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Cover Picture

The jewelled hilt of a Maharajah's sword. (See Harding and Stronge p.3.) *Photograph by Frank Greenaway.*

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John Chisholm 1905-1987

It is with great sadness that we report the death on Friday 13 November of John Chisholm, Editor of the *Journal* from 1973 until 1985 and then Consultant Editor.

John Richard Harrison Chisholm, MA, FRSA, FZS, MRI, FGA, born 27 November 1905, was one of three sons of Hugh Chisholm, who was City Editor of *The Times* and Editor of the *Encyclopaedia Britannica* and was a considerable literary figure in the early decades of this century. John obviously inherited his father's ways with words and their precise meanings, a trait which led to his very successful career as a lawyer and, subsequently, as Editor of this *Journal*.

He was educated at Westminster School and then went up to Christ Church, Oxford, where he took his BA in 1929 (MA 1943). He practised as a solicitor from 1932 to 1974. He had a long association with the Equity and Law Life Assurance Society and was a past Chairman of the Life Assurance Legal Society. He was a director of a wide range of companies.

During the last months of the Second World War he spent several weeks in bed with what his doctor called 'a low-grade infection of the lungs' and his second wife, Marie-Louise, chanced upon Selwyn's *Retail Jewellers Handbook* in the local library; they both found it fascinating. Among the advertisements in the end-pages was one for the National Association of Goldsmiths and another on the same page for the Gemmological Association which mentioned the Correspondence Course. In a bantering fashion husband and wife bet each other that they couldn't pass the Diploma examination; both started the correspondence course.

Following an apprenticeship reading (for Gordon Andrews, the first Editor) the proofs of articles for the *Journal of Gemmology*, it soon became evident that his gemmological knowledge and dedication to the intricacies of proof reading were fitting qualifications for appointment as an Examiner for the Association. He took up this post in 1955 with Dr (now Sir) G.F. Claringbull and Mr B.W. Anderson. He was in sole charge of the Preliminary Examination, setting papers and marking them. This continued until 1963 when Mr (later Dr) A.J. Allnutt was appointed. Since then he was concerned with the Diploma examinations, usually marking Part 1. He retired from the post of Examiner in 1982 after 27 years devoted service.

When Gordon Andrews retired as Secretary of the Association and Editor of the *Journal* in 1973 John Chisholm was the obvious successor – a man of scholarship with a trained legal mind and the ability to check manuscripts in the minutest detail. A manuscript paper checked by J.R.H.C. would be covered with numerous corrections and improvements, which his eagle eyes had sought out – lesser mortals commonly missed many of the errors. Over the years he improved the layout of the *Journal* and gradually increased the number and quality of the papers. It was not unknown for him to pay himself for colour illustrations which he could see would improve the understanding and quality of a particular paper.

Since he gained his Diploma in 1950 the Officers of the Association have consulted him regularly on legal matters – a source of advice, given gratuitously, over a period of nearly forty years. John was elected a Vice-President of the Association in November 1984 (see *J.Gemm.*, XIX, 5, 452) – a fitting tribute to a man who has given superlative service to the Association for very many years.

J.R.H.C. is survived by his three sons and their families, to whom we extend our deepest sympathy.

E.A.J. with the earlier assistance of J.R.H.C.

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The gemstones in a Maharajah's sword

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and

Susan H. Stronge
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Abstract

A brief summary of the history surrounding a Maharajah's sword is followed by a brief description of the diamonds, rubies, emeralds and onyx which decorate the hilt. The diamonds are compared with other diamonds cut in Indian styles, and the rubies and emeralds tentatively ascribed to Burmese and Colombian origins respectively.

Introduction

One hundred years ago in 1888 a sword with a jewelled hilt was bought for £150 by the South Kensington Museum (now the Victoria and Albert Museum) from Miss Malcolm. Miss Malcolm was a niece of Sir John Malcolm (almost certainly a daughter of one of his brothers) to whom the sword had been presented after it had been taken by the army from the Maharajah Holkar at the battle of Mehidpur in 1817. Details of the historical events of those times have been described elsewhere (Stronge and Harding, 1988) and in this article they are summarized briefly before the description of the gemstones which decorate the sword.

Historical background

After Aurangzeb's death in 1707 the Mughal empire in India disintegrated and many groups struggled to fill the resulting power vacuum. In 1674 Shivaji had founded an independent Maratha state which developed to play an important role in the eighteenth century. The Maratha houses, like that of Holkar, were established when Shivaji allowed his military leaders to retain any conquered lands as hereditary property. Meanwhile the trading interests of the British East India Company had been growing and their protection eventually involved the British Government and the appointment of a Governor-General in 1793. Some Maratha houses co-operated with the British but others, including Holkar, were not ready to relinquish their power without a fight, and so, in 1817, after two periods of inconclusive conflict Lord Hastings gathered a large army at Mehidpur to crush the opposition. Part of this force comprised the army of the Deccan under the command of Sir Thomas Hislop with Malcolm as his political agent. The battle took place on 21 December and was won by the British forces. The jewels of Holkar's family were captured from the fleeing cavalry and among them was the Maharajah's sword. The Rajah of Mysore presented the sword to Malcolm 'in acknowledgement of the kindness and consideration with which he treated the auxiliary troops' (Wilson, 1888, p.198). The sword then became an heirloom in the Malcolm family.

The sword

The total length of the sword is 92 cm and the curving blade has clearly had a certain amount of use; originally it must have broadened slightly in the last quarter of its length where it becomes double-edged but re-grinding has reduced the width. Just below the languet of the hilt on one face (Figures 1 and 2) is a gold-inlaid umbrella or *chatr* which indicates royal ownership. The gold hilt is richly decorated with flower and leaf motifs and the tilted disc-pommel is ornamented with a floral scroll on each face; these surfaces are studded with rubies, diamonds and emeralds (Figures 2, 3 and 4) and the only plain surface is at the back of the knuckle guard which terminates in the stylized tiger-head. In all, there are 378 rubies, 276 diamonds, 38 emeralds and the tiger's eyes are onyx, a total of 694 gemstones.

a) *Ruby*

The rubies comprise table-cuts, cabochons or pieces of polished rough, most being rounded but some of quite irregular shape, although this variation is masked by the geometry of the settings. One point cut ruby terminates the spike at the end of

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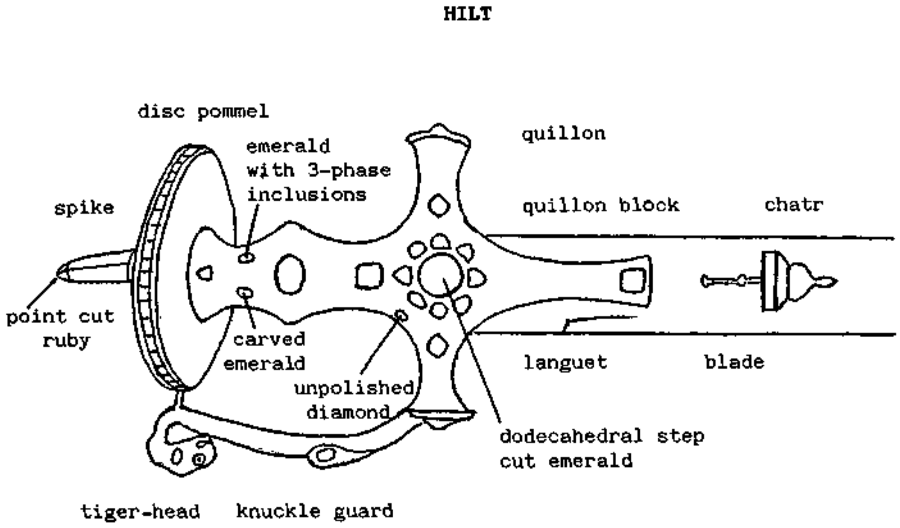

Fig. 1. Sketch of right-hand side of the sword with nomenclature of different parts and positions of some notable stones.

Fig. 2. The right-hand side of the hilt.

Fig. 3. The left-hand side of the hilt.

Fig. 4. The outside of the disc pommel.

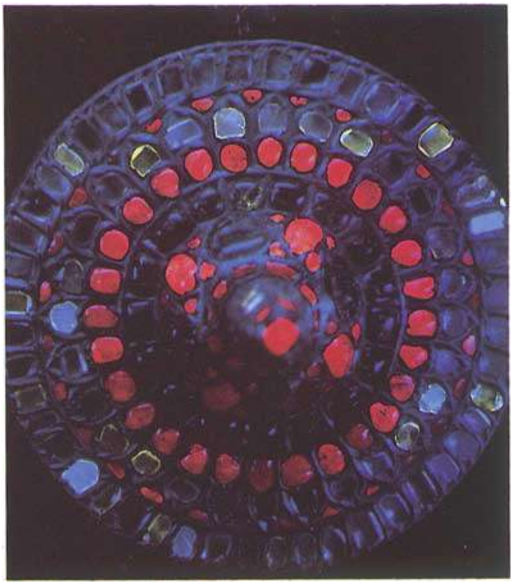

Fig. 5. The outside of the disc pommel in ultraviolet radiation.

the hilt. In general the rubies are a fine rich red comparable with good Burmese stones and they show a strong chromium spectrum, but some are paler red with a backing of orange enamel or foil, a colour that makes one suspect at first that the stone may be spinel or paste. However, their chromium spectra indicate that they are rubies, and their inclusions of fine rutile needles, silk, twin planes, colourless rounded crystals and liquid-filled feathers are also found in the more richly coloured rubies. Strong fluorescence in long-wave ultraviolet radiation is shown by the richly coloured rubies but the response is weaker in the paler foiled stones. Some rubies contain drill holes, of different diameters in different stones, and have either been used in necklaces or earrings or were at one time destined for such use. An oval star ruby of fine colour is set next to the hexagonal emerald in the quillon block.

b) *Diamond*

The diamonds range in size from tiny chips to cut and polished stones 9 mm across at the girdle. Most are polished cleavage pieces more or less rectangular, oval or triangular but in detail some are quite irregular in outline, and in places these irregularities have been used to advantage in the floral and leaf designs. The margins of the irregular

Fig. 6. The carved emerald on the knuckle guard and adjacent diamond terminating the quillon.

Fig. 7. The diamond terminating the quillon opposite the knuckle guard.

stones have commonly been left unpolished but many of the more regularly shaped stones have small girdle facets. Most of the latter have polished flat table facets and flat bases but a few have table facets that are slightly curved and this gives a rippled effect in reflected light. A similar effect was observed on the pavilion facets of the 56.71 ct tabular diamond described by Jobbins *et al* (1984) and may either be a feature of a particular style or period, or a consequence of the Indians' use of steel polishing wheels rather than the iron ones favoured by European cutters. Some diamonds are set in cavities which themselves have curved reflecting surfaces and this further enhances the play of light from the sword hilt. One stone on the quillon block above the *chatr* is an unpolished flat octahedron of high lustre and quality and could be termed a glassy. In ultraviolet radiation the diamonds show a range of fluorescence from pale bluish white to pale yellowish green to inert (see Figure 5).

Two unusual diamonds terminate the quillon (see Figures 6, 7 and 8). Both have roughly circular girdles averaging 9 mm in diameter which are close to or coincident with a flat base. At the knuckle guard end of the quillon the diamond has a row of 16 rectangular facets above the girdle and these are surmounted by 16 triangular and 16 elongate pentagonal facets which rise to a small table facet 2.5 mm in diameter. In the other diamond the row of rectangular facets is absent, and 21 triangular facets and 21 elongate facets rise to a table facet 2.8 mm in diameter. The form of the cut in the two stones compares with parts of Indian-cut stones figured by Tavernier (1889), and resembles the upper part of the Koh-i-noor as drawn by Professor Tennant and published in Ball's translation of *Travels in India* by Tavernier (see Figure 8c). The cut is also similar to one depicted by Tillander (1980), reproduced in Figure 8d, which is an example of one of more than 200 cuts of diamond known by the end of the fifteenth century.

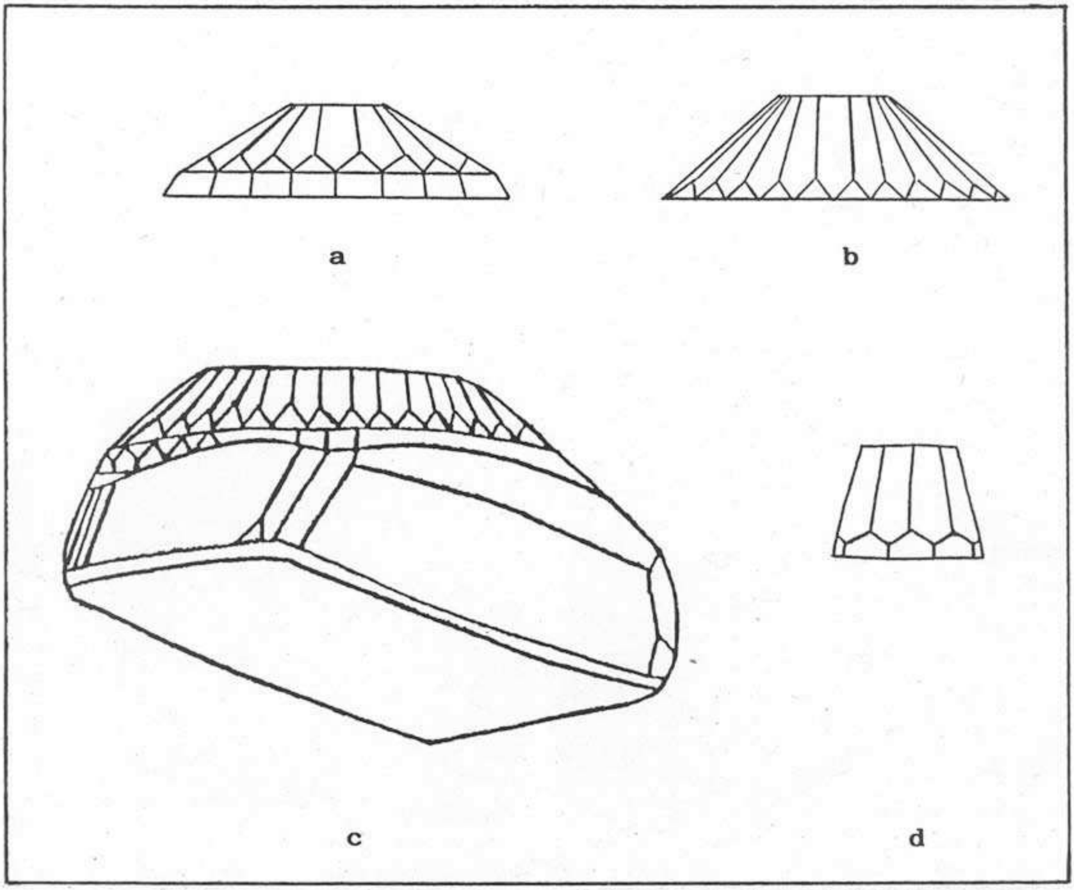

Fig. 8. Sketches of diamonds terminating the quillon: (a) next to knuckle guard, and (b) at opposite end of quillon. Sketch of Koh-i-noor (c) after Tennant, and diamond with pentagonal facets (d) after Tillander (1980, p.208).

c) *Emerald*

The green stones are all backed by green foil or enamel and this disguises a considerable range of intensity of the stones' body colours. The two largest emeralds at the centre of the quillon block on either side of the hilt are emerald-cuts, the one above the *chatr* being dodecahedral (15 mm across) and the other hexagonal (11 mm across). Both stones are set pavilion outwards, and both show a distinct chromium spectrum and have typical emerald inclusions.

Apart from the two emerald cut stones on the outer surface of the disc pommel, the remaining emeralds comprise rounded polished fragments, oval cabochons and four carved stones. The carved stones illustrate simple or floral designs and lie in positions in the overall pattern which fulfil the dictates of colour symmetry rather than emphasize any significance the carving may have. The largest carved emerald is set on the knuckle guard but is of rather poor quality with a weak chromium spectrum. Two green stones on the outside of the pommel do not show a chromium spectrum and should be called green beryl. In contrast some stones show good emerald colour and one on the hilt near the disc pommel is typical of fine Colombian stones. It and many others contain spiky two-phase inclusions but only one stone with three-phase inclusions was seen.

d) *Onyx*

Two hemispherical pieces of onyx with circular black centres and white rims constitute the eyes in the tiger-head on the knuckle guard.

Discussion

The stones have some characteristics which can be explained by reference to the past history of Holkar. There is a considerable variation in quality although this does not relate to their position in the decorative composition. In the imperial products of the Mughals the stones of exceptional size, shape or colour would be given a place of prominence, and those which were especially treasured became effectively part of the emperor's insignia, being set and re-set as each successive emperor wished. One example of this was the Koh-i-noor which was owned successively by Mir Jumla, Shah Jahan, Aurangzeb, Nadir Shah, and a succession of Persian and Afghan emperors until 1813 when Shah Sujah lost it to Ranjit Singh, the Lion of the Punjab. His headquarters were in Lahore, bordering the Maratha territory to the northwest, but he kept a neutral stance and did not become involved in the disputes between the Marathas and the British.

The house of Holkar did not have resources to compare with those of Ranjit Singh, and although there are a few high quality stones in the sword, others are not so fine, and some stones have served other purposes in the past. One example is the carved emerald on the knuckle guard which is of poor quality and is not one which would have been given prominence had a better choice of stones been available.

The date of manufacture of the sword is not known; all that can be said is that it is pre-1817. The provenance of the stones is also problematic. Some emeralds are almost certainly from Colombia but others may be European; the rubies do not have diagnostic inclusions but stones with similar characteristics are known from Burma, Afghanistan and possibly other parts of the Himalayas. The diamonds are probably Indian or Brazilian, but again distinctive inclusions are lacking. However, despite the mixed quality of the individual stones, they have all been combined on the sword to create an effect of opulence and splendour.

Acknowledgement

We would like to thank Frank Greenaway (British Museum (Natural History)) for taking the photographs.

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Surface repaired corundum – two unusual variations

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In 1984, gemmologists in London (Scarratt and Harding, 1984) and Bangkok (Hughes, 1984) reported on an entirely new type of ruby treatment, dubbed 'surface repair', involving the filling of surface pits with glass. Since that time large numbers of rubies and even some sapphires (Scarratt, *et al*, 1986) have been seen treated in this way.

In June of 1987 two unusual variations of surface repair were submitted to the laboratory of the Asian Institute of Gemological Sciences in Bangkok for identification. The first of these was a 2.24 ct ruby. Microscopic examination revealed the stone to be a very unusual assembled gem in which a small chunk of natural Burmese ruby was fused with glass to the side of a larger piece of Verneuil synthetic ruby. The stone was then faceted to hide the junction of the two pieces.

An unusual feature of this stone is the use of glass to join the two pieces together. Figures 1 and 2 show the stone as it appears with overhead lighting in the microscope (10x). Notice the difference in lustre between the corundum/synthetic corundum and the glass separating them. Higher magnification reveals the colourless nature of the glass, as well as spherical gas bubbles. This is shown in Figure 3. Note also the dense white patch of silk in the upper right corner of the stone in Figure 3.

With regard to the stone's manufacture, it appears that the natural and synthetic pieces were roughly shaped and put together. Glass was then used to fix them together, and the stone faceted to hide the join. Evidence of this is shown by the facets, which stretch across all three materials.

Identification of this stone was not a problem. Although the natural portion contained natural inclusions such as rutile silk, the Verneuil section contained gas bubbles and curved striae. Also found in the synthetic portion were induced fingerprints and feathers. Gas bubbles were found in the glass portion.

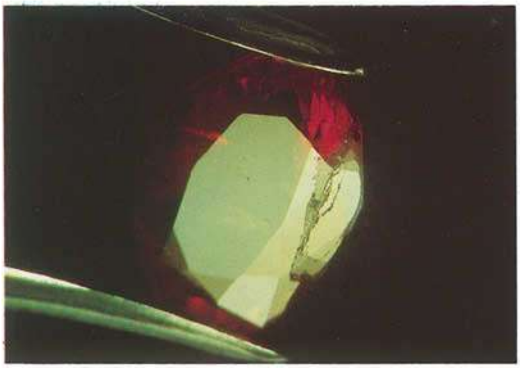

Fig. 1. Overhead lighting reveals a small piece of natural Burmese ruby (right) held to a much larger piece of Verneuil synthetic ruby (left) with glass. The slightly more dull lustre of the glass filling reveals its true nature. 10x. Photo by Wimon Manorotkul, AIGS.

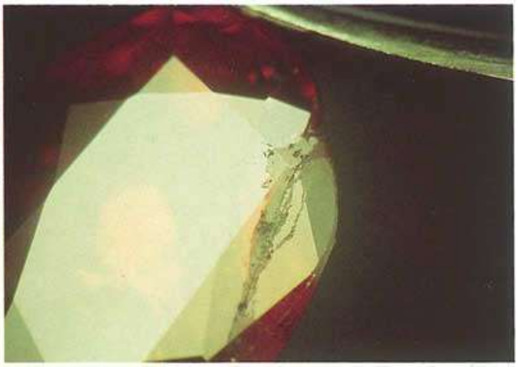

Fig. 2. An enlarged view of the same stone as in Fig. 1. Again, the glass is visible in overhead lighting due to its poorer lustre. 30x. Photo by Wimon Manorotkul, AIGS.

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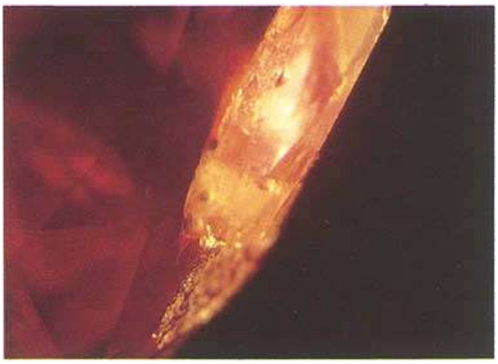

Fig. 3. Dark field illumination reveals the glassy material used to bind a small piece of natural ruby to a larger piece of synthetic ruby. Gas bubbles are visible in the glass portion while a dense white cloud of rutile silk is visible in the upper right corner of the natural piece at right. 50x. Photo by Wimon Manorotkul, AIGS.

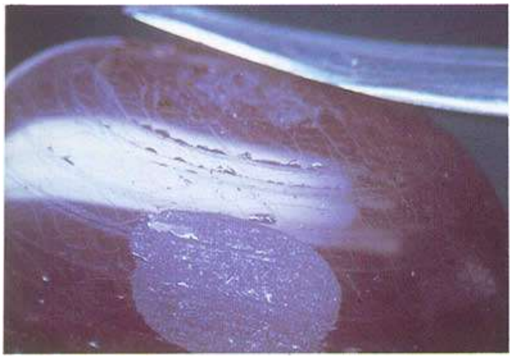

Fig. 4. Each of the cracks in this heavily included natural ruby has been filled with glass. The glass is visible with overhead lighting, due to its lower lustre. 25x. Photo by Wimon Manorotkul, AIGS.

