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and

PROCEEDINGS OF THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN
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MEASURING ABSORPTION BANDS IN GEMSTONE SPECTRA

By F. S. H. TISDALL, F.G.A.

IT has often been stated that when using the spectroscope for diagnostic purposes there is no need to measure the exact position of the bands in the absorption spectra of gemstones, the characteristic appearance of any given spectrum being sufficient for identification; all that is necessary is to familiarize oneself with the configuration of the bands appearing in the spectrum of a given gem in order to be able to recognize it at sight, so rendering measurement superfluous. In general this is prefectly true, and the practical gemmologist thus escapes the necessity of purchasing an instrument equipped with a measuring device, buys himself an efficient prism instrument, and learns by experience what the various spectra look like, and so adds a very valuable method of gem testing to his accomplishments. Not a very great deal of practice is necessary, for instance, to recognize at sight the spectra of rubies, almandine garnets, and other stones possessing distinctive and readily memorized spectra, but, while this is undeniably so, I have always felt that there is room in my testing equipment for a spectroscope with which I can measure, and so verify exactly, the wavelength of any absorption band. As a matter of fact I possessed and used a Beck wavelength grating spectroscope a long time before acquiring a prism instrument; and it was only after many years that I realized the great practical value of the latter, and how rapid and positive it is in use.

It is, then, normal practice to-day to use a prism instrument to identify species and varieties that crop up regularly; but there are gems that one meets with only comparatively rarely, and although the spectra of even these are admirably illustrated in several well-known books dealing with the subject it is very reassuring to have an instrument with which bands can be measured. Such gems as spessartite garnet, enstatite and sinhalite display absorption spectra which have considerable diagnostic value, but they are not frequently seen, and when encountered for the first time may prove puzzling. Measurement of the absorption bands will resolve the perplexity. There is, too, always the possibility of discovering and measuring a hitherto unknown band, such as the one at 4190Å I saw and measured recently in a beautiful rose-red tourmaline. I could find no trace of such a band in the descriptive literature which I have available, though it may be (and probably is) recorded in the exhaustively complete descriptions of all known gem spectra made by Messrs. Anderson and Payne some years ago.

A difficulty, however, arises: unless one is prepared to go to the rather considerable expense of purchasing a Hartridge "reversion" spectroscope, the wavelength grating instrument made by Beck cannot be invariably depended upon to give a high degree of accuracy. Although it is always possible to measure sufficiently accurately for purposes of identification, yet if one is going to measure at all it enhances both the value and the pleasure of the operation to know that it has been carried out with something very close to absolute precision. I have often found that, due to parallax, my measurements have been anything up to 20Å out, and it was with the object of eliminating this error that, with the aid of a toolmaker friend, I devised a stand for supporting the spectroscope rigidly and firmly in an erect position above the body tube of the microscope.

Most gemmologists are familiar with the usual set-up employed when using a spectroscope in conjunction with a microscope. The accompanying photograph (Fig. 1) illustrates both the method and also the stand which I use. The eyepiece is removed from the body tube of the microscope; a gem is placed, table downwards, on a glass plate in the centre of the stage; by means of the substage-mirror and condenser a strong beam of light from the lamp is focused on the gem, and the transmitted light, by adjusting the focus of the microscope, is made to flood the body tube with light. It is this

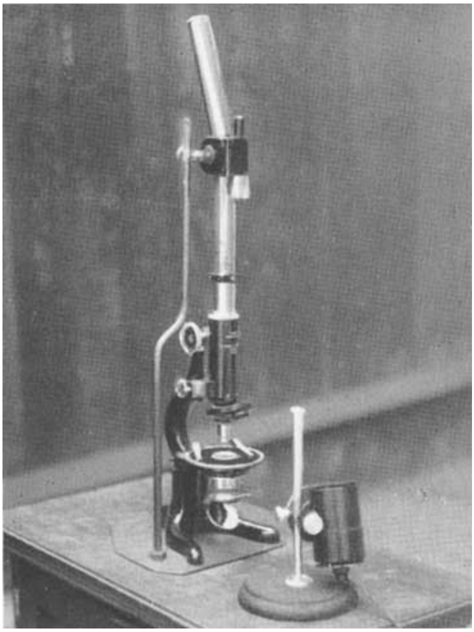

Fig. 1.

brilliant concentration of transmitted light that is analysed by the spectroscope.

Practical-minded gemmologists, whether having toolmaker acquaintances or not, may like some details of the stand shown in the photograph:

The base plate is made from $^{15}/_{32}''$ brass, and measures, at its longest and widest, $7\frac{9}{16}'' \times 7\frac{3}{8}''$, the corners being bevelled off as seen in the plan (Fig. 2). The supporting rod, shown in the elevation (Fig. 3) is centred 2″ from the front of the plate, and $\frac{15}{16}''$ from the side. Fig. 2 will make these measurements clear. The rod itself (Fig. 3) is of $\frac{3}{8}''$ steel; it is rivetted to the plate and the bottom $\frac{3}{4}''$ is threaded. A large hexagonal nut was screwed up the thread before the rod was rivetted; then by screwing the nut hard down on to the plate the rod was secured firmly in an upright position. The top of the rod stands $19\frac{1}{2}''$ above the upper surface of the base plate, though its actual length is $\frac{1}{2}''$ or so greater than this, for, to bring the spectroscope above the body tube of the microscope, the rod is cranked, as Fig. 3 shows, giving a lateral displacement of about $1\frac{1}{2}''$. The top $2\frac{5}{8}''$ of the rod are turned down to a diameter of $^{11}/_{32}''$ to take a double clamp (bought entire at a tool shop) which serves the dual purpose of holding the bolt which is screwed into the threaded hole, made for the purpose in the centre of the spectroscope, and of clamping the spectroscope to the rod.

The method I employ to obtain accurate measurements is as follows:

The microscope lamp and spectroscope are set up as shown in Fig. I and a synthetic ruby placed on a glass plate in the centre of the stage. A synthetic ruby is always used for this purpose because it can always be relied upon to give a good spectrum; because the principal absorption bands are narrow and "sharp"; and because these principal bands are found at both ends of the spectrum, i.e. in the red, and in the blue.

The light is switched on, and the mirror and the focus of the microscope (the eyepiece being removed) adjusted so as to flood the body tube with light. Next the spectroscope is clamped into position, but not tightly. Then the drum of the spectroscope is turned until the crosswires are brought into the position corresponding to 6942Å, which is the wavelength of the line in the fluorescent doublet nearest the deep red. Finally the spectroscope itself is carefully positioned so

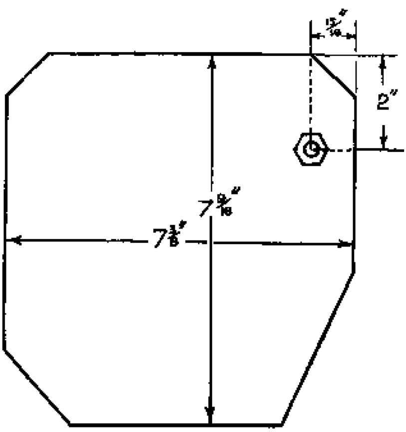

Fig. 2.

