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MORE NOTES ON IMMERSION CONTACT PHOTOGRAPHY

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

FOUR years have elapsed since the first account was given in this Journal of " Immersion contact photography." [1] This very simple yet effective photographic technique involved the use of no camera, nor indeed of any apparatus beyond a glass cell and a few immersion fluids. It was found that when transparent gems were placed in liquid in a glass cell, and light from an overhead source was passed through them on to a sheet of printing paper or slow film, the contrast occasioned by the difference between the refractive index of the stones and that of the fluid was demonstrated in a spectacular manner when the photographic image was developed.

Stones with an index higher than that of the liquid displayed (in the *negative* picture) a white marginal rim, while the facet edges were marked with dark lines. If the index of the stone was lower than that of the fluid the effects were reversed. Moreover, the width of the marginal border and of the lines caused by the facet edges gave a clear indication of how nearly the index of the stone approached that of the liquid.

A positive print from one such photograph which had been taken on slow film (Fig. 1) will remind readers of the striking effects produced. The stones in this case were immersed in bromonaphthalene. A key to the stones is given in the rough sketch shown as Fig. 1a. Though for sodium light the liquid has a refractive index near 1·66, for the violet light which is chiefly operative with this unsensitized emulsion it is nearer 1·70. Hence the spodumene, for instance, is shown, by its narrow white border, to have an index slightly lower than that for the liquid.

Another immersion contact photograph having some interest is reproduced in Fig. 2. This was taken to confirm a suspicion that some of the beads in a tourmaline necklet were in fact aquamarine. The necklet was immersed in a cell of bromobenzene (1·56 for sodium light) and a contact photograph taken on Ilford " line " film by exposing for 15 seconds under an enlarger lamp stopped down to f/16. An enlarger is very convenient for the job, if available, as the stones in the cell can be arranged as one wishes in the light passing through the orange filter below the projection lens before swinging this on one side to make the actual exposure. It can be seen from the positive print reproduced that the tourmalines, having a higher index than the bromobenzene, all display a strong dark rim, where the aquamarines hardly show any border, since their index almost exactly matches that of the liquid for violet light. No fewer than five aquamarine " intruders " can be clearly seen in the photograph—a result not easily obtained by more orthodox methods.

As reported in a second article,[2] a convenient means has been found for making these immersion contrast effects visible without resorting to any kind of photographic process. In the present note I wish to report on recent developments in the original photographic technique which have potential practical value in gem testing.

In the original paper it had already been mentioned that major inclusions, zoning and other structures in stones were clearly visible in contact photographs if the immersion fluid had an index near that of the stone. Also, it was pointed out that this provided a convenient record of the shape, size, and facet disposition of the stones so photographed.

Some months ago, a reputedly genuine sapphire was sent from overseas for test in the Laboratory. A brief inspection under the

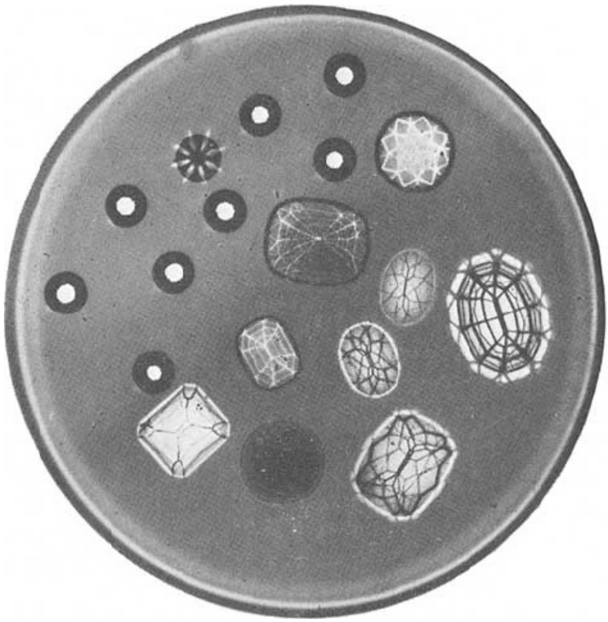
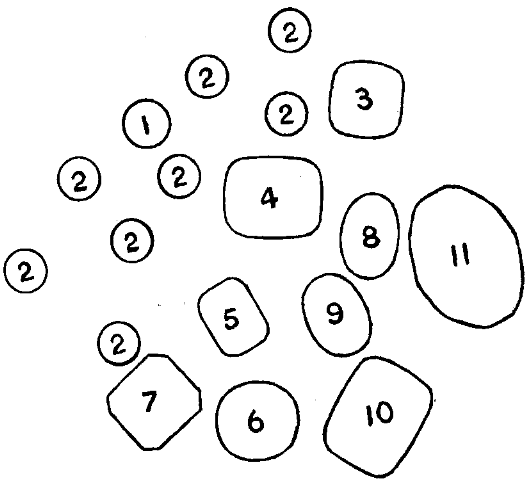


Fig. 1



1. *Synthetic rutile*
2. *White Zircon*
3. *White sapphire*
4. *Golden chrysoberyl*
5. *Pink spinel*
6. *Brown sinhalite*
7. *Green spodumene*
8. *Phenakite*
9. *Hambergite*
10. *Tourmaline*
11. *Citrine*

Fig. 1a.

microscope sufficed to show the presence of numerous bubbles, and there was no shadow of doubt that the stone was a Verneuil synthetic. Curved bands of colour could also be seen when the stone was tilted slightly from the horizontal position. In view of a possible dispute about the identity of the stone after it had left our hands, it was thought wise to take an immersion contact photograph of the specimen immersed in a cell of methylene iodide.

The exposure was carried out under an enlarger lamp, using a narrow beam as described above. When the resultant photograph was examined with a lens, it was noted with some surprise and (one must admit) excitement, that a clearly-defined series of curved lines could be seen traversing the entire stone. This was remarkable for two reasons : firstly, because no curved striae of any kind could be seen in the stone itself when examined with lens or microscope in this orientation (resting on its table facet), and secondly, though curved swathes of colour could be seen when the stone was tilted (as mentioned above) these were the ordinary broad bands familiar in synthetic blue sapphire, and not the closely-spaced striae revealed in the photograph, which were almost like the " gramophone lines " one sees in synthetic ruby. They were, in fact, too closely spaced to be visible with the naked eye.

Encouraged by this result, another trial was later made with a large synthetic sapphire mounted in a ring in which, owing to the setting and the orientation of the stone, it was extremely difficult to see curved bands of any kind—and these were needed as proof, since the stone was remarkably free from bubbles. An immersion contact photograph in methylene iodide again rendered visible the " invisible " structure lines, and again as closely-spaced striae. An enlargement from this film is reproduced in Fig. 3. The only slightly curved striae may be discerned in the centre of the mounted stone, parallel to the length of the specimen. This negative was over-exposed and prints thus show poor contrast. The far more spectacular striae in an " alexandrite " type synthetic corundum, as revealed by the same technique, are shown in Fig. 4—again enlarged from a " line " film negative. One has to admit that in this case the lines were also visible under lens or microscope in this direction.

The powers of the method were further explored, and its crowning triumph in revealing invisible features came when it

Fig. 2.

enabled faint but indubitable growth-lines to be seen in two samples of *colourless* synthetic sapphire. Failure must be admitted, however, in the case of several yellow synthetics in which the same technique was followed.

Close inspection of some of the negatives showing the curved striae has revealed a series of faint *straight* lines intersecting the growth lines at a steep angle. The straight lines are strictly parallel to one another, and may be of the same nature as the straight lines parallel to rhombohedral planes, ascribable probably to twinning, which can sometimes be seen in synthetic corundum when viewed in directions nearly parallel to the trigonal axis—preferably between crossed polars. This is one of many points which require further investigation.

Experiment showed that for the curved striae to reveal themselves in these contact photographs the liquid must be very nearly the same refractive index as the stone. Thus attempts with synthetic sapphires immersed in bromonaphthalene were unsuccessful. A narrow beam of light is also advantageous, but in the absence of an enlarger something quite simple could probably be rigged—a focusing torch would probably prove quite effective. Given these not very onerous conditions we obviously have here a valuable accessory means of proving stones to be synthetic which are reluctant to yield this information under the microscope.

Since boules are commonly split before stones are cut from them, it is fairly certain that large synthetics at least will be cut with their table facet nearly parallel to the length of the boule—which means to say that the curved striae, which are always parallel to the cap of the original boule, will be viewed in an advantageous direction at right angles to the table facet, or very nearly so. It is undoubtedly

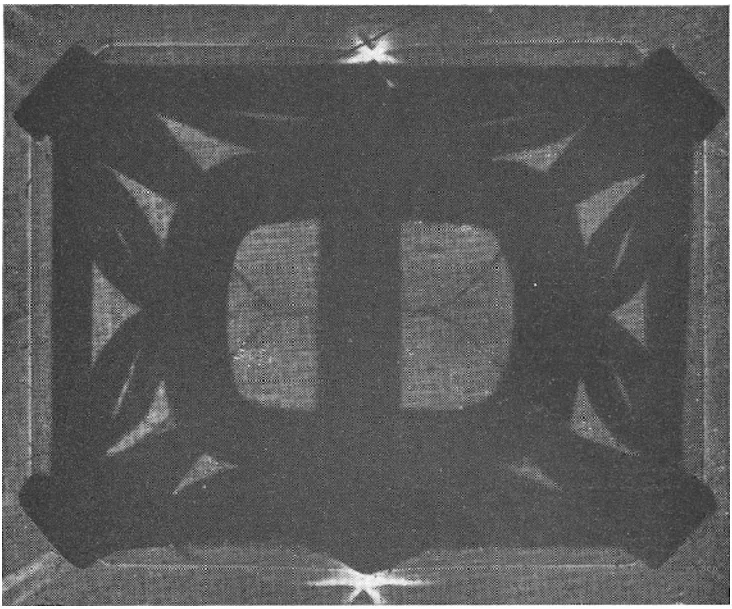


Fig. 3. Synthetic sapphire in ring immersed in methylene iodide.

this fact that makes the striae show up in these photographs, which are all taken with the stone resting on its table.