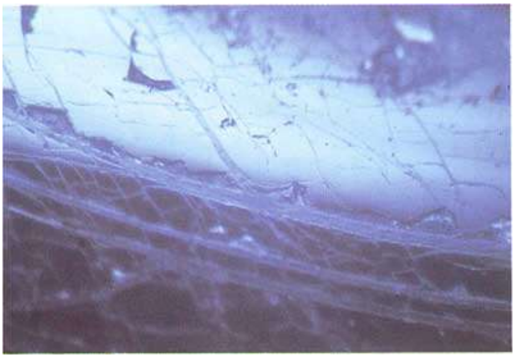

Fig. 5. Same as Fig. 4, but with slightly higher magnification. 50x. Photo by Wimon Manorotkul, AIGS.

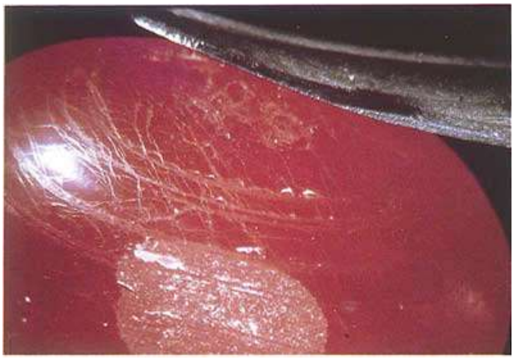

Fig. 6. Same as Fig. 4, but with a more yellowish light source. 25x. Photo by Wimon Manorotkul, AIGS.

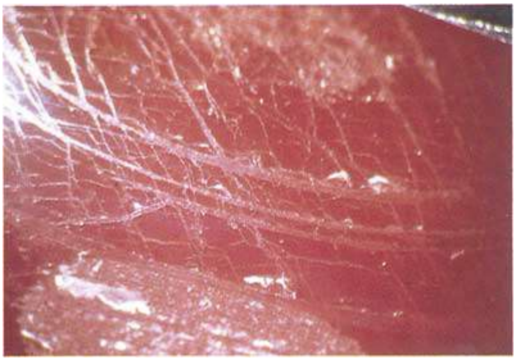

Fig. 7. Same as Fig. 5, but with a more yellowish light source. 50x. Photo by Wimon Manorotkul, AIGS.

During the recent ICA Congress held in May 1987 in Bangkok, Dr Henry Hänni of Switzerland described to the author a new treatment used on rubies. This consisted of introducing glass into the fractures of low-grade ruby cabochons from Africa. It differed from ordinary surface repair in that the glass actually penetrated into the fractures.

The first stone of this type seen in Bangkok was brought in during June 1987. It was a heavily included 13.74 ct ruby cabochon, as shown in Figures 5-8. Overhead lighting or immersion in methylene iodide revealed each of the cracks to be filled with a glassy substance. It was not possible to determine how deep the glass penetrated into the cracks, but it did appear to extend a fair distance under the surface.

Detection of this treatment is the same as for ordinary surface repair. Overhead lighting reveals the glass, due to its lustre being lower than the surrounding corundum. Immersion in methylene iodide also allows the glass to be seen, as it appears in high relief compared with the surrounding corundum, due to the lower RI of the glass. Gas bubbles may also be seen in the glass filling.

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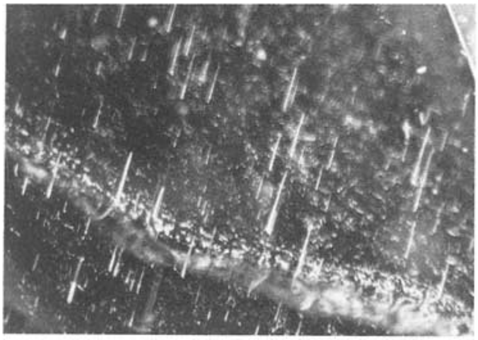
[*Manuscript received 24 July 1987.*]

The Gemmological Association has collaborated with the Gem Testing Laboratory of Great Britain to arrange a programme of one-day courses.

The courses have been designed for the Association by Ken Scarratt and will be held at the Gem Testing Laboratory in London. The aim is to give practical instruction and experience to students studying gemmology, particularly those preparing to take the FGA examination by home study, and updates specialized courses for all gemmologists.

DO YOU KNOW WHICH IS THE NATURAL EMERALD?



If not, book for our course on 21 April.

Various types of one-day courses are being offered during 1988, the dates of which are:

24 March	**Basic practical gem testing techniques**
21 April	**Emerald, amethyst and opal**
19 and 20 May	**Practical diamond grading examination revision**
16 and 17 June	**Practical gem testing examination revision**
5 July	**Organic gem materials, including amber and pearls**
29 September	**Diamond grading**
27 October	**Jade, turquoise, lapis lazuli and their simulants**
24 November	**Ruby and sapphire**

The National Association of Goldsmiths are also arranging courses on practical gemstone knowledge at the Laboratory. **These are to be held on 4 March, 13 May, 7 July and 7 October 1988.**

Each course is limited to 8 participants and is offered at the low charge of £55 plus VAT (including lunch). The courses are open to all students and members of the Association who would like to take a short refresher course. For further information contact Paula Jennings on 01-726 4374.

A doublet made of a natural green sapphire crown and a Verneuil synthetic ruby pavilion

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Abstract

With all the concern to recognise the modern synthetics (Knischka, Chatham, Kashan, Ramaura, Inamori), one would tend to give too quickly a natural origin to a stone presenting at first sight unequivocal inclusions, and thus forget to check for a possible doublet.

The two rubies received recently by the writer for identification fall into this category.

Ring A

Ring B

Fig. 1. The two rings received for testing the quality and origin of the rubies.

Appearance

Two oval-cut ruby and diamond cluster rings (Figure 1) were received for testing the quality and origin of the rubies.

At first sight, the rubies were of a beautiful red colour not dissimilar to that found in Burmese stones. The diamonds and rings were also of a very good make and quality.

Under the microscope

Under the microscope, and in dark-field illumination, many rutile needles giving rise to 'silk', long canals, strong straight colour zonings, 'feathers', were easily seen, but surprisingly seemed to be concentrated in one zone near the surface. The rings were tilted in order to view the ruby's pavilion, which appeared abnormally free of inclusions.

At this stage it was decided to take a closer look at the girdle and to change the lighting conditions of the microscope to reflected light.

In reflected light, the rubies proved to be doublets since a groove could be seen in the middle of the girdle. The stones were again tilted in the face up position, and they appeared green under the microscope.

With both lightings on, dark-field illumination and reflected light, and by just slightly inclining the stones, the two colours green and red appeared (Figures 2, 3). From this point it was decided to check the refractive indices, absorption spectrum, and ultraviolet fluorescence of these composite stones.

Refractive indices

The refractive index determinations were carried out using a Rayner Dialdex refractometer and monochromatic sodium light. Only the table facet was tested since the stones were mounted and that

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Fig. 2. Ring A

Fig. 3. Ring B

Figs. 2 and 3. The two rubies seen under the microscope in dark-field illumination and reflected light, showing clearly the two different materials composing these stones.

their owner did not allow the writer to have them unmounted.

The indices obtained were 1.773 1.765, giving a birefringence of .008, with optic sign (–), confirming the crown to be corundum, variety green sapphire.

Absorption spectrum

The light reflected from the stone's table was analysed through a Gem Beck spectroscope unit, and revealed a strong band centred at 450 nm. This, the rather high refractive indices for corundum, and the inclusions observed are characteristic of Australian green sapphires.

The same procedure was carried on the pavilion of the stones and revealed bands and lines centred at 440-450, 468, 472, 477, 500-610, 630-670, 695 nm. This absorption spectrum is characteristic of ruby, either natural or synthetic.

Ultraviolet fluorescence

The stones were examined with a Multispec combined LW/SW unit, and revealed two different behaviours for the crown and pavilion.

In the table facet up position, the stones remained inert to LW and SW. On the contrary, the pavilion when presented horizontally, fluoresced a strong brick-red to LW.

Since some natural rubies can have similar behaviours (Sri Lanka, Burma, Africa), it was decided to try and obtain a Plato or curved striae by immersing the stones in methylene iodide between crossed polaroids.

Examination in methylene iodide

The stones immersed in methylene iodide were observed on a horizontal Eickhorst stand between crossed polaroids coupled to a Gemolite Bausch & Lomb Mark V microscope, and revealed strong

Fig. 4. Strong straight colour zones in the crown, and curved growth lines in the pavilion made visible when the stone is immersed in methylene iodide.

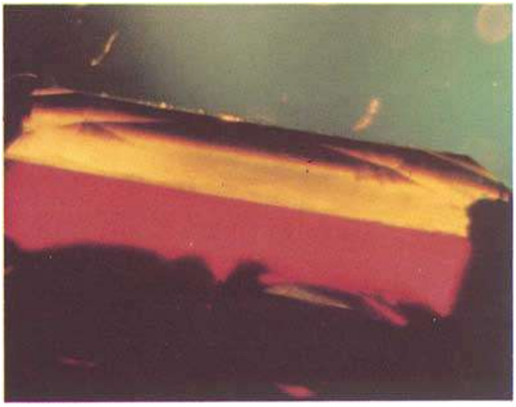

Fig. 5. The two different corundums composing this doublet show even more clearly when the stone is immersed in methylene iodide.

straight colour zones in the crown, and curved growing lines in the pavilion (Figure 4).

The Plato striations which also betray 'Verneuil synthetics' were not secured due to the mounting.

Also of interest is to visualize how the two different corundum layers composing this doublet react when immersed in methylene iodide and between crossed polaroids (Figures 4, 5).

Conclusion

These very convincing ruby doublets of an excellent colour, made of a natural green Australian sapphire crown and a Verneuil synthetic pavilion, should encourage every gemmologist to take great care to observe the inclusions in detail as to where they lie, if they are distributed with a certain logic. If, as for these stones, they seem to be confined in one zone of the stone, or if they are of different constitution for the crown and pavilion, on or near the surface, and do not traverse the stone, then a doublet should be suspected, and the stone thoroughly checked.

[*Manuscript received 9 July 1987.*]

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Morphology and twinning in Chatham synthetic blue sapphire

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Abstract

Morphological properties of Chatham synthetic blue sapphires are described. The crystals reveal tabular to rhombohedral habit with *c* $\{0001\}$, *r* $\{10\bar{1}1\}$, *d* $\{01\bar{1}2\}$ and *n* $\{22\bar{4}3\}$ as predominant crystal forms as well as ϒ $\{01\bar{1}5\}$ as subordinate form. Most crystals disclose contact twinning by reflection across $\{10\bar{1}0\}$ with *a* $\{11\bar{2}0\}$ as composition plane. Single and repeated (cyclic) twinning is observed. The application of internal structural properties such as families of straight parallel growth planes and twin boundaries on the distinction of natural and synthetic corundum is briefly discussed.

Fig. 1. Crystal group of Chatham synthetic blue sapphires, 9.45 ct in weight, consisting of five untwinned and six twinned individuals. Size approx. 13 x 16 mm (*photo by O. Medenbach, Bochum*).

Fig. 2. Crystal group of Chatham synthetic blue sapphires, 7.02 ct in weight, consisting of two untwinned and one twinned individual. Size approx. 10 x 15 mm (*photo by O. Medenbach, Bochum*).

Introduction

Chatham synthetic blue sapphires were first reported by Bank (1977), Scarratt (1977), and Koivula (1981) and more detailed descriptions of this new synthetic gem material were written by Gübelin (1982, 1983) and Kane (1982). Additional papers dealing with gemmological properties of flux-grown Chatham synthetic sapphires were published by Gunawardene (1983) and Brown (1984). In the papers cited above, emphasis is laid on microscopic description of diagnostic features, eg. inclusions of small needles or platelets of platinum as well as 'fingerprint' feathers consisting of residual flux. Only limited information is available about structural features such as morphology and growth structures as well as about the possible presence of twinning. These features, however, are incidentally of diagnostic value for the distinction of natural and synthetic rubies (cf. Schmetzer 1985, 1986a,b, 1987). Therefore, a crystallographic investigation of structural properties of Chatham synthetic sapphires was undertaken by the present authors.

Materials and methods

For the determination of structural properties of Chatham synthetic blue sapphires, both rough crystals and faceted stones were available. The group of five rough samples under investigation was found to consist of single individuals as well as of irregularly intergrown crystal groups and clusters (Figures 1, 2). One sample was formed by four individuals which were irregularly intergrown. On one side of the sapphires a glaze-like layer of transparent material was attached to the crystals, presumably in order to improve the stability of the crystal group. This coating was amorphous to

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X-rays, and by electron-microprobe the material was found to contain, K, Ca, Pb, Al and Si as major components (cf. Scarratt 1977, Kane 1982, Brown 1984). A similar coating was observed on one side of one of the sapphire clusters which consisted of 11 sapphire crystals.

In order to determine the morphology and twinning of Chatham synthetic sapphires the crystal faces of all five rough samples including individuals from crystal groups and clusters were first examined with an optical two-circle reflecting goniometer and later identified by means of the stereographic projection. In a second step, families of straight parallel growth planes as well as twin boundaries were microscopically investigated immersed in methylene iodide with the aid of a sample holder with horizontal and vertical rotation axes. This method (Schmetzer, 1985, 1986a) allows an easy microscopic determination of structural features in rough and faceted gemstones. Thus, in addition to the five samples of rough individuals, eight faceted stones of various sizes were also included in the present study.

Results

The five rough samples were found to consist of single crystals and twinned individuals. Twinning is caused by one single reflection, or even by repeated reflections across the first-order hexagonal prism $(10\bar{1}0)$, which is easily recognizable due to the re-entrant angles of the samples. In general, twinned and untwinned individuals are irregularly intergrown. The five samples investigated in this study are described as indicated below:

Sample	Number of individuals	Untwinned individuals	Twinned individuals
1	11	5	6
2	1		1
3	4		4
4	3	2	1
5	1		1

The crystal faces which were identified in both untwinned and twinned crystals are identical, the samples displayed tabular to rhombohedral habit with the basal pinacoid *c* $\{0001\}$, the positive rhombohedron *r* $\{10\bar{1}1\}$, the negative rhombohedron *d* $\{01\bar{1}2\}$ and the hexagonal dipyramid *n* $\{22\bar{4}3\}$ as predominant forms, as well as the negative rhombohedron ϒ $\{01\bar{1}5\}$ as subordinate form (Figure 3). Occasionally, an oscillatory development of both negative rhombohedrons *d* and ϒ was observed causing parallel striations on these crystal faces. No prism faces were detected.

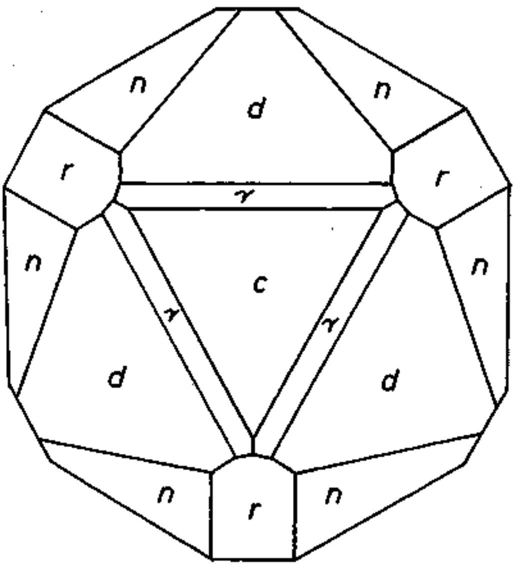

Fig. 3. Idealized single crystal of Chatham synthetic sapphire viewed in a direction parallel to the *c*-axis.

All single and repeatedly twinned individuals (cyclic twinning) were contact twins with the second-order prism *a* $\{11\bar{2}0\}$ as composition plane (Figures 4, 5). In the crystal class of corundum $\bar{3}\,2/m$, the second-order hexagonal prism *a* $\{11\bar{2}0\}$ is parallel to a mirror plane. Thus, this face cannot be a twin plane but is a composition plane of two single crystals twinned by a reflection across the first-order hexagonal prism $\{10\bar{1}0\}$, which is not a mirror plane in crystal class $\bar{3}\,2/m$. In repeatedly twinned individuals, which are also called cyclic twins, all twin boundaries intersect in a straight line. Hence, the twinned crystals are more distorted than the untwinned individuals, especially the negative rhombohedral faces *d* $(01\bar{1}2)$ and ϒ $(01\bar{1}5)$ vary significantly in size.

In the immersion microscope, families of straight parallel growth planes were determined which reflect the external growth faces of the crystals. These growth faces are parallel to the predominant forms *c* $\{0001\}$, *r* $\{10\bar{1}1\}$, *d* $\{01\bar{1}2\}$, and *n* $\{22\bar{4}3\}$. The most frequently observed angles, which are made by two families of straight parallel growth planes, equal 154° (made by the faces *r* and *n*), 148° (made by the faces *d* and *n*), 128° (made by the faces *n* and *n'*), and less commonly 133° (made by the faces *r* and *d*). The composition planes *a* $\{11\bar{2}0\}$ of the individuals, which are related by reflection twinning on $\{10\bar{1}0\}$ are also observable in the gem microscope without having problems (Figures 6, 7, 8).

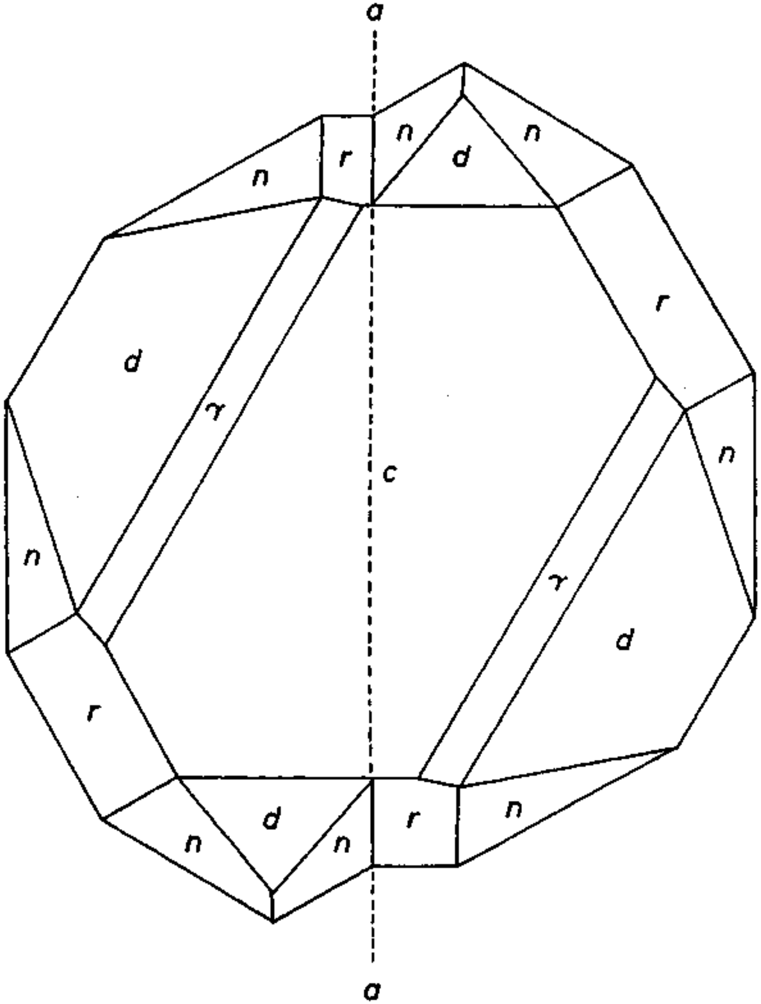

Fig. 4. Slightly distorted crystal of Chatham synthetic sapphire viewed in a direction parallel to the *c*-axis. The crystal reveals contact twinning across (10$\bar{1}$0) with *a* (11$\bar{2}$0) as composition plane; re-entrant angles are formed by the faces *n* and *r*.

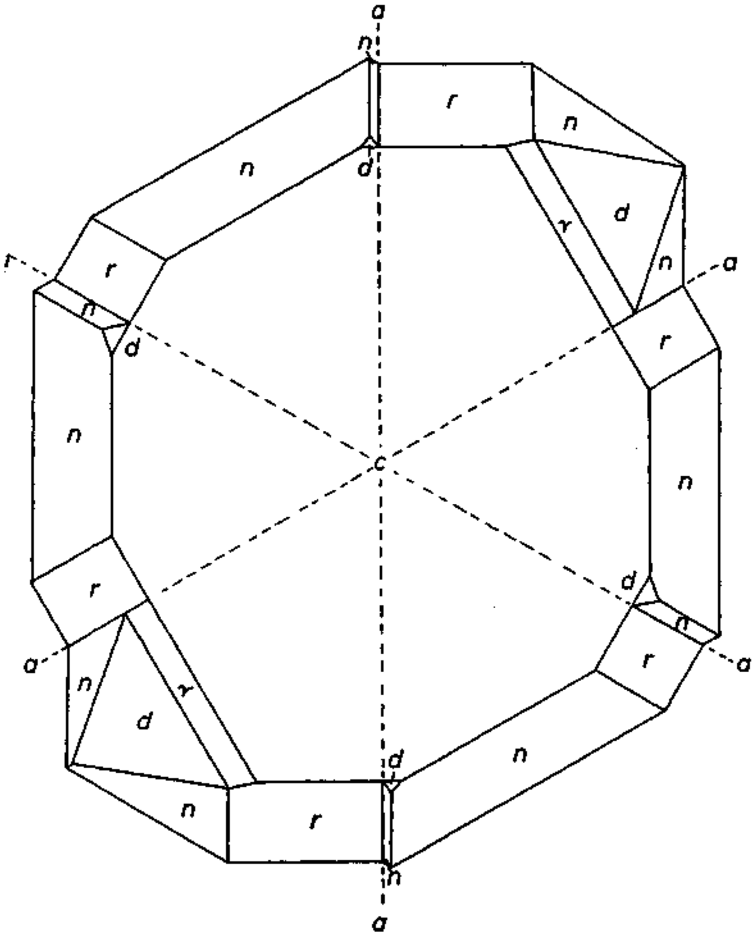

Fig. 5. Distorted crystal of Chatham synthetic sapphire viewed in a direction parallel to the *c*-axis. The crystal reveals repeated (cyclic) twinning across {10$\bar{1}$0} with *a* {11$\bar{2}$0} as composition planes; re-entrant angles are formed by the faces *n* and *r*.