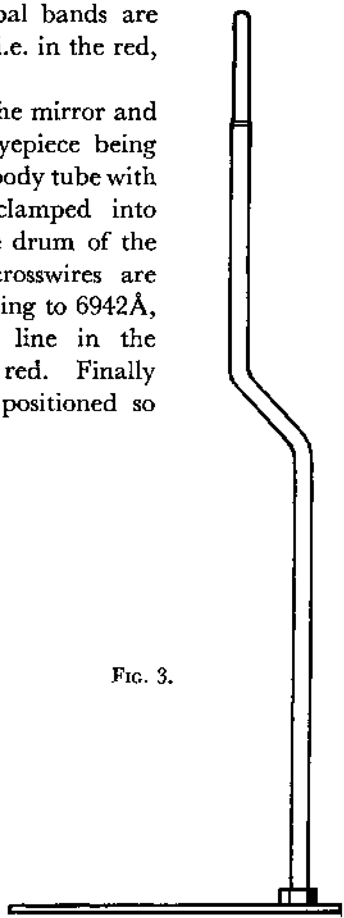

Fig. 3.

that the centre of the crosswires corresponds exactly with the 6942Å band, and the clamp is then screwed up firmly. Care is needed during these operations as all subsequent measurements depend on the accuracy with which they have been carried out. Confirmation of the correct centring of the crosswires on the 6942Å band may now be obtained by measuring the position of the other bands, both in the red and in the blue. If the initial adjustment has been carefully made it should be possible to measure the other bands to a high degree of precision—often exactly, and never with an error greater than ±5Å.

It should be noted that high accuracy is obtainable only when the eye is sensitive, and rested. Continued experimenting will result in tiring the optic processes and greatly impair the power to make accurate measurements.

Having adjusted the spectroscope and clamped it firmly in position it is now possible to replace the ruby by any stone, the spectrum of which it is desired to examine. The spectroscope must be left positioned and the stone itself gently moved about on the glass plate (or the plate may be moved) looking through the spectroscope eyepiece after every movement. Eventually a position will be found (patience will be necessary) which will yield a clear spectrum and any line or band may then be measured with the same degree of accuracy as that with which those in the spectrum of ruby were measured.

If the makers have correctly adjusted their instrument, all bands will be measured accurately when the axis of the collimator of the spectroscope is exactly coincident with the axis of the body tube of the microscope, and the method I have outlined will enable this position to be found. Tilting the collimator forward (i.e. towards the lamp) will bring the crosswires nearer towards the violet, and tilting it in the opposite direction will bring the crosswires towards the red—the error known as parallax. Faults of this kind may result in discrepancies of up to 20Å, hence the need for a method of securing the spectroscope firmly once the correct position has been found.

The only disadvantage accompanying the above process is that when observing the spectrum the red end is towards the right instead of the left, the other way round being the convention current in the gemmological world. This drawback is, however, not a serious one, and in no way affects the validity or accuracy of a measurement.

A word as to the method of use. By placing the base plate of the stand upon the tiled fender of a fireplace (a good, firm support, about 6″ above the floor level) I find that the eyepiece of the spectroscope is brought comfortably to eye-level when one is seated in an easy chair. Observations can be made by leaning forward, always remembering not to continue for too protracted a period lest the eye becomes tired and accuracy be impaired.

A final word with regard to the spectrum of red spinel. It is well known that red spinels very seldom display a spectrum at all by transmitted light, but when illuminated by "scattered" light most of them show what has been aptly called the "organ pipe" spectrum, consisting of five or more fluorescent bands. This is an enchanting spectrum to observe and is, of course, completely diagnostic. By raising the high intensity lamp to a level well above that of the microscope stage, extending the focusing sleeve in order to concentrate the beam, and then directing this small, bright spot of light *downwards* on to the stone a fine fluorescent spectrum may be obtained, and the bands measured if desired. A little patience may be necessary to achieve the best result. A good position for the stone is resting on its base facets with the table facing the lamp; but sometimes *too* bright illumination tends to obscure the bands, and by rotating the stage of the microscope a position may often be found in which the overall luminosity of the spectrum is reduced and the fluorescent bands will then stand out well. This method of top lighting is also suitable for detecting the often difficult to see 4320Å band in turquoise. To avoid searching it is helpful to set the crosswires at 4320Å to begin with and then one knows exactly where to look.

EMERALD FROM BURBAR, COLOMBIA

By W. F. EPPLER

A NEW occurrence of emerald in Burbar, Colombia, should not be confused with emerald from another new locality, the Vego de San Juan Mine, near the village Gachala. Perhaps the location "Burbar", which is reported to be situated between Bogotà and Muzo, is identical with "Borur", about one hundred miles north-west of Bogotà, and somewhat south of Muzo (Gems and Gemology, Spring, 1961, p. 142).

The physical properties of the stones mined in the new area are practically the same as for the other Colombian emeralds. Judging from the material available to the author, the stones exhibit a poor colour and they look like shattered pieces of former bigger crystals, with many cracks and fissures.

Some of the inclusions are typical for material from Colombia, with beautiful groups and single crystals of pyrite, many of them bearing a liquid-filled and pointed tube, which usually reveals the presence of a gas bubble (Figs. 1 and 2). These particular three-

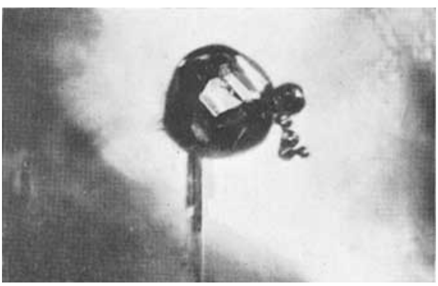

FIG. 1. *Emerald from Burbar, Colombia. Crystals of pyrite from which a tube of growth started in the direction of the c-axis; reflected light.* 120 ×

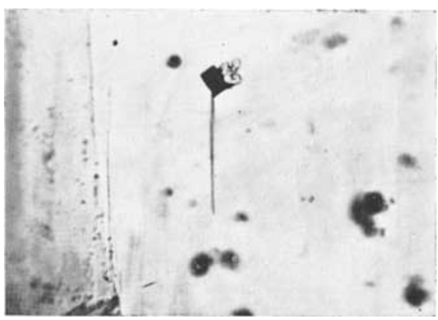

FIG. 2. *Pyrite and calcite and a tube of growth. The dark spots out of focus are also pyrite; transmitted light.* 65 ×. *Emerald from Burbar, Colombia.*

phase inclusions indicate a disturbance of growth. The pyrite was pre-existing and when it was reached by the growing emerald crystal and finally embedded, the host crystal started to leave behind it parts of the "mother-liquor" unsuitable for its lattice. For these reasons it is understandable that a kind of "wake" originated following strictly the direction of the c-axis and narrowing steadily until it ended in a point. Generally, these features indicate a hydrothermal origin so often seen with other minerals of similar genesis.

Another similarity with Colombian emeralds from the known localities are "normal" three-phase inclusions. Those parallel to the c-axis exhibit surprisingly a singly refractive but lozenge-shaped crystal as the solid phase, the form of which hitherto was claimed as a reliable criterion for Russian emeralds only. The three-phase inclusions parallel to the base plane have ragged outlines (Fig. 3), sometimes ramifying in a system of flat channels. New as an inclusion in emerald from Colombia seems to be a network of irregular tubes with strange forms, also parallel to the basal plane of the host crystal (Figs. 4 and 5). They are filled either with a

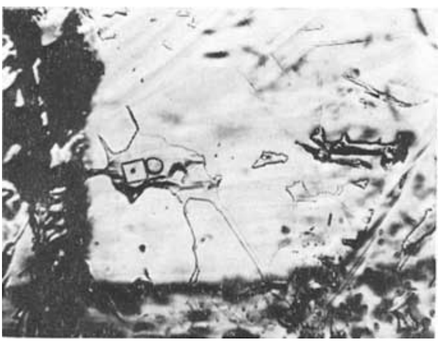

FIG. 3. *Emerald from Burbar, Colombia. Three-phase inclusions parallel to the basal plane.* 65 ×.