Transparency Tests

Before closing this article, it is perhaps permissible to remind readers of another interesting development of immersion contact photography, which merits further exploration, and that is, the differences in transparency for various wavelengths of light which such photographs can be made to reveal. In Fig. 1, for instance, the brown sinhalite (numbered 6) is seen to be nearly opaque to the operative violet light, and the golden chrysoberyl (numbered 4) very nearly so. Similarly, the green tourmalines in the necklace shown in Fig. 2 appear notably dark in the contact photograph, being almost opaque to violet light.

Obviously, by using panchromatic film and a series of good colour filters, much information concerning the colour absorption of the various stones could be obtained, and incidentally concerning their dispersion, compared with the known dispersion of the liquid used.

Experiments of this kind, however, would no longer be very simple, and would have small value in practical testing. But transparency tests extended into the ultra-violet can be of real

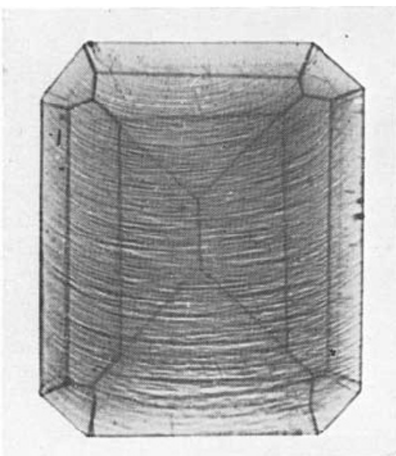


Fig. 4.

Synthetic "alexandrite type" sapphire, immersed in methylene iodide.

diagnostic importance in distinguishing between synthetic and natural emerald, and between synthetic or natural red, pink, yellow or colourless corundums. In each case it has been found that the synthetic stone is notably more transparent to ultra-violet light than the natural[3]. In these latter traces of iron probably act as the absorbing factor.

We have to thank Mr. Norman Day[4] for the brilliant suggestion (backed by a series of fruitful experiments) that immersion contact photographs taken with one of the inexpensive short-wave mercury lamps first introduced to gemmologists by Caudell and Webster[5] could be made to reveal these differences in ultra-violet transparency very clearly. Ordinary printing-paper (e.g. Velox) was found preferable to the faster bromide paper for such experiments, as it is less sensitive to the residual violet light passed by the OX7 glass filter of this lamp. Exposures must be short and are rather critical. It is almost essential when testing an unknown stone by this method to include known natural and synthetic stones on the same photograph for comparison.

Day used a dish made from thin pyrex glass, which is silica-rich and thus fairly transparent to ultra-violet rays. The difficulty of dish transparency can be side-stepped, the writer found, by putting the stones directly on the paper, immersed in water in any convenient dish (such as a developing dish). A parcel of some hundreds of calibre rubies, for instance, could be checked by this means to give a guide as to whether any synthetics were present. Glycerine is also transparent a long way down into the ultra-violet, and could be used in place of water provided the paper were well rinsed before development. Its higher index of refraction (1·47) would allow more light to pass into the stones than when they are immersed in water (1·33).

No satisfactory comprehensive papers can be found in the literature dealing with the ultra-violet transparency of minerals. Of the two references known to me, the first is a paper by Miller published in 1862 (Phil. Trans.). In this, which, it will be realized, dates from a time when the spectroscope was in its very early stages, no wavelengths are given ; simply the relative lengths of the spectra of light transmitted through his rocksalt spectrometer with quartz lens camera. This paper is chiefly interesting in that, of the three diamonds tested by Miller, two were clearly of the rarer type II variety.

The second reference is to a paper by Absolom (Phil. Mag., 1917) in which wavelengths are given of the last line transmitted from a copper arc when passed through various minerals.

Looking at these and other known data the general conclusion can be drawn that substances, whether liquid or solid, of low refractive index and dispersion are relatively transparent to ultraviolet light (water, glycerine, rock salt, fluorspar, quartz). But this generalization refers only to the true ultimate absorption of the substance and can be profoundly modified by the presence of absorbing impurities, such as iron. Hence the variations between synthetic and natural stones and the relative opacity of amethyst and citrine compared with rock crystal, which was noted by Mr. Day.

It has been found that differences between type I and type II diamond are clearly shown by this method, and the fact that strontium titanate with its high dispersion is more absorbent of near

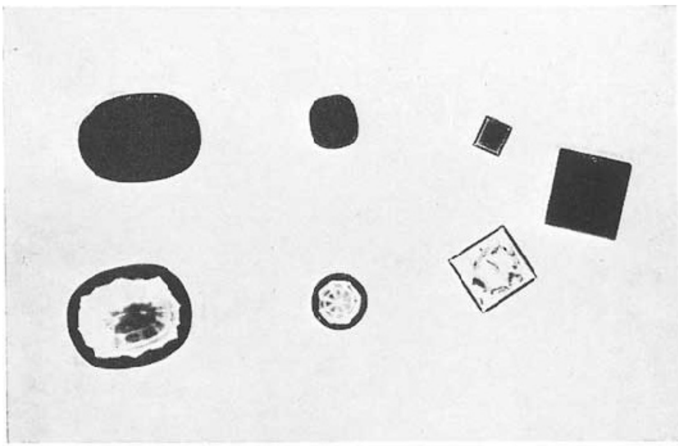


Fig. 5.

Top row (from left) : Yellow sapphire, type I diamond and two natural emeralds.

Bottom row : Synthetic yellow sapphire, type II diamond, synthetic emerald.

ultra-violet light than diamond with its relatively low dispersion may provide a useful test for distinguishing the two when mounting precludes a density test.

Fig. 5 shows an example of an ultra-violet contact photograph in which the stones were immersed in water and rested directly on line film.

Enough perhaps has been said to indicate the rich potentialities of immersion contact photography in practical gem-testing, over and above its original use in demonstrating differences in refractive index. Much work remains to be done—and will be done, as opportunity permits.

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COBRA EMERALD MINE REOPENED

The Cobra Emerald Mine, situated in the Gravelotte district of the Northern Transvaal, has been reopened recently and production commenced.

Before the last war, the Cobra Emerald Mine was a consistent producer of the best qualities and quantities of Emeralds mined in South Africa ; the highest output, recorded in 1937, was 154·081 carats.

The Cobra Emerald Mine is presently owned and operated by African Gem Company, P.O. Box 9112, Johannesburg.

DOUBLING OF THE BACK FACETS IN DIAMOND

by R. KEITH MITCHELL, F.G.A.

THE photograph reproduced in Figure 1 is of an interesting stone lent to me recently by Mr. John Croydon of Ipswich. The stone was not easy to photograph and for the sake of clarity I have drawn the effect seen, in diagram form, in Figure 2. In spite of the extraordinarily pronounced " doubling " of the culet and back facets to be seen in these two illustrations the stone is in fact a diamond.

Such " doubly-refracting " diamonds have been encountered from time to time and may even have lead to their being dismissed as white zircon. But apart from possible anomalous patches due to strain, such stones are just as isotropic as any other diamond. The " doubling " effect is an optical illusion entirely due to reflection. This, in turn, is due to the unusually bad cutting of the stone.

In the present stone the pavilion facets are inclined to each other at an angle of approximately 80°. They are, therefore, as shown in Figure 3, steep enough to allow totally reflected images of opposing edges of the culet to be seen through the front of the gem. The effect is enhanced by the fact that the pavilion facet edges are not diametrically opposite each other, so further reflections give the impression that these edges are also doubled.

Examined with a x10 lens the stone gives a very passable impression of being strongly birefringent, but closer inspection shows that something is not as it should be. Firstly a double image of the culet in a birefringent stone will show one image laterally displaced in respect of the other in one direction only. Here the " displacement " consists of a second and larger culet image outside the first one. Also the space between the two images is mirror-like in appearance (total reflection) while if this were genuine doubling both images would be transparent. It will also be noticed that the doubled pavilion facet edges diverge and that in one case an edge is actually seen in triplicate. None of these things could happen in the genuinely birefringent stone.

Having established these points of variance the question then became one of proving that the effect was due to simple reflection.

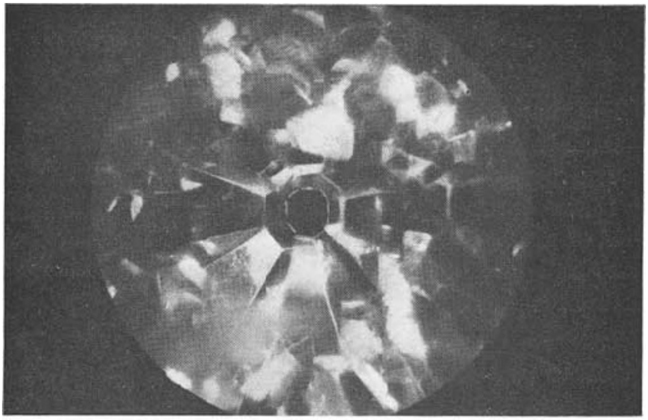

Fig. 1.