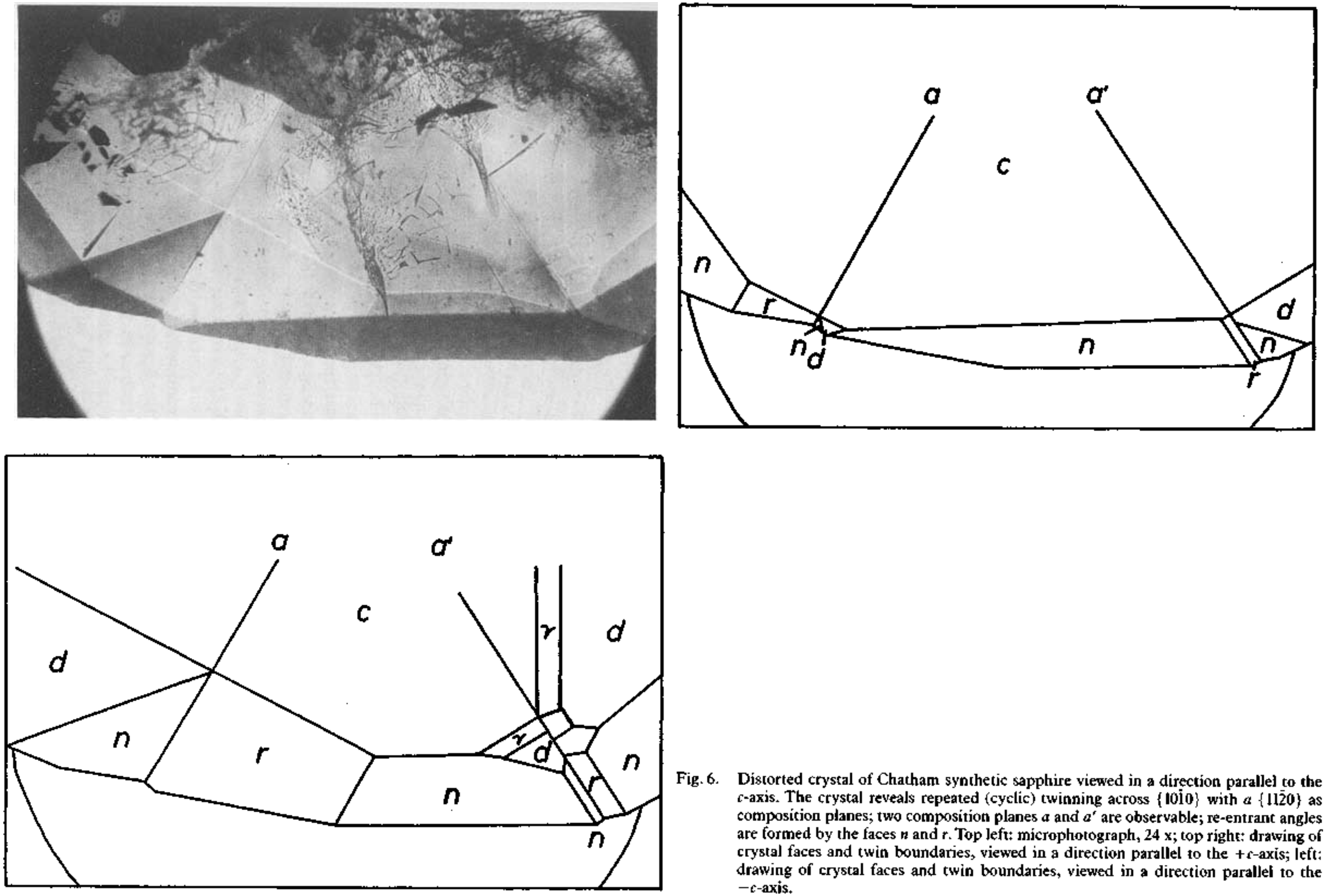

Fig. 6. Distorted crystal of Chatham synthetic sapphire viewed in a direction parallel to the *c*-axis. The crystal reveals repeated (cyclic) twinning across $\{10\bar{1}0\}$ with *a* $\{11\bar{2}0\}$ as composition planes; two composition planes *a* and *a'* are observable; re-entrant angles are formed by the faces *n* and *r*. Top left: microphotograph, 24 x; top right: drawing of crystal faces and twin boundaries, viewed in a direction parallel to the +*c*-axis; left: drawing of crystal faces and twin boundaries, viewed in a direction parallel to the −*c*-axis.

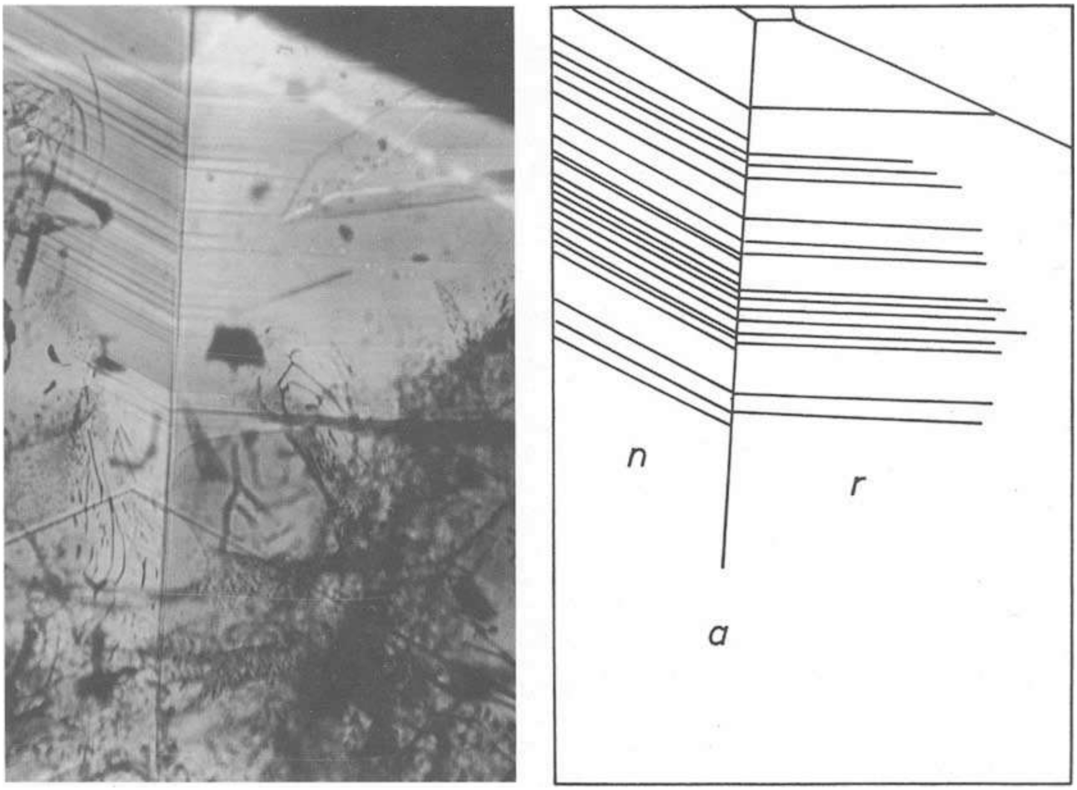

Fig. 7. Families of straight parallel growth planes in Chatham synthetic sapphire, growth sectors confined to the positive rhombohedron *r* $(10\bar{1}1)$ [right part] and the hexagonal dipyramid *n* $(22\bar{4}3)$ [left part] are divided by a twin boundary parallel to *a* $(11\bar{2}0)$; a re-entrant angle is formed by the faces *n* and *r*. Left: microphotograph, 40 x; right: drawing of growth and composition planes.

Discussion

The habit of Chatham synthetic blue sapphire is similar to the habit of Chatham synthetic ruby (cf. Schmetzer, 1985, 1986 a, b). In both varieties, the predominant forms are the basal pinacoid *c* $\{0001\}$, the positive rhombohedron *r* $\{10\bar{1}1\}$, the negative rhombohedron *d* $\{01\bar{1}2\}$, and the hexagonal dipyramid *n* $\{22\bar{4}3\}$. In Chatham synthetic blue sapphire, an additional negative rhombohedron Υ $\{01\bar{1}5\}$ was observed, which was previously mentioned for Knischka synthetic rubies, too (Knischka, 1980; Knischka & Gübelin, 1980). Most Chatham synthetic blue sapphires are twinned by a reflection across $\{10\bar{1}0\}$ with $\{11\bar{2}0\}$ as composition plane. Single and repeated (cyclic) twinning was observed. According to the knowledge of the authors, cyclic twinning of corundum has not yet been described in the literature though single twinning across $(10\bar{1}0)$ with $(10\bar{1}0)$ or $(11\bar{2}0)$ as composition planes is already known for flux-grown ruby and corundum (cf. Schmetzer, 1986 b, 1987). Twinning and internal growth structures in Chatham synthetic blue sapphire are closely related to internal structural features of Chatham synthetic ruby and thus, similar growth conditions, e.g. the compositions of fluxes, are evident for both varieties.

The results which are described in this paper disclose some discrepancies with literature data. Prism faces, growth planes parallel to prism faces forming angles of 120° (which is also described as hexagonal zoning) as well as polysynthetic twin lamellae, which are briefly mentioned by Kane (1982), Gübelin (1982, 1983) and Gunawardene (1983), were never observed. Unfortunately, in the papers cited no detailed informations about the determinative procedures of these structural properties are quoted, and thus no final explanations of these discrepancies are possible.

For the distinction of natural and synthetic rubies and sapphires, the application of growth structures and twinning may lead to conclusive results in some cases. In natural corundum, families of straight parallel growth planes parallel to the

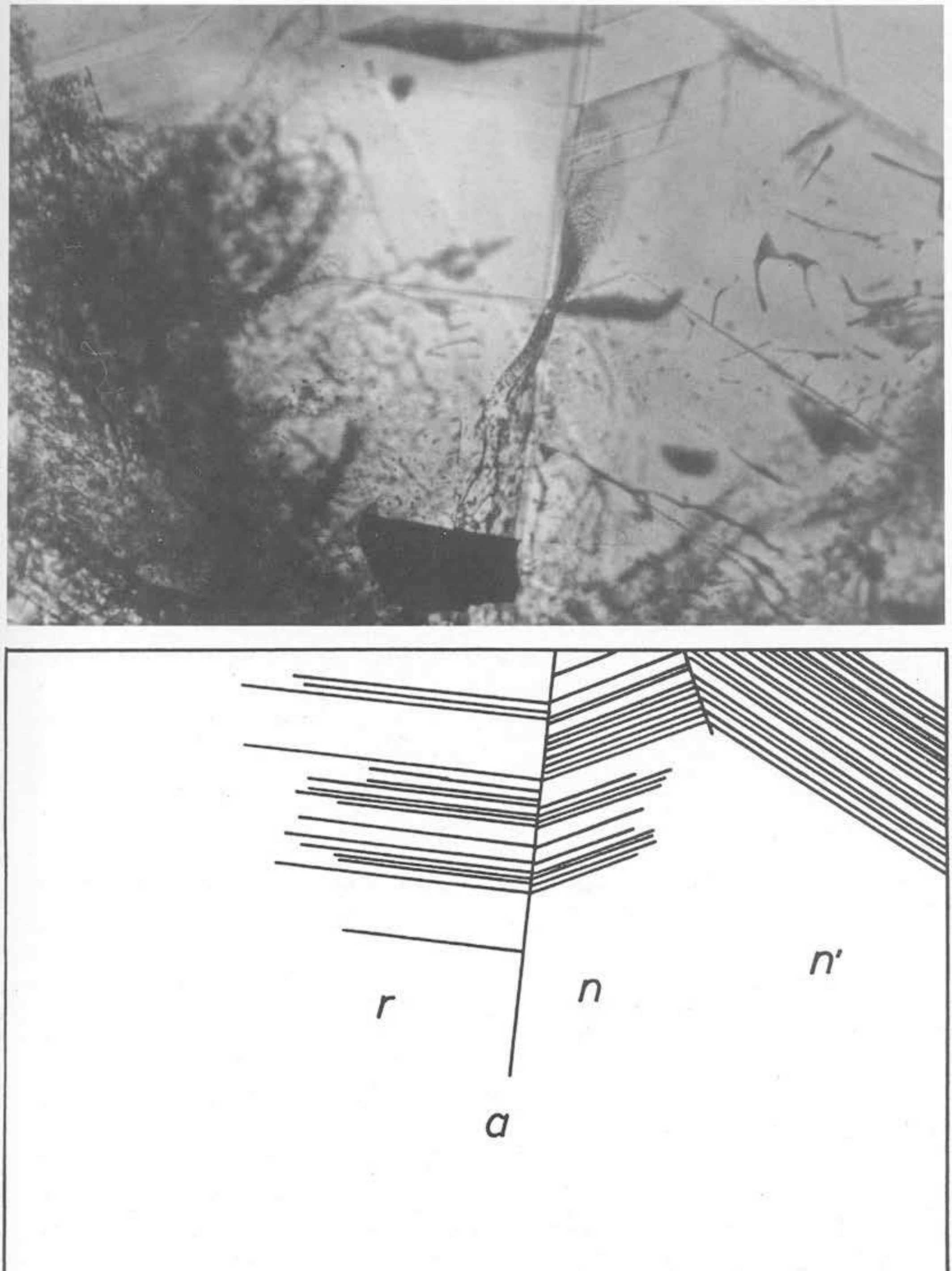

Fig. 8. Families of straight parallel growth planes in Chatham synthetic sapphire, growth sectors confined to the positive rhombohedron *r* (10$\bar{1}$1) [left part] and the hexagonal dipyramid *n* (22$\bar{4}$3) [right part] are divided by a twin boundary parallel to *a* (11$\bar{2}$0); a re-entrant angle is formed by the faces *n* and *r* [centre]; planes parallel to *n* and *n'* {22$\bar{4}$3} form an angle of 128° [right part]. Upper part: microphotograph, 30 x; lower part: drawing of growth and composition planes.

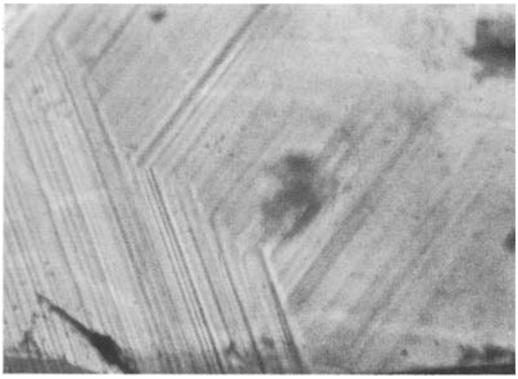

Fig. 9. Families of straight parallel growth planes that form an angle in natural ruby from Sri Lanka viewed in a direction parallel to the *c*-axis; planes parallel to prism faces *a* and *a'* $\{11\bar{2}0\}$ form an angle of 120°. 30 x.

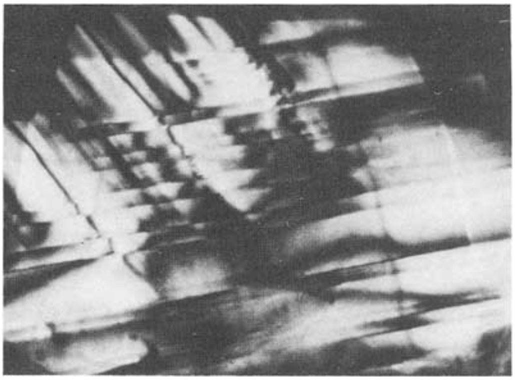

Fig. 10. Families of intersecting glide planes parallel to prism faces *a*, *a'* and *a''* $\{11\bar{2}0\}$ in synthetic orange sapphire which was produced by the Verneuil technique; view in a direction parallel to the *c*-axis. Crossed polars 25 x.

prism faces *a* $\{11\bar{2}0\}$ forming angles of 120° are frequently observable (Figure 9). In synthetic sapphires which were grown by the Verneuil technique, intersecting glide planes (the so-called Plato lines) parallel to *a* $\{11\bar{2}0\}$ are often present (Figure 10). Flux grown synthetic corundum of particular producers is recognizable by the presence of a single twin boundary parallel to *a* $\{11\bar{2}0\}$ (Figures 6, 7, 8). For a more detailed discussion of these problems, the reader is referred to the recent papers of Schmetzer (1985, 1986 a, b, 1987).

Acknowledgements

Chatham synthetic blue sapphires which were investigated in the present study were kindly supplied by the firm R. Litzenberger of Idar-Oberstein, West Germany. Financial support was given by grants of the Wirtschaftsministerium des Landes Rheinland-Pfalz, West Germany.

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Identifying yellow sapphires – two important techniques

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Abstract

The author discusses two new techniques for identifying yellow/orange sapphires.

1. Placing a blue filter between the light source and immersion cell provides the contrast necessary to resolve the colour banding (straight or curved) in natural and synthetic yellow/orange sapphires.

2. Heat treatment in Sri Lankan yellow to orange sapphires can be identified by exposing the stones to the heat and light of a strong bulb. Upon heating up slightly, the colour of heat-treated specimens will become darker and more brownish. As it cools back to room temperature the colour returns to normal.

The blue filter as a gemmological tool

In dealing with the corundum gemstones, yellow sapphires are often thought to be among the most difficult to identify. This is largely because yellow sapphires are frequently completely free of inclusions and the colour banding is more difficult to find in this colour than almost any other. The author has developed a new technique which makes it possible to locate the colour banding (straight or curved) in virtually all natural and synthetic yellow sapphires, thus greatly aiding their identification.

Natural yellow sapphires are produced primarily from four sources: Sri Lanka, Thailand, Australia and Tanzania. All of these stones contain straight growth lines (colour bands). Synthetic yellow/orange sapphires are of two types: Chatham has begun producing a flux-grown product, and this contains straight growth lines, but is extremely rare; the vast majority of all synthetic yellow/orange sapphires are produced by the Verneuil process, and, as such, contain curved growth lines. It must be stressed that all yellow/orange sapphires, synthetic or natural, possess these lines. The trick is simply to find them, and to see if they are straight or curved.

Although the presence of other inclusions or an iron absorption spectrum will allow identification, frequently these features are absent. This makes it imperative to locate the growth lines for positive identification. The traditional technique has been to immerse the stone in methylene iodide and examine it in the microscope with light field illumination. Some gemmologists suggest that a piece of tissue paper be placed over the light to provide diffusion. A better method is to use a piece of frosted white plastic or glass, as it won't catch fire. This is readily available from shops making plastic signs for less than $1.00.

The main problem with this technique, however, is that one is looking for yellow lines in a yellow stone immersed in a yellow liquid over a yellowish light (tungsten filament). Is it any wonder that they are hard to find? Some have suggested twisting the overhead fluorescent light under the microscope and placing the immersion cell on top of this. It is a definite improvement, but still not good enough. One day in 1981, while pulling my hair out in frustration at my inability to locate the bands in a yellow sapphire, I stumbled across a solution. Prior to this, on a lark, I had bought thin pieces of plastic of different colours in Bangkok's finest sign shop. On that fateful day, rather than lose more hair, I decided to see what would happen if these were placed under the immersion cell. One by one I tried them: red, green, yellow and then blue. Lo and behold, when the blue filter was placed under the cell (with the white one), the colour bands appeared! I broke it in half and tried a double thickness. Even better! Since that day we at AIGS have taught of and used the blue filter for the testing of all yellow and orange sapphires, and have been able to locate the colour banding in perhaps 98-99% of all stones.

I wish I could tell you that I knew what I was doing from the start, but such was not the case; the discovery was pure accident. However, it is possible to explain the effect. With the white filter only, the bands are difficult to see because they are the same colour as the stone; immersion in a yellow liquid

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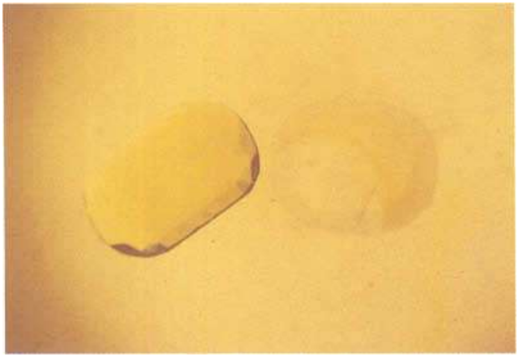

Fig. 1. Two yellow sapphires: a natural (left) and a Verneuil synthetic (right) are shown immersed in methylene iodide with diffuse light-field tungsten illumination. Due to the lack of contrast between the stone and the background, the colour zoning is difficult to see.

Fig. 2. The same two stones from Fig. 1, but now with a blue filter placed below the immersion cell. The blue filter provides contrast between the colour zoning and the background, making it much easier to resolve.

hardly improves the situation very much. The addition of a blue filter (a frosted blue filter allows elimination of the white filter), although cutting down on the available light, provides the contrast necessary to see the lines. Experimentation has shown that deep blue filters work better than light blue ones, up to a point. Experiment to find the best combination. The effect is not subtle; the blue filter provides an improvement of several magnitudes.

Not only does the blue filter work for yellow and orange sapphires, but other colour filters work for other corundums. It has been found that the colour of the filter should match the absorption maxima (wavelength of maximum absorption) of the stone. Thus, for rubies a filter of a yellow-green colour works best.

The effect of the blue filter on a yellow sapphire is shown in Figures 1 and 2. Figure 1 shows two stones over a white filter only; Figure 2 shows the same stones over a frosted blue filter.

Identifying heat treatment in Sri Lankan yellow and orange sapphires

Prior to 1981, to the best of the author's knowledge, heat treatment was not practised on Sri Lankan yellow/orange sapphires. The technique of deepening the colour of yellow/orange Sri Lankan sapphires by the appropriate heat treatment first came to our attention in 1981, when Bangkok gem dealer Robert Stevenson of Gem Resource showed the author a Sri Lankan orange sapphire of unbelievably rich colour. He claimed that it was treated in a new way (later learned to be a new heat treatment) and gave it to us to check the colour stability.