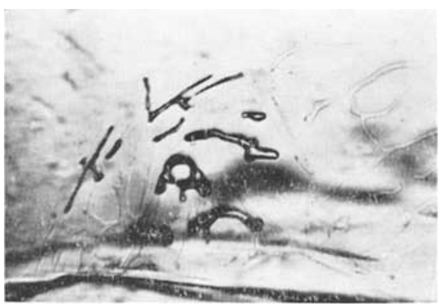

FIG. 4. *Emerald from Burbar, Colombia. A network of liquid (bright) and gas (dark) inclusions in a healed crack parallel to the basal plane.* 65 ×.

liquid, having a faint appearance, or they contain a gas bubble and exhibit a dark rim and a strong relief. Sometimes they are very flat. Without doubt, they are the indigestible remnants within a healed crack.

In studying these sometimes irritating healed fissures—because they may appear to be artificially made—it is necessary to be cautious if the stone is immersed in a suitable liquid, for example in monobromobenzene. As some of the cracks are extended to the outer surface of the stone they are filled with air. In submerging the stone, the fissures are not totally filled with the liquid, but large flattened air bubbles, or films of air, are entrapped exhibiting unusual forms (Fig. 6). During a longer observation under the microscope, they may diminish, alter their outlines or even disappear as the result of the slow rise in temperature of the stone due to the intense illumination. At first sight, they look very strange and they can easily be mistaken for a particular feature.

Of the other inclusions, two kinds of transparent and doubly refractive crystals are unusual. One kind (Fig. 7) is a small but well

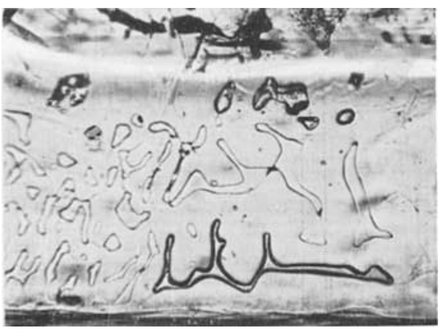

FIG. 5. *Another healed fissure parallel to the basal plane with liquid and gas inclusions.* 65 ×. *Emerald from Burbar, Colombia.*

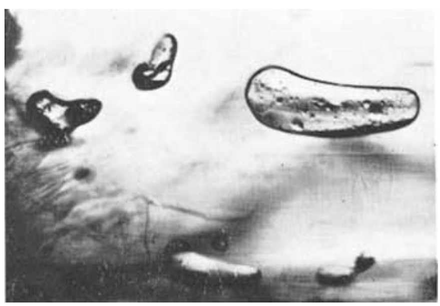

FIG. 6. *Emerald from Burbar, Colombia, embedded in monobromobenzene. An unhealed crack with flat air bubbles.* 65 ×.

developed single crystal with a R.I. greater than emerald (1·58). Possibly, but not certainly, it could be calcite. The other prefers to form crystal groups (Fig. 8) or even clusters. The R.I. is lower than 1·58 and its nature is still unknown.

In case the emeralds from Burbar, Colombia, should enter the market in greater quantities, it should easily be possible to distinguish them from stones of other deposits by their marked inclusions.

The author is indebted to Dr. E. J. Gübelin, Lucerne, for having placed so generously at his disposal the material with which these observations have been made.

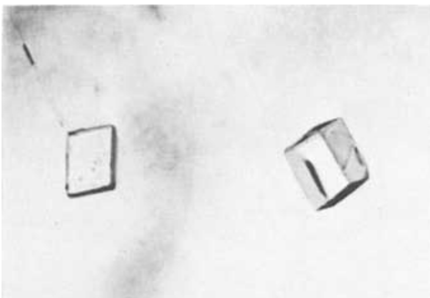

FIG. 7. *Well developed transparent and doubly refractive crystals with a R.I. greater than* 1·58, *possibly calcite.* 120 ×. *Emerald from Burbar, Colombia.*

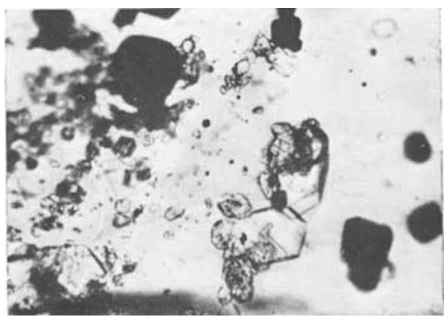

FIG. 8. *Groups of birefringent crystals of unknown nature with a R.I. lower than* 1·58. 22 ×. *Emerald from Burbar, Colombia.*

OBSERVATIONS ON GARNET

By R. A. HOWIE, M.A., Ph.D., F.G.S.

THE garnets have always attracted the attention of mineralogists as well as gemmologists, both for their well developed natural symmetry and for their range of colour and physical properties. In a recent paper in this Journal, L. C. Trumper[1] advocated the plotting of refractive index against specific gravity for the garnet group of minerals as an aid to determining whether any intermixing takes place between the grossular-uvarovite-andradite (ugrandite) series and the pyrope-spessartine-almandine (pyralspite) series. This useful plot of actual determinations for 58 garnets was superimposed on straight lines joining the "calculated" constants for the six end-member molecules quoted by Anderson[2], and as calculated originally 48 years ago by Ford[3] and later modified by Fleischer[4]. These authors used a large number of collected analyses of garnets to establish by extrapolation the most probable values for the end-member garnet molecules, and these values served for many years as an invaluable aid in estimating the composition of unknown garnets from a consideration of their refractive indices and specific gravities and also their cell edges as determined by X-rays. Natural garnets corresponding in composition to the end-member molecules are unknown, however, and although examples of grossular and andradite occur which are fairly close to the end-member composition other garnet species are less "pure", and in particular pyrope garnets with more than about 75 per cent of the pyrope molecule have not been recorded. Thus the calculated end-member properties involved very considerable extrapolation and were correspondingly and of necessity somewhat inaccurate.

This situation was, however, transformed by the synthesis in 1955 by Coes[5] of the five commonest pure end-member garnet compositions, i.e. almandine, andradite, grossular, spessartine and pyrope, and by the subsequent determination by Skinner[6] of their optical and physical properties. It is the purpose of this note to draw attention to these determinations in the belief that they greatly advance the study of this absorbing mineral family.

End-member constants as measured by Skinner. Earlier extrapolated values given in brackets.

	Density	*Ref. Index*
Almandine	4·318 (4·325)	1·830 (1·830)
Andradite	3·859 (3·835)	1·887 (1·895)
Grossular	3·594 (3·594)	1·734 (1·735)
Pyrope	3·582 (3·510)	1·714 (1·705)
*Spessartine	4·190 (4·180)	1·800 (1·800)

* The name spessartine is preferred for the manganese aluminium garnet, spessartite being used by petrologists as a name for a lamprophyric dyke rock.

It may be of interest also to mention the two diagrams constructed by Winchell[7] in which specific gravity in the garnets is plotted as a contour, the refractive index and cell edge being taken as independent variables and used as ordinate and abscissa, while the chemical compositions of the end-member molecules and the specific gravity are plotted as functions of the two variables. Using these diagrams it is possible to estimate compositions in terms of the three-component or four-component composition field. The use of such diagrams and of such data is, of course, based on the assumption that the optical and physical properties represented are additive functions of the molecular proportions of the end-members. This is in general true for an isomorphous cubic series and has been demonstrated to hold for the synthetic almandine-pyrope and grossular-pyrope series[8].