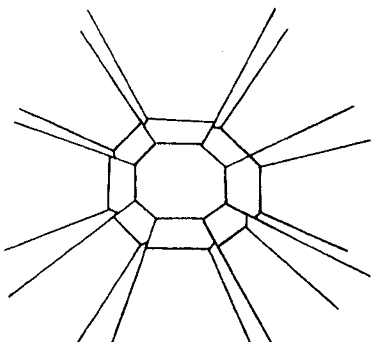

FIG. 2.

DIAGRAMATIC DRAWING OF "DOUBLING" SEEN IN FIGURE 1.

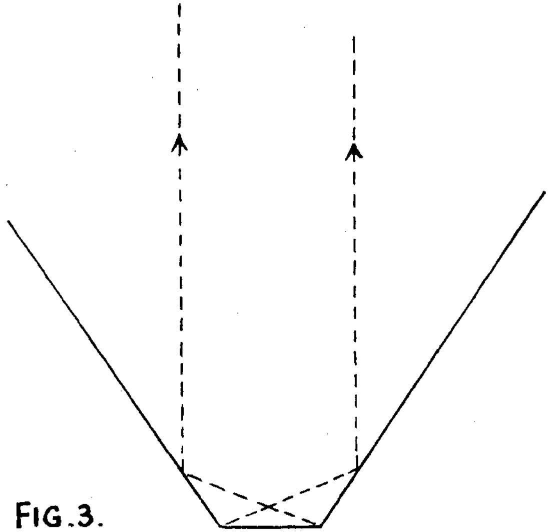

FIG. 3.

DIAGRAM SHOWING HOW STEEP ANGLED PAVILION PERMITS CULET REFLECTIONS TO BE SEEN THROUGH TABLE OF STONE

This did not seem easy until the thought occurred to put a minute dot of ink on one culet edge. This was done and its reflection was seen in the second image but on the opposite side of the stone. The matter was proven.

It may be asked—Why does this happen only in occasional stones ? The answer is simple enough—it is just a matter of cut. In a correctly cut stone the pavilion facets converge at about 100°. At this angle any reflected images of the culet edges would pass out of the side facets of the crown and no complete culet image could be seen through the table. It is possible in many instances, even in modern stones, to see reflections of opposed pavilion facet edges, but, without the " double " culet, the eye sees no significance in this fact.

I am grateful to Mr. Croydon for the loan of this stone and permission to write about it and to Mr. Robert Webster for help in the rather difficult matter of producing an acceptable print from my rather inexpert photo-micrograph negative.

DIAMOND SELLING PRACTICES IN AMERICA*

by RICHARD T. LIDDICOAT, Jnr.

FOR the past three to four years the Gemological Institute of America has been engaged in an analysis of the diamond marketing structure from the point of sale of rough by the Diamond Trading Company to its purchase by the retail jeweller.

This investigation was initiated to provide a means of appraising exactly the effect of make on price.

The need for such a study was pointed to by some of the diamond-selling methods employed by many jewellers. Specifically we wondered if some of the best-trained jewellers weren't being persuaded unwisely to muzzle some of their most effective weapons : i.e., those based on their superior knowledge of diamonds. Out of this study came our new diamond correspondence course, the diamond evaluation class, and a number of convictions regarding the sale of diamonds at retail.

Many signs point to the conclusion that interest in diamonds is high—but few jewellers seem to take utmost advantage of this interest to increase their sales to a maximum. Diamond sales seem at best to represent a small part of their potential.

Every jeweller must believe that diamonds bring pleasure and beauty into their owners' lives. Therefore, the jeweller who sells a diamond to a person who wouldn't otherwise buy one is performing a valuable service.

In certain respects fine jewellers seem to have oriented their diamond selling more to what other jewellers will think than to serving the public taste.

This is demonstrated by the manner in which diamonds are offered and the jeweller's interpretation of grading standards. First let us examine the methods by which diamonds are sold by many jewellers and the direction of recent trends in this field.

There are still many jewellers who offer basically one grade only. They may obtain a heavily flawed stone, if requested, or have

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a price line which is offered almost reluctantly—but basically they contend that they offer one grade.

This grade may be called top colour, flawless ; " blue-white, perfect " ; " the finest money can buy " ; " a good value " ; or " the famous Jones & Jones quality."

Firms handling one grade only meet price competition either by more effective selling or by hedging their established standards for that grade. Standards are hedged through forcing the grader to be less particular on colour or clarity or to buy spread stones. If these stores sell more effectively, they could be adding sales without the handicap of having only one price to offer in each size. If they hedge, the reputation of the firm is threatened, if and when qualities sold as the finest are demonstrated by competitors to be misrepresented.

If its grade is really top quality in all respects, the firm earns a reputation for high prices. A single grade at highest to fairly high quality gives the fake discount man and the high-markup house a beautiful screen behind which to operate. Perhaps the fact that so many jewellers have offered diamonds in only one grade is responsible for the common question, " What is a one-carat diamond worth ? "

Thus the single-grade diamond house is condemned if it maintains the standards it claims and condemned if it doesn't. In the face of this, it is amazing that so many fine firms have continued to emphasize one grade only.

To better their competitive position, other firms have added an extra grade or more to be able to offer lower prices. In our opinion, this is a step in the right direction. The question that arises immediately is how far a fine firm should go.

A satisfactory solution is one which preserves the reputation of the firm and keeps inventory within sensible bounds. A thorough analysis of the reputation question suggests a review of the development and meaning of diamond quality standards.

Inclusions not visible to the unaided eye and poor proportions are not considered important by jewellers in many countries. Many years ago jewellers in the U.S.A. and Canada started using watchmaker's loupes to examine diamonds. Gradually more powerful ones were used. This trend to more careful grading was culminated in the Jewelery Trade Practice Rules of the Federal Trade Commission and the American Gem Society Rulings. Such standards are wonderful if they are interpreted in the way they were intended ; that is, that no stone should be sold when described by the highest quality terms unless it meets these certain standards. However, it does not mean anything less is undesirable, which is the interpretation applied to quality terms by many ethical jewellers.

Diamond grades and diamond standards from the customer's angle are much different than from the jeweller's. What does the term perfect or flawless mean to a layman ? When it is understood what is involved, how many would choose a larger stone for the same money ?

The Gemological Institute's imperfection system employs a standard nomenclature ; flawless ; very, very slightly imperfect ; very slightly imperfect ; and imperfect ; with each grade below flawless divided into two categories for pricing purposes.

In this system flaws are not visible to the unaided eye in any grade above SI_2, and even then are difficult to see. In fact, stones of that grade contain no visible flaws face up in the mounting. An SI_2 of the finest colour and make has a value between 50% and 60% of a flawless stone of the same colour and make.

Unless the flaws are cleavages they do little if any harm to the stone. To the customer, inclusions which make a stone unique and reduce its price could well add to its desirability if presented positively. The fact that a flaw is shown to him under magnification surely adds to his confidence. In fact, the sceptic may well prefer the inclusion he has seen to the one he fears is there in the stone represented to him as flawless. In any event, confidence is inspired by the fact that inclusions present are pointed out. When flaws are invisible and have no effect on beauty, what is their importance to the layman who wants a larger stone than he could afford in a flawless, top-colour stone of fine make ? The perfect and flawless standards were written to protect him from misrepresentation—not to force him to buy only flawless or perfect goods.

In colour standards, a somewhat similar situation exists. How far down the colour scale must one go before colour is visible face up ? Of course, the size of the stone governs to a degree the point at which colour becomes visible.

In the diamond-colour picture, grading terminology and colour scales tend to present a somewhat misleading picture, in that grades at the very top of any scale differ in transparency rather than in colour. On the American Gem Society's Colorimeter Scale, it takes a keen eye to detect any colour whatsoever above 1·5, even under the controlled conditions afforded by the Diamondlite. It takes a keen eye to note colour in a 2·5 face up in a mounting. On the Institute's letter colour scale, this would be about I, and roughly a top crystal in the old terminology. The lowest colour not visible face up in a mounting will usually cost about 80% to 85% of an otherwise similar stone of top colour.

This discussion so far assumes that yellow is considered ugly by the average customer. Some layman like topaz and golden sapphire colours and would like a yellow diamond unless told that a yellow stone is inferior. Yellow quartz is one of the more popular stones with the buying public, indicating that many people find yellow an attractive colour. When he consistently directs customers away from yellow colours in diamonds, the jeweller is stressing rarity rather than what to someone else is beauty. In view of all this, how vital to the potential owner are the jeweller's quality standards in clarity and colour ?

How many jewellers who handle genuine stones are interested in wearing or owning synthetics ? Very, very few. Yet how often have layman friends said to you, " why buy a real stone when the synthetic is hard to tell from the real and a lot cheaper ? "

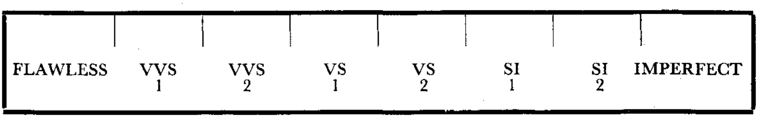

Fig. 1
A Clarity Yardstick.

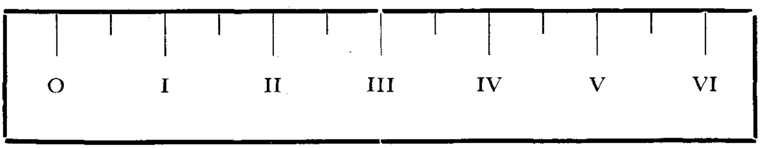

Fig. 2
The American Gem Society's Colour Yardstick.