At this point we must pause for a moment to describe the methods used for checking colour stability. For several years prior to 1981, we had been routinely checking the colour stability of all Sri Lankan yellow/orange sapphires brought in for testing. This meant placing the stone on a metal platform and bringing a very hot 150 watt spotlight to within 1 cm of the stone, for up to one hour. (Note: Mr Cap Beesley (1983) of the American Gemological Laboratories has previously described a fade test for stones consisting of exposing the specimen to unfiltered ultraviolet light. If unfiltered short-wave ultraviolet were to be used with Sri Lankan yellow/orange sapphires, this will have exactly the opposite effect, deepening the colour, not lightening it.) The colour in those stones which had been irradiated to deepen the colour would always fade, usually well within one hour. If the stone was naturally coloured there would be no change. (However, reliable sources have reported in Sri Lanka that some yellow/orange stones will fade slightly, or a lot, right after being unearthed. Still, this does not negate the fade test as described above, as a customer wants to know the colour stability, whether irradiated by man or naturally coloured. The AIGS refuses to test Sri Lankan yellow/orange sapphires unless permitted to do this test.) We had tested a number of naturally coloured very deep yellow/orange Sri Lankan sapphires prior to 1981 which showed no change in colour during the fade test. Thus, you can imagine our surprise when, on performing the fade test on Mr Stevenson's stone, we noticed that the colour became much darker and more brownish. As it cooled back down to room temperature, the colour returned to normal. Amazing, but true!

Since that fateful day we have had the opportunity to observe first-hand the treatment process and can testify that it involves only heat (heat to 1800-1900°C in an oxidizing atmosphere). We have

Fig. 3. A heat-treated Sri Lankan yellow/orange sapphire is shown face-down at room temperature.

Fig. 4. The same stone from Fig. 3 is now shown just after it was exposed within 1 cm to the heat and light of a 150 watt spotlight for 15 minutes. The colour has become much darker and more brownish. After it returns to room temperature the colour will return to that in Fig. 3.

performed the fade test on literally thousands of stones and have found the following:

Origin	Reaction during fade test
Natural Sri Lankan yellow/orange sapphires	No change in most. Some may show some fading.
Natural or heat-treated yellow/orange sapphires from Thailand, Australia, Tanzania	No change
Irradiated Sri Lankan yellow/orange sapphires	The colour fades within one hour.
Heat-treated Sri Lankan yellow/orange sapphires	The colour temporarily becomes darker and more brownish. As the stone cools to room temperature, the colour returns to its original state. See Figures 3 and 4 for before and after representations.

In order to detect even slight changes in colour, comparison stones should be used. In other words, select two stones of similar colour. Perform the fade test on one only. While it is still hot (use tweezers!) compare its colour to the other. If it is a heat-treated Sri Lankan yellow/orange sapphire, its colour will have darkened noticeably. As for the reasons that this test works, the author can only speculate. The colour in natural Sri Lankan yellow/orange sapphires appears to be due mainly to colour centres. In the heat-treated Sri Lankan yellow/orange sapphires, however, it appears to be some type of mechanical coloration due to the exsolution of reddish Fe-rich mineral particles (hematite?). Apparently the colour of the particles is temperature dependent; hence the change as the stone is heated during the fade test.

We have found that there is a direct correlation between the original depth of colour before the fade test and the amount of change during the test. In general, the darker and more orangy/brownish the colour is to start with, the more change will be noticed during the test; the lighter the colour is to start with, the less change will be noticed during the test. It is not necessary to use only a 150 watt spotlight. Experiments have shown that almost any source of gentle heat will do, even a microscope bulb. Avoid overheating the specimen, however, for this could damage certain natural stones containing carbon dioxide inclusions.

The author feels that this test is extremely important for it represents the first *simple* test for detecting heat treatment in any type of corundum. It is believed that, in the future, as the gem markets begin to realize the vital importance of detecting *all* treatments in gemstones, tests such as this will come into widespread use.

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Post Diploma

David Kent, FGA

London

We are very fortunate in London to have an evening class especially for Post Diploma students. I believe I can claim to be the oldest inhabitant and still a student!

In 1946, after six years' wartime army service in India and Germany, I wished to attend evening classes in order to improve my scanty knowledge of the German language. I consulted *Floodlight*, the educational booklet issued by the (then) London County Council, to see where German classes were held. However, I saw that 'Gemmology' was the subject listed before 'German' and decided to study gemmology instead. I had already returned to the retail jewellery trade, in which I had been employed since leaving school in 1929, and gemmology would be useful for my future career.

Having managed to obtain my Diploma in 1948, I immediately joined the class which was then held at the Chelsea Polytechnic. Our instructors were Basil W. Anderson and Alec Farn. Mr Anderson used to alternate a practical evening, using stones from his extensive collection, with talks on all subjects keeping us up-to-date with the latest gemmological information.

For instance we were given instruction on the distant vision or spot method of determining the refractive index of cabochon-cut stones very soon after Lester B. Benson devised it in America.

B.W.A. was very interested in emeralds and would inform us on all newly discovered sources during the 1950s and 1960s. Great strides were made in producing synthetic gem materials and we were given every opportunity to learn the different methods of manufacture. Glass, natural and artificial, was another favourite topic for interesting evening talks.

The class was treated to a series of articles on spectroscopy which B.W.A. and C.J. Payne had studied over many years. Their results were then published in 40 monthly instalments in *The Gemmologist* between 1953-1957.

At Christmas time and end of term we would be set light-hearted competitions. Prizes would be awarded and ranged from an orange to a bar of chocolate or a small group of crystals. Sometimes individual members would be called to the front of the class to give two-minute lecturettes on a subject of the master's choice – two minutes seemed a very long time.

The evening class moved from Chelsea in 1957 to the Northern Polytechnic and again in 1969 to the City of London Polytechnic (Sir John Cass College, Aldgate) where we now meet once a week.

During 1966 Basil Anderson moved to the west of England. Before he left he entertained us by recounting his experiences in a lecture entitled '40 years a gemmologist', starting in 1925 when he opened the gem laboratory in a small Hatton Garden room with a commissionaire, a balance and a telephone.

B.W.A. and Alec Farn were also keen on teaching us gemmological identification without instruments, with perhaps a lens only, using eyes, tongue, heft and even sound (natural and cultured pearls rattle differently together).

There have been many jewellers in the class as well as taxi drivers, doctors, solicitors and other professions. Members would sometimes speak on subjects close to their hearts.

Werner Stern was most interesting on the history of Idar-Oberstein, also on various methods of hardness testing.

I remember particularly talks given by that epitome of an English gentleman, Sir James Walton, eminent surgeon and later our Chairman/ Curator and President of the National Association of Goldsmiths. He was interested in ways of testing specific gravity. He once gave us a long talk on atomic structure – any little knowledge I had at the start had evaporated at the end!

Sir James once confounded us all by bringing to class a collection of 52 jade and jade-like minerals

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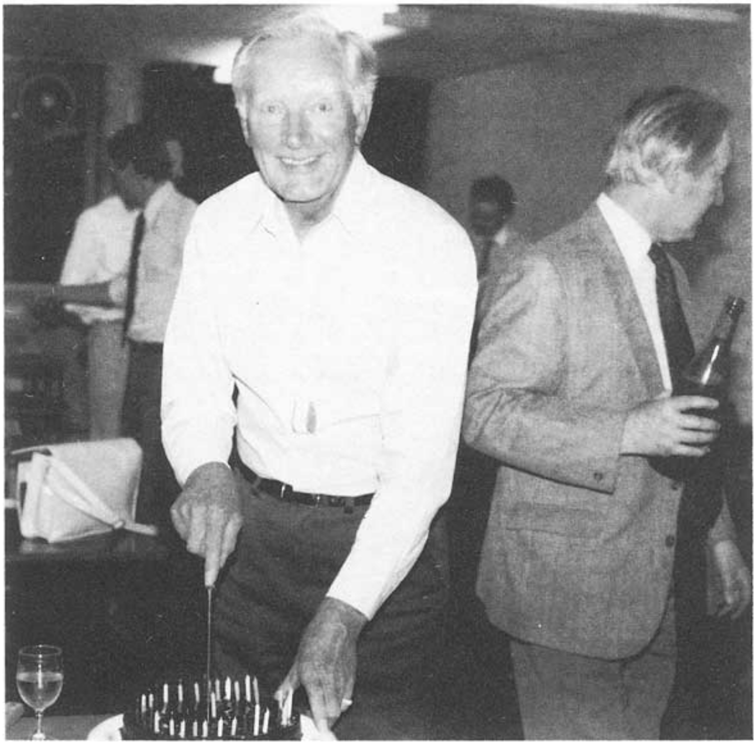

Surprise 70th birthday party for David Kent at a Post Diploma class, June 1985. *Photo by Rosemary Ross.*

housed in a box with a Plaster of Paris bed. Since then I have never been wholly confident of jade recognition.

Another member was Keith Mitchell who would advise us with his extensive knowledge of coloured gemstones.

We occasionally had lectures by visiting experts in various fields and I still have notes of those given by Robert Webster, Thorold Jones, Ernest Rutland and many others. For instance I remember talks on microscopy by Colonel Sprague; Mrs Alice Sumner-Tait on her exciting journeys when gem hunting in Brazil and East Africa; Elsie Ruff, a great enthusiast on sources of jade and C.J. Payne once came and gave us a very full description of the goniometer and how to use it. I have never quite recovered from the experience. I also have notes and charts on an occasion when we conducted an experiment in class on the relative volatility of mixed heavy liquids and the change in specific gravity at room temperatures. I must mention that this was under the guidance of Robert Webster.

In 1966 Alan Jobbins took over as instructor and has continued the good work. The class continues to thrive with most of the thirty members attending regularly. Therefore it tends to be a gemmologists' club and a great deal of specimen stone swapping takes place. We still have practical evenings alternating with talks mostly by E.A.J., usually illustrated with beautiful slides from photographs taken by him in various parts of the world. These lectures could include exotic birds and plants since Alan is a keen ornithologist as was B.W.A. Some of his lectures are also presented to international audiences. Occasionally we have a special evening on subjects such as jade, ivory or jewellery, when members bring pieces from their own collections for inspection and discussion.

In 1986 a party of American gemmologists visited the class and they returned to the USA wishing they had similar opportunities there.

[*Manuscript received 1 September 1987.*]

J. Gemm., 1988, 21, 1

Emerald-coloured rough

David J. Smith, FGA

H.B. Smith & Son (Brighton) Ltd., Brighton BN2 2TA

On 15 July last year two specimens of 'emerald looking' rough were handed to us for testing. These weighed 95 and 19.5 grams (see Figure 1). They had been brought back from Zambia and apparently there was considerably more of this material available.

It appeared to be of a very good colour, but almost too good to be true. The surface consisted of patches of sandy material mixed with patches of pyrite. Examination with fibre optic lights in the transparent areas revealed inclusions not compatible with those found in emerald and under the Chelsea filter only green light was visible. The surface of the specimens looked too loose to make a good SG determination.

We expressed our doubts to the customer who really could not believe that they were not genuine emeralds. In order to get nearer to the truth we suggested polishing a flat on the small stone. This revealed a quartz reading. Emerald-green quartz – maybe this was a new deposit? The customer insisted that the large one was natural emerald, and demanded more tests.

It was not feasible to polish a flat on this specimen so that it could balance on the refractometer, so we suggested cutting off a section. This

Fig. 1. The two specimens of 'emerald looking' rough with a centimetre scale.

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Fig. 2. The larger specimen cut in two. The surface has been scraped to show where the sand and pyrite had been stuck on.

Fig. 3. A close-up of the larger of the two cut pieces.

Fig. 4. A piece of metal (possibly aluminium) can be seen in the cavity in the top left-hand corner. Transmitted light.

was agreed and all was revealed (see Figures 2, 3 and 4). The stone consisted of a central body of colourless quartz that had a green lacquer all over it. This was wrapped in slabs and many pieces of clear quartz also painted with green lacquer, which can be seen peeling off where we had disturbed it with the saw. It was all held strongly together with a softish gum and the sand and pyrite had been stuck on (Figure 2 shows where we had scraped off this layer). Also there was a piece of softish metal (possibly aluminium) which can be seen in Figure 4 in the large cavity in the top left-hand corner.

It was now obvious that this was a composite stone and a fake.

[*Manuscript received 7 August 1987.*]

The XXI International Gemmological Conference, Brazil 1987

Report by Alan Jobbins

The conference, which was superbly organized by Elizabeth and Ian MacGregor and their Brazilian helpers, was held in the Hotel Atlantico Sul some 35km WSW of Rio de Janeiro. The conference, held from 20–24 September, was followed by an excursion starting on 26 September and finishing on 4 October. Some 45 delegates (from 19 countries), local observers, wives and guests attended. The excursion route took in the following towns: Belo Horizonte, Diamantina, Aracuai, Teofilo Otoni, Governador Valadares, Itabira and Ouro Preto. The mining operations visited included: Sampaio and Boa Vista diamond mines; Tejucana diamond dredging operations; Urubu feldspar and lithium pegmatite mine; Marambaia Valley aquamarine and chrysoberyl mines; Golconda feldspar pegmatite mine; Hematita alexandrite and Belmont emerald mines; Capão topaz mine.

The papers read are listed below, broadly in the order in which they were presented.

MacGregor, B.I. (Brazil). Introduction to the Conference and Brazil.

Sauer, D., and Cassedanne, J.P. (Brazil). Classification of the gemstone deposits of Brazil.

Koivula, J. (USA). Mirror image reversals: inclusions as symmetrical art.

Chikayama, A. (Japan). Recent report from Burma: gem occurrences and gem emporium.

Chalmers, O. (Australia). The opal fields of South Australia.

Poirot, J.P. (France). Coatings of imitation pearls.

Pienaar, H.S. (South Africa). A numerical approach to gem identification.

Kanis, J. (Portugal). A new emerald deposit in Zimbabwe 'Machingwe Mine'.

Barros, J.C. (Brazil), and Kinnaird, J. (UK). Emeralds from Goias State, Brazil.

Schwarz, D. (Brazil). A locality review of known Brazilian emerald occurrences and a mineralogical comparison of emeralds from major producing areas.

Gübelin, E. (Switzerland). Recently observed inclusions in gemstones.

Zwaan, P.C. (The Netherlands). Gemstones from Cuba.

Saul, J.M. (France). An unusual glass specimen from East Africa.

Graziani, G. (Italy). Blue corundum analyzed by unusual techniques.

Ripoll, V.M., de Brum, T.M., Hofmeister, T., and Juchem, D. (Brazil). Mineralogical and gemmological characteristics of corundum from Santa Catarina.

Shida, J. (Japan). The colour of padparadscha sapphires.

Arps, C.E.S. (The Netherlands). Observations on gem gravels from Sri Lanka.

Juchem, P.L., Hofmeister, T., and de Brum, T.M. (Brazil). Gemstones in the State of Rio Grande do Sul, Brazil.

Segnit, E.R. (Australia). Some notes on tourmaline, black opal and 'treated matrix' from Autralia.

Pie Roger, R.M. (Spain). Gemmological materials found in Spain.

Jobbins, E.A., Scarratt, K., and Harding, R.R. (UK). The British Crown Jewels.

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Fig. 1. Hand sorting emerald concentrate on a moving belt at the Belmont emerald mine near Itabira, Minas Gerais, Brazil.

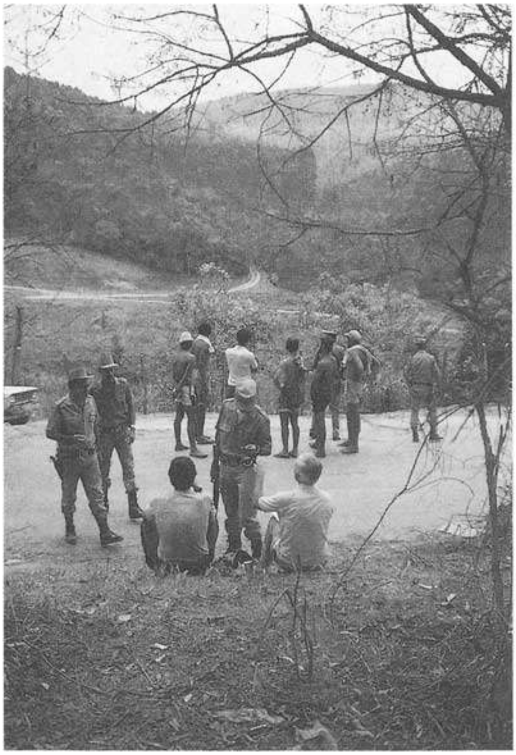

Fig. 2. The Hematita alexandrite deposit (background) with members of the Conference (seated) discussing gemstone rough with military police guarding the deposit. Garimpeiros (free-lance miners) are standing behind the police.

Becker, G. (West Germany). Apatite – colour change by heat treatment.

Middleton, R.C. (Brazil). The geology around the Virgem de Lapa gem-bearing pegmatite bodies.

Castelo Branco, R.M.G., de Menezes, J.S. (Brazil). Occur rences of gems in the State of Ceara, north–eastern Brazil.

Superchi, M. (Italy). An Italian ornamental material: the 'pot stone' from Valmalenco (Lombardy).

Eliezri, I.Z. (Israel). Geological evidence supporting identification of the gemstones in the breastplate of the High Priest in the Bible.

Zoysa, J. (Sri Lanka). A chrysoberyl–bearing pegmatite near Pattara, Sri Lanka.

Schiffmann, C. (Switzerland). Subjects of topical interest raised and discussed.

Svisero, D.P. (Brazil), and Meyer, H.O.A. (USA). Diamonds and kimberlites in continental Brazil: a review.

Haralyi, N.L.E. (Brazil). Considerations concerning flat tened and elongated diamonds.

Sobolev, N.V. (USSR). Comparative study of crystalline inclusions in diamonds from the USSR and India.

Koivula, J.I. (USA). Visual evidence of elastic deforma tions in diamonds.

Meyer, H.O.A. (USA). Diamonds deposits of Venezuela.

Hughes, R.W. (Thailand). Gemmological developments in Bangkok – new treatments, techniques, etc.

Saul, J. (France). The origins of diamonds and the exist ence of porosity and carbonate-rich fluids deep in the crust.

Miyata, T., and Hosaka, M. (Japan). On the synthesis of rose quartz.

Schmetzer, K. (West Germany). Methods of distinction of natural and synthetic citrine.

J. Gemm., 1988, 21, 1

The refractometer – distant vision and awkward specimens

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Distant vision is one of those grey areas which lurk in the gemmological shadows.

It is easy enough to go over the prescribed routine (see Figure 1) but when a keen student is bold enough to say 'I don't find it easy because the blob is generally too vague to see exactly, when bisected by the shadow', what can one do?

Knowing that communication arises from the communicant seeing and understanding, and not in the instructor's teaching, one can either hope for the bell, repeat the exercise more thoroughly, or search for inspiration. In searching for inspiration I took one of the nearby fibre optic lights and directed the light on to the stone under test, whilst leaving the Rayner monochromatic light source in the conventional position (see Figure 2). The vague blob produced by the monochromatic light source acting on a green jadeite suddenly registered bright green as the fibre optic light transmitted the green of the stone down through the refractometer optics to register within the liquid blob shadow on the scale (Figure 3). The bisection position could now be seen quite positively and a usefully accurate refractive index obtained. Most gems submitted to distant vision techniques are generally transparent to semi-opaque and therefore permit the fibre optic light to penetrate the specimen and project its colour on to the scale.

The technique is also successful with the occasional opaque stone, when the fibre optic light can be aimed horizontally at the liquid interface of the specimen under test and the refractometer prism.

While this method may not achieve third place decimal accuracy with distant vision, one point in its favour is that we only need to bring the test

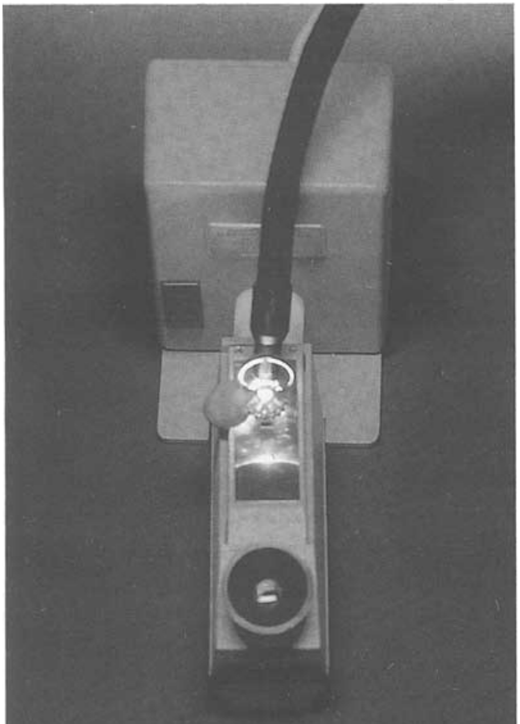

Fig. 2. Fibre optic light source directed on to the stone under test.

Fig. 3. Bright green blob seen when fibre optic light was directed through jadeite.

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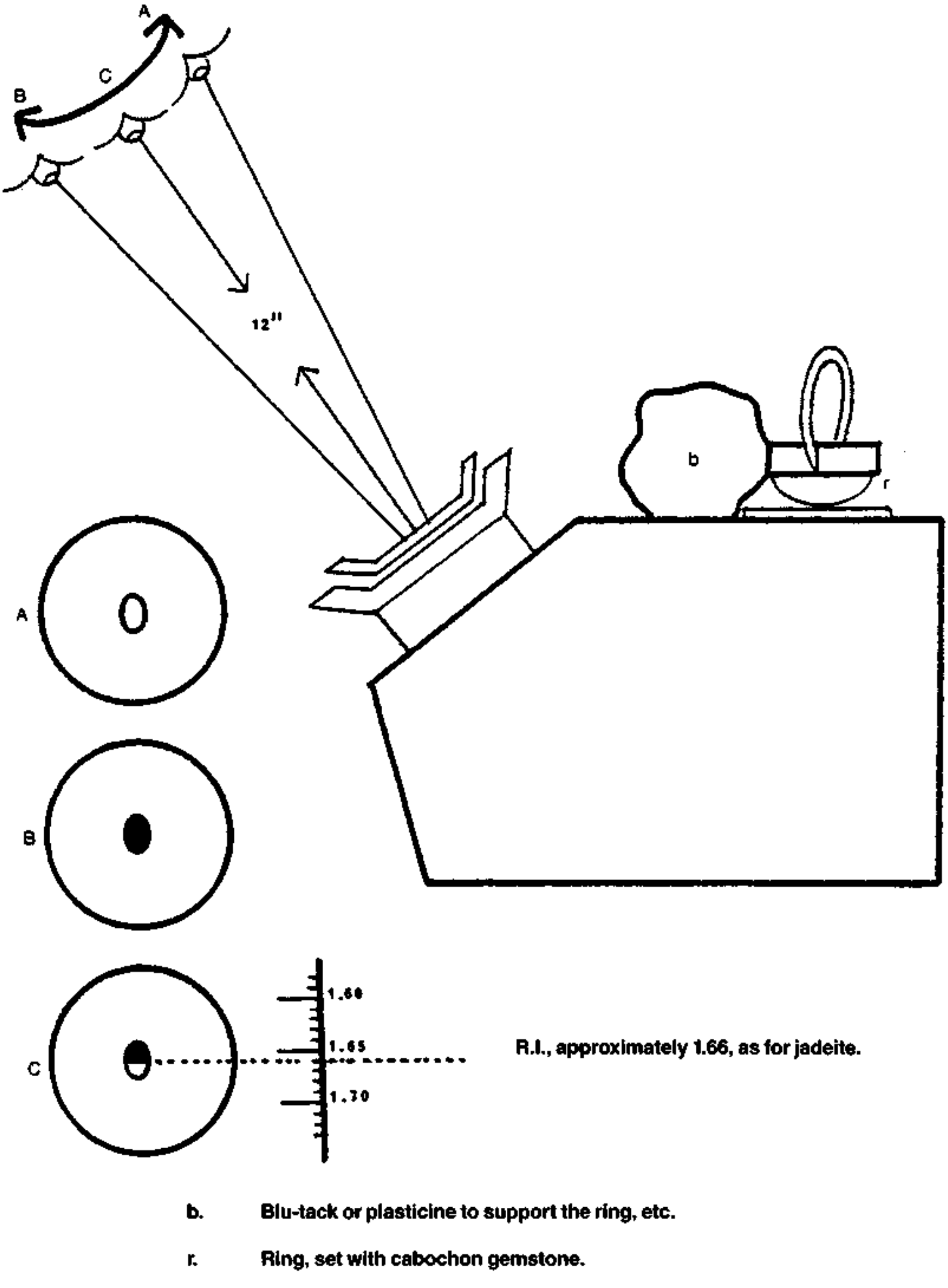


Fig. 1. Distant vision technique for cabochons, etc.

