiograph of a cultured pearl was taken which gave the typical " cultured " black ring on the negative ; the pearl was then immersed in a strong solution of silver nitrate in a test tube, boiled for about thirty minutes and allowed to stand overnight. During this treatment the pearl first turned to a golden bronze shade and then to a bronze black. On taking an X-ray picture after this treatment the " reversal " was clearly evident.

This experiment, while not proving that silver nitrate is in all cases the stain used, does give credence to the supposition that if such a " reversed " effect is observed the pearl is stained. It must be further remarked that while this " reversal " has been clearly seen in stained cultured pearls I have been unable to detect similar effects in natural pearls which I have good reason to suppose to be artificially coloured.

More recently, during routine testing, a further case of " reversal " came to light ; this time, however, the pearls were not black pearls, but white, or more correctly " rosée." These pearls, which on being tested were found to be cultured, showed on the negative the " reversal " extremely strongly. Whether this was caused by some form of staining, or due to some other factor, such as doctoring of the bead used as a nucleus in order to produce a faster deposition of nacre—and such treatment has been credibly reported—could not be determined. The " rosée " staining of cultured pearls has long been known, and the stain employed was always considered to be an organic dye. To further test this point a radiograph of a known " rosée " stained cultured pearl was taken —this showed *no* " reversal," thus in this case the real reason for the effect cannot yet be proven.

NEW REFRACTOMETER

The Gemological Institute of America has announced the production of low priced refractometer (approx. £6 to £7). The instrument is small, measuring about 2 in. x 2 in., with a base width of under one inch. It is claimed that the new instrument is accurate in performance, though it is not expected to replace the larger instruments already on the market. A further claim is that it gives readings for cabochon cut stones. The main features seem to be its low price and, possibly, the fact that it can be carried in a waistcoat pocket. Its accuracy will be more properly assessed when a sample instrument is received in this country.

The
Gem Industry
at
Idar-Oberstein

ALREADY in 1936 at Idar-Oberstein there existed a Gemmological Institute connected with the University of Frankfurt. During the war the activity of the Institute stopped, and when the technical school of gem-cutters was destroyed most of the instruments and books were lost. In 1947, Professor K. Schlossmacher, author of " Edelsteinkunde," was called to Idar-Oberstein to re-establish the Institute. As a first task, the few instruments which are still at hand have to be repaired and, above all, a library has to be brought together. By the kindness of foreign countries' Institutes and Associations the Idar Institute now gets the most important gemmological journals. Professor Schlossmacher has the task of instructing the members of the gem industry by lectures and to make them acquainted with the newest investigations. In the time a series of lectures concerning gem sources is given. Besides that, he instructs at the technical school of gem-cutters. As soon as a laboratory is established he will be able to begin with scientific investigations, too. There are many scientific and technical problems which are of importance for the industry and there exists an especial interest in the question of the origin of agates and for the chemical and physical conditions of agate colouring Reports on the results of investigations and many other questions are given in the gemmological journals of Germany and foreign countries. Professor Schlossmacher has now begun to prepare a new fourth edition of his important book " Edelsteinkunde."

The gem industry at Idar-Oberstein has developed out of the manufacturing of native agates, which were found in the time of the Romans, 2,000 years ago. Modern times has brought about an important development by opening the trade. From all over the world rough stones were imported and cut stones were exported to many countries So a many-sided industry developed, which depends completely on the world market. Dealers of rough stones from Idar in foreign countries searched for gem sources and they visited the rough stone markents. In Idar these stones were cut and the smaller part of them sold in Germany, the larger part being exported. In connection with this industry, in the neighbouring quarter of Oberstein there developed a jewellery and hardware industry. By this development the fate of the industry in import as well as in export is connected very closely with the markets of foreign countries. Already the first world war had caused a severe interruption of these relations. Since 1933 political economy has added to these difficulties. When in 1939 the second world war began the connections with foreign countries were interrupted completely. It is true that on the market in Germany there could be sold a small quantity, but therewith it was broken into the stocks, because import of rough stones was impossible. So for 15 years the industry had to work under conditions which were opposed to its whole development and structure. The post-war years have not brought any improvement. The reform of currency has decimated the money and now by a law for taxes on property this will be continued. Thus stocks and money are lost more and more. Besides that, the dealer of rough stones will meet a market abroad in which prices have risen enormously in comparison with former times. The whole industry, however, depends on the import of rough stones. It is true that the blockade of stocks and the system of contingencies for the trade within Germany were diminished during the last time and partly they even were repealed, so the market in Germany is free to-day, but a luxury industry is without prospects in Germany to-day. Without a connection with the world market the industry isn't able to live. One hopes at Idar that this question will be answered in the near future, and then the industry will win back its old place by its acknowledged quality.