Reverting to the object of the plot used by Trumper, which is to ascertain whether any intermixing takes place between the two garnet groups, reference may be made to a dark apple-green andradite-spessartine garnet[9] from Pajsberg manganese and iron mine, Sweden, which has a molecular composition $Alm_{1\cdot2}$ $And_{70\cdot6}$ $Py_{0\cdot4}$ $Spess_{27\cdot8}$ (with Ref. index 1·893, Density 3·98) and to a peach-tan garnet[10] from Nevada containing roughly equal amounts of spessartine and grossular; the analysis of this garnet indicates a composition $Spess_{42\cdot8}$ $Gro_{41\cdot4}$ $Alm_{12\cdot4}$ $And_{3\cdot4}$ (Ref. index 1·780, Density 3·92). In the pyralspite group, there is more general evidence of intermixing with small amounts of the other group. Examples from mineralogical tests[11] listed below show, where Ugr. represents the molecular percentage of the ugrandite series present, from 18·5 to 35·9 per cent. intermixing. It may be of geological interest to note that these six garnets all come from relatively high-

And.	*Gro.*	*Ugr.*	*Alm.*	*Py.*	*Spess.*	*Ref. index.*	*Density*	*Rock*
9·6	19·0	28·6	57·3	12·0	2·1	1·795	4·08	eclogite
11·8	20·0	31·8	53·4	13·0	1·8	1·801	4·04	eclogite
15·3	20·6	35·9	47·6	16·4	0·1	1·787	3·82	schist
4·1	16·5	20·6	29·3	49·4	0·7	1·756	3·76	eclogite
4·0	14·5	18·5	35·1	45·7	0·7	1·7615	3·835	eclogitic
2·7	21·7	24·4	12·1	5·2	58·3	1·798	4·14	schist

grade metamorphic rocks where under conditions of high pressures and temperatures any intermixing of the two series would be more likely to take place.

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SPESSARTINE OR SPESSARTITE?

A note in the preceding article by Dr. R. A. Howie points out that the name spessartine is to be preferred to spessartite for the manganese aluminium garnet which gemmologists know by the latter name. Various authors refer to the word spessartite as being derived from the Spessart district of Bavaria, where this garnet was first found, though the occurrence did not appear to have any gem significance, and also mention spessartine as the French form of the word.

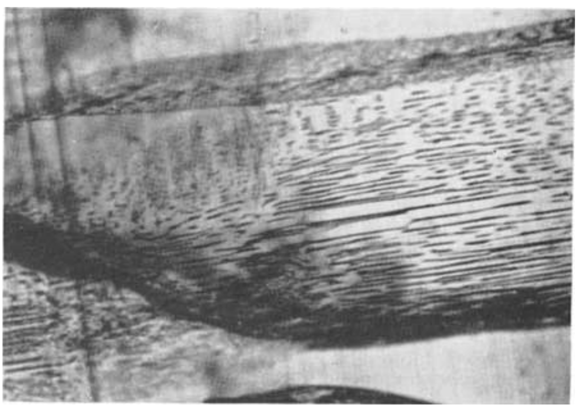
Whether gemmologists should concede that the work preferred by mineralogists and petrologists is the better term for this garnet is arguable, though in Great Britain pronouncements by mineralogists have usually been followed. Gemmologists, however, still prefer to use iolite for the gem mineral which mineralogists refer to as cordierite.

NEW-TYPE INCLUSIONS IN CHATHAM SYNTHETIC EMERALDS*

By F. DUYK

FROM examination of recently produced synthetic emeralds made by Carroll Chatham, it is evident that there are two new elements in the nature and disposition of the inclusions. Firstly, the liquid canals are more elongated and more strictly oriented. Secondly, a new type of inclusion, a brownish elongated fissure in the shape of what may be described as a bird's feather has been observed. It is evident that the introduction of new chemicals in the production formula is the cause of these alterations in the inclusion pattern.

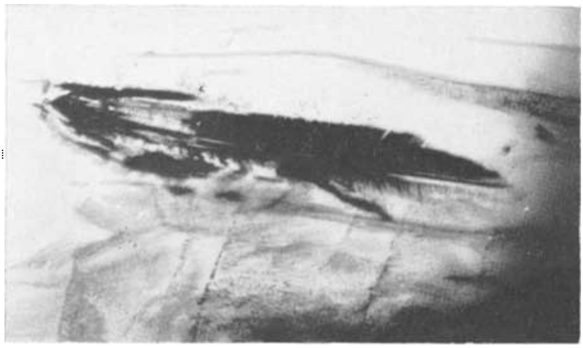
The physical and optical properties remain unchanged and discrimination between natural and synthetic emeralds can still be effected by the usual methods.



Elongated liquid canals in Chatham synthetic emerald

*(This note has been translated, with permission, from *Technica*, June, 1963, (Journal of the National Committee of Jewellers & Watchmakers in Belgium). The photos reproduced are by the author, who is President of the Belgian Gemmological Society.)

Brownish elongated fissure in shape of a bird's feather.



Other inclusion patterns seen in Chatham synthetic emerald.

CORUNDUM AND AMETHYST FROM TANGANYIKA

By E. H. RUTLAND, Ph.D., F.G.A.

THE old Roman saying that something new keeps turning up in Africa surely applies to gemstones. As the vast continent is opened up, perhaps it is not surprising that new deposits are found, but the gem wealth already produced in Africa must greatly exceed that of the whole rest of the world put together. One cannot help feeling that Africa has had its fair share, and more.

The two kinds of gems described below were shown to me by Mr. Charles Mathews, of Hatton Garden, through whose firm so many rare and interesting gemstones have reached the market. Mr. Mathews spent three weeks in Tanganyika last year and visited some new corundum mines during his stay. The stones he brought back exhibit some unusual features and the locality does not yet appear to have been described. A few notes may therefore be appropriate.

The mines are situated in bush country on the upper reaches of the Umba river, some 50 miles inland from Tanga. The lower part of the Umba river forms the boundary with Kenya, but its upper course lies wholly within Tanganyika.

The corundum occurs in a vermiculite from which it is easily separated by hand. There is only slight evidence of wear by water on the rough material. The gem quality corundum consists mainly of broken pieces up to $1\frac{1}{2}''$ in diameter, but tabular hexagonal prisms are also found. Much of the material is fractured internally but there are also fine clean pieces of excellent transparency. The output of the mine could be very substantial as it covers a vast area.

The stones are found in a large range of red, blue, purple and other tints and parti-coloured stones are frequent. In these, the colour changes from the prism faces inward, either towards a lighter or a darker shade. The outside might be blue and the centre yellow; or a dark red centre might be surrounded by pale brown material. The finest colours are rare, as always, but pleasant fancy tints occur, similar to the best that can be found in Ceylon. Several stones had a very fine rich amethyst purple that turned much redder in tungsten light.

The most striking feature of the stones is their exceptionally strong dichroism. In many stones this could be seen plainly with the

FIG. 1. *Twinning planes in Umba sapphire.*

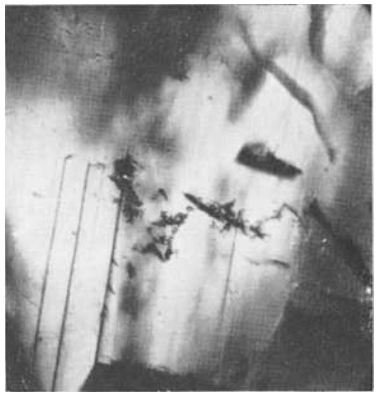


FIG. 2. *Tubes and crystal aggregates in Umba ruby.*

FIG. 3. *Tube with jagged edges in Umba sapphire.*

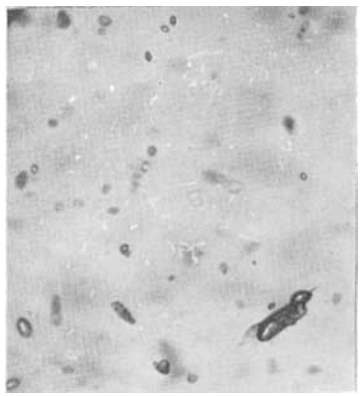


FIG. 4. *Rounded crystals in Umba sapphire.*

naked eye as they were turned about. The colour changed from a pale pink to a dark magenta or from yellow to brown. So pronounced was this effect that it was sometimes difficult to describe the colour in simple terms. Some problems will arise when it comes to cutting the stones to present their best colour.