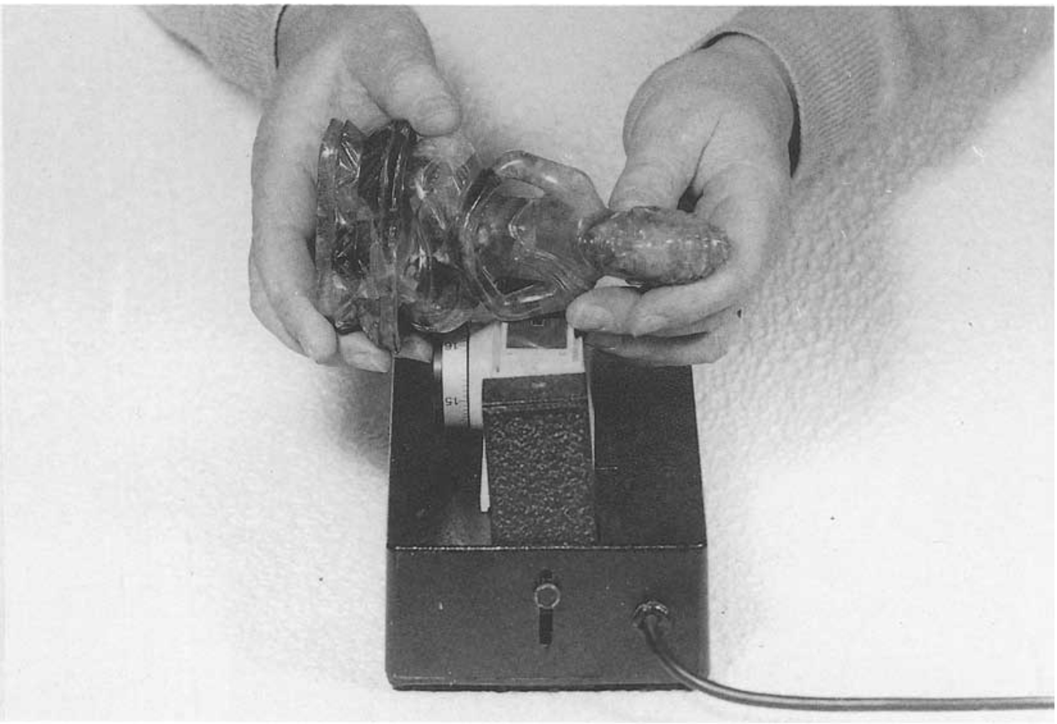


Fig. 4 A fluorspar Buddha carving on the refractometer.

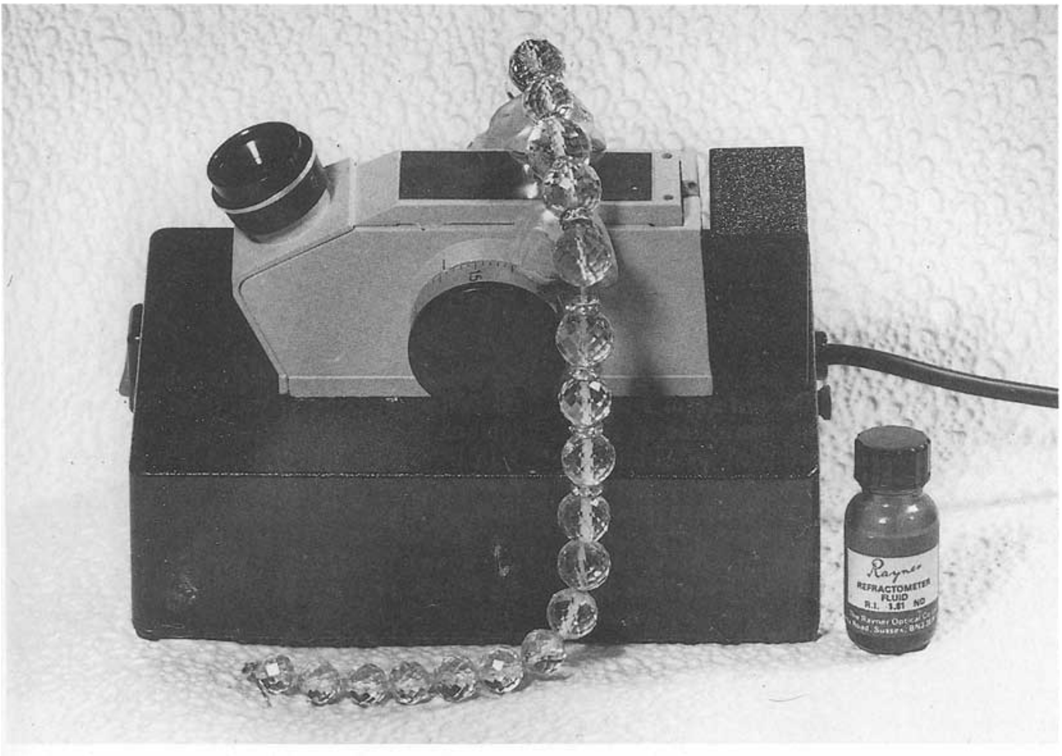
material into contact with the refractometer prism, and virtually all cabochon gems oblige by projecting beyond the setting, thus facilitating such contact. What is not generally appreciated from this is that all sorts of sizes and shapes can be tested in this way and therefore beads, baroque shapes, carvings, bangles and the like, can be accommodated. Figure 4 shows a Buddha carving in fluorspar being tested. I feel it important to mention that the best results for distant vision with a refractometer are gained in the 1.50 to 1.70 range of refractive indices. Above and below these values the determinations become extremely cramped and difficult to extract accurately. The difficulty outside this central range is in obtaining a blob bisection position. The critical bisection is aided in much higher or lower refractive gems by sliding the specimen gently off the central position of the prism, but while this enables the bisection position to be achieved, it also introduces a slight error.

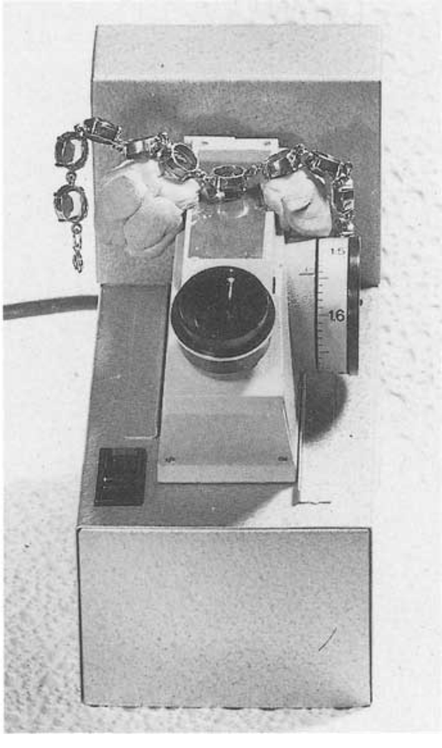
To illustrate this, select the flat table facet of a cut rock crystal and position it centrally on the refractometer as for a normal direct scale reading. The ordinary ray should register 1.544. While watching the shadow reading, slide the specimen gently toward the eyepiece of the instrument and the reading will lower to about 1.540, and when it is slid gently towards the back of the instrument the ordinary ray will rise to about 1.548. It is good refractometer practice to keep such a specimen handy in your refractometer case as it keeps an eye on the accuracy of your instrument, and if you should find a slight error of, say, 0.003 when the rock crystal is centrally located on the prism, then this can be added to, or subtracted from, all subsequent readings to counterbalance the constant error.

Chunky bracelets, earrings and faceted bead necklets, can cause some difficulty in arriving at a 'safe' RI measurement; the main concern being to protect the instrument from the jewellery 'running off' the refractometer and chipping the prism. Large blobs of Blu-Tack or plasticine are useful in acting as control holds over the jewellery and so permit gentle contact to be made between gem and the soft and brittle prism (see Figure 5, the bead necklace, and Figure 6, the faceted stone bracelet).

The above details are abstracted from 'The refractometer technique', a highly informative chapter in a forthcoming book *Practical diamond and gem identification* to be published by NAG Press Ltd.

[*Manuscript received 26 October 1987.*]





Figs. 5 and 6. Large balls of Blu-Tack are positioned on the flanks of the refractometer. These take a firm hold of the necklet and bracelet and allow them to be straddled across the prism so that one gem at a time may be carefully lowered into contact with the prism.

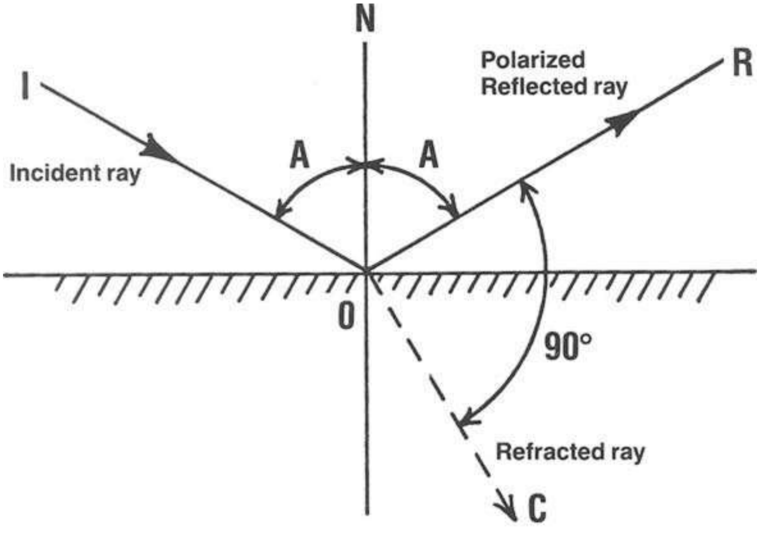
Further development of the Brewster-angle refractometer

Peter Read, C.Eng., FGA

Brewster's law states that complete polarization of a ray reflected from the surface of a denser medium occurs when it is normal (i.e. at right-angles) to its associated refracted ray within that medium (Figure 1). If the Brewster angle of polarization is A, then the refractive index of the reflecting medium is equal to *tan A*. (The plane of polarization is the same as the plane of the reflecting medium, which is why vertically polarized sunglasses cut down the glare from horizontal surfaces such as the sea.)

Although B.W. Anderson proved that a gemstone's refractive index could be derived by utilizing the Brewster angle of polarization,[1] he told the writer that this method of measurement was not developed by him into a usable instrument because of the mechanical difficulty involved in rotating a beam of light about the facet surface of a gemstone while simultaneously following the movement of the reflected ray with a suitable polarization detector (although, in hindsight, there was a simpler solution!).

In 1979, the writer built his first experimental Brewster-angle refractometer[2] which used a high-intensity beam of collimated white light and passed the rays reflected from the polished surface of a gemstone through a vertically-orientated polarizing filter onto a translucent screen. The Brewster angle of polarization was detected by varying the angle of the incident ray until the light spot on the screen was extinguished, and this angle was translated via a scale into an RI reading. Limitations of this simple optical model were two-fold. Because white rather than monochromatic light was used, the extinction of the light spot on the screen was not total at the Brewster angle; the sensitivity of the instrument was further limited by the low intensity of the imaged light spot (this was due partly to the



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light absorbed by both the polarizing filter and the screen, and partly to the reflectivity of the gem's surface – particularly in the case of low RI stones).

By coincidence, while the writer was evaluating this first model, Dr R.M. Yu (of Hong Kong University) was also exploring the possibility of using the Brewster-angle phenomenon as a means of measuring a gem's RI. With Yu's method,[3] a graduated transparent scale is illuminated by a fluorescent lamp whose light is diffused by means of a strip of translucent white plastic. Light from the illuminated scale is reflected from the polished surface of the gem and viewed through an appropriately orientated polarizing filter. As the various points on the scale subtend different angles to the reflecting surface of the gem, the observer sees a dark band on this otherwise evenly illuminated scale, this band occurring at angles of viewing close to the Brewster angle for the gem. The position of the band on the scale can therefore be used as an indication of the gem's RI, and the scale can be calibrated accordingly.

The recent availability of a small, relatively low-cost, laser using a helium-neon plasma tube with a vertically-polarized output of 0.5 mW at 632.8 nm has enabled the writer to develop a more sophisticated electronic version of his original optical model.

In this redesigned version (Figures 2-4) the laser is mounted so that it can be pivoted through 20 degrees beneath a 1 mm diameter gemstone test aperture, with the pivot fulcrum coincident with the aperture position (Figure 5). When a gemstone is placed in position over the aperture, the beam reflected from the polished surface of the gem is detected by a photodiode. To ensure that the reflected laser beam is detected over the full range of angles, a photodiode was chosen that has a light sensitive area of at least 9 mm^2, and this is placed close to the point of reflection.

The photodiode output is amplified and displayed on a panel meter. Because of the high polarization ratio of the laser (500:1), a very positive null is obtained on the meter reading when pivoting the beam through the gem's Brewster angle. To avoid the necessity of fitting a mechanical scale to translate the beam/laser angle into an RI reading, a small transducer has been fitted to the laser pivot shaft. This converts the angular movement of the laser into a voltage which, via a 'Null/RI' change-over switch, is then displayed as an RI reading on the same panel meter. While the original model covered the RI range of 1.43 to 2.90 (fluorspar to rutile), the new version has been designed to include high-RI materials such as hematite and has

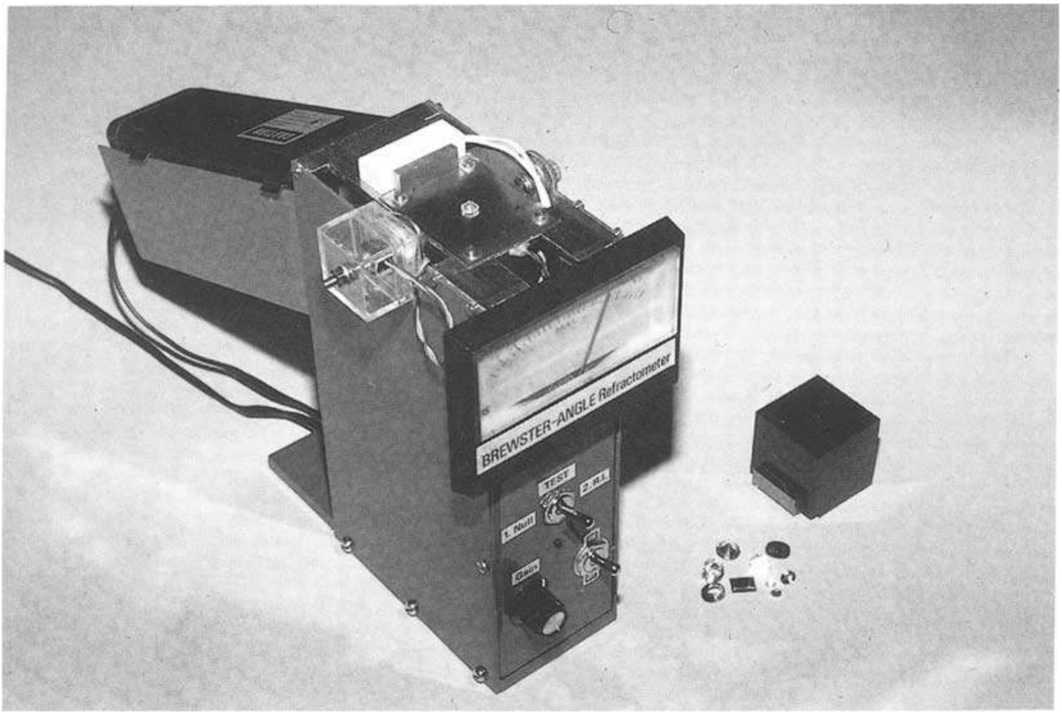
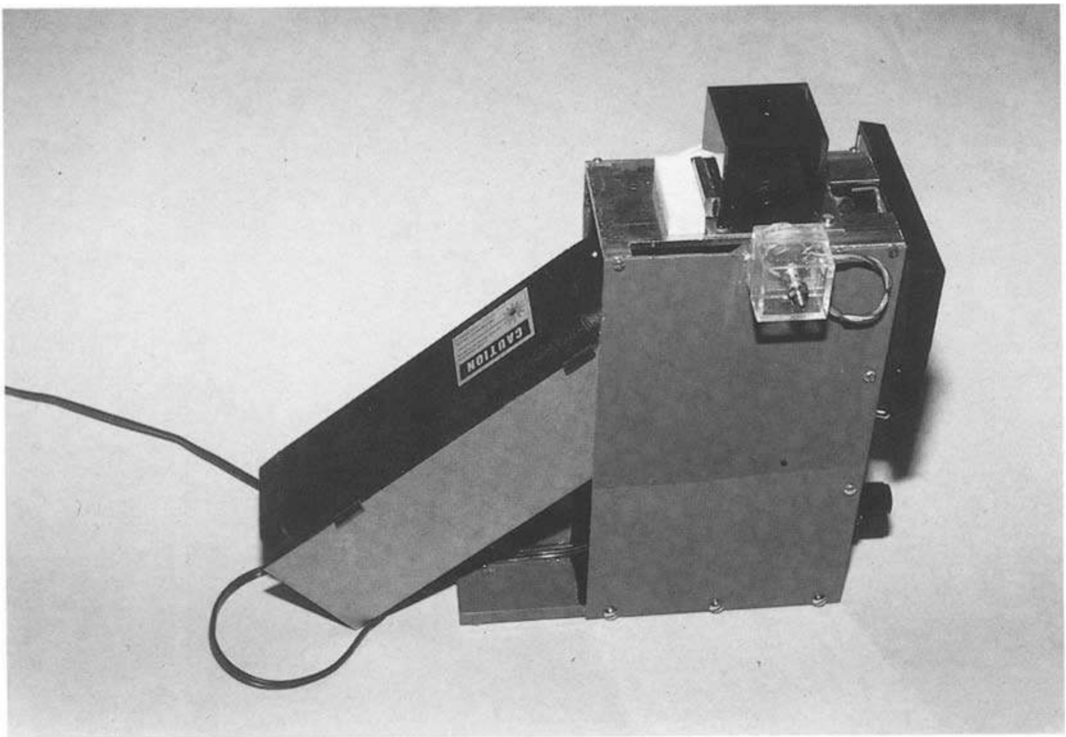


Fig. 2. General view of the experimental Brewster-angle refractometer. The magnetic interlock has been by-passed and the safety cover removed to show a synthetic rutile specimen illuminated by the laser beam.

Fig. 3. (Left). View of the instrument's control panel. The panel meter is used via the two-position 'TEST' switch for both null indication when pivoting the laser beam, and for direct readout of a gem's RI when the null is found.

Fig. 4. (Below). Side view of the refractometer showing the angle/voltage transducer fitted to the laser pivot and the safety cover in position over the test platform.



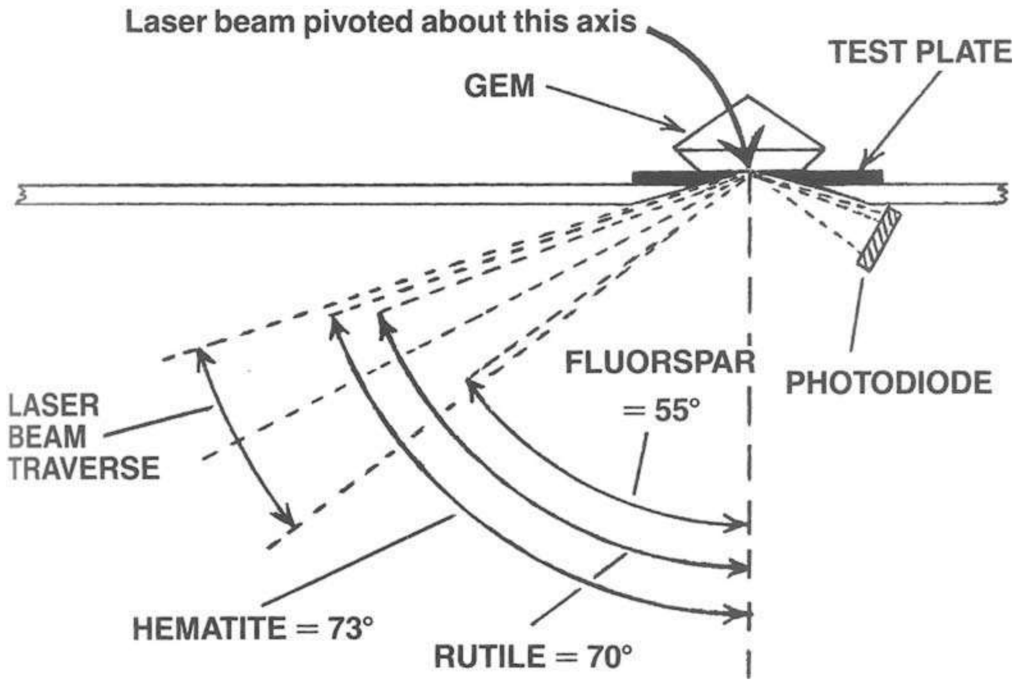


Fig. 5. Sketch showing the optics of the experimental refractometer.

a measuring range of 1.40 to 3.3.