Gemmological Abstracts

" Crystals and X-rays." By Kathleen Lonsdale, D.Sc., F.R.S. Bell, London, 1949. 199 pp. Illustrated. 21s.

Fellows of the Gemmological Association who recently had the privilege of listening to Dr. Kathleen Lonsdale's talk on the structure of diamond will be interested to learn that her book on the determination of crystal structure by means of X-rays has just been published.

The book is based on a course of lectures given at University College, London, in 1946. It opens with an interesting historical introduction, pivoting on the year 1912—the year of the famous Laue experiment, from which all the vast superstructure of X-ray crystal analysis stems. This is followed by a clear account of the generation and properties of X-rays. The next chapter, on " The Geometry of Crystals," opens with the X-ray crystallographer's answer to a question familiar to students of gemmology, " What is meant by a crystalline substance? " " One in which the internal atomic or molecular arrangement is regular and periodic in three dimensions over intervals which are large compared with the unit of periodicity." Thereafter follow some pages describing the symmetry of the seven crystal systems, and notes on crystal drawing and projection. Of the conventional drawings of crystals in parallel perspective Dr. Lonsdale, with a typical flash of humour, remarks: " Such drawings are also made as if the eye were looking down from a little above and slightly to the right . . . like a benevolent Conservative government."

The author then describes how the introduction of planes, axes, and inversion axes to the seven systems leads to the 32 crystal classes ; how the addition of glide planes and screw axes increases the number of possible frameworks to 230 space groups ; and how, even when the space group of a crystal has been determined, this is still only the bare bones of the crystal, into which ions, or atoms, or molecules can be introduced in an infinite variety of ways. To correct the idea that any actual rigid framework exists, Mrs. Lonsdale writes: " The space lattice is quite imaginary ; there is no actual framework. The atomic model is quite imaginary ; the crystal is much more like a quivering jelly full of vibrating pips."

Next, the information which can be derived from Laue photographs, powder photographs, divergent beam methods (so powerfully developed by Dr. Lonsdale) and rotation photographs is described, and the notion of the " reciprocal lattice "—the periodic distribution of the reflecting power (to X-rays) of a crystal—is explained. There is a long chapter on " Atomic and Electronic Distribution " which gives an account of the difficult and time-consuming methods by which the actual spatial distribution of the atoms in a crystal is determined, followed by a chapter on " Extra-structural Studies." which deals with such topics as crystal texture and imperfections of structure, thermal vibrations, and so on. In the final chapter are given some of the achievements in different departments of science of the methods of X-ray crystallography. There is an adequate index.

The book is short—under 200 pages—and the subject a vast and complex one. Dr. Lonsdale has done wonders to compress so much into so little space, but there is naturally little room for concessions to the inexpert reader. However, for anyone who is not afraid of thinking mathematically in three dimensions Dr. Lonsdale's book provides as excellent and up to date a survey of the subject as can be imagined. The book is well illustrated with photographs and diagrams, the latter in particular being very helpful.

B. W. A.

" Dictionary of Gems and Gemology. By R. M. Shipley and others. 4th edition. 261 pp. Published by G.I.A.

An expanded edition of a very helpful gem dictionary, containing much additional information. It is a pity that some minor errors of former editions have not been corrected.

General

" Silicon Carbide Refractometer." By Jack de Ment. The Mineralogist (Oregon), February, 1949, p. 99.

A postulation of the use of beta-silicon carbide in refractometers. Should such a refractometer be produced it is not likely to be of significance to the gemmologist.

" Improvement in the Colour of Precious Stones by Heat Treatment." By K. F. Chudoba. " Achat," 1949, Vol. 2, No. 1, pp. 9-12.