The inclusions were reminiscent of other corundums but had a distinct tang of their own. There were well marked twinning planes (Fig. 1) and most stones evidenced twinning between crossed nicols. There were long tubes with jagged edges, like lances with pennants fluttering from them (Figs. 2 and 3). There were crystal aggregates, somewhat similar to those found in Burma ruby; and also more sparsely scattered rounded crystals (Fig. 4). Finally, there were short tubes in parallel arrangement. Both large and small trigons occurred on the pinacoid (Fig. 5) and several surfaces showed long tube-like ridges. These may conceivably be of the same origin as the tubes found inside the stones, mentioned above.

The constants that were measured conformed to those usual in corundum. The refractive index measured in sodium light on a Rayner refractometer, ranged from 1·76 to 1·77 with a birefringence estimated at ·008. The specific gravity, measured hydrostatically on three specimens was very slightly below 4·00.

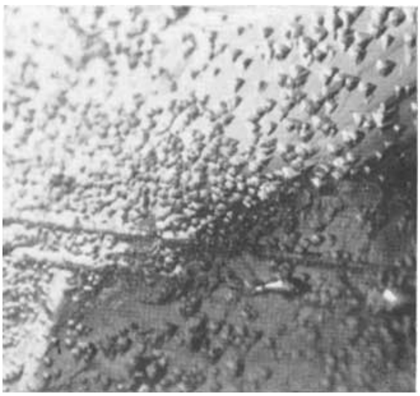


FIG. 5.
Trigons and tubes on the surface of an Umba sapphire.

AMETHYST

Another gem brought back by Mr. Mathews was amethyst of a fine colour. He obtained a quantity of the rough material at Dar es Salaam but was unable to ascertain its provenance. He was assured it came from Tanganyika.

Here again the material came in broken pieces, but Mr. Mathews also gave me a well-formed prism capped with pyramids at either end. This and many other pieces were of a rich colour inside covered with a layer of translucent white milky quartz. In good pieces the colour was strong and pleasing, without being too dark, and with a distinct red tone. The ordinary ray carried the red hue whilst the extraordinary ray showed a paler and colder tint.

A special feature of some of these stones was an abundance of fibrous rutile inclusions arranged in sprays and bundles radiating from a common origin (Figs. 6 and 7). Some were geniculated and all were so thin that they were not at all obvious to the naked eye. Only when light was reflected from the fibres was a sheen visible. Thin slices might nevertheless make attractive "Hair Stones". In other respects the stones were clean and conformed to all the usual characteristics of quartz.

Fig. 6. *Rutile fibres in Tanganyika Amethyst.*

Fig. 8. *Rutile fibres and colour zoning in Tanganyika Amethyst.*

AN INTERESTING DOCUMENT ABOUT EIGHTEENTH CENTURY GEM TRADING IN THE ASSOCIATION'S LIBRARY

THE eighteenth century document, reproduced, greatly reduced, on the opposite page, relates to a commercial transaction between London and the East Indies. An interesting feature is the apparent importance at that time of rough coral and coral beads as items of trade. Another point is the inclusion of the words "diamond boart" in printed form in a commercial document. This might not here mean a form of industrial diamond but an inferior grade of gem diamonds, for returns were to be made in "Pearls, Diamonds and Diamond Boart and other Precious Stones or Jewels". The boart could have been for use in cutting diamonds but the word was not clearly defined at that time.

The document is dated 1756 and is a form of indemnity given by Joseph Salvador, a trader, to the United Company of Merchants of England trading with the East Indies.

Joseph Salvador, whose signature and seal are on the document, was a person of considerable commercial interests, including a substantial trade in precious stones. Upon completion the transaction would have resulted in a substantial profit and at one time Joseph Salvador was an extremely wealthy merchant.

The document was acquired by the Association in 1956 and is in the Sir James Walton Library.

The Association would be interested in receiving from members any information about other old documents relating to transactions in precious stones. Some of the older publications on gems are required for the library and the librarian would be pleased to have details of any texts available.

KNOW *all Men by theſe Preſents, That* I Joseph Salvador of London Merchant

held and firmly bound unto The United Company of Merchants of *England*, Trading to the *Eaſt-Indies, in the Sum of* Three thousand five hundred Pounds *of lawful Money of* Great-Britain, *to be paid unto the ſaid* United Company, *or their certain Attorney or Succeſſors: To which Payment well and truly to be made* I *bind* Myself my *Heirs, Executors, and Adminiſtrators, firmly by theſe Preſents. Sealed with Seal. Dated the* One and Twentieth *Day of* January *in the Year of our Lord One Thouſand Seven Hundred and Fifty* Six *and in the* Twenty Ninth *Year of the Reign of our Sovereign Lord* George the Second *by the Grace of* GOD, *of* Great-Britain, France, *and* Ireland, *King, Defender of the Faith,* and ſo forth.

WHEREAS the *Court of Directors* of the above-named *United Company of Merchants of* England, *Trading to the* Eaſt-Indies, have at the ſpecial Inſtance and Requeſt of the above-bounden Joseph Salvador Licenced and Permitted Him the ſaid Joseph Salvador to ſend on the Ship Walpole Captain Francis Fowler Commander 1 Chest marked IS/F No 5 Cont.g Coral Beads Value £500 — 1 D.o IS/F Cont.g D.o value £430 — 1 D.o SB No 5 Cont.g D.o value £460 — 1 D.o SB Cont.g Rough Coral value £260 — 1 D.o GM No 7 Cont.g Rough Coral value £100 — Value together One thousand Seven hundred and fifty pounds for Fort St George

in the *Eaſt-Indies*, there to be inveſted, and Returns made in Pearls, Diamonds, Diamond Boart, or other precious Stones or Jewels, and in no other Goods whatſoever, upon the Conditions herein after contained, He the ſaid Joseph Salvador having conſented and agreed, and conſenting and agreeing, to run the Riſque and Hazard of all Loſſes, Damages, Misfortunes, and Caſualties whatſoever, of, upon, or relating to the ſame, and to free and diſcharge the ſaid Company therefrom. **Now the Conditions** of this Obligation are ſuch, That if the ſaid Joseph Salvador His Executors, Adminiſtrators, or Aſſigns, do and ſhall Conſign the ſaid Coral Beads and Rough Coral to the Preſident of Fort St George together with any other Perſon or Perſons He ſhall think fit, and do allow the ſaid Preſident Two Pounds *per Cent.* Commiſſion for the ſame, and do pay, or cauſe to be paid, the Duties uſually payable on Coral Beads and Rough Coral at Fort St George aforeſaid, on Importation there; And if He the ſaid Joseph Salvador His Executors, Adminiſtrators, or Aſſigns, or His Agents or Attorneys, do lay out and expend or employ the ſaid Adventure, and every Part thereof, in Pearls, Diamonds, Diamond Boart, or other precious Stones or Jewels, and not in any other Goods, or at Intereſt, or in other Trade, or on any other Account whatſoever; and if ſuch Pearls, Diamonds, or Diamond Boart, precious Stones, and Jewels, ſhall within Thirty Six Months after the Sale of the said Coral Beads & Rough Coral at Fort St George aforeſaid be put on Board or Loaden on one or more Ship or Ships, employed in the Service of the ſaid *United Company*, and bound for ***London***, and if Oath ſhall be made before the ſaid Preſident of the real Coſt of the ſaid Pearls, Diamonds, or Diamond Boart, precious Stones, and Jewels, before the Shipping or Loading thereof, and if the ſaid Pearls, Diamonds, or Diamond Boart, precious Stones, and Jewels, be brought into the Treaſury of the ſaid *United Company*, in order to be Sold at the ſaid *Company's* Candle (the Danger of the Seas, and other unavoidable Accidents excepted) then this Obligation to be void and of none Effect, or elſe to remain and be in full Force and Virtue.