To allow for possible non-linearities in the angle/voltage transducer, the RI scale of the panel meter was calibrated by first measuring a series of ten gemstones with RIs ranging from 1.43 to 3.2. From a graph relating these RIs to the scale readings on the meter, evenly spaced calibration points were derived (1.4, 1.5, 1.6 etc) and marked on the meter scale.

To avoid overloading the null meter when testing high reflectivity stones such as CZ, diamond and rutile, a 'Gain' control is fitted to reduce the amplification of the photodiode output until the vicinity of the Brewster angle is reached. As a further safeguard, this time to the operator's eyes, a light-tight box, painted on the inside with matt black paint to absorb the laser beam, is placed over the gem during testing. This safety cover is fitted with a small bar magnet which operates a magnetic reed switch to turn off the laser beam when the cover is removed from the test platform.

While this instrument cannot yet resolve refractive indices to an accuracy better than ±0.01 at the lower half of its range, and ±0.1 towards the top end of its scale, it is hoped that a further version with improved laser pivot bearings, a friction-lock control to adjust the laser beam angle (at the moment, the laser is pivoted by hand and cannot be locked in position at the null point), and a 1:5 gearing of the angle/voltage transducer drive, will further improve its capability.

Finally it should be mentioned that one of the main advantages of the Brewster-angle refractometer over the reflectivity meter is that provided the facet of the gem to be tested is reasonably flat, the accuracy of reading is not affected by the degree of polish as this only affects the sharpness of the null and not its angular position. In use, the Brewster-angle refractometer is a much quicker means of determining RI than by measuring the angle of minimum deviation on a table spectrometer. Unlike high-range critical-angle refractometers (using strontium titanate or cubic zirconium oxide tables) the Brewster-angle model also has the advantage of not requiring toxic contact fluids.

Acknowledgement

In conclusion, the writer would like to acknowledge the assistance afforded by the Rayner Optical Company in constructing the mechanical section of the experimental model.

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1. Anderson, B.W., 1941. Brewster angle, Gemmologist, **X**, 61-3.
2. Read, P.G., 1979. An experimental Brewster-angle refractometer. *Journal of Gemmology*, **XVI**, 8, 537-41.
3. Yu, R.M., 1979. The Brewster-angle refractometer. *Gems & Gemology*, **Winter**, 245-7.

[*Manuscript received 2 September 1987.*]

Gemmological Abstracts

AHRENS, J.R., 1987. The Burma emporium. *Lapidary Journal*, **41**, 4, 42–50, 4 figs in colour.

The article describes a visit to the government-run gem auctions in Rangoon. M.O'D.

ATKINSON, W.J., 1987. The exploration and development of Australian diamond. *Industrial Diamond Review*, **47**, 1, 1–8, 2 maps.

Alluvial diamonds have been known in Australia since 1851 but the most significant event was the setting up of the Ashton Joint Venture in 1972 to explore for diamonds in the Kimberley region of Western Australia, which has resulted in the location of ~90 kimberlite and lamproitic bodies and two alluvial diamond deposits. The diamondiferous Ellendale olivine lamproites (25 m.y.) was discovered in 1977. Diamondiferous kimberlite, although theoretically predictable, had yet to be found on the Australian continent, and a separate suite of indicator minerals had to be identified as characteristic of the olivine lamproites within the leucite lamproites; this suite, of fine grain size, is dominated by chromite. The richly diamondiferous Argyle lamproite was discovered in 1979. These olivine lamproite diatremes have large surface areas but extremely narrow feeder pipes. The Argyle diatreme (1100 ≃ 1200 m.y.) is infilled with sandy lapilli-tuff consisting of ~40% rounded quartz grains together with lamproite clasts. The Argyle pipe contains 3 ppm diamonds, mostly as brown, frosted, irregular shaped stones with inclusions of graphite; they are generally heavily resorbed dodecahedra, i.e. predominantly industrial quality currently averaging $6.50 carat, but with some gem material, including very rare pink stones. Two associated alluvial deposits average 4 carats/tonne. R.A.H.

BALFOUR, I., 1987. Famous diamonds of the world, XXXI. Eugénie. *Indiaqua*, **47**, (1987/2), 117–19.

The rough from which the Eugénie was cut weighed more than 100 carats and was found around 1760 in the province of Minas Gerais, Brazil. It is said that the stone was cut in Holland into an oval-shaped brilliant of 51 ct. It was given by Catherine II, Empress of Russia, to Prince Potemkin (for a time the stone was known as the 'Potemkin' diamond). After Prince Potemkin's death, the diamond was bought by Napoleon III for his young bride, Empress Eugénie. The diamond had two further owners, but its whereabouts now are unknown. P.G.R.

BALFOUR, I., 1987. Famous diamonds of the world, XXXII. Kimberley. *Indiaqua*, **47**, (1987/2), 120–1.

The Kimberley diamond, allegedly from the Kimberley Mine in South Africa, weighing 490 carats in the rough, was initially fashioned into a 70 carat emerald-cut stone in 1921. In 1958 it was recut to its present weight of 55.09 carats. The Kimberley was sold to a private Texas collector in 1971. P.G.R.

BANK, H., 1987. (a) Schwarzer Turmalin als Glas bestimmt. (Black tourmaline identified as glass.) *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, **36**, 1/2, 88–90; (b) Schleifwürdige Spinelle aus Nigeria. (Gem quality spinel from Nigeria.) Id., 90; (c) Zu den optischen Daten von Phenakit. (On the optical data of phenakite.) Id., 90–2.

(a) An opaque black cabochon of 0.106ct, that had been certified by an overseas gemmological laboratory as being glass, was found to be tourmaline after careful testing. (b) The second note deals with gem quality spinels from Nigeria. The crystals were of a pale violet colour. (c) The last note deals with phenakite and compares optical data of stones from Brazil, Madagascar, Nigeria and the USSR. E.S.

BANK, H., LEYSER, K.-G., MAES, J., 1987. Grüne Diopside aus Ostafrika als Grossulare bzw. Kornerupine angesehen. (Green diopsides from East Africa wrongly identified as grossularites and kornerupines.) *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, **36**, 1/2, 86–8.

Details of the method of correct identification of green diopsides are described. E.S.

BOSE, M., 1987. Dearer diamonds. *The Times Newspaper*, No. 62873, 15 September 1987, p.33.

Diamond prices have been rising owing to big

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buying by the Japanese, probably due to the strength of the yen against the dollar. Diamonds should be valued not as investments but for their beauty, rarity and long-lasting quality. J.R.H.C.

Brightman, R., Willhelm, M.-L., 1987. Resin bonded malachite. *Australian Gemmologist*, **16**, 6, 239-40, 2 figs in colour.

A bangle from Tanzania had been made from malachite fragments set in matrix of resin and malachite dust. Resin fluoresced blue/green under ultraviolet light and contained bubbles. RI 1.54-1.55 was due to resin. Bubbles and fragments obvious with lens. R.K.M.

Brown, G., 1987. The Kruss UV spectroscope (model UVS-2000). *Wahroongai News*, **21**, 1, 18-19.

A new instrument using mercury vapour light w/l 250 to 600nm and a fluorescent integrating screen to display unabsorbed emission lines. Report says that one would expect a little more diagnostic and discriminatory potential for the price (DM6860). R.K.M.

Brown, G., Bracewell, H., 1987. 'Citron chrysophrase'. *Australian Gemmologist*, **16**, 6, 231-3, 4 figs in colour, 1 map.

A massive lime-green material associated with common opal, magnesite and chrysoprase, found at Yunamindera, a gold mining area of Western Australia, had hardness about 4½, SG 2.90, spot RI 1.60 with large DR. Slow solubility in hydrochloric acid suggested a carbonate, probably a nickeloan magnesite. Chrysoprase is a misnomer. R.K.M.

Clancey, A., 1987. Rocks in gemmology. *Wahroongai News*, **20**, 10, 24-9.

A considered attempt to relate gem species to their types of parent rock, a subject for a larger book here reduced to six pages. R.K.M.

Cyr, K.R., 1987. Pride of the Philippines. *Lapidary Journal*, **41**, 4, 51-8, 1 fig. in colour.

Ornamental materials from the Philippines include shells of various kinds and varieties of quartz. M.O'D.

Fryer, C.W., ed., Crowningshield, R., Hurwit, K.N., Kane, R.E., 1987. Gem Trade Lab notes. *Gems & Gemology*, **23**, 2, 104-10, 20 figs in colour.

An epidote with tremolite needle inclusions and opals which proved to be a new type of assembled stone, opal chips cemented into a glass dome, are described. A cultured pearl drop filed or otherwise 'worked' at one end, lost its 'orient' and turned milky – no explanation could be offered. A sphere from the Upper Cretaceous era had been called a fossil pearl; confirmed to have a concentric structure but the absence of nacre precluded calling it other than a calcareous concretion.

A nice peridot cat's-eye is illustrated – these are rare. Dyed yellow quartzite, offered in all innocence as jadeite at the 1987 Tucson Gem and Mineral show, gave a spot reading of 1.55 and dye came off on an acetone swab.

An exceptionally deep-cut pale blue sapphire resembled a 'native-cut' Ceylon stone. Colour was entirely in the culet and curved zoning was detected there. A Plato test confirmed this as synthetic. A large yellow sapphire showed clearly visible curved zoning which is unusual in synthetics of this colour. A blue sapphire had discoid fractures which confirmed heating, and irregular misty 'smoke-ring' inclusions which have not been seen before.

A small brownish-green stone from Thailand was identified as sapphirine by RI, 1.711 and 1.718. These very rare gems are more normally a deep sapphire blue. Carved beads offered at Tucson by dealers from Beijing were shown to be surface dyed serpentine when sawn in half and polished – dye was soluble in acetone. A bi-colour drop topaz was purplish-pink and orange-yellow either side of a twin plane. All items are illustrated. R.K.M.

Fuhrbach, J., 1987. Want to buy a 'hot diamond'? – a letter. *Gems & Gemology*, **23**, 2, 111, 2 figs.

A 'black diamond' in a ring caused redness and a sore on the wearer's finger. Unset, the stone had an SG of 5.272 but no RI was obtained. A Geiger counter confirmed that there was strong gamma radiation and the amorphous substance was identified as pitchblende. R.K.M.

Galia, W., 1987. Eine neue Generation synthetischer Rubine von P.O. Knischka unter Verwendung natürlicher Nährsubstanz. (A new generation of synthetic rubies from P.O. Knischka grown without the use of seeding crystals.) *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, **36**, 1/2, 19-31, 21 figs (4 in colour), 1 table, 1 graph, bibl.

The synthetic ruby crystals were produced without seed crystal by spontaneous nucleation from flux according to US patent 4 525 171. These crystals are now being produced commercially. The author describes a ruby prism of 328.5 ct. Growth takes eighteen months with hardly any platinum inclusions. No curved growth marks can be seen. There are some milky or cloudy dispersions. Traces of Pt, Na, W and Ta were detected, showing that the crucible was platinum and the flux contained

$Na_2W_2O_7$ and Ta_2O_5. The UV absorption was found by using a recording double-beam Leitz Unicam spectrophotometer as well as a Krüss UV spectroscope. The new material yields stones of up to 5 ct of high transparency. The colour leans towards purple. RI 1.762–1.770, DR 0.008. SG 3.97–4.01. Definite dichroism from reddish-orange to saturated purplish-red. E.S.

GNEVUSHEV, M.A., ZIL'BERSHTEIN, A.H., KRASHENNIKOVA, G.E., 1986. (Birefringence of diamonds from shock metamorphosed rocks.) *Zapiski Vses. Min. Obshch.*, **115**, 4, 442–6.

Birefringent plates (⊥[111]) of diamond from shock metamorphosed gneisses were studied by optical crystallographic methods. Two of the plates have their optic axis oriented along [100] of the diamond and their birefringence must be due to deformation. The latter is calculated to have required a residual mechanical stress of 21 and 41 kbar. The fact that the elongation of these plates corresponds with the lowest *n* is further evidence of a deformation origin of the birefringence. R.A.H.

HAUGEN, S.O., 1987. A system for evaluation of opal. *Australian Gemmologist*, **16**, 6, 213–15.

A precis of a suggested points system of evaluation for this immensely variable gem. R.K.M.

HEINDORFF, J., 1986. Transparent plagioclase feldspar. *Wahroongai News*, **20**, 10, 21–3.

Ms Heindorf says [gemmological] reference books give little information on plagioclase gems, so she has condensed some available facts to remedy this. R.K.M.

HENN, U., 1987. Inclusions in yellow chrysoberyl, natural and synthetic alexandrite. *Australian Gemmologist*, **16**, 6, 217–20, 12 figs in colour.

Inclusions can indicate origin but need microprobe to identify. Natural alexandrites usually show phlogopite regardless of sources. Some Japanese synthetics are clean, others show flux, platinum, and fingerprint 'veils' ('rumpled feathers'). Origins difficult or impossible from inclusions. R.K.M.

HEYLMUN, E.B., 1987, Virgin Valley. *Lapidary Journal*, **41**, 3, 33–44, 5 figs (3 in colour).

Fine dark opal pseudomorphous after wood is found in the Virgin Valley area of Nevada, USA. M.O'D.

INGELSON, A., 1987. Western Canada's finest. *Lapidary Journal*, **41**, 4, 20–6, 6 figs in colour.

A short account of mineral museums in western Canada and their contents. M.O'D.

KANE, R.E., 1987. Three notable fancy-colour diamonds: purplish red, purple pink, reddish purple. *Gems & Gemology*, **23**, 2, 90–5, 9 figs in colour.

A gemmological report on three diamonds sold early this year at Christie's, New York, for quite astonishing record prices – the highest, an 0.95ct purplish-red with surface blemishes, for $880,000. All three stones are strongly coloured, and are said to have originated from Brazilian mines more than thirty years ago. A 415.5nm absorption line was seen at room temperature in the largest stone and again in the other two when moderately cooled. LW UV fluorescence was bluish-white in all three stones but less intense in the largest one. X-rays gave similar fluorescence. No phosphorescence. Polariscope showed interference indicating patterns of considerable strain mottled in linear forms, sometimes cross-hatched. The 0.59ct stone was colour grained corresponding with the strain patterns. Inclusions of olivine and graphite were found. R.K.M.

KELLY, S.M.B., BROWN, G., 1987. A new synthetic emerald. *Australian Gemmologist*, **16**, 6, 237–8, 7 figs in colour.

Five stones were thought to be Japanese made by the Gilson process. RI 1.533–1.588, SG 2.64, with small variations. Heavily included, transparent to semi-transparent. Chelsea filter, red. No fluorescence to UV. Variable strength absorption spectra. R.K.M.

KIEFERT, L., SCHMETZER, K., 1987. Pink and violet sapphires from Nepal. *Australian Gemmologist*, **16**, 6, 225–9, 16 figs in colour.

Rough, faceted and cabochon specimens examined, exact origins unknown. Crystals had calcite, phlogopite, margarite and rutile adhering. Constants normal for corundum. Colours pink to light red and reddish-violet, sapphires rather than rubies. Low quality because extensive inclusions preclude faceting other than in very small sizes. R.K.M.

KIEFERT, L., SCHMETZER, K., 1987. Blaue und gelbe Sapphire aus der Provinz Kaduna, Nigeria. (Blue and yellow sapphires from the province of Kaduna, Nigeria.) *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, **36**, 1/2, 61–78, 35 figs (3 in colour), bibl.

An English version of this article was published in the *Journal of Gemmology*, 1987, **20**, 7/8, 427–42. E.S.

KOIVULA, J.I., 1987. The rutilated topaz misnomer. *Gems & Gemology*, **23**, 2, 100–3, 7 figs in colour.

Needles in colourless topaz, incorrectly identified as rutile, are shown to be hollow growth tubes stained by iron oxide. R.K.M.

LIND, TH., HENN, U., BANK, H., 1987. Nach dem Hydrothermalverfahren hergestellte synthetische Smaragde aus der UdSSR. (Hydrothermally produced synthetic emeralds from the USSR.) *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, **36**, 1/2, 51–60, 9 figs (2 in colour), bibl.

The authors had the opportunity to examine 50 synthetic emeralds produced in the USSR by hydrothermal method. SG 2.68–2.7, RI n_o1.578–1.584, n_e1.571–1.581. DR 0.005–0.008. Absorption spectrum showed strong iron bands causing strong pleochroism of yellowish-green to blue. E.S.

LIVSTRAND, U., 1987. The black opals of Lightning Ridge. *Lapidary Journal*, **41**, 3, 49–56, 4 figs (1 in colour).

A brief guide to the mining of opal at Lightning Ridge, New South Wales, Australia, is given. M.O'D.

MARTIN, D.D., 1987. Gemstone durability: design to display. *Gems & Gemology*, **23**, 2, 63–77, 18 figs in colour.

An excellent summary of many causes of damage to gemstones in manufacture, display, cleaning, repair and wear. A valuable paper! R.K.M.

PECOVER, S.R., 1987. New concepts on the origin of sapphire in northeastern New South Wales. *Australian Gemmologist*, **16**, 6, 221.

Associates sapphire with explosive volcanic formations and with the rare diamond occurrence. Suggests that recognition of tuffaceous rock formations as primary sources of sapphire could lead to major expansion of the mining industry in this area. R.K.M.

POUGH, F.H., 1987. Gem treatment: scapolite. *Lapidary Journal*, **41**, 4, 14–17.

This is a general description of the scapolite mineral group. M.O'D.

POUGH, F.H., 1987. Anhydrite. *Lapidary Journal*, **41**, 5, 16–18.

Occurrences of anhydrite are described with notes on fashioning possibilities. M.O'D.

POUGH, F.H., 1987. Actinolite and tremolite, a couple of amphiboles. *Lapidary Journal*, **41**, 6, 16–18.

Brief description of the ornamental amphiboles. M.O'D.

READ, P.G., 1987. Light effects. *Canadian Jeweller*, May 1987, 22.

The use of photoluminescence in gem identification, ranging from the cross-filter method of excitation by means of LW/SW UV and X-rays, is described. Mention is made of the use of UV to distinguish between natural and synthetic diamonds, particularly in the case of the Sumitomo product. (Author's abstract) P.G.R.

READ, P.G., 1987. Polarised light. *Canadian Jeweller*, June 1987, 9.

Contains a brief history of the development of polarising devices, and then describes the use of the konoscope attachment to the polariscope. (Author's abstract) P.G.R.

ROBERT, D., 1987. Topazes bleus aprés traitement. (Blue topaz after treatment.) *Revue de Gemmologie*, 91, 17–20, 6 figs in colour.

Topaz is frequently irradiated to give a deep blue colour. The process of treatment is described. M.O'D.

SCHMETZER, K., 1987. Ein neuer Typ orientierter leistenförmiger Einschlüsse in Spinell. (A new type of lath-like inclusion in spinel.) *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, **36**, 1/2, 11–17, 7 figs, bibl.

The blueish-violet spinel from Sri Lanka with orientated inclusions was tested microscopically, with X-ray single crystal diffraction and by electron microscope. The sample showed four sets of lath-like doubly refracting crystal inclusions, orientated parallel to the three-fold axes of the host. The guest mineral is a Al_2SiO_5 polymorph, probably sillimanite. The new type of inclusion is quite different from the orientated rutile needles or titanium crystals described in Sri Lankan star spinels. E.S.

SCHMETZER, K., 1987. (a) Dreiphaseneinschlüsse in einem gelben Sapphir aus Sri Lanka. (Three phase inclusions in a yellow sapphire from Sri Lanka.) *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, **36**, 1/2, 79–81; (b) Zur Nomenklatur und Bestimmung von Südsee-Zuchtperlen. (Nomenclature and determination of South Sea cultured pearls.) Id., 83–6.

(a) The three-phase inclusions were found in an untreated yellow sapphire from Sri Lanka. The inclusions form tabular negative crystals, orientated with their table parallel top the basal face of the host crystal. They are filled with doubly refractive crystals, as well as liquid gas. Identification of crystal inclusions was not possible, but mica is a possibility with liquid and gaseous CO_2 a probability. (b) Cultured South Sea pearls are either nucleated with round or irregularly- shaped mother-of-pearl beads, or are non-bead nucleated. When seen in X-ray radiographs these so-called Keshi pearls have structures identical with non-bead nucleated tissue-implanted cultured freshwater pearls (Biwa). It can therefore be assumed that these Keshi pearls are non- bead nucleated tissue-implanted. E.S.

Schmetzer, K., Bank, H., 1987. Synthetische Lechleitner-Rubine mit natürlichen Kernen und synthetischen Überzügen. (Synthetic Lechleitner rubies with natural core and synthetic coating.) *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, **36**, 1/2, 1- 10; 21 figs (4 in colour), bibl.

A new type of Lechleitner ruby was investigated. This consisted of a natural core of light-coloured ruby or colourless corundum from Sri Lanka covered by a thin layer of flux-grown synthetic ruby. The natural cores of the examined stones were partly rough crystals, partly bruted or cut stones. A very careful microscopic examination is called for, especially of the contact zone, which can resemble the first generation of the so-called 'Knischka' rubies. Determination of trace elements, especially those of the residue of the flux, as well as X-ray fluorescence, microprobe analysis and spectroscopic examination can help in final determination. E.S.

Schramm, M., Henn, U., 1987. Schleifwürdige grüne Diopside aus Indien. (Cuttable green diopsides from India.) *Zeitschrift der Deutschen Gemmologischen Gesellschaft*, **36**, 1/2, 81-3. bibl.

The prismatic crystals from India have a length of about 3cm, SG 3.27-3.32. RI n_x1.669-1.670, n_z1.698-1.700, DR 0.029-0.030. The relatively high iron content of 2.51 and 4.13% respectively show that the crystals are not pure diopside, but very near to diopside, which is confirmed by the RI. E.S.

Shigley, J.E., Koivula, J.I., Fryer, C.W., 1987. The occurrences and gemmological properties of Wessel Mine sugilite. *Gems & Gemology*, **23**, 2, 78-89, 13 figs in colour.

The purple mangoan form of the rare mineral sugilite is found in small amounts at the Wessel Mine in the Kalahari region of South Africa, some of it intermixed with chalcedony of similar hue. An excellent material for cabochons or for carving, the best is purple or blueish-purple in colour, which looks redder in incandescent light. RI 1.607, massive and multi-crystalline, it shows no birefringence (1.544 for chalcedony when it occurs). SG varies from 2.80, to 2.70 for the chalcedonic material. H 5½ to 6½, tough. Often attractively banded or grained. Absorption band is seen at 419nm, with other narrow manganese bands in darker material, but not in sugilite with high chalcedony content. R.K.M.