The appearance of natural gemstones has always been improved by grinding and polishing, but it is also possible to improve their colour. Apart from colour improvement one may aim at removing spots and streaks. The desired change may be obtained by heat treatment, sometimes by cooling and frequently by radium, X-ray or other radiation. It is well known that yellow, red or brown zircons can be heat treated at about 300° C., the product being a colourless stone, and which is sometimes given misleading names. About 1921 zircons of a beautiful blue colour from Siam were put on the market ; blue zircons were up to then unknown and it was found that this colour, too, was obtained by heat treatment. Amethyst-coloured quartz can be heated to resemble topaz (about 500-600° C.), light green beryl can be coloured blue (aquamarine) by heating the stone to about 400° C., when it loses all colour, becoming blue as it cools off. Yellow and brown topaz may become pink (350-450° C.), while dark green tourmaline may obtain a more pleasing light green colour. Some of these enhanced colours are not permanent ; they fade with time. Some zircons lose their colour in ordinary daylight, while other stones regain their original colour by cathode or X-ray radiation (treated pink topaz, treated citrine). Many problems relating to these colour changes are still unsolved.

E. S.

" Violet Filter as Tester for Emeralds." By S. v. Gliszczynski. " Achat," 1949, Vol. 2, No. 1, pp. 13-14.

There are many colour filters for the identification of emeralds, the best known being the Walton Loupe and the Chelsea Colour Filter. These filters are dichromatic, i.e. they only transmit two spectral colours. Genuine emeralds viewed through these filters appear red. Dr. F. Vandrey-Goettingen has developed another filter for emerald testing consisting of a violet film sandwiched between glass squares of 4.5 x 5.5 cm. size. Green tourmaline and olivine appear blue under this filter, which is preferably used under artificial light. In order to spot green glass imitations, appearing red under the filter, a hardness test with a steel file is recommended. (This test would be unfair to a genuine emerald and is to be deplored.—Ed.)

E. S.

MARGINALIA

Informal notes on points of interest and opinions of a controversial character compiled by Fellows of the Association (Contributor in this issue is F. E. Leak).

WILL ever the topaz-quartz controversy come to an end? The managing director of one provincial organization apparently made this a doubtful proposition when he complained, " The trouble with you gemmologists is that you are too honest." But, coming from a man who runs his business with unquestionable integrity, surely this remark is in itself an indication regarding the ultimate solution of the problem? On the other hand, it has become more than apparent since the foundation of the West of England Gemmological Laboratory that some jewellers in this country are ignorant of their trade. The number of puzzling specimens tested has been infinitesimal compared with those that almost reveal their identity by appearance alone. These are the people who, when they get the worst of a bargain, have been known to condemn the business methods exploited by a few unscrupulous dealers and traders. Surely they should blame themselves.

The Gemmological Association recently appointed a committee to consider the vexatious question of misnomers. I can remember three such committees set up by various organizations, one at international level, and I daresay there have been even more. Have they achieved anything concrete? Certainly, this continued publicity, if it reaches the required quarters of the trade, must have some success—when the diehards and others die out. It must not be forgotten that simultaneously with the publication of the report of the G.A. Committee, the Association found it necessary to make a statement regarding " Synthetic Zircons." The outlook does not seem to be propitious since there is undoubtedly a lack of unanimity throughout the trade on this subject, and until that is brought about there can be no possibility of enacted control. The present legal position as exemplified by the existing Appraiser's Licence that can be purchased without examination or proof of ability is ridiculous. For the payment of £2 any inexperienced person is entitled to set up in business as a house agent and at the same time to value anything under the sun. It is reputed that certain undesirables find this a profitable sideline to their legitimate business.

Returning to the original query, is its insistence due to our laziness in speech? It is so much easier to pronounce the monosyllabic word. The same might apply to the demantoid-olivine business, in which case the sound of the latter is much softer. The majority of the remainder of the high-sounding misnomers take up so much time and wind to pronounce, and this may be the cause of their declining popularity. Other excuses have, I know, been put forward. Recently the Gemological Institute of America has advocated the use of " topaz-quartz " in preference to " quartz-topaz." This is confusion worse confounded.