Sealed and Delivered (being firſt duly ſtampt) in the Preſence of

Philip Cray
R Holt

Joseph Salvador

BLUE-DYED FOSSIL CORAL
(Tampa Bay, Florida)

By ROBERT WEBSTER, F.G.A.

THE existence of chalcedonic pseudomorphs after coral from Tampa Bay, Florida, U.S.A. has been known since 1825 and a very detailed article on these corals has been written by James G. Manchester[1] and is well referenced.

Charming as specimens, especially when sliced and polished, these silica fossils have more recently been fashioned as a gem material in baroque form by the tumbling process, or cut as cabochons.

Some few weeks back the writer received through the courtesy of Mr. A. M. Ramsay, of Glasgow, further specimens of this material, including three specimens which had been dyed a turquoise blue colour.

Greenish-blue in colour the three pieces are pitted with depressions of various sizes and degree of penetration which mar the overall appearance of the finished stones. The refractive index, taken by the distant vision method, gave a value near 1·53. The density, owing to the extreme porosity of the material, could not be assessed with any accuracy, and further, the ethylene dibromide used in the place of water for the direct weighing method of density determination tended to debase the blue colour. The hardness was about 7.

Examination of the absorption spectrum showed a diffuse band in the red part of the spectrum, which is centred about 6480Å. This is rather typical of a dyestuff absorption. Under the ultra-violet lamp, either the medium-pressure long-wave lamp (3650Å) or the fluorescent tube lamp giving the best results, a greenish or greenish-yellow glow was seen on the less heavily stained parts. This is in keeping with results obtained on unstained material where a yellow and a blue glow may be seen in different areas.

The unstained fossil coral is quite attractive in itself and it is difficult to explain why it was found necessary to "gild the lily".

REFERENCE

1. Manchester (James G.) *Collecting semi-precious stones in Florida.* Rocks & Minerals. Vol. 16. No. 12.

Gemmological Abstracts

POUGH (F. H.). *The synthetic emerald family.* Lapidary Journ., 1963, 17, 3, pp. 380-387.

A survey of the methods of synthetic emerald production used by Hautefeuille and Perry in the 1880's, and Nacken, Espig, Chatham and Lechleitner in the present century.

S.P.

PUGH (H. L. D.), LEES (J.) and BLAND (J. A.). *Synthesis and X-ray analysis of diamond.* Nature, Vol. 191, No. 4791, pp. 865-867. August, 1961.

Diamonds have been synthesized by heating a disc of nickel in contact with a rod of graphite at approximately 2,000°K. and 6,000 atmospheres, using a modified type of tetrahedral anvil apparatus. The largest diamonds so produced are $0{\cdot}3 \times 0{\cdot}3 \times 0{\cdot}4$ mm.

R.A.H.

JOHNSON (P. W.). *New sapphire find in Baja California.* Lapidary Journ., 1963, 17, 3, p. 449.

A blue opaque sapphire has been found in the central part of the Sierra Juarez of Baja California. Clear material has not yet been found.

S.P.

LEIPER (H.). *Gem sphene discovered in San Diego, Calif.* Lapidary Journ., 1963, 17, 3, p. 448.

Gem-grade sphene has been found in San Diego County, California. Two faceted stones of a little over a carat each in weight are greenish yellow and free of inclusions.

S.P.

CROWNINGSHIELD (R.). *Care of gem materials and their substitutes in manufacturing, repairing, displaying and wearing of jewellery.* Gems and Gemology, 1963, XI, 1, pp. 3-11.

An excellent article summarizing some of the difficulties experienced when handling jewellery. Emphasis is placed upon the importance of jewellers and jewellery repairers not only to know the identity of stones but also the treatment they may have undergone. Heat-treatment, colour fading, and cracking or splitting from sudden change of temperature are considered. One means of removing an artificial coating on a diamond is dry heat and the heat necessary to size a ring or repair a claw may be all that is needed to change the colour, unless the stone is unset before the repair is commenced. Pearls and turquoises can be harmed by hair sprays and perfumes.

The article concludes with a comment about some of the fantastic examples of retail jewellers' negligence when returning items they have borrowed.

S.P.

LIDDICOAT (R. T.). *Rapid sight estimates of diamond cutting quality.* Gems and Gemology, 1962/3, 11 and 12, pp. 323-335 and 365-375.

An informative article on estimating the accuracy of cutting of a brilliant-cut diamond. Describes methods of estimating, without actual measurement, the correctness of the facet angles by observation of the reflection of the table facet on the pavilion facets, and similarly of the reflection of the bezel facets. The article gives a number of examples and is copiously illustrated by photographs taken by Jeanne G. M. Martin.

31 illus. R.W.

BROCK (T. J.). *The pride of India.* Australian Gemmologist, No. 21, pp. 8-9, March 1963.

The story of the jewel-encrusted embroidery called the Pride of India.

R.W.

HEMRICH (G.). *Variscite—An American gemstone.* Gems and Minerals, 1963, 311, pp. 15-17.

Occurences of variscite found in the U.S.A. are confined to Utah, Nevada and Arizona. Variscite is predominantly a hydrated phosphate of aluminium. When iron is present in any but trace amounts, it becomes strengite. There are many hydrated phosphates associated with variscite, which have been made for their discoverers or for their localities with the usual abandon that characterizes mineral nomenclature.

Very small vivid green orthorhombic crystals of variscite have been found lining cavities in quartz or chert but usually the mineral is found in nodular form. S.P.

Theisen (V.). *Das Karat gestern und heute.* The carat weight yesterday and to-day. Zeitschr.d. deutsch. Gesell. f. Edelsteinkunde, 1962, 41, pp. 27-29.

In the July, 1963, issue of the Journal the above abstract was incorrectly attributed to V. Thurm and not to the author, Verena Theisen.

Webster (R.). *Jewellery and the expert witness.* Medicine, Science and the Law, 1963, 3, 4, pp. 228-245.

A brief outline of some of the factors which need to be considered in relation to jewellery, silverware, and gems and evidence given by an expert witness in a Court of Law.

S.P.

BOOK REVIEWS

Gump (R.). *Jade—Stone of Heaven.* Doubleday and Co. Inc. 1962. 256 pp., $8.95 Can.

It does not take the reader long to realize that jadeite, as distinct from nephrite, is Richard Gump's first love, and to realize too that the wonderful jadeites produced during the latter part of the Ch'ien-lung era (1736-1796 A.D.) and following, represent, for this author, the most desirable of all. His enthusiasm does not cover the earlier portion of the Ch'ien-lung in quite the same way—a period before "caution" and "fitness' were thrown to the winds.

This is a book by an American who has lived with jade for the greater part of his life. Indeed, he was born into its atmosphere. He is a third generation member of a San Francisco family of jade collectors.

Jade burst upon the Western world in 1840 with the sack of the Summer Palace, and it was not long before large collections were assembling in Europe. Yet it is stated in this volume that the Western world "has been artistically aware of jade for less than

50 years". While this may apply to the U.S.A., it is certainly not true of Europe. One can think of exclusive stores in London alone where jade displays have been current for more than fifty years and customers were not just jade collectors and specialists.

The author's style is commendable. It makes for easy reading and there is a wealth of good illustration. In fact, it is over-illustrated. To read a book on so specialized a subject as jade is to want *meat*, not a catalogue. Constantly one is here interrupted to study illustrations and to read captions before turning the page, and this often involves going back to pick up the thread of the text. The usual cry is that illustrations are lacking in this type of material and illustrations are of course extremely important. Yet, unless one is merely idling through a volume, as one turns the pages of a well-produced magazine, too many illustrations can be very irritating.