Stevens, E., 1986. The diploma course - adequacy or inadequacy. *Wahroongai News*, **20**, 10, 10-15.

A criticism of gemmological teaching in Australia, suggesting objectives which might improve this, including an examination requirement for 100% accuracy in identification. Author is concerned at extreme breadth of educational background among students, from lowest to highest qualifications, and suggests, among other reforms, a pre-entrance education standard. R.K.M.

Stockton, C.M., 1987. The separation of natural from synthetic emeralds by infrared spectroscopy. *Gems & Gemology*, **23**, 2, 96-9, 2 figs in colour.

A laboratory test which is unlikely to be available to the ordinary gemmologist, Fourier transform infrared spectroscopy can distinguish synthetic from natural emerald nondestructively in less than five minutes. Flux synthetics lack water and therefore do not have the strong absorption band between 3400 and 4000$^{cm^{-1}}$ which is present in all natural emeralds. Hydrothermal synthetics contain water and their infrared spectra at those wavelengths are rather similar to those of the natural stones. Other spectral lines will distinguish these. Infrared absorption is greatest in the extraordinary ray so cut stones should be tested in more than one direction to ensure positive identification. R.K.M.

Zeitner, J.C., 1987. Queretaro opals. *Lapidary Journal*, **41**, 3, 20-4, 3 figs in colour.

Occurrences of opals in the Mexican state of Queretaro are described. M.O'D.

Zoysa, E.G., 1987. New gems from the Ratnapura area, Sri Lanka. *Australian Gemmologist*, **16**, 6, 239-40, 3 figs in colour.

Describes chatoyant fibrolite, scheelite and green orthoclase. R.K.M.

Anon. 1987. Gem news. *Gems & Gemology*, **23**, 2, 122-4, 4 figs in colour.

A 14.33 ct rough diamond found when washing for gold in north California is the largest yet from that state. A 1.06 ct alexandrite from a new Brazilian locality has a colour-change to rival that of the finest Russian stones. A 320 ct rough ekanite has been found in Sri Lanka. Chinese pictorial marble tiles from Yunnan are illustrated. A large pink pearl was shown to be coral. R.K.M.

Book Reviews

ARNOTH, J., 1986. *Achate, Bilder im Stein.* (Agate, pictures in stone.) Naturhistorisches Museum Basel, pp.103, illus. in black-and-white and in colour. Price on application.

This is the most attractive book I have yet to see on agate. Using the landscape format, the publishers manage to present over fifty pages of coloured pictures after introductory chapters dealing with agate formation. It is largely a picture book but of the highest quality. M.O'D.

BOYLE, R.W., 1987. *Gold: history and genesis of deposits.* Van Nostrand Reinhold, New York. pp. xvii, 676. Illus. in black-and-white and in colour. £39.95.

The literature of gold is now so large and diffuse that a set of benchmark papers is very welcome. The first chapter deals with the general history of gold and the types of auriferous deposits; it is followed by a large number of papers classified into eighteen chapters. Most papers are accompanied by lists of references and there is an author and a subject index. The editor has provided summaries and comments on the papers which give the book a continuity which it would otherwise lack. The book can, in fact, be read through without too much difficulty though it is fair to say that the level is graduate at least, thus placing it out of the reach of many who might otherwise profit by it. On the other hand the price is reasonable for a work of this size and the standard of production is good.

M.O'D.

FLEISCHER, M., 1986. *Glossary of mineral species.* Fifth edn. Mineralogical Record, Tucson, pp.227. Price on application.

Now the established reference book for mineral names and compositions, the *Glossary* includes about 340 new names for this edition. Additionally, about 750 entries have been changed in some respect about 13 additional mineral groups are added. Following established practice each entry gives chemical composition, crystal system and colour where appropriate. M.O'D.

HABSBURG, G. VON, 1986. *Faberge, Hofjuwelier der Zaren.* (Fabergé, jeweller to the Tsars.) Bayerische Nationalmuseum, Münich, pp.359, illus. in black-and-white and in colour. Price on application.

This is a beautifully produced catalogue of an exhibition of the work of Fabergé, held in 1986 at the Bayerische Nationalmuseum. Fabergé's life and work are described in preliminary chapters.

M.O'D.

LANGE-MECHLEN, S., 1982. *Diamanten.* 3rd revised edn. (Diamonds.) Belser Verlag, Stuttgart, pp.120, illus. in black-and- white and in colour. £14.95.

This short book concentrates upon the cutting and grading of diamond, but also comments briefly upon other important stones in the final chapters. There is a short bibliography. M.O'D.

SUHNER, B., 1984. *Infra-rot Spektren von Mineralien.* (Infrared spectra of minerals.) The author, Basel, 2 vols, pagination irregular. Limited edition of 150 copies. Price on application.

Infrared spectra of 300 minerals are depicted and described. The work, a thesis submitted to the University of Basel, can be consulted at the British Library's Science Reference and Information Service. M.O'D.

VAN PELT, H., VAN PELT, E., 1987. *Birthday book of gems.* Published by the authors, Los Angeles. pp. 126. Illus. in colour. Price on application.

Arranged with a diary page facing a colour picture of a gemstone, this book can be used over the years without confusion as the specific days of the week are not given. However, many, if not most, readers will want to keep the book clean for the sake of the superb illustrations which are as good (at least) as any I have seen previously. It is difficult to single out a particular one, but the black opal (for the first week of October) is quite magnificent. Each picture carries a detailed caption on the diary page. M.O'D.

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Proceedings of the Gemmological Association of Great Britain and Association Notices

OBITUARY

It is with great regret that we announce the death of Mr J.R.H. Chisholm, MA, FRSA, FZS, MRI, FGA, a Vice– President of the Association and past Editor of the *Journal*. A full obituary is given on p.2 above.

Mr Leslie F. Cole, FGA (D.1937 with Distinction), London, died on 6 December 1987. A full obituary will appear in the next issue of the *Journal*.

GIFTS TO THE ASSOCIATION

The Council of the Association have received recently several substantial gifts which will greatly augment the teaching and display collections. Our most sincere thanks to these generous donors.

The late Neville Deane, FGA, bequeathed his extensive collection of some thousands of natural and synthetic cut stones. The scope and variety of the collection, built up over many decades, reflects his wide interests, both as a teacher and a collector. It will be of enormous help to future students.

Mr George Lindley, FGA, who recently retired from the precious stone trade, has donated his collection of historic books to mark this event. These are a most welcome addition to the library.

Mr W.C. Buckingham, FGA, has retired from the gem trade after spending fifty years with the firm of George Lindley & Co. Ltd. To mark his retiral he has presented to the Association his large collection of rough zircons from many localities. He sees the gift as a tribute to former colleagues including George Lindley, Ted Thomson, John Shotton and Jim Hallet among others; also to the new owners of his former firm. To mark the occasion further he wishes to fund a bursary to promote research on the rough zircons by Post Diploma student(s) with a view to publishing the results as a paper(s) in this *Journal*. It is envisaged that there will be a monetary award for suitable papers. Details of the scheme have yet to be finalized, but interested students are invited to write to the Association marking their letters 'The Buckingham Bursary'.

Mr Jerry Johnson, FGA, of J. & J. Gems, USA, has kindly donated several specimens of cut stones and crystal fragments of pleochroic labradorite from Oregon, USA.

NEWS OF FELLOWS

On 17 September 1987 Mr Eric C. Emms, B.Sc., FGA, gave an illustrated talk on the workings of the Gem Testing Laboratory of Great Britain to members of The Academy (a group of young people involved in the London jewellery trade). He was assisted by Mr Nicholas Sturman, FGA.

On 9 September 1987 Mr Michael O'Donoghue, MA, FGS, FGA, gave a lecture entitled 'The origin of gemstones' to the King's Lynn Society of Arts and Sciences.

On 16 September 1987 Mr P.G. Read, FGA, gave an illustrated talk on 'The design of gem testing instruments' to the Yorkshire Centre of the National Association of Goldsmiths in Leeds. After the talk he demonstrated his newly developed Brewster–angle refractometer which uses a polarized laser light source and electronic read–out.

On 23 September 1987 Mr A.E. Farn, FGA, gave a talk to the Wessex Branch of the National Association of Goldsmiths entitled 'The history of pearls'.

During a visit to the Far East last autumn, Mr P.G. Read gave illustrated talks on 'The design of gem testing instruments' to the Singapore Gemologist Society on 4 October, to the Sydney branch of the Australian Gemmological Association on 7 October, and to the Brisbane branch on 14 October. After each talk he demonstrated his Gemdata gem identification program and his Brewster–angle refractometer with laser light source.

MEMBERS' MEETINGS

Midlands Branch

On 18 September 1987 at Dr Johnson House, Bull Street, Birmingham, Dr J.B. Nelson, Ph.D., FGS, FRMS, F.Inst.P., FGA, gave a presentation

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on 'A new gem-testing optical bench'.

On 16 October 1987 at Dr Johnson House Mr Grenville Millington, FGA, gave an illustrated talk entitled 'Inclusions in gemstones'.

On 20 November 1987 at Dr Johnson House Mr Michael J. O'Donoghue, MA, FGS, FGA, gave a lecture entitled 'The geological occurrence of gem minerals in Pakistan'.

North West Branch

On 21 October 1987 at Church House, Hanover Street, Liverpool 1, Mr Bill Ford of the Wirral Lapidary Society gave a demonstration of gemstone faceting.

On 18 November 1987 at Church House the Annual General Meeting was held at which Mr R. Perrett, FGA, was elected Chairman and Mrs I. Knight, FGA, re-elected Secretary.

ANNUAL REUNION OF MEMBERS AND PRESENTATION OF AWARDS

The Annual Reunion of Members and Presentation of Awards was held on 9 November 1987 at Goldsmiths' Hall, London. The Chairman, Mr David Callaghan, presided and welcomed those present. The 1987 examinations had been held in 32 countries throughout the world in over 95 centres. This had involved a great deal of organization by the Education Department of the Association. Mr Callaghan paid tribute to Mr Leslie Fitzgerald and his team for all the work they do. He announced that the Tully Medal had been awarded to Mr Duncan Lamont Pay, a former employee of A. & G. Cairncross, Perth, and that the President of the National Association of Goldsmiths, Mr Jimmy Cairncross, was present to see him receive his award. Over a hundred candidates were present to receive their Gem Diamond Certificates and Diplomas, including those who had come from Canada, Cyprus, Finland, Holland, Hong Kong, Spain, Sri Lanka, Sweden, USA and West Germany.

Mr Callaghan then called upon Dr George Harrison Jones, Chairman of the Education Committee, to present the awards.

After the presentations, Dr Jones delivered his address. He began by thanking the Chairman and members of the Council for according him the privilege of presenting the awards, a privilege which he accepted, with great pleasure, on behalf

Figs 1 and 2. The Tully Medallist, Duncan Lamont Pay, and the Rayner Diploma Prize winner, Henry Chan-Fan Cheng, receiving their awards from Dr George Harrison Jones.

of those members of the Association and those members of the staff who had worked so hard to produce the new correspondence courses.

He continued by congratulating all the candidates who received their certificates and diplomas, awards which were highly regarded throughout the world and which represented a great deal of hard work and application. He further congratulated those who had gained their awards with distinction as this required a mark of 80% or more and was a considerable achievement. He finally congratulated the tutors and lecturers of the successful candidates, who had managed to cover the Diploma course in the short time of one academic year.

The considerable developments in science and technology had produced new materials, new synthetics, new processes and new methods of gemstone treatment, and one had only to look at the examination papers over the years to realize that the course content is continually expanding. With this in mind, the Association had introduced a degree of flexibility into their correspondence courses, so that students may take up to four years to complete the two sections, Preliminary and Diploma. Dr Jones considered that colleges would have to review their systems in the near future with a view to extending their courses.

It was emphasized that the courses and examinations were designed to provide and test for a sound basis for the continuing study of gemmology. It was essential for all gemmologists to keep up-to-date with current developments and as textbooks tend to become out-dated, Dr Jones strongly recommended the reading of current published material such as the *Journal of Gemmology.* He stated that the Association was very fortunate in having the services of Mr Alan Jobbins as Editor and Mrs Mary Burland as Editorial Assistant but that neither the Editor nor his assistant wrote the *Journal.* The *Journal* attempts to cater for all tastes and to keep its readers up-to-date and therefore any member who came across something of interest to fellow gemmologists should write it up and submit it to the Editor for his consideration.

Those wishing to continue their studies would be interested to know that the Association will be launching the new Gem Diamond Home Study Course, produced by Mr Eric Bruton and his team, during 1988.

Dr Jones concluded by saying that the Association was a group of people with a common interest – gemmology – and that he hoped that those present would enjoy a long association with the GA. He also hoped that they would derive as much pleasure from gemmology as he does.

The Vice-Chairman, Mr Noel Deeks, gave the vote of thanks, paying tribute to the work Dr Jones had done on the Home Study course. He said that he hoped that many of those present would become active members of the Association.

In conclusion Mr Callaghan thanked Mr Jonathan Brown, Secretary of the Association, and his staff for their work on the new courses.

COUNCIL MEETING

At the meeting of the Council held on 22 September 1987 at the Royal Automobile Club, Pall Mall, London S.W.1, the business transacted included the following:

(1) the subscription rate for 1988 for Fellows and Ordinary members in the UK was increased to £27.00 and the rate for overseas members fixed at US $65.00;

(2) the following were elected to membership:

Fellowship

Allen, Elizabeth A., London. 1987
Ashby, Paul J., Dover. 1987
Atkinson, Mavis W., Queensbury. 1987
Barnes, Joyce J., Marazion. 1987
Bourke, Mary, Enniscorthy, Wexford, Ireland. 1987
Brummer, Pieter, Almelo, Netherlands. 1987
Carmody, Justine L., Thames Ditton. 1987
Chang, Nancy A., Hong Kong. 1987
Chanter, James E., Newton Abbot. 1987
Cheng, Henry C.F., Kowloon, Hong Kong. 1987
Cheng, Lau K.L.K., Kowloon, Hong Kong. 1987
Dodani, Manoj B., Kowloon, Hong Kong. 1987
Dunstall, Robert, Northampton. 1987
Forsberg, Pierre G., Kisa, Sweden. 1987
Fox, Julie A., Maidstone. 1987
Griffiths, Sarah J., Carshalton. 1987
Groenenboom, Peter, Amsterdam, Netherlands. 1979
Hawkins, Philippa L., London. 1987
Hayes, Alan G.J., Stockport. 1987
Hud, Julie A., Nottingham. 1987
Hud, Michael, Nottingham. 1987
Humpage, Susan A., Edgbaston. 1987
Indrebø, Solveig, Oslo, Norway. 1986
Johnson, Jane, Headcorn. 1976
Kangasniemi, Risto I., Tampere, Finland. 1987
Lightfoot, Paul, Ottery St Mary. 1987
Lindquist, Maria T., London. 1987
McDonald, Richard G., Edinburgh. 1987
Manzi, Michael J., Penzance. 1987
Martick, Barbara A., London. 1981
Martine-Leyland, Eric, Vancouver, BC, Canada. 1987
Orrey, Russell A., Barrowby. 1987
Osborne, David L., Canvey Island. 1969
Padley, Stanley J., Bromyard. 1987

Powell, Philip V., Cheltenham. 1987
Richards, David, Ruddington. 1983
Riley, Mark J., Quedgeley. 1987
Shah, Manoj D., Bombay, India. 1986
Smith, Marilyn L., London. 1987
Sokhal, Baljender, Cannock. 1987
Thomas, David D., Cheam. 1987
Tsotros, Alex, Johannesburg, South Africa. 1987
Vilpas–Vesterinen, Leeni A., Helsinki, Finland. 1987
Watts–Goodearle, Gwendolyn R., Toronto, Ont., Canada. 1987
Wightman, Janice T., Burbage. 1987
Woodhouse, Neville, Chesterfield. 1974
Wren, Rebecca J., Ware. 1987
Yau, Vivian, Lantau, Hong Kong. 1987
Youngs, Michael A., Felixstowe. 1987
Zandvoort, Christien, Rotterdam, Netherlands. 1985

Transfers from Ordinary Membership to Fellowship

Arias Garnacho, Antonio, Madrid, Spain. 1987
Arthur, Lynne, Denny. 1987
Birchall, Steven, Hyde. 1987
Brillo, Douglas, Halifax. 1987
Canty, Jess, London. 1987
Ching, Estella S.T., Hong Kong. 1987
Coward, Stephanie J., Colchester. 1987
de Cosse Brissac, Helene, Princess of Liechtenstein, Steiermak, Austria. 1987
Dominy, Geoffrey, Edmonton, Alta., Canada. 1987
Elson, Patricia D., Swansea. 1987
Esser, Clara L.M., Singapore. 1987
Gambini, Elena, Milan, Italy. 1987
Gay, Michael, Romsey. 1987
Genot, Luc P.A., Brussels, Belgium. 1987
Greenwold, Lynn, Stow on the Wold, 1987
Hage–Chahine–Sawaya, Nayla, London. 1987
Hall, Warren S., Purley. 1987
Hilton, Holly A., London. 1987
Hulm, Valerie A., Hong Kong. 1987
Huppach, Friedrich H., Colne. 1987
Judge, Susan D., Hong Kong. 1987
Keast, Edmund J., Sanderstead. 1987
Kneip, John R., London. 1987
Knight, James H., Godalming. 1987
Knox, George T., South Harrow. 1987
Kramer, Stephan A., Bradford. 1987
Kubota, Kazuyuki, Tokyo, Japan. 1987
Lekamge, Neil S., Kandy, Sri Lanka. 1987
McArthur, Niven R., Dunedin, New Zealand. 1987
McCleland, Susan M.F., Haslemere. 1987
Michaels, Amy J., Montgomery, Ala., USA
Millar, Ewan, Paisley, 1987
Miyabayashi, Yuki, Osaka, Japan. 1987
Monnas, Edith S., Athens, Greece. 1987
Ng, Avis L., London. 1987
Nimry, Lina, London. 1987
Pay, Duncan L., Newport–on–Tay. 1987
Perera, Callistus R., Colombo, Sri Lanka. 1987
Rothon, Jeremy, Blairgowrie, South Africa. 1987
Schneirla, Peter C., New York, NY, USA. 1987
Shread, Andrew, Beeston. 1987
Straitouri, Sophia, London. 1987
Straub, Bernard C., Reading. 1987
Sullivan, Maeve D., Kowloon, Hong Kong. 1987
Tajima, Hidemasa, Osaka, Japan. 1987
Takizawa, Toshiko, Tokyo, Japan. 1987
Talberg, Judy, Burkina, West Africa. 1987
Tambuyser, Paul B., Schoorl, Netherlands. 1987
Taylor, Helen M., Whitby. 1987
Van Moppes, Michael, Crowhurst. 1987
Vest, Geraldine M., Lafayette, Ind., USA. 1987
Vincent, Patricia J., Wokingham. 1987
Watson, Charles E., Jakarta, Indonesia. 1987
Yanagi, Nurue, Niigata Pref., Japan. 1987

Ordinary Membership

Agoren, B. David, London.
Bruno, Roberta, Torino, Italy.
Dada, Timothy A., London.
Dangedara, Deunuge A.N., London.
England, Corey J., Moline, Ill., USA.
Forester, Nanette M., Beverly Hills, Calif., USA.
Geach, Julian C., London.
Gordon, Jillian, Christchurch, New Zealand.
Gouverneur, Keith, Tamanaco, Caracas, Venezuela.
Griffith, Pritpal, Wembley.
Hochberg, Naomi, Ramat Gan, Israel.
Jarvis, Hilary A., London.
Jefferson, Gareth, London.
Kastritseas, Iraclis P., Rhodes, Greece.
Kops, Doreen A., Perth, WA, Australia.
Laurie, John J.W., Monte Carlo, Monaco.
Levy, John, London.
Lilley, Elaine, Hull.
Liyanage, Penny, Ashford Common.
McIlwraith, Philomena M., Kowloon, Hong Kong.
Rhoades Walkley, Barrie, Tadley.
Ross, William C., Norwich.
Search, Martin J., St Peter Port, Guernsey, CI.
Sullivan, David C.K., Durban, S. Africa.
Taylor, Frederick W., Tewkesbury.
Tociapski, Paul, Bogota, Colombia.
Turner, David B., Benwell.
Van Camp, Coralie A., Auckland, New Zealand.
Wiles, Susan, Hull.
Williams, Ann R., Caithness.