* * * *

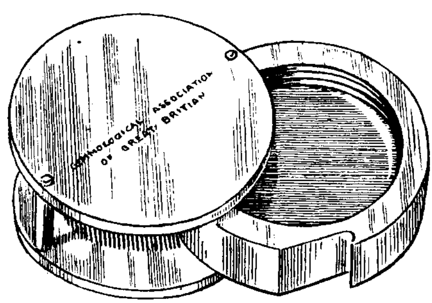
Surely it is time that some effort is made to amend the colour descriptions applied to gems, and apparently slavishly copied from one text-book to another, even from the generally accepted standard works downwards. As the matter now stands it is fair play for the facetious or imaginative mind. What happens if the Board of Standards intervenes? I picture Mr. B. W. Anderson proudly exhibiting his latest acquisition, the standard specimen of pigeon's blood, and religiously renewing it at prescribed intervals. But the highlight of this nonsense must be achieved when the University lecturer in forestry informs his bewildered students that the pistachio nut is epidote-coloured. None of my raspberries have, thank goodness, ever looked, whether in an under-ripe, mature or putrid state and either raw or cooked, like an alexandrite in artificial light. I was on one occasion reminded by the managing director of a well-known City firm, a keen hunting man and presumably *au fait* in all the accessories that accompany this sport, that there is more than one colour for sherry.

Crude sarcasm without a doubt. But surely the absurdity of this position deserves nothing more. Here is further work for the G.A. Committee on nomenclature and work that will be certainly breaking fresh ground. No one will raise the slightest objection to the many sensible colour descriptions that have been employed, provided they are truthful. The difficulty will be to find an expression that will be acceptable throughout the length and breadth of the country. Even such an innocent sounding expression as straw-yellow is liable to countless mental interpretations. Some years ago an instrument called the Colorimeter was described in one of the trade papers. This analysed scientifically the colour of any material in terms of the proportions of the three primary colours contained. Maybe this would also provide a basis on which a range of shades of colour applicable to all varieties of gemstones could be classified. At present, who is to say when a pale green beryl becomes an emerald, or a ruby degrades into a pink sapphire? Its application under normal trading conditions would be almost an impossibility, but it would achieve a standard and no doubt the Association would serve, if necessary, as arbitrator.

* * * *

I recently had a ruby set up on the stage of a microscope in the approved manner for observing absorption spectrum. The bench not being a model of neatness and order, by mistake I placed a dichroscope down the tube of the microscope. The effect seen was quite startling and the twin colours were quite vivid.

Since then I have experimented with stones the dichroism of which is generally regarded as weak, and have found the arrangement most helpful. It is a snag, I know, if light happens to be passing through the stone, from table to culet, in a direction of single refraction, but in doubtful cases it certainly seems worth the effort of sticking the stone into plasticine so that the girdle is at right angles to the glass slip.



CHELSEA COLOUR FILTER

The Chelsea Colour Filter is now available in aluminium casing which is neater and more compact than the older type of mounting. The accompanying illustration shows the new type of filter.

Obtainable from the Gemmological Association of Great Britain, 93-94, Hatton Garden, London, E.C.1, the filter costs 8s. 6d., post free.

Though it has certain limitations, the Chelsea Filter has proved to be a very useful aid to gem-testing.

ASSOCIATION NOTICES

TALKS BY FELLOWS

F. E. Leak: "Pearls"—Toc H, St. George (Bristol) Group, January 27th, 1949. "The Science of Jewellery"—Mina Road (Bristol) Junior Mixed School, Parent-Teacher Association, February 16th, 1949. "Pearls"—St. Mary's Church, Shirehampton (Bristol), Youth Fellowship, February 20th, 1949.

H. S. Reese: "The Identification of Gemstones"—Southport Scientific Society, December 16th, 1948.

R. Webster: "Pearl"—L.C.C. School of Arts and Crafts, January 14th, 1949.

James Gillougley: "Diamonds"—Film-lecture to Geological section of Paisley Philosophical Institution, March 15th, 1949.

A lecture, "Gemstones of to-day and yester years," was given by Prof. W. T. Gordon, M.A., D.Sc., F.R.S.E., at the Museum Lecture Theatre, University Road, Bristol, on February 9th. F. Leak, F.G.A., assisted at the lecture and arranged a special exhibit which was shown at the Museum the week before and the week after Prof. Gordon's lecture.

GEMMOLOGICAL EXHIBITION

The Exhibition will be held from October 4th to 7th, 1949, at the Goldsmiths' Hall, London, E.C.2.

AMERICAN NOMENCLATURE

The Educational Committee of the Gemological Institute of America has recommended that the term "topaz-quartz" be used as a satisfactory synonym for citrine. The term "topaz," when used for citrine or "quartz-topaz," was outruled. The Institute is preparing a complete list of Nomenclature of Gemstones and it will be interesting to compare its recommendations with those that the British Organization published in Volume I, No. 6, of its Journal.