There are mistakes in this book that could easily have been avoided. On page 41 there is a design of a New Zealand *mere*. This is not a *mere* but a *patu-patu*, a design never carved in nephrite. It is commonly made of wood or whalebone. Nor, as stated, was the *hei-tiki* worn only by women during pregnancies. Captain Cook recorded both men and women wearing *tikis* in New Zealand. Whether or not the design represents the human embryo is debatable. It is merely one of many hypotheses. Mention is also made of a *mere* in New Caledonia. This island had no *mere*, unless one that chanced to be there by trade. What it had was a jade *nbouet*—a circular jade disc with a sharp cutting edge. This disc was set into a wooden handle and used primarily as a cleaver or cutter.

Certainly corroboration of jadeite occurrences in both Turkestan and China itself is still awaited, but there are too many contradictions to be positive, one way or the other. The great Bishop collection has jadeite carvings that pre-date the 18th century, i.e. the period when commercial quantities of jadeite entered China from Burma and lapidaries began to discard nephrite for the more colourful medium.

It is refreshing to find the author asking questions regarding the mystery of jade. On pages 45 and 46 he appears to come close to an answer. Certainly man's basic urge, and need, are the things that make for survival—food, clothing, shelter. Of these three, food comes first, since tribes existed, and still exist, without either clothing or shelter. Because of this basic importance to man he made a rite of eating—even eating one's enemy was often more a religious rite than a necessity. With man's emerging mind he wanted not only to survive (which is instinctive) but to survive under rather better conditions than those of the animal. For this purpose he needed tools and fine tools were of some hard stone. The best obtainable implement, then or now, outside of metal, was jade. In colour this jade was usually green or greenish. Nature herself is mainly green. To early man green meant vegetation, something edible, something vital. The jade implement must therefore have appealed strongly to his colour sense, and with a highly polished implement man could hardly fail to be fascinated. Quite apart from the intrinsic value of the implement there was the psychological value in a Stone-age society. It amounted almost to worship.

The development of jade would therefore appear to be: use, beauty (ornamental perhaps), symbol, in that order. And here the author seems happiest. His divisions on the subject of symbolism are very good indeed.

Yet it is not necessary to fool ourselves—even about the symbolism of jade. Symbolism is not greatly mysterious, however indispensable some people feel it to be. The need of symbols is basically economic. There is always some sort of gain involved, in money or goods or virtue or a life-hereafter. A reward of some kind is implicit—if I do this I get that.

For the person anxious to own a good piece of jade and who feels compelled to know something about the subject, this book is excellent. With the serious student of jade it needs far more documentary evidence. For instance—it is stated that the people of Persia attributed power of immortality to jade. This is interesting and no doubt correct, but where did the author cull this bit of information? There are few enough references to the jade of Persia.

When we get to the last two chapters, the author is again on very familiar ground and able to draw on his extensive experience. His final chapter—Buying a piece of Heaven—is informative and full of sound advice for the aspirant.

This is a commendable book and one that every jade lover will want to add to his library. If only as a reference to the various jade pieces it is of value.

E.R.

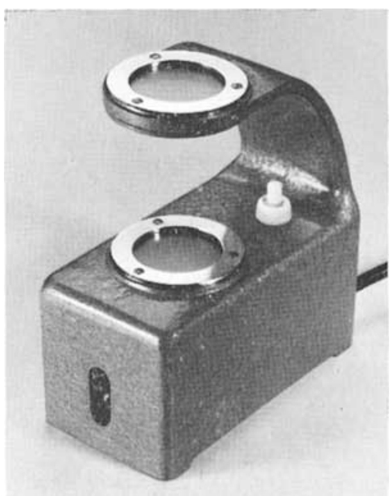
WILD (K. E.). *Die Edelsteinindustrie in Idar-Oberstein und ihre Geschichte.* The precious stone industry in Idar-Oberstein and its history. Spring 1963. Special brochure of the Zeitschrift d. Deutsch. Gesellschaft f. Edelsteinkunde. 52 pp., illus., bibliography.

This special issue of the German Gemmological Association is a very well written account of the industry, with emphasis on the historical development. The information is accurate and concise and the illustrations are well chosen. Only in a very few instances would an informed reader detect in his own field of work slightly erroneous statements. This is not surprising considering the jealousy with which many of the small and specialized firms guard their secrets and the vastness of the subject ranging from the importation of rough material from all over the world to the cutting, treating and selling of diamond and precious, ornamental and technical stones.

W.S.

A NEW POLARISCOPE INCORPORATING BENCH LIGHT FOR REFRACTOMETER

The new Rayner polariscope, with refractometer light, is a useful instrument for the gemmologist. There are two glass-mounted polaroids with a distance of 2¼" between them. This allows quite large specimens or pieces of jewellery to be tested. The bottom polaroid is illuminated from a lamp built into the body of the instrument.



At the front there is an aperture against which the Rayner refractometer can be placed for illumination from the lamp. The weight is 28 ounces and the instrument is designed for use on 230/240 volts Ac.

U.K. price £7 15s. 0d. Postage, packing and insurance extra.

ASSOCIATION NOTICES

TALKS BY MEMBERS

CAFFELL, E. W., "Gemstones", Farnborough Clockhouse Townswomens' Guild, 18th July, 1963.

BLYTHE, G. A., "Diamonds and their substitutes", Southend G.H.S. Scientific and Geographical Society, 17th September, 1963.

RAVEN, R. H., "Gems", Billericay Round Table, 28th August, and Soroptomist Club of Chelmsford, 26th September, 1963.

MEMBERS' MEETINGS

1963

28th Oct.	Reunion of members and presentation of awards, Goldsmiths' Hall, London. Reunion 6 p.m., presentation 7.15 p.m. Mr. Lionel Burke, Public Relations Manager of De Beers Consolidated Mines Ltd., has kindly consented to present the awards.
30th Oct.	Midlands Branch. Norman Harper on "Classification and grading of diamond crystals".
20th Nov.	Midlands Branch social evening.

1964

30th Jan.	West of Scotland Branch meeting. J. Gillougley, F.G.A., will speak on "Pearls".
5th Mar.	London meeting. Photographic evening at Goldsmiths' Hall.
26th Mar.	West of Scotland Branch meeting.
9th Apr.	Herbert Smith Memorial Lecture by Sir Lawrence Bragg, F.R.S., Royal Institution.
30th Apr.	West of Scotland Branch annual meeting.

WEST OF SCOTLAND BRANCH

On Sunday 9th June, 1963, a joint field outing to Balmerino, Fife, was held by members of the West of Scotland and East of Scotland Branches of the Gemmological Association, and the Scottish Mineral and Lapidary Club.

The parties arrived simultaneously at their rendezvous—the Seymour Hotel, Newport, and guided by Mr. R. Bennett of the S.M.L.C. drove down to the sea shore. This proved unproductive, so a move was made to Balmedowside Farm. In the woods above the farm agate and cornelian were strewn on the surface of the gound in amazing profusion. The pieces were small but the quality of some of them was good, and all members found something to bring home. A small group attempted to dig away the side of a hill, but soon gave up, concluding that the Lapidary Club had been there before them and taken all. They were completely demoralized when a large and promising looking nodule painstakingly extracted by Mr. E. Macdonald proved to be grey chalcedony all the way through.

It was an excellent outing and enjoyed by all who attended.