If some customers feel this way how can they appreciate the jeweller's feeling about such intangibles as River versus a Wesselton—or even a Top Cape ? If anything, this lack of appreciation of differences not visible to the unaided eye is most common in the well-educated and wealthy groups the prestige jeweller is seeking to sell.

Oddly, many jewellers lay great stress on clarity and colour in grades the layman cannot distinguish ; yet make, the easily distinguishable characteristic of diamonds, is often disregarded. Make should be stressed and minimum acceptable standards for his finest quality set by the jeweller.

The American-cut proportions were worked out and offered originally as the compromise, giving maximum fire consistent with maximum brilliancy at a decent weight yield from the octahedral crystal. Considerable departures from the highest clarity standard—flawless—and the highest colour can be made without change in a diamond's appearance. However, more than slight deviation from either the proportions or the angles of the American-cut affects the stone's beauty. Although price reductions of up to 50% are possible with make discrepancies alone, it seems to be the last quality factor which should be lowered to meet price competition.

However, if size is the only concern of an individual, make quality reductions added to those in colour and clarity give the jeweller a wide range of sizes to offer at a given price. The trained jeweller can select make deviations, such as the thin crown and spread table with correct pavilion, so that at least the brilliancy remains high in the quality which offers maximum size for money spent.

Taking these prices versus quality standards into consideration, how can the over-all diamond situation be improved ?

It will never improve until fine jewellers take a realistic attitude in offering diamonds to the public. The real potential has never been reached in selling diamonds. True, more engaged couples declare their intentions with diamond than at any time in the past, but this represents a small part of what is possible.

If jewellers make it clear that a customer can have a stone which he would like at a price he can afford, much as he can when purchasing the items which compete for the consumer's money, half the battle is won.

The average person knows nothing about diamond quality. To the layman, the size of the price ticket is what determines quality. Anything which clarifies diamond grading without befuddling is sure to aid the ethical jeweller. Unless the trained man takes advantage of his training to help his customer, he fails to perform a duty and fails at the same time to make the customer aware of the real advantages to him of the jeweller's knowledge. It is constantly amazing how fearful many fine jewellers are of giving customers any information whatsoever—this is to prevent boredom, they say. Yet a short exposition of how to grade diamonds and the care used is often the one item that brings customers.

Figure 3 demonstrates graphically how a customer who has been given a very brief account of the three C's* and how diamonds are graded may be shown how he may choose quality desired at the price he wishes to pay.

CLARITY AND CUTTING GRADES

AGS Colour Grades →		**0.-1·4**	**1.9-2·4**	**2.4-2·8**	**3.5-4·0**	**4.5-5·0**
Flawless	Fine Cut	$1000	910	860	670	390
	Good Cut	925	840	795	630	360
	Fair Cut	800	730	690	535	310
	Poor Cut	615	560	530	410	240
$V.V.S_2$	Fine Cut	820	750	710	550	330
	Good Cut	760	695	655	510	305
	Fair Cut	655	600	570	440	265
	Poor Cut	505	460	435	340	260
$V.S_2$	Fine Cut	670	640	590	450	280
	Good Cut	620	590	545	415	260
	Fair Cut	535	510	470	360	225
	Poor Cut	410	395	360	275	170
$S.I_2$	Fine Cut	550	510	480	380	230
	Good Cut	510	470	445	350	210
	Fair Cut	440	410	385	305	185
	Poor Cut	340	315	295	235	140
		Colourless			Colour visible **Face-up**	

Fig. 3

Assuming a Retail Value of $1000.00 *for a Diamond which is Flawless, of Finest Colour, and Cut to the Standards of the American Cut, the other Figures show comparable Retail Values depending on Quality. In no Imperfection Grade listed would a flaw be visible to the unaided eye when the Diamond is mounted. Note that there are Gaps between both the Colour and Imperfection Grades Shown. Fair and Poor Cuts represent Degrees of Spreading.*

* The term " 3 C's " is employed by American jewellers to indicate Colour, Clarity or imperfection and Cutting grades of relative quality.

One simple way to convey a complex story without boring the listener is by diagram. By showing the yardstick by which each quality factor is judged and his careful grading methods, the jeweller establishes himself as an expert and gives the layman a better idea of what is important in buying a diamond. A diagram such as that shown in Figure 3 may be used to demonstrate the range of possibilities in quality and size variation at a given price. It is clear that the price of a stone with the finest make can drop over 50% with reductions in colour and clarity grades insufficient to affect the appearance of the mounted stone. Few customers understand this. If clarified by diagram, the customer's choice may be different and it is sure to be made with greater assurance. A simple, logical presentation establishes the confidence that produces immediate sales or brings " lookers " back.

When a jeweller handles one grade only, X money buys one size only. That size may seem too small. The same problem exists when only two or three qualities are handled. Why not increase the size range by adding grades ? Some jewellers say, " We will never reduce our standards." In effect this is saying, " We will continue pushing our own ideas and tastes on our customers." In other words, such a jeweller uses his training and the keen eye he has developed with years of practice to force on his customer a more expensive stone because it has a quality requiring the jeweller's training and keen eye to appreciate. Is this realistic or is it fair to the average customer ?

What seems to stand between such jewellers and offering any or all grades is pride. This is often prompted by a natural unwillingness to give outside appraisers grounds on which to criticize merchandise. How can a firm's reputation be impugned if the customer has been told in detail exactly what he is getting and the same information appears on the sales slip ? If a customer wants a 1-carat stone in a platinum mounting and wants to pay no more than $500, what valid reason is there for not supplying such a stone ?

When asked this question, some jewellers say, " Even if I tell him what it is, he may tell his wife or another jeweller it is blue-white and perfect." Often firms which sell nothing but flawless, fine-coloured diamonds cut to exacting standards have their merchandise criticized by the unethical. Unwarranted criticism of others' merchandise of prices is one of the banes of the jewellery industry. However, no need nor desire for another's appraisal exists if your customer has been given a clear story of the quality of the merchandise (and if the grading is listed on the sales slip).

Maintaining high standards can be done regardless of the qualities which are sold. To the layman, standards have to do with business ethics ; in other words, the manner in which merchandise is presented and represented. This has nothing to do with specialization, which is the true nature of a one-quality policy.

So long as goods are represented honestly and each grade is listed on the sales slip, why not offer the customer the stone that will give him the most satisfaction ? The average customer will take more pride in a stone 30% or 40% larger for the same price if he cannot see a quality difference. It seems somewhat more important to satisfy customers than to try to silence appraisers.

One other argument against many grades is more logical. It refers to firms which have difficulty selling their top merchandise and who feel that adding grades will reduce their average sale.

It should be emphasized that adding grades is not suggested only as an answer to price competition—these suggestions are offered in the belief that they will increase customer confidence as well as satisfaction and increase the diamond sales potential. If grades are added and the result is nothing more than a lower average sale, the diamond salesmen are not selling effectively or qualities and grading are not explained effectively.

A jeweller has been highly successful in maintaining sales of his finest quality while stepping up the sale of some-what lower-priced goods. His simple system makes clear graphically where every stone falls on each scale. This is carried out on price tags by a colour code. This system makes the finest seem most desirable and keeps the jeweller constantly in an open-to-buy condition in many sizes of his top quality while increasing the sale of lower priced goods as well. This firm handles a range permitting stones to be offered as low as half the price of their finest, while keeping make fine and colour high. With little effect on appearance, a considerably wider range is possible and seems desirable.

To summarize : We at the Gemological Institute are convinced that the full potential of diamond sales possibilities has not approached realization. We feel that one reason is that some of the quality standards imposed by many fine jewellers are unappreciated by the average person. As a result, for those who can neither appreciate nor afford the finest in a good size, prices are much higher than they need to be. Why force such people into unethical establishments by failing to offer what they want at a price within their reach ? By giving the customer a clear picture of just what is available to him for the amount he can spend, and showing him that a stone of a size of which he will be proud is well within his budget, the jeweller can increase his diamond sales tremendously.

By offering a wide range of qualities and prices and letting the public know about it, the legitimate jeweller removes the protective screen behind which the long-markup man and so-called discount man operate.

Why continue to force on the customer an appreciation of quality gained only through long training and experience, when that appreciation of the very finest quality is not shared by the average customer ? Why rob that customer of the pleasure of owning a diamond or reduce his pride of possession by selling a smaller stone than the size he would enjoy most ?

One of the factors tending to affect diamond sales is the public's limited knowledge of the product. The trained progressive jeweller is in a position to dispel that fear without either boring his prospective customer or using a technical approach.

The greater knowledge possessed by gemologists means diamonds can be presented to customers more excitingly and displays and advertising can be better planned to attract favourable attention to diamonds—that is how diamond knowledge best serves the jeweller.

It is the retailer's function to *serve* the public to the best of his ability, but not to use his ability to convince customers that what they want is not the best for them. The trained jeweller who will merchandise diamonds realistically will increase customer satisfaction, as well as his success in business.

Gemmological Abstracts

FRANCO (R. R.). *A côr das pedras preciosas.* Gemologia, Ano. 1, No. 1, pp. 23-27.

Deals in general terms with intrinsic colour in precious stones, explaining briefly allochromatism, idiochromatism, heat treatment and so on. Gems listed under their colouring elements and again under colour headings. It is to be noted that although Peridot appears in the text, its place under " Gemas Verdes " (Green Gems) is taken by " crisólita "—a confusing usage. Mention is made of the local practice of selling greenish, heat-treated quartz as Brazilianite, to the detriment of the true mineral of that name.

R.K.M.

MOREIRA (P. S.). *Os grandes diamantes Brasilieros.* Gemologia, Ano. 1, No. 1, pp. 5-12.