The Gemmological Association considers that while the term "topaz-quartz" is preferable to "quartz-topaz," the expression "topaz" is undesirable as a colour adjective, and that this controversial subject requires a bold and logical decision.

GIFTS TO THE ASSOCIATION

The Council of the Association acknowledges gifts of specimen stones from Wilson & Gill (London), Theo Stern (London), M. Weinstein (London), W. Steinfels, Ltd. (London), J. H. Underdown (London, W. Nathanson (London), and a donation from E. W. Maton (Cardiff).

CORRECTION

Vol. II, January, 1949, p. 5, fig. 3. For "almandine" read "demantoid."

Ibid., p. 16. For "A. S. Alexander" read "A. E. Alexander."

AUSTRALIA

A conference of the Lecturers in Gemmology of the State Branches of the Gemmological Association of Australia was held in Sydney on Saturday, 5th February. Those present were: Dr. D. P. Mellor, President of the G.A.A.; Mr. A. Wirth, President, N.S.W. Branch; Mr. J. S. Taylor, Secretary of the G.A.A.; Mr. Whitworth, N.S.W. Lecturer; Mr. R. O. Chalmers, N.S.W. Lecturer; Mr. H. E. E. Brock, S.A. Lecturer; Mrs. S. G. Whincup, Victorian Lecturer; and Mr. Robinson, Queensland Lecturer.

In opening the Conference, Dr. Mellor pointed out that this Conference was the result of a recommendation made at the last Federal Conference.

Dr. Mellor referred to the extension of the Diploma Examination and that the centres of study were widely separated and the Lecturers had the problem before them of sorting out any difficulties or discrepancies which might occur in the Syllabus or lecture material. He stated how important he thought it was to keep the standard of the examination high and comparable with the British standard, and said that he fully realized what a difficult problem it was to keep the same standard from year to year, as he had found from his own experience in other fields.

The President then touched briefly on the Post-Diploma Courses and Research Diploma, and repeated the remarks that he made on the same subject at the Federal Conference, in which he emphasized the importance of making this Research Diploma cover something in the nature of original work, preferably but not necessarily in the nature of some original investigations into Australian gems.

Dr. Mellor then turned the conduct of the meeting over to Mr. Wirth, the Chairman, who endorsed the welcome given by Dr. Mellor and thanked the Lecturers for the co-operation they had given to the Association. He pointed out that without the assistance of the Lecturers the Association would not be where it was to-day, and he knew that this fact was appreciated by all concerned.

The conference went on to discuss the many subjects of the agenda. Revisions were made to many of the lecture papers of the Preliminary and Diploma courses; some subjects are to be re-written and amendments added to bring them up to date to include recent development and discovery.

Among the subjects continued and discussed was the advisability of:

(*a*) Post-Diploma study.

(*b*) The need for more equipment and specimens.

(*c*) Text and reference books to be recognized and recommended.

(*d*) The possibility of a Research Diploma.

It was recommended that the Diploma practical examination time be extended to four hours and that the theory examination should remain at three hours to be held on a night prior to the practical. It was also recommended that a Conference of Lecturers should, if possible, be held at regular intervals and in different capital cities.

A highlight of the conference was an able demonstration by Mr. H. E. E. Brock, F.G.A.A., of a number of ingenious instruments and aids to more simple and rapid gemstone determination and investigation.

Results of Australian 1948 Diploma Examination

November, 1948, saw the second Diploma Examination held in Australia and the Association is happy to announce that they had a record number of 94 candidates (including one correspondent student), covering the four states of the Commonwealth.

Following is a list of successful candidates arranged in alphabetical order and in their respective States, who have qualified for a Fellowship Diploma of the Association:

NEW SOUTH WALES

Cambridge, J.
Casey, A. K.
Davies, E.
Freeman, A.
Garvin, J.
Green, L.
Greene, K.
Giles, R.
Jeremy, Miss R.
Jopling, A. V.
Merrington, A. W.
Messenger, W. F.
Morris, B.
Plowman, E. J.
Proud, S.
Stuart, B.
Tofler, Miss S.