EXAMINATIONS IN GEMMOLOGY, 1963

In the 1963 examinations 215 candidates sat for the preliminary examination and 132 for the diploma. Centres for the examinations were established in Australia, Canada, Ceylon, Finland, Holland, Hong Kong, India, Kenya, Lebanon, Malaya, New Zealand, Norway, Portugal, South Africa, Southern Rhodesia, Sweden, Switzerland, United States of America, and West Cameroon, apart from the United Kingdom.

Upon the recommendation of the examiners the Tully Memorial Medal has been awarded to Mr. G. V. Axon, of New York, U.S.A. The Rayner Prize has been awarded to Mrs. M. Davis, of Wembley.

The following is a list of successful candidates, arranged alphabetically:—

Diploma Examinations

Tully Memorial Medal

Axon, Gordon Vose, New York, U.S.A.

Qualified with Distinction

Abbott, Henry Charles, Liverpool
Axon, Gordon Vose, New York, U.S.A.
Blatter, Robert, Toronto, Canada
Cooper, Alfred, Swinton
Dambrink, Darel W. J., Apeldoorn, Holland
Forbes, David Reginald, Toronto, Canada
Fryer, Charles William, San Diego, U.S.A.
Gaydon, Julie Hazel, Surbiton
Ghisalberti, Danilo, Lucerne, Switzerland
Holländer, Helmut, Pforzheim, Germany
Hopkins, Peter James, Allestree
Houston, David F., El Cerrito, U.S.A.
Kiuas, Eljas-Jussi, Pukinmäki, Finland
Loupekine, Igor Serge, Nairobi, Kenya
Porter, Robert George, Brisbane, Australia
Quartermaine, Helen Laurie, Kuala Lumpur, Malaya
Spacey, Peter William, Sutton Coldfield
Teissala, Hannu, Helsinki, Finland
West, Peter John, London
Wilson, Douglas, St. Morris, Australia

Qualified

Addis, Clare Weston, London
Allaby, Frank Edmund, Warrington
Berry, William, Kirkcaldy
Bilby, David, London
Bromly, Ivan Paul, London
Campin, Andrew John, Mansfield
Coop, Norah Marian Nita, London
Dahlsveen, Jon, Trondheim, Norway
Feltell, Raymond, Birmingham
Fernandez, Cyril William Anthony, Bombay, India
Fernando, Kurukula S. L. T., Colombo, Ceylon
Franklin, Jerry Neal, Parkersberg, U.S.A.
Fraley, Lawrence, Wheelersburg, U.S.A.
George, Stanley William, London
Giblin, Michael, Bury
Graham, Martin James Peel, Reigate
Herring, John Thomas, Radcliffe-on-Trent
Horrox, Conrad, Manchester
Hudson, Felix Nettleton, Dunfermline
Irwin, Eric, Liverpool
Jensen, Bjarne Anfin, Bergen, Norway
Kari, Raija, Lahti, Finland
Kaufmann, E. Pius, Montreal, Canada
Krzempek, Evelyn, Nottingham
Lahtinen, Åke Johannes, Helsinki, Finland
Mackenzie, Iain Fraser, Warrington
Mäki, Kalero, Riihimäki, Finland
Meddings, Ann Elizabeth, Burton-on-Trent
Morrell, Anthony, Knaresbrough
Mullen, Joseph, Glasgow
Nairis, Henno Jaen, Stockholm, Sweden
Neerbye, Erling, Oslo, Norway
Nimalasuriya, Nanda, Colombo, Ceylon
Paananen, Erkki, Helsinki, Finland
Primavesi, Thomas, Montreal, Canada
Pudner, Robert Arnold, Liverpool
Pyke, John Stopford, Higher Bebington
Reekie, Robert, Stratford upon Avon
Rintala, Berit, Riihimäki, Finland
Scholl, Werner, Zollikerberg, Switzerland
Schwartz, Raymond Noah, London
Slaven, Ronald W., Loanhead
Smith, Benjamin Henry, Wilmington, U.S.A.
Snell, Richard Geoffrey Fox, Bournemouth
Städelin, Alwin, Lucerne, Switzerland
Stanley, Edward, Manchester
Storgmeir, Inkeri, Helsinki, Finland
Straiton, Timothy, Hove
de Szejko, Anna-Liisa, Hämeenkylä, Finland
de Szejko, Wiktor Ingof, Hämeenkylä, Finland
Tarratt, Christopher David, London
Taylor, John Livsey, Blackpool
Thomson, Patrick Norman, Cape, South Africa
Thorne, Anthony Reginald, Plymouth
Thurlby, Paul Anthony, Birmingham
Virtanen, Pentti Einari, Helsinki, Finland
Watts, James Wilfred, Grimsby
Wight, Peter Martin, Wallasey
Wood, Mary Bayne Haddow, Sidmouth

PRELIMINARY EXAMINATION

RAYNER PRIZE

Davis, Margaret, Wembley

Adshead, Christine V., London
Allan, Christine, Colchester
Allport, Leslie, Birmingham
Anderson, Doris, London
Axon, Gordon Vose, New York, U.S.A.
Bagi, Julius, Toronto, Canada
Baguley, Kenneth, Liverpool
Bailey, Ronald, Plymouth
Barker, Brian Michael, Pinner
Barrett, Susan Mary, Birmingham
Baxendale, Paul Donovan, Birmingham
Beckwith, John Martin Emmerson, Darlington
Bell, Ronald, Thornaby-on-Tees
Bird, Albert James, Liverpool
Blackburn, Brian Joseph, Solihull
Blatter, Robert, Toronto, Canada
Böhmke, F. C., Shabani, S. Rhodesia
Bond, Cecil Allen, Waltham Abbey
Bourne, Francis Frederick, Blackwood, Australia
Brimelow, William, Grantham
Brooks, Lorraine, London
Burslem, William Arthur, Liverpool
Campbell, Ellie, Toorak Gardens, Australia
Chambers, Edwin Joseph, Dagenham
Climie, Robert, Newton St. Boswells
Clough, Michael Bernard, Bolton
Colclough, Albert Cecil, Rainham
Cornish, Stanley, Birmingham
Davis, Margaret, Wembley
Delaquaize, J., Hong Kong
Demaline, Charles Tracey Stewart, Hamilton, Canada
Dowie, Frederick Gordon, Christchurch, New Zealand
Forbes, David Reginald, Toronto, Canada
Forrest, Samuel Porteous, Troon
Foster, Angela, Liverpool
Francis, George Meredith, Fallbrook, U.S.A.
Franklin, Jerry Neal, Parkersberg, U.S.A.
Franks, Ivor Selwyn, London
Fryer, Charles William, San Diego, U.S.A.
Gatling, George, Orpington
Gasser, Josef, Lucerne, Switzerland
Ghisalberti, Danilo, Lucerne, Switzerland
Gold, Leslie Trevor, London
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Lewis, Kenneth Charles, Rainham
Logan, David James, Ayr
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Østby, Tor Martin, Oslo, Norway
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Wilson, Douglas Newton, St. Morris Australia
Wrigglesworth, Anthony, Leeds
Wright, Harold David, Ilford

CRYSTAL COLOUR SLIDES

At the request of the Association Mr. R. Keith Mitchell has prepared a set of colour slides of gem crystals. The cubic, tetragonal, hexagonal, trigonal, orthorhombic, monoclinic and triclinic crystal systems have been covered. More than 160 crystals are illustrated together with crystal drawings.

There are 12 cardboard-mounted (2 × 2 ins.) slides contained in a special clear plastic viewing folder. With the folder is a 20-page booklet which contains a full description of each crystal.

The slides, folder and booklet cost £2 10s. 0d.

MIDLANDS BRANCH

The West Midlands Branch of the British Association for the Advancement of Science has given approval to the Midlands Branch of the Gemmological Association to become affiliated.

The Midlands Branch will be holding their annual dinner and dance at "La Reserve", Sutton Coldfield on the 20th November.

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