An account of large diamonds found in Brazil. Some 28 are listed with details of weight and provenance. A final table lists the 60 largest stones found in all parts of the World. It is significant that 23 of these are Brazilian, some ten of which, including the Presidente Vargas 726·28 cts., the Darcy Vargas 460 cts., the Coromandel 6º 400·65 cts., have been found in the last twenty years.

1 Illus. R.K.M.

GRODZINSKI (P.). *Gemstones in early Indian writings.* Gemmologist. Vol. XXV, No. 295, pp. 28-30. February, 1956.

The literature of the Middle Ages provides some curious writings on gemstones. Dr. Grodzinski's article is built up from extracts from the French work *Les lapidaires Indiens* by L. Finot. It mainly deals with the legends about diamond.

R.W.

SINKANKAS (J.). *Some freaks and rarities among gemstones.* Gems and Gemology. Vol. VIII, No. 7, pp. 197-202 and 229. Fall, 1955.

Details some unusual specimens and varieties of gemstones. These include a golden beryl crystal from Madagascar which produced a number of chatoyant cabochons, one of 44 carats. One of these was subsequently heat-treated to give an aquamarine colour. Another beryl crystal of full blue colour from Brazil is discussed. This showed a cat's-eye effect. Morganite cat's-eyes are discussed. Star beryls from an unknown locality in Brazil are mentioned and the nature of the inclusions producing the star effect referred to. Enstatite-hypersthene from India is another stone mentioned and sphalerite (zinc blende) from a number of sources is discussed in respect to the difficulty in polishing. A notable specimen of near-colourless material (cleiophane) from New Jersey was fashioned into a trap-cut stone of 10 carats ; it looked like a slightly greenish diamond. Small stones have been cut from the clear pink-coloured tremolite called *hexagonite.* Hexagonite appears to be a name new to English gemmology. Greenish-blue boracite from Germany, orange-brown calcite from Baja (Lower) California, Mexico, and colourless magnesite from Bahia, Brazil, have been faceted into stones.

R.W.

LEA (I.). *Notes on microscopic crystals included in some minerals.* Gems and Gemology. Vol. VIII, No. 7, pp. 203-207 and 218. Fall, 1955.

The article is a verbatim reprint of two of three papers written for the Proceedings of the Academy of Natural Sciences of Philadelphia by Isaac Lea in 1869. These papers probably represent the earliest work done in the United States on gemstone inclusions. Most of the inclusions referred to are needles in garnets, star garnets, sapphires and star corundums, and in red spinels (spinelle ruby). The second paper records the inclusions seen in fourteen individual specimens and other observations on some rubies and sapphires. Of historical value only.

1 illus. R.W

GÜBELIN (E.). *Amblygonite—new gem.* Gems and Gemology. Vol. VIII, No. 7, pp. 208-214. Fall, 1955.

During 1953 some pale yellow crystals were found in a drawer of an old museum, and these were identified by Dr. A. Schroder of the University of Hamburg as amblygonite. The present article is an exposition of the characters of this lithium aluminium fluo-hydroxy-phosphate mineral. The colour, the symmetry and habit of the crystals are given. There is one direction of cleavage parallel to the basal plane. Amblygonite belongs to an isomorphous series in which the refractive index diminishes and the density increases with increasing amount of fluorine. The gem material, which has a hardness of 6, is however fairly constant with refractive indices of 1·61 and 1·64 (birefringence is 0·026) and the density 3·01 to 3·03. The axial angle is given and compared with that of spodumene. A table of the constants found from individual stones is given. The inclusions are cloud-like and in parallel formation, the parallel bands running either parallel to each other or intersecting each other, and they consist of a multitude of tiny cracks mixed with impure matter. Under long-wave ultra-violet a faint greenish-yellow fluorescence has been noted. X-ray powder photographs were made using Cu-K radiation in a 114mm. diameter Debye-Scherrer camera. A table of the lines and their intensities is appended. There is no information concerning localities.
6 illus. R.W.

WATABA (N.). *Electron microscopic observations of aragonite crystals on cultured pearls.* Gems and Gemology. Vol. VIII, No. 7, pp. 215-218. Fall, 1955.

The article is a reprint of a report of the Faculty of Fisheries, Prefectorial University of Mie, Japan, Vol. 1, No. 3, pp. 449-454. The author had previously made a study of the surface crystals of cultured pearls and had distinguished three types of surface pattern : volute, parallel and irregular, caused by different modes of aggregation of aragonite crystals. As the crystals are so small, about 2·5 μ in diameter, they could not be well examined by an optical microscope and the electron microscope was employed in the later investigations. Three pearls were examined, one of each type. The method used was to clean the pearl surface with alcohol and then place it on a polymerizing methylmethachryl on a glass slide. After polymerization the pearl was removed leaving an imprint on the plastic surface. This was then plated with a thin membrane of aluminium, and this replica of the pearl's surface in aluminium was electron micrographed at 50kV, giving a magnification of ×2000. The results obtained with these three pearls is given and the data obtained discussed. A concluding summary is appended in which the author gives his theory of pearl formation as the nacreous layer of pearls is formed by repeated crystallization, partial dissolution and recrystallization.

6 illus. R.W.

BROWN (J. C.). *Kollur : Reputed home of the Koh-i-nur.* Gemmologist. Vol. XXIV, Nos. 292/3, pp. 199-203 ; 222-225. November/December, 1955.

A critical review of the history of the Koh-i-nur diamond which now rests in the front of the Queen Mother's crown. Some writers relate the name Koh-i-nur to the place Kollur where many large diamonds had been found. The history of the stone since it came into the possession of Nadir Shah in 1739 has been well told in Major General Sitwell's recent work *The Crown Jewels and other regalia in the Tower of London*, but before this time the history is controversial—there being two major contentions, one, based on their weights, is that the Koh-i-nur and Baber's diamond were identical, and the other is that the Koh-i-nur is part of the Great Mogul diamond remarked upon by Tavernier. The history of Baber ; notes on Tavernier's travels, and other records are marshalled in order to give the reader some idea of the difficulties in deciding the origin of the famous diamond. The visit of Tavernier to the Indian mines and his description of them, the diamonds found there and the methods of mining are given. It is said that despite his claim Tavernier was not the first European to visit the mines. The *rati*, the seed of the *Abrus precatorius*, is the weight used for jewels in Northern India, but the *mangelin*, the seed of *Adenanthera pavonia* (calculated to be 1·45 metric carats), is used in Golconda and Southern India. The geological features of the area are briefly touched upon.

12 references. 4 illus. R.W.

AMRINGE (E. V. VAN). *Crocidolite and Tiger's eye.* Gemmologist. Vol. XXIV, No. 293, pp. 230-232. December, 1955. (Abstracted from the Mineralogist for September, 1954.)

Asbestos is discussed as a mineral ; the varieties are named (chrysotile misspelled as chrysolite), and the commercial significance of the mineral remarked upon. Particular attention given to the crocidolite variety. The Griqualand West, Northern Cape Colony deposits are discussed geologically and with reference to the mining. The pseudomorphs of the mineral found at Naauwpoort in the Hay district near Prieska, are a soft oxidized variety of golden yellow colour called *griqualandite* and the hard siliceous variety of golden yellow through yellowish-brown to a red colour ; the material so well known as Tiger's eye. When less altered, somewhat softer and of a blue colour, it is known as Hawk's eye. Sixty years ago the material fetched 22s. 6d. per carat; it is now one of the cheapest of attractive gemstones. The material is cut as cabochons and as cameos and intaglios. An interesting stone resembling cat's eye is prepared from tiger's eye by treating the rough material with hydrochloric acid. R.W.

ANON. *A pearl fishery will take place.* Gemmologist. Vol. XXV, No. 294, pp. 1-3. January, 1956.

After a lapse of 28 years a pearl fishery took place in the Gulf of Manaar last year. Some notes on Tuticorin and the fisheries is given. The pearl producing oyster is the *Margaritifera vulgaris.* The Indian pearl banks, or paars, extend over a distance of 100 miles from Cape Comorin to Rameswaram. There are three divisions ; the southern from Cape Comorin to Manapad, the central from Manapad to Vaipar, and the northern from Vaipar to Rameswaram. The central division, the Tuticorin division, being the most productive. The paars fished last year were the Tholayiram, Kuthadiyar, Vadaombathur and Saithombathur.
3 illus. R.W.

GÜBELIN (E.). *Further notes on gemstone inclusions.* Gemmologist. Vol. XXV, No. 295, pp. 21-24. February, 1956.

A report on the lecture given by Dr. E. Gübelin to the Gemmological Association in October, 1955.
12 illus. R.W.

GRODZINSKI (P.). *Engraving on diamond.* Gemmologist. Vol. XXIV, No. 293, pp. 219-221. December, 1955.

The article traces something of the history of engraving on diamond and mentions some of the engraved diamonds recorded in literature, with special reference to an engraved diamond showing the head of the Dutch Queen Fredrica.
10 references. 1 illus. R.W.

ANDERTON (R.). *The new Gachala emerald mine in Colombia.* Gems and Gemology. Vol. VIII, No. 7, pp. 195/6. Fall, 1955.