EXECUTIVE COMMITTEE MEETING

At a meeting of the Executive Committee held on 28 October 1987 at Saint Dunstan's House the business transacted included the election of the following:

Fellowship

Anckar, Bjorn H., Gothenburg, Sweden. 1987
Andrews, Robert E., Birch Vale. 1969
Arratia Sanhueza, Juan A., London. 1987
Bishop, Lyndall A., Kowloon, Hong Kong. 1987
Brophy, Mark S.J., Cheadle. 1978
Chan, Richard K.M., London. 1987
Chan, William T.W., Kowloon, Hong Kong. 1987
Choy, Boo S.R., Hong Kong. 1987
de Gasson, Maria I.M., Bangkok, Thailand. 1987
de Jong, Peter, Zwyndrecht, The Netherlands. 1987
Dunham Lord, Rosemary M., Bangkok, Thailand. 1987
Fox Worthington, Peter J.J.E., Auckland, New Zealand. 1985
Gaynor, David, Ryton. 1987
Glenister, James E., Tunbridge Wells. 1987
Graham, Peter D., Liverpool. 1981
Gunaratne, Dhammika D., Moratuwa, Sri Lanka. 1987
Heindorff, Judith H., Brisbane, Qld., Australia. 1987
Hirst, Susan C., Palmerston North, New Zealand. 1987
Ho, Chi F.P., Kowloon, Hong Kong. 1987
Hutchings, Beverly J., Willowdale, Ont., Canada. 1987
Huuskonen, Kari O., Helsinki, Finland. 1987
Kallioniemi, Anne M., Helsinki, Finland. 1987
Lambert, Roslyn, West Wickham. 1987
Lee, Lap T., Kowloon, Hong Kong. 1987
Leung, Tak L., Kowloon, Hong Kong. 1987
Luk, Kwok Y.S., Hong Kong. 1987
Luk, Woon C., Kowloon, Hong Kong. 1987
Madden, Denise E., Hong Kong. 1987
Malmsten–Ghazawi, Scharon L., Masala, Finland. 1987
Manders, Andrew P., Longlevens. 1987
Marks, Jan H., Dordrecht, The Netherlands. 1987
Menegatti, Brigitte, Hong Kong. 1987
Nath, Meenakshi, Bombay, India. 1987
Pak, Lai B.L., Hong Kong. 1987
Parker, Vaughan A., King's Lynn. 1987
Parkin, Ann E., New York, NY, USA. 1987
Rayner, John C., Hinckley. 1987
Reponen, Seppo J., Kouvola, Finland. 1987
Rouhselang, Coleen A., Austin, Tex., USA. 1987
Sanghvi, Smitesh H., Bombay, India. 1987
Stanbury, Derek C., Bartley Green. 1987
Straton–Ferrier, Sophie L., Edinburgh. 1987
Tidswell, Eric, Bingley. 1987
Tovey, Kevin G., Newport. 1987
Tsang Ngai, Wing G., Hong Kong. 1987
Turnbull, Daniel A., Glasgow. 1987
Van Dyk, Delene, Cape Town, South Africa. 1987
Visser, Frederiik, Annaparochie, The Netherlands. 1987
Webster, William J., Glasgow. 1987
Whittle, Helen M., Clevedon. 1987
Wolfsbergen, Margaretha T., The Hague, The Netherlands. 1987
Wong, Qui L.S., Hong Kong. 1987
You, Yun B., Inchon, South Korea. 1987

Ordinary Membership

Abdel Shaheed, Gale, Newark.
Beaty, Harold W., Spokane, Wash., USA.
Bourdillon, Catriona C.C., London.
Collingwood, Mark A., Leeds.
Collins, Barry M., Kempston.
Cousins, Nigel T., Deal.
Cox, Vann S., Leeds.
Crombie, Sylvia, Hemel Hempstead.
Cross, Margaret J., Leeds.
Dickinson, Julie, London.
Eyles, Joan M., London.
Fisher, Dorothy A., Surbiton.
Gau, Robert B.R., Taiwan.
Hartley, John M., Blackpool.
Kenney, George T., Lihue, Hawaii, USA.
Kirby, Marcus D., Leeds.
Leddicoat, Andrew, Guiseley.
Lowe, Paul A., Truro.
McCallum, Simon L., Newbury.
McKenna, Joseph T., London.
O'Sullivan, Susan A., London.
Ridgeway, Elizabeth J., London.
Rowlands, Alan F., London.
Silverthorne, Bernard C., London.
Theodorou, Theodoros, Limassol, Cyprus.
Tock, Graham B., Hull.
Vanhefflin, Keith, Kirton Lindsey.
Yuill, J. Martin, Lanark.

GEM DIAMOND EXAMINATION 1987

In the Post–Diploma Gem Diamond Examination 38 candidates sat and 38 qualified. The following is a list of the candidates arranged alphabetically.

Abrahams, Roy H., Ruislip.
Adams, Amanda C., Leicester.
Bartlett, Lynne, London.
Casanova Guillen, Luis M., Barcelona, Spain.
Deeley, Peter J., Birmingham.
Domenech Lahoz, Christiane, Barcelona, Spain.
Fernandez Sanchez, Fernando, Barcelona, Spain.
Gardiner, Margot, Glasgow.
Green, Gwynneth M., Worcester.

Hall, Michael J., London.
Hamilton, Ann, Paisley.
Haque, M. Manzurul, London.
Henderson, Mark M., Guildford.
Hepburn, John A., Orpington.
Horne, Allan R., Brighton.
Jones, Kevin P., Coventry.
Layhe-Cook, Judith A., Stratford-upon-Avon.
Linley, Mark A., Worcester.
Lloyd, Jeremy J., Birmingham.
Magudia, Ratilal H., St Albans.
Marti Beltran, Fernando, Barcelona, Spain.
Neumand, Marion J.S., Richmond.
Palmer, Valerie G., London.
Phillips, Glenys J., Brighouse.
Poblador Cerezo, Luis M., Barcelona, Spain.
Rafols Garrit, Yolanda, Barcelona, Spain.
Rice, Karen L., Solihull.
Ruiz Roser, Emilio, Barcelona, Spain.
Serra Palau, Carles, Barcelona, Spain.
Simpson, Geoffrey P., Stockport.
Smith, Gillian M., Sheffield.
Smith, Susan A., London,
Stewart, Robert, London.
Thompson, Howard W., New Malden.
Tortosa Domingo, Ramon, Barcelona, Spain.
Vara, Pradip, London.
Vilanova Cardona, Elvira, Barcelona.
Walsh, Claire E., Hendon.

EXAMINATIONS IN GEMMOLOGY 1987

In the 1987 Examination in Gemmology 530 candidates sat the Preliminary Examination and 305 (57.5%) passed, 512 sat the Diploma Examination and 222 (43.6%) passed, 21 with distinction.

The Tully Medal for the candidate (trade or non-trade) who submits the best set of answers in the Diploma Examination has been awarded to Duncan Lamont Pay of Newport-on-Tay, Fife, Scotland.

The Anderson/Bank Prize for the best non-trade candidate of the year in the Diploma Examination has been awarded to Julia Drukker-Loth of Huizen, The Netherlands.

The Rayner Diploma Prize for the best candidate of the year who derives his main income from activities essentially connected with the jewellery trade has been awarded to Henry Chan-Fan Cheng of Kowloon, Hong Kong.

The Anderson Medal for the best candidate of the year in the Preliminary Examination has been awarded to Betty Stocker of Chipping Campden, Gloucestershire.

The Rayner Preliminary Prize for the best candidate under the age of 21 years on 1 June whose main income is derived from activities essentially connected with the jewellery trade has been awarded to David Webster of Glasgow.

The names of the successful candidates are as follows:

DIPLOMA

Qualified with Distinction

Cheng, Henry C.F., Hong Kong.
Chiu, Man Kam, Hong Kong.
Cosman, Maria A., Montfoort, Netherlands.
Coward, Stephanie J., Colchester.
Dominy, Geoffrey, Edmonton, Alta, Canada.
Drukker-Loth, Julia M., Huizen, Netherlands.
Guarino Alemany, Ma T., Barcelona, Spain.
Hash, Daniel W., Watrous, Sask., Canada.
Keast, Edmund J., Sanderstead.
Knight, James H., Godalming.
Lam, Cecilia S.L., Alberta, Canada.
Lau, Rosanna W.Y., Hong Kong.
Madden, Denise E., Hong Kong.
Pay, Duncan L., Newport-on-Tay.
Riley, Mark J., Cheltenham.
Straub, Bernard C., Reading.
Tambuyser, Paul B., Antwerp, Belgium.
Thevathasan, Nuala A., London.
Vest, Geraldine M., W. Layfayette, Ind., USA.
Visser, Frederik, St Annaparochie, Netherlands.
Zwack, Geraldine M., Bangkok. Thailand.

Qualified

Allen, Elizabeth A., Southgate.
Anckar, Bjorn H. Gothenburg, Sweden.
Aresti, Anthony, London.
Arias Garnacho, Antonio, Madrid, Spain.
Arratia San Hueza, Antonio, London.
Arthur, Lynne, Falkirk.
Ashby, Paul J., Dover.
Asiain De Los Angeles, Jorge J., Barcelona, Spain.
Atkinson, Mavis W., Bradford.
Au Yeung, Kwai H., Hong Kong.
Aziz, Khalid, Idar-Oberstein, W. Germany.
Baker, June, Ottawa, Ont., Canada.
Baker, Sylvia V.J., Bangkok, Thailand.
Barnes, Joyce J., Marazion.
Bernad Serra, Marcos, Barcelona, Spain.
Billingham, Carole Jane, London.
Birchall, Steven, Hyde.
Bishop, Lyndall A., Hong Kong.
Bourke, Mary, Enniscorthy, Wexford, Ireland.
Brill, Douglas, Halifax.
Brophy, Mark S.J., Manchester.
Brouwer, Mariette H., Utrecht, Netherlands.
Brummer, Pieter, Almelo, Netherlands.
Burgues Montserrat, Ma Jesus, Barcelona, Spain.
Canty, Jesse, London.
Carmody, Justine L., Thames Ditton.
Chan, Richard Ki-Mun, London.

Chan, William T.W., Hong Kong.
Chang, Nancy A., Hong Kong.
Chanter, James E., Newton Abbot.
Cheng, Lau K.L.K., Kowloon, Hong Kong.
Ching, Estella S.T., Hong Kong.
Choy, Boo S.R., Hong Kong.
Corduff, Rosalie P., Stoke-on-Trent.
Cros, Jean-Marc, London.
Dale, Ann F., Silver Spring, Md., USA.
Dallas, James A., London.
Dalmau Bafalluy, Ma N., Barcelona, Spain.
de Cosse Brissac, Helene, Princess of Liechtenstein, Steiermak, Austria.
de Jong, Peter, Zwijndrecht, Netherlands.
Dodani, Manoj B., Hong Kong.
Dufficy, Margaret H., San Rafael, Calif., USA.
Dunham Lord, Rosemary M., Sunbury-on-Thames.
Dunn, Wendy S., Putney.
Dunstall, Robert, Northampton.
Elson, Patricia D., Swansea.
Esser, Clara L.M., Singapore.
Ferrer Coma, Montserrat, Barcelona, Spain.
Filion, Marie Marchand, Montreal, Que., Canada.
Forsberg, Pierre G.C., Stockholm, Sweden.
Fox, Julie A., Maidstone.
Fu, Milai M., Hong Kong.
Gambini, Elena, Milan, Italy.
Gay, Michael, Romsey.
Gaynor, David, Crawcrook.
Genot, Luc P.A., Brussels, Belgium.
Gervilla Linares, Fernando, Barcelona, Spain.
Girard, Patricia A., Dunoon.
Glenister, James E., Eastbourne.
Glover, Graham D.B., London.
Greenwold, Lynn, Stow-on-the-Wold.
Griffiths, Sarah J.C., London.
Gunaratne, Dhammika D., Moratuwa, Sri Lanka.
Hage-Chahine Sawaya, Nayla, London.
Hakola, Arto K., Outokumpu, Finland.
Hall, Warren S., Croydon.
Hawkins, Philippa L., London.
Hayes, Alan G.J., Bramhall.
Heindorff, Judith H., Brisbane, Qld, Australia.
Hellqvist, Ing-Britt E., Stockholm, Sweden.
Hilton, Holly A., London.
Hirst, Susan C., Palmerston North, New Zealand.
Ho, Chi F.P., Hong Kong.
Hud, Julie A., Nottingham.
Hud, Michael, Nottingham.
Huiskamp, Eveline A., The Hague, Netherlands.
Hulm, Valerie A., Hong Kong.
Humpage, Susan A., Birmingham.
Huppach, Friedrich H., Barnoldswick.
Hutchings, Beverly J., Toronto, Ont., Canada.
Huuskonen, Kari O., Helsinki, Finland.
Iguaz Esteban, Yolanda, Barcelona, Spain.
Judge, Susan D., Hong Kong.
Kangasniemi, Risto I., Tampere, Finland.
Kiallioniemi, Anne M., Helsinki, Finland.
Kneip, John R., London.
Knox, George T., Harrow.
Kramer, Stephen A., Bradford.
Kubota, Kazuyuki, Tokyo, Japan.
Lai, Chun C., Hong Kong.
Lam, Mau K.J., Hong Kong.
Lambert, Roslyn, Shirley.
Latre Gonzalez, Jose, Barcelona, Spain.
Lee, Lap Tak, Hong Kong.
Lekamge, Neil Senaka, Kandy, Sri Lanka.
Leung, Tak Leong, Hong Kong.
Leung, Wai Hung, Hong Kong.
Levy, Laurence M., London.
Leyens, Richard, London.
Lightfoot, Paul, Ottery St Mary.
Lindquist, Maria T. London.
Lu, Lucy S.G., Hong Kong.
Luk, Kwok Y.S., Hong Kong.
Luk, Woon Chi, Hong Kong.
McArthur, Niven R., Dunedin.
McCleland, Susan M.F., Haslemere.
McDonald, Richard G., Edinburgh.
Malmsten-Ghazawi, Scharon L., Kirkkonummi, Finland.
Manders, Andrew Paul, Gloucester.
Manzi, Michael J., Penzance.
Markov, Mark, London.
Marks, Jan H. Dordrecht, Netherlands.
Marsh, Lesley F., Harare, Zimbabwe.
Martine-Leyland, Eric, Vancouver, BC, Canada.
Maupu, Francoise R.J., St Rambert en Bugey, France.
Melian de Gasson, Maria I., Bangkok, Thailand.
Menegatti, Brigitte, Hong Kong.
Metaxas, George C., Nicosia, Cyprus.
Michaels, Amy J., Montgomery, Ala., USA.
Millar, Ewan, Paisley.
Minner, Loren M., Belen, New Mexico.
Miyabayashi, Yuki, Osaka, Japan.
Molina Torreblanca, Amparo, Barcelona, Spain.
Monnas, Edith S., Athens, Greece.
Moreno Garcia, Rosa Ma, Barcelona, Spain.
Morris, Vincent P., York.
Nath, Meenakshi, Bombay, India.
Navarro Garcia, Rodolfo, Barcelona, Spain.
Naylor, Tina, Wigan.
Ng, Avis L., London.
Ng, Siu Kai, Hong Kong.
Nimry, Lina, Amman, Jordan.
Offord, Nigel J., Chandlers Ford.
Ono, Yoshimi, Osaka, Japan.
Orrey, Russell A., Grantham.
Ortoli Lockwood, Dominique J., London.
Padley, Stanley J., Bredenbury.

Pak, Lai B.L., Hong Kong.
Palmer, Lorraine F., Worthing.
Parker, Vaughan A., King's Lynn.
Parkin, Ann E., New York, NY, USA.
Perera, Callistus R., Colombo, Sri Lanka.
Peryer, Keith G., Luton.
Pick, Velma M., London.
Pitkanen, Marja-Leena A., Lahti, Finland.
Powell, Philip V., Cheltenham.
Pridham, Michelle A., Colchester.
Rayner, John, Nottingham.
Redmann, Markus, Idar-Oberstein, W. Germany.
Reponen, Seppo J., Kouvola, Finland.
Romero Caminero, Luz, Barcelona, Spain.
Rothon, Jeremy, Johannesburg, S. Africa.
Roucouna, Catherine, Athens, Greece.
Rouhselang, Coleen A., Austin, Tex., USA.
Rumsey, Shearer C., Laurel, Miss., USA.
Saminathan, Kannika, Idar-Oberstein, W. Germany.
Sanghvi, Smitesh H., Bombay, India.
Schneirla, Peter C., New York, NY, USA.
Scott, Doreen M., Liverpool.
Shread, Andrew, Beeston.
Sierra Martinez, Ma Dolores, Barcelona, Spain.
Silverman, Sivan J., Boston.
Smith, Marilyn L., Barnes.
Sokhal, Baljender, London.
Stanbury, Derek C., Birmingham.
Straitouri, Sophie, London.
Straton-Ferrier, Sophie L., Edinburgh.
Sullivan, Maeve D., Hong Kong.
Tajima, Hidemasa, Osaka, Japan.
Takizawa, Toshiko, Tokyo, Japan.
Talberg, Judy, London.
Tang, Ho C.M.T., Hong Kong.
Tapia Canadell, Laura, Barcelona, Spain.
Taylor, Helen M., Whitby.
Thomas, David D., Cheam.
Tidswell, Eric, Bingley.
Tovey, Kevin G., Newport, Gwent.
Tsang Ngai, Wing G., Hong Kong.
Tsotros, Alexios, Johannesburg, S. Africa.
Tsui, Tommy K.W., Hong Kong.
Turnbull, Daniel A., Glasgow.
Van Dyk, Delene, Cape Town, CP, S. Africa.
Van Moppes, Michael, Crowhurst, E. Sussex.
Vazquez, Gerard M., Paris, France.
Vilpas-Vesterinen, Leeni A., Helsinki, Finland.
Vincent, Patricia J., Wokingham.
Visser, Gerja, Schoonhoven, The Netherlands.
Wang, Chun J., Hong Kong.
Watson, Charles E., Cambridge.
Watts-Goodearle, Gwendolyn R., Toronto, Ont., Canada.
Webster, William, Glasgow.
Whittle, Helen M., Sutton Coldfield.
Wightman, Janice T., Hinckley.
Wilkinson, Fiona J., London.
Wirman, Anna L., Stockholm, Sweden.
Wolfsbergen, Margaretha T., Wassenaar, Netherlands.
Wong, Qui L.S., Hong Kong.
Wren, Rebecca J., Ware.
Yanagi, Nurue, Niigata Pref., Japan.
Yau, Vivian, Hong Kong.
You, Yun B., Inchon, S. Korea.
Youngs, Michael A., Felixstowe.

PRELIMINARY

Qualified

Adams, Jacqueline E., London.
Aitken, Roderick I., London.
Alcaraz Lamana, Carlos, Barcelona, Spain.
Allison, Rudie J., Fort Madison, Ia., USA.
Andres Sabate, Begona, Barcelona, Spain.
Athanassopoulou, Joanna, Athens, Greece.
Atkins, Tristan A., Banstead.
Atkinson, Henry N., Windhoek, Namibia.
Attanayake, Indrimala, Kosgama, Sri Lanka.
Attar, Simon, London.
Bagnall, Maria, London.
Baker, June, Ottawa,, Ont., Canada.
Barratt, Claire A., Gillingham.
Bartoszewicz, Edward J., Solihull.
Bassioudis, Vassilis, Thessaloniki, Greece.
Bauco, Robert, London.
Belenguer Blat, Carmen, Barcelona, Spain.
Bignotti, Fabrizio, London.
Blonk, Astrid, Woerden, The Netherlands.
Boersma, Ellen, Schoonhoven, The Netherlands.
Booth, Christine, Hong Kong.
Boozer, Joan B., Hong Kong.
Boyadjian, Liza A., Heston.
Boyer, Alice M., Brookeville, Md., USA.
Bradley, Peter F., Fort Myers, Fla., USA.
Bridgewood, Alan, Bramhope.
Bron, Harm, Heerenveen, The Netherlands.
Brunne, Willemine C., Schoonhoven, The Netherlands.
Bryne, David M., Smethwick.
Cadavid Tortosa, Manuel, Barcelona, Spain.
Canton Garbin, Jorge J., Barcelona, Spain.
Carbonell Lopez, Jose, Barcelona, Spain.
Carr, Anthony L., Harborne.
Carracedo Oliva, Robert, Barcelona, Spain.
Carrington, Lynn P., Cheadle Hulme.
Carry, Peter D., Aberdeen.
Catterall, Cherrylyne F., Bombay, India.
Chan, Albert H.S., Hong Kong.
Chan, Ellen S.-W., Hong Kong.
Chan, Peggy, Shatin, Hong Kong.
Chan Cheng, Rosalia Y.K., Hong Kong.

Chang, Bob–Song, Willowdale, Ont., Canada.
Cheng, Chan F.H., Kowloon, Hong Kong.
Cheng, Wui–Kei, Pokfulam, Hong Kong.
Chiu, Man K., Kowloon, Hong Kong.
Chow, Hung F., Singapore.
Cijvat, Pieternella C., Naarden, The Netherlands.
Climent Coscolluela, Nuria, Barcelona, Spain.
Collins, Steven J.C., Letchworth.
Conyers, Gareth J., Osterley.
Cowdrey, John W.F., South Harrow.
Cox, Vann S., Leeds.
Crombie, Sylvia, Hemel Hempstead.
Dale, Ann F., Kenner, La., USA.
Dalmau Domenech, Marta, Barcelona, Spain.
Danis Terra, Rut, Barcelona, Spain.
Dash, Suzanna, London.
Dawson, Craig R., Dunedin, New Zealand.
Deacon, Richard H., Shrivenham.
De Campos Batista, Sergio, Barcelona, Spain.
Dechef, Eveline E.J., Carp, Ont., Canada.
Deen, Mohamed A., Colombo, Sri Lanka.
De Mendoza Sentena, Garcia A., Barcelona, Spain.
De Vries, Judith H., Delfzijl, The Netherlands.
De Waal, Irina, Delft, The Netherlands.
Dibbens, Ian J., Christchurch.
Druguet Torner, Ma Elena, Barcelona, Spain.
Dunham Lord, Rosemary M., Bangkok, Thailand.
Emi, Toshitaka, Osaka, Japan.
Erikawa, Yoko, Tokyo, Japan.
Escalona Larroy, Jose A., Barcelona, Spain.
Eslahjou, Sepideh, Willowdale, Ont., Canada.
Evans, Elma H., Spring Valley, Calif., USA.
Evans, Philip, Hereford.
Farinos Folgado, Ramon, Barcelona, Spain.
Farthing, Russell, Colchester.
Fearnley, June, Sheffield.
Feenie, Helen L., Hong Kong.
Feijoo Sunol, Jorge C., Barcelona, Spain.
Fenwick, Johanna C., Plymouth.
Fernandez Orera, Angel, Barcelona, Spain.
Fernandez Pascual, Ana M., Barcelona, Spain.
Fernandez–Llam, Luis V.S., Barcelona, Spain.
Ferrandiz Pico, Eulalia, Barcelona, Spain.
Ferry, John M., Norwich.
Filion, Marie M., Montreal, Que., Canada.
Flores Masvidal, David, Barcelona, Spain.
Forsythe. Catherine C., Birmingham.
Fowler, Jennifer A., Barley, nr. Burnley.
Franco da Fonseca, Ana L., Barcelona, Spain.
French, Michael, London.
Fung, Chow C.Y.A., Hong Kong.
Garcia Bonilla, Francisco, Barcelona, Spain.
Gellini, Delio, Harrogate.
Girod, Daniel F., Amsterdam, The Netherlands.
Glaysher, Andrew J., Horsham.
Gohel, Dilhar M., Northwood.
Goliats, Helen, Handen, Sweden.
Gomes da Silveira, Luiz A., Barcelona, Spain.
Gomez Lopez, Enrique, Barcelona, Spain.
Gordon, Scott, Oklahoma City, Okla., USA.
Goto, Charles T., Osaka, Japan.
Gould, Jean H.I., Sydenham.
Granito, Yvonne S., Mississauga, Ont., Canada.
Greenway, Arlette, Kowloon, Hong Kong.
Grieder, Judith Y., Hong Kong.
Grimaldi, John W.H., Stowmarket.
Guardiola Gomez, Ma Irina, Barcelona, Spain.
Guirado Gispert, Francesc, Barcelona, Spain.
Hammett, Pauline J., Birmingham.
Hapugaskumbura, Wee B.W., Kumburegama, Sri Lanka.
Hara, Yasuko H., Tokyo, Japan.
Harrison, Roger F.J., King's Langley.
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PROGRAMME OF LONDON EVENING MEETINGS 1988

The following meetings have been arranged to take place in London in 1988. Full details will be circulated, to those members in the South East of England only, nearer