QUEENSLAND

Acton, C. F.
Arthus, J. H.
Evans, H. D.
Hay, C. A.
Johnston, J.
Lewis, A. R.
Maxwell, D.
Morrow, A. S.
Nissen, C. E.
Nissen, L. W. R.
O'Neill, R. L.
Parker, G. H.
Shaw, A. E.
Steele, A. G.
Steinmuller, G. S.
Wheatley, Miss P.

MELBOURNE

Aiyard, F. A.
Bilney, J. F.
Black, R.
Burrows, M.
Feltham, C.
Funston, W. E.
Locke, K.
Newland, W. G.
Rumbold, S. D.
Vanderkelen, P. W.

ADELAIDE

Abbott, A. M.
Bartram, Miss E.
Brock, H. E. E.
Burgess, C. R.
Campbell, P. C.
Dunbar, W. R.
Earl, A. W.
Heath, R. D.
Ibbotson, K. B.
Jenkins, M. A.
Kavanagh, L. R.
Leak, K. M.
Lyons, J. B.
McCabe, P.
Offe, Miss J.
Quilliam, A.
Roder, A. E.
Shiels, J.
Stead, R. A.
Williams, L.
Zeising, R. C.

Mr. John H. Pope, of Melbourne, who qualified in the Fellowship Examination of the Gemmological Association of Great Britain in 1946, was also successful in obtaining qualification in the 1947 Diploma examinations of the Gemmological Association of Australia.

ANNUAL GENERAL MEETING

The 18th (third since incorporation) Annual General Meeting of the Association was held on Wednesday, March 23rd, 1949, at 7 p.m., in Prince Henry's Room, 17, Fleet Street, London, E.C.4. Mr. F. H. Knowles-Brown, who presided, welcomed members and referred briefly to the history of the 340-year-old room in which the meeting was held.

On the proposal of Mr. R. Popley, seconded by Mr. J. H. Stanley, the adoption of the Annual Report and Accounts was unanimously approved. Mr. Popley referred to the good work done by the Association during the year under review, and specially mentioned the Gemmological Exhibition, Dr. Gübelin's lecture on "Inclusions in Gemstones," and the various interesting films that had been shown. He also emphasized the need for the Association to continue to work for the benefit of the jewellery industry.

The President, Dr. G. F. Herbert Smith, remarked that H.M. Queen Mary had been most impressed with the Exhibition, and that it had undoubtedly enhanced the prestige of the Association.

The following Officers were elected for the ensuing year:—

President—G. F. Herbert Smith, M.A., D.Sc. ; Chairman—F. H. Knowles-Brown, F.S.M.C., F.G.A. ; Vice-Chairman—G. F. Claringbull, Ph.D., B.Sc., F.G.S. ; Treasurer—S. F. Bones, F.G.A.

The following Fellows were re-elected to serve on the Council: Messrs. R. V. Blott, M. L. Crombie, T. G. Jones and R. K. Mitchell.

Messrs. Watson Collin & Co. were re-appointed as Auditors to the Association.

The Chairman thanked the Officers, Council, Members and staff for their support during the past year which had been most happy and beneficial to the Association.

The general meeting was then declared closed, and Mr. Knowles-Brown instituted a discussion on future activities of the Association. It was recommended that instructive films on general subjects should be shown during the forthcoming year, and that more information should be made available about gemstone inclusions. Other matters relating to the 1949 Exhibition, close co-operation with the jewellery industry, general policy and social activities were referred back to the Council.

A vote of thanks to the Chairman was proposed by Mr. S. F. Bones, seconded by Mr. R. V.Blott, and carried with acclamation.

EXAMINATIONS IN GEMMOLOGY

The 1949 Examinations in Gemmology will take place as follows:—

Preliminary—Wednesday, June 15th.

Diploma (Theory)—Thursday, June 16th.

Diploma (Practical)—

- Edinburgh—Monday, June 6th.
- Glasgow—Tuesday, June 7th.
- Plymouth—Thursday, June 9th.
- Birmingham—Friday, June 10th.
- London—Friday, June 17th.
- Overseas—Friday, June 17th.

All entries should reach the Director of Examinations, Gemmological Association of Great Britain, 93/94, Hatton Garden, London, E.C.1, not later than May 4th.

" OPERATION DIAMOND "

On Monday, March 14th, a recently produced film, " Operation Diamond," was shown to members of the Association at the British Council Cinema. The film told two interesting and true stories in which diamonds were the centre of interest and around which the story of diamonds from the mine to jewellery was told.

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No. 2
April, 1949

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