Said to have been accidentally discovered during 1954 in the Province of Cundinmarca, Colombia, is a new emerald mine, Las Vegas de San Juan, or as locally known, the Gachala, which lies some five miles from Chivor. An estimated million dollars worth of emeralds was taken out by contraband miners during the first six months. Since then the Government has prevented further mining and a legal concession has been applied for, but banditry is still rife. The deposits have been considered to have been thrown down from higher levels of the mountain, and no crystals in matrix (Gangas) have been found. Simple shovel and bar mining of the soft sand and gravels is the method used for recovery of the emeralds, which are said to be of better quality than those of Chivor, and indeed nearer to those of Muzo. The inclusions or *jardin* tend to settle at the bottom of the crystals and make for cleaner and clearer stones. Chivor is said not now to be worked and Muzo is about to operate on a limited scale. Cosquez has not been operated for many years. The outlook for greater emerald production is poor.
1 illus. R.W.

ANDERSON (B. W.) : PAYNE (C. J.). *The spectroscope and its applications to gemmology.* Gemmologist. Vols. XXIV and XXV, Nos. 293/4/5, pp. 226-228 ; 4-6 ; 25-27. December, 1955, January/February, 1956.

This research series continues with the completion of the absorption spectra due to iron in the ferric state. Andradite garnet, of which demantoid is the gemmologically important variety, has earlier been discussed in view of the chromium absorption spectra in the deeper green colours of this gem. The absorption bands in demantoid due to ferric iron are mentioned as being the most diagnostic, especially in the paler greens and yellowish-green types where the violet end of the spectrum is not absorbed by the chromium spectrum as is the case with the deeper green coloured material. The strongest of the iron bands in demantoid is a narrow and intense line at 4430A in the blue-violet absorption and thus appear to sharply edge the violet producing a cut-off effect. Other weaker lines in demantoid are at 4850 and 4640A. The absorption spectrum of epidote was first observed by H. Becquerel in 1889, who found it to vary with direction. The main band in epidote is near 4550A, but is only clearly seen in pale and transparent specimens, for in the darker varieties the general absorption in the violet, common with brownish stones, tends to mask this band. A general summing up is given of the gems which owe their absorption spectra to ferric iron. Absorption spectra due to manganese are confined to three natural gem materials ; rhodonite, rhodochrosite and spessartite garnet. The absorption spectra in the case of these three minerals, as observed on transparent specimens, are as follows : rhodonite shows bands at 5480, 5030, 4550A, with weaker bands at 4120 and 4080A. Rhodochrosite shows bands at 5510, 4545, and 4100A, while spessartite shows bands at 4950, 4890, 4620, 4320, 4240 and 4120A. The wavelength 4120A appears to be a key position for bands due to manganese. In the yellow-green synthetic spinel bands due to manganese are present at 4485 and 4230A, and these are sometimes seen in conjunction with the cobalt spectrum in the paler blue synthetic spinels made to imitate the blue zircon and the aquamarine. It is inferred that the manganese is incorporated in these cases in order to give a greenish cast to the stones. Comment is made on the assertion of the Bradleys that manganese is the colouring agent in the red and pink tourmalines, and the absorption spectrum of these varieties of tourmaline is discussed in relation to this theory. The absorption spectrum of the red and pink tourmalines is given as a broad absorption in the green, centred at 5250A, within the long wavelength end of which is seen a very distinctive narrow line at 5370A, and in addition two lines in the blue at 4580 and 4500A. The writers, dealing with coloration by cobalt, explain that cobalt in natural minerals gives a red colour, but in glass and synthetic spinel a blue colour is induced by cobalt compounds. This is

explained by reference to the theory of Hantzsch, who established that red and pink colours are found where the cobalt ion is surrounded by six oxygens, while blue colours are produced when the ions are surrounded by only four oxygens. The absorption spectra of cobalt-coloured materials of a blue colour consist of three strong bands in the orange, yellow and green. These bands may vary slightly in position and in width in different materials, the most important examples being that in synthetic blue spinel the bands are centred at 6300, 5800 and 5380A, while in blue glass the bands are centred at 6560, 5900 and 5380A, and, moreover, in the case of synthetic blue spinel the centre band is the broadest, whilst in blue glass it is the narrowest of the three. In cobalt-coloured plastics the bands, although similar in disposition, have their centres again slightly different. The writers express disagreement with the theory given by Wherry that cobalt is the cause of the colour in natural blue spinel. It is noted that the appearance of the cobalt spectrum in a stone is proof that the stone is an imitation or manufactured stone. A sharp line at 4750A is seen in the vanadium-coloured synthetic sapphire which is made to imitate the alexandrite. This line at 4750A is due to vanadium and is characteristic for this alexandrite imitation, and is another example of the absorption spectrum giving a nearly positive answer to the nature of a stone. Mention is made, however, that there has been a case of a natural sapphire exhibiting this vanadium line at 4750A.
7 illus. R.W.

ANON. *The story of Verneuil.* Gemmologist. Vols. XXIV and XXV, Nos. 293/4/5, pp. 228-229 ; 13-16 ; 31-34. December, 1955, and January/February, 1956.

Based on a lecture given in Paris by Professor Lafuma on the history of the origins of synthetic gems and the man who contributed so much to their development. Many scientists tackled the problems of the synthesis of ruby during the nineteenth century, but Verneuil alone had the merit of perfecting the method of its production. Auguste Verneuil was born at Dunkirk in 1856 and started researches on the problems of ruby synthesis in Frémy's laboratory in the Museum of Natural History in 1873. In 1905 he was appointed professor at the Conservatoire of Arts and Crafts. Reference is made to Gaudin's experiments in 1837 and to

Ebelmen's work on ruby in 1847, when he was professor of the Conservatoire and Verneuil's predecessor in the chair. The experiments of Frémy and Feil are fully told, as are the later experiments carried out by Frémy in conjunction with Verneuil. Reasons are given for Gaudin's lack of success. The conditions needed in order to produce transparent ruby crystallized by fusion are, according to Verneuil, to carry out the fusion in the part of the flame richest in hydrogen and carbon, to produce the increase of the mass of corundum by superposed layers from bottom to top, and lastly to obtain fusion in such conditions as to limit the contact of the melted material to an extremely small surface. A description of the inverted furnace devised by Verneuil is given and the method of the working of such a furnace is explained. In this type of furnace the conditions postulated by Verneuil are achieved. The paragraphs on the properties of the rubies made by this process may, in the light of more recent knowledge, be contestable. These very valuable notes culled from the Paris lecture are followed by a short review of the synthetic stone industry of France and Switzerland. In this survey some notes are given on garnet-topped doublets which were first made by a French firm in the Jura, and were called *doublée* stones. It is stated also that the same firm elaborated a process of making a vein in an emerald-coloured glass in order to imitate the natural stone. The discoveries of Verneuil gave birth to the industrial production of synthetics around Saint-Claude and Septmoncel in the Jura. A historical survey of the industry in France and Switzerland is given, in which the world crisis of 1929 is said to have nearly killed the industry. The story of the Djéva factory at Monthey in Switzerland is told and the article closes with contemporary reports on the Verneuil experiments published in the Horological Journal for 1890 and 1891.
2 illus. R.W.

ANON. *Cyclotron-coloured diamonds.* Diamond News and S. African Watchmaker and Jeweller. Jan., 1956, p. 5.

A report that cyclotron-coloured diamonds are available in several shades of green and gold, though rare in commerce at the moment because of the skill required in producing them. The colour change is permanent. S.P.

ASSOCIATION NOTICES

COUNCIL MEETING

Mr. F. H. Knowles-Brown, Chairman, presided at a meeting of the Council held at Saint Dunstan's House, Carey Lane, London, E.C.2, on Thursday, 19th January, 1956.

The following were elected to membership :—

FELLOWSHIP

Lyon, Rodger S. B., Dundee
Roulet, Bernard, Geneva, Switzerland

PROBATIONARY

Cox, Karl J., Hounslow
Gard, Alan M., London
White-Hide, Richard G., Wadhurst

ORDINARY

Albert, Gilbert, Geneva, Switzerland
Campbell, (Mrs.) Elizabeth, Washington, U.S.A.
Hopkins (Miss) Iris P., London
Jank, Robert A., Boscombe
Molyneux, Frank, London
Semple, Walter, Baillieston
Smyth, John C., Baltimore, U.S.A.
Thurm, Rudolf, Benghazi, Libya

TALKS BY FELLOWS

STOLLERY, E. : " Agate Collecting," Rotary Club of Inverness, 14th December, 1955.

A. L. KEMP : " Gemstones," Farnham Round Table, 17th January, 1956.

T. LEWIS ELLIS : " Dumb Jewels." Hove Rotary Club, Tuesday, 31st January.

WOOD, S. D. " Diamonds." King's Park Parish Church Literary and Debating Society, 14th February, and Kelvingrove Museum and Art Gallery Association, 22nd February.

SIMPSON, B. " Gemstones and their geological aspect." Mid-Glamorgan Scientific Society, 1st February ; " Gemstones." Young People's Guild, Mumbles, Swansea, 13th February, 1956 ; " The geological aspect of gemstones." Geological Society of the University of Exeter, 9th March, 1956.

BLYTHE, G. " Gemstones." Women's Gas Federation, Southend-on-Sea, 12th March, 1956.

138,484 PEARLS TESTED

The Laboratory of the Diamond, Pearl and Precious Stone Trade Section of the London Chamber of Commerce had a busy year in 1955, and in particular received for testing no fewer than 138,484 pearls. This was a considerably greater number than in the previous year, mainly because a merchant from Pakistan submitted a very large consignment to the laboratory. It is a remarkable tribute to the reputation of the laboratory, that these pearls should have been brought to London for testing in preference to any other centre.

TRIBUTE TO DR. E. H. KRAUS

Dr. Edward Henry Kraus, who is well known to English-speaking gemmologists as senior author of the best American text on gemstones and as President of the Gemological Institute of America, celebrated his eightieth birthday on December 1st last. Among his other distinctions, Kraus is Professor Emeritus of Crystallography and Mineralogy, and Dean Emeritus of the College of Literature, Science and the Arts of the University of Michigan—to which University he first came as assistant professor of mineralogy as long ago as 1904. He has been the author of several text-books on crystallography and mineralogy, and of nearly 100 papers on these subjects. He also earned himself a high reputation as a teacher and an administrator.

" Gems and Gem Materials," which first appeared in 1925, was written in collaboration with E. F. Holden. After the tragic death of the younger author, C. B. Slawson filled his place. The fifth edition of " Kraus and Slawson," an attractive and well-illustrated text, appeared in 1947. Dr. Kraus's career—and the part he has played in American Gemmology—is in many respects parallel to that of Dr. G. F. Herbert Smith in this country.

The entire Nov.–Dec. number of the " American Mineralogist " is dedicated to Kraus in honour of his 80th birthday. The papers in this issue are mostly purely mineralogical, but there are one or two contributions which should interest gemmologists, even if all except one of them make stiff reading. The exception is a paper by Richard T. Liddicoat (Director of the G.I.A.) on " Techniques employed in the identification of gemstones." This gives a very able summary of present-day practice in gem determination in the U.S.A., and reveals notable divergences between the methods favoured in America and those used in Britain.

According to Liddicoat, the three most important gem-testing instruments are the refractometer, a simple polariscope, and a binocular microscope equipped with dark-ground illumination. The spectroscope is not even mentioned. This in European eyes throws the article out of balance. Thus, we find two pages in this nine-page article devoted to a description of various methods by which interference figures can be viewed and studied in faceted stones. Though this is well worth reading for its own sake, the information derived from interference figures (optical nature and sign) can almost always be more quickly derived from careful refractometer readings, as Liddicoat himself explains in an excellent summary of the significance of shadow-edge movements which he gives on a later page. The spectroscope, on the other hand, provides evidence (often conclusive) on the identity of gem varieties which is quite independent of results obtained with any other instruments, and often provides a safe short-cut in awkward cases. Mr. Liddicoat's article concludes with an explanation (compressed in masterly fashion) of pearl-testing by means of X-radiography, and succeeds in making the often exceedingly tricky separation of cultured from natural pearls seem a very simple matter. There are points in Liddicoat's exposition which are open to question. For instance the remark that " the rather narrow gap between the melting point at about 2100°C and boiling point about 100° higher makes synthetic corundum difficult to produce by the Verneuil process without gas bubbles." This seems to imply that the bubbles in synthetic corundum are or were filled by vaporized alumina instead of hydrogen as generally accepted.

One of the most interesting of the other papers is " Chalchihuitl—a study in jade," by Dr. W. F. Foshag. Foshag identifies the Aztec gemstone chalchihuitl with jadeite or closely allied minerals, and gives news of a recently discovered occurrence of jadeite in the Montagua valley of Guatemala, close to the serpentine area of the Sierra de las Minas. There is considerable evidence that this was a source for some of the jade artifacts used by Mayan and other ancient Meso-American cultures. It is unfortunate that Dr. Foshag's earlier and fuller accounts of this important new find of jadeite are not available to the English reader. As in other occurrences of jadeite, it is associated with serpentine, and often contains abundant albite. There are other serpentine areas in Guatemala and Mexico which may contain jadeite deposits.

Other papers in the Kraus issue of the " Amer. Min." include a study of pleochroism in synthetic ruby by Denning and Mandarino and of piezobirefringence in diamond by E. Poindexter. In the first of these, the absorption of the ordinary and extraordinary rays in a synthetic ruby sphere of 9·52 mm. diameter was quantitatively measured for various wavelengths of light. From these measurements, " biabsorption " curves, analogous to birefringence curves, were prepared. An apparent anomaly was that for light of 4860A the biabsorption parallel to the c-axis was not zero as theory demands for a uniaxial substance.

In Poindexter's research on the piezobirefringence of diamond, a parallelopiped of the mineral was subjected to considerable stresses between crossed polars, and the relative retardation produced by each known stress was observed. Diamond was found to be nearly isotropic in its effects, and to recover immediately without deformation upon the removal of loads, however great. It behaves as a negative uniaxial crystal when compressed on the cube or octahedron faces, and as negative biaxial when compressed in any other direction. There is much interesting but difficult theoretical discussion in the course of this important paper.

A shorter but valuable contribution on the same subject is given by Slawson and Denning later in the journal.

One other paper in this fine number may be briefly mentioned—one on " coesite " or silica-C by L. S. Ramsdell. Coesite is a high pressure form of silica which is not found in nature. The material was in the form of very small colourless transparent crystals, some of which showed simple monoclinic forms resembling gypsum. Though monoclinic, silica-C is dimensionally hexagonal, with the a and c axes equal and the monoclinic angle = 120°—an interesting state of affairs. The density of coesite is given as 3·01. The number of formula weights in the unit cell obstinately works out at about 17 instead of the 18 or 16 demanded by theory. It is suspected there may be deviations from the strict stoichiometric ratio of silicon to oxygen to account for this discrepancy.

B.W.A.

JADE STORY

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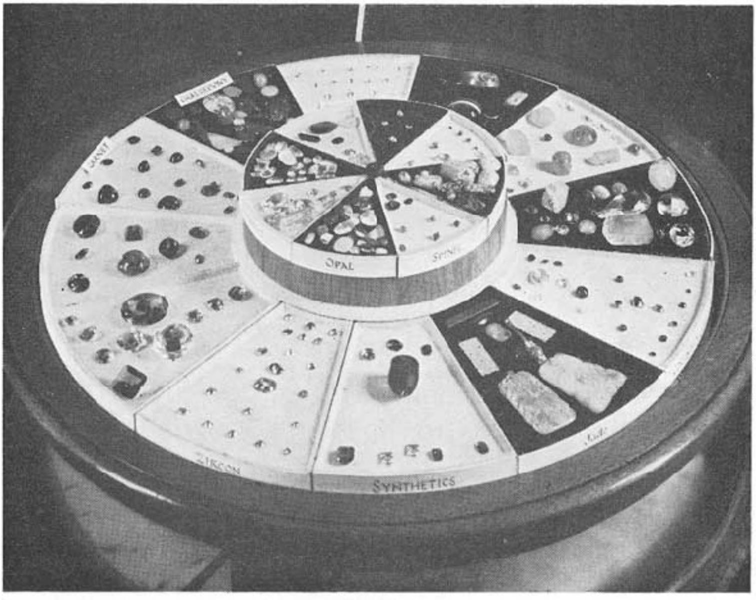
GEMMOLOGY AT HASLEMERE

The Haslemere Educational Museum, which enjoys a more-than-local fame for its excellent work in promoting natural history studies, has always regarded geology and mineralogy as within its sphere of interest. Under the energetic direction of Mr. John Clegg, the present curator, the displays of ornamental and economic minerals were supplemented by temporary loan exhibitions of gemstones in 1951 and 1954 and it has now been possible to arrange a small, but representative collection of gemstones for permanent public display. A Fellow of the Gemmological Association, Mr. E. J. Burbage, has been associated with Mr. Clegg in this project. Collectors may be interested in the Haslemere solution of how to display one's specimens without incurring the expense of calling in a jewellery case-maker : following a suggestion by Mr. A. Ross Popley, the display pads were made of dental plaster, moulded to take the stones, and surfaced by spraying with " Modelcraft " shredded rayon fibre. The construction of the pads, and other fittings and electrical wiring was carried out by Mr. H. Burbage.



ANNUAL MEETING

At the 26th annual general meeting of the Association held on 1st March, 1956, at Goldsmiths' Hall, Foster Lane, London, E.C.2, the following Officers were re-elected :— President : Sir Lawrence Bragg, F.R.S. ; Chairman : Mr. F. H. Knowles-Brown ; Vice-Chairman : Mr. N. A. Harper ; Treasurer : Mr. Lawson Clarke. Messrs. R. Webster and W. Stern were re-elected to serve on the Council. Messrs. Watson Collin & Co. continue as auditors to the Association.

MEMBERS' MEETINGS

Midlands : A meeting of the Branch was held at the Chartered Auctioneers' and Estate Agents' Institute, Birmingham, on Friday, 2nd March, 1956. Mr. E. R. Kempson, of Messrs. Johnson, Matthey & Co. Ltd. gave a talk on " Gold for industry and the goldsmith."

The Herbert Smith Lecture for 1956 was given by Dr. Frederick Pough, lately Curator of Minerals in the American Museum of Natural History, on Wednesday, 28th March, at the British Council Cinema, London, W.1. Dr. Pough's lecture will be given in the next issue of the Journal.

London : Members of the Association met at Saint Dunstan's House, London, E.C.2, for another "Any Questions" evening on Wednesday, 1st February, 1956.

A report follows of a members' meeting held at Saint Dunstan's House on 1st February, 1956, on the occasion of an annual " Any Questions " evening. The Secretary, Mr. G. F. Andrews, presided, and the panel consisted of Mr. A. E. Farn and Mr. T. H. Bevis-Smith.

The first question sought to know whether it was a lack of culture to describe synthetic emeralds as " cultured." The panel agreed that it was " uncultured " so to describe them, and there was support from members, though some disagreed. One thought that it was a word that should be reserved for pearls—or mushrooms. Elsewhere in the audience it was considered that " cultured " was only a selling word and that synthetic emeralds were correctly described as being synthetic.

The second question produced the reply that wearers of pearls should have them cleaned and re-strung regularly. Another point was that certain cosmetics had a bad effect upon pearls, because of their sulphide content.

One of the problems regarding the identification of such items as topaz and quartz was that sometimes they "turned up," as one speaker put it, "not in their normal guise." An example of difficult pieces to identify was a recent instance of a pre-Georgian piece containing table-cut diamonds which had none of the normal appearance of diamonds. The Siam ruby was often very well imitated by garnets. One member of the panel said he recalled a case of a stone replacement which became necessary ; the customer insisted that the stones in the piece were rubies and the speaker was equally confident that they were garnets. The stones were, in fact, rubies, but this fact had to be proved with the aid of instruments.

Another questioner wanted to know whether the panel deemed the Chelsea filter more likely to inform than to mislead the "average jeweller." The first speaker considered that it was a great help to the jeweller but was best used to confirm an opinion already formed. In the early days the filter was considered an "absolute guide" to emerald—but nowadays one had had second thoughts on this. Another speaker considered that, perhaps, even yet the "average jeweller" had not much idea of gemmology. The filter "was not gospel", one had to bear in mind that, for instance, green zircon showed red under the filter. Fluor and other stones also showed red under it. The consensus of opinion was that in the right (i.e. fairly experienced) hands the filter was a very useful thing.

Another questioner had submitted : "What power lens would the team recommend to the student of gemmology, and what magnifications of the microscope ? "

The first speaker to answer this said that for the lens he felt that ×10, which he had used for many years, was suitable. As far as the microscope was concerned a power of ×38 up to ×99 or ×100 was ample. Of late years this speaker had preferred to use a binocular microscope whenever such was available.

The second speaker recommended a lens of from ×8 to ×12 according to the eyesight of the user, provided the lens was a good one with a flat field. He used ×25 most of the time on a microscope and sometimes up to ×60. Any higher magnification than this, in the speaker's view, would lead to the enlargement of error if an error were being obtained ; that is, unless one were going in for the study of inclusions and so on. It was agreed among speakers in the body of the hall that $\times 10$ was an accepted standard in the U.S.A. for the " clean " diamond.

There was some discussion of the point that sometimes customers were invited to use the lens, and most people present thought that it was not good practice to allow the customer to use the lens ; the client did not know what he was looking at (or for), and might well be disappointed when he had no reason to be.

The Trade as a Career

There was a deal of discussion on a question from the body of the meeting asking whether the panel would suggest the following of the jewellery trade by a school-leaver.

Among the points made by various speakers, the one which brought the largest measure of audible agreement was that it depended upon which part of the trade the lad should be encouraged to join. The feeling was that the man at the bench was the first to suffer if trade slumped, and the last to recover when it improved. One speaker recalled having, before the war, taken home 3s. 6d. for a week's work—because there had just not been anything for him to do.

The job needed a great measure of skill and concentration and this speaker felt that the appropriate reward was not there. As far as the man in the front shop was concerned—well, he had not done that job, so he did not feel competent to comment.

Earlier, it had been said that the jewellery trade covered jewellery, silver and horology. The lad could obtain a very fine apprenticeship in the trade and could then specialize in one of these three lines.

A speaker, who declared from the body of the hall that he was not in the trade, said that he was dismayed to hear the comments concerning the lot of the craftsman. He instanced other industries, such as milling, where young men could compete for quite valuable scholarships which would enable them to visit other countries, including the U.S.A., to see what was done in these countries to make the industry more efficient, and, generally, the young folk had a great opportunity to acquire a sound knowledge of their trade. He warned the jewellers in forthright fashion that if they did not organize themselves to make the technician's job attractive and really give the thing proper attention they would soon find themselves without craftsmen in these days of competition for the best skilled people.

Another contributor said that it was too bad about the people in Hatton Garden ; if they made £50,000 last year and only £49,000 this year they had lost £1,000 ! He recounted the story of the shopkeeper adjacent to the Garden who told him he was very sorry for these people in the jewellery trade. Many of them had had to part with one of their three motor-cars—and he always kept some loose change in his pocket so that he could slip them something to help them along . . . A sally which was enjoyed by the gentlemen from Hatton Garden who were present at the meeting.

A Choice of Words

As is to be expected at a meeting of this kind, there are " hardy annuals " among the questions. One of them is why the trade continues to encourage the use of the terms " precious " and " semi-precious."

The general merriment from the previous question and answer having subsided, it soon became apparent that there were two schools of thought on this topic, at least. One school felt that it did not really matter very much because we all knew what was meant. Another school—shall we call them the purists ?—felt that the word semi-precious was ridiculous. It was also suggested that we should refer to all stones as gemstones (though some thought this signified uncut stones) ; others felt that they should be collectively and equally referred to as gems.

One speaker confessed that he had almost given up trying, after many years, to influence the people in his firm to abandon the " semi-precious " term. It was also remarked that anything worth £30 a carat was not justifiably referred to as " semi-precious." The view was also expressed that all stones considered worth mounting in jewellery were entitled to be regarded as precious.

In connection with another question speakers gave the view that the term " golden quartz " was better than citrine. The majority of jewellers, thought this speaker, would continue to call it topaz and sell it as such. The meeting was reminded that the recently passed Merchandise Act barred such a description and it was thought that an action might well lie where such a misleading description was used. In a supplementary, a questioner asked when was the term topaz given to fluosilicate of aluminium. From the body of the hall came the answer that, as far as the speaker was able to ascertain, the Latin *topazus* was used by Pliny for the green stone we now call peridot. After the Middle Ages the term had been used for yellow stones down to about the Renaissance, when there was a distinction between yellow stones in that some were found to be harder. This speaker thought that the term topaz for a yellow stone ante-dated citrine by about 200 or 300 years.

The panel was asked what it considered were the ethics in regard to the mixing of natural and artificial stones and misnomers on the one hand and on the other hand keeping them distinct in displays, as was enforced on the Continent, where separate windows as well as separate displays were compulsory.

There was again considerable discussion of the point and it seemed that one or two points were agreed to by the great majority. The first was that it was bad practice to mix real and other stones in the same piece of jewellery. Next, the method of display rather turned upon the amount of window space the jeweller had available. One bad practice, it was considered, was to exhibit a piece in the window without a price. People would look at it and hurry away ; they felt that as it was not priced it was probably expensive and they did not want to be humiliated by going into the shop and having to walk out again without buying anything.

It was better to give attention to the grouping of pieces on their various pads in the window, and probably the best thing to do in a limited space was to head the pad with a generic description of the stones present in the pieces on the pad, and to mark the price of the items. There was no great measure of difference between the big shops in London and in Paris as far as normal practice was concerned ; the difficulties began with the man who had a small amount of window space.

The panel was next asked what were its members' most intriguing stones which had had to be tested.

The first answer to this was that it was awkward to think of something at such short notice but that day the speaker had had in for test a red stone on a bar brooch surrounded by colourless table-cut stones. He had been fortunate in having seen this particular piece before. The first time it had come in he had been convinced that this 8-carat stone was probably a garnet or a natural spinel—or, failing that, a glass. He had applied the spectroscope and could not recognize anything at all ; he had wanted to try to recognize it without the refractometer. Finally, he had taken its refractive indices—and had been very much surprised. It was, in fact, quite a nice red topaz.

Another speaker referred to what he called his " most embarrassing stone." About a month before, he had been brought for examination a gipsy ring with a 2½-carat diamond. It did not look quite right and he had thought it was a doublet. Finally, examination proved that it was a diamond doublet, with glass.

A question of considerable interest elicited the information that the questioner had heard of something which, so far, had not come to the attention of the panel. It appears that in U.S.A. there is a new method of determining the age of minerals to within plus or minus 50,000,000 years. The process uses potassium 40 over argon and by this means it had been established that the oldest piece of rock so far discovered was one showing an age of 2,900 million years. There was a piece in Canada which very nearly approached this age.

The question was asked whether gemmology was a science ; was the governing council turning to the scientific attitude and was the trade no longer possessing an effective voice in stating its requirements? The consensus of opinion among panel members seemed to be as follows—gemmology is an art which in these modern times calls upon the aid of many sciences. It would be a bad thing for a gemmologist in touch with the public to set himself up as a scientist, because he would only frighten his customers away. Fellows of the Association, it was considered, were artists with scientific training rather than scientists. As far as the trade's voice was concerned, there were ample opportunities at annual general meetings and other occasions to make itself heard.

Subject to a few slight revisions this report is reprinted, with permission, from the *Jeweller and Metalworker.*

GIFTS TO THE ASSOCIATION

The Council of the Association has received, with deep appreciation, the following gifts :—

From Mr. Anthony Walton, a case of gem-testing instruments and crystal models and other gemmological items from the collection of his father, the late Sir James Walton, K.C.V.O.

From Miss Maxine Scott, F.G.A., a copy of " Gem Cutting," a lapidary's manual by John Sinkankas, autographed and dedicated to the Association by the author.

From Mr. Malcolm Gardner, a copy of "Adventure in Diamonds" by D. E. Walker.

From Mr. B. W. Anderson, a copy of his book "Gem Testing" translated into German under the title of " Praktische Edelsteinprüfung " by Prof. W. F. Eppler.

OBITUARY

The Council of the Association has recorded with deep regret the death of Ernest Arthur Dodd, T.D., Vice-President of the Association, aged 89. A director of P. G. Dodd & Son, Ltd., Jewellers, of Cornhill, London, he was Chairman of the Association before its Incorporation from 1935 until 1942, and was a past-President and past-Chairman of the National Association of Goldsmiths, and past-Chairman of the Pearl and Precious Stone Trade Section of the London Chamber of Commerce.

A memorial service, at which the Association was represented, was held at St. Michael's, Cornhill, on Wednesday, 11th April, 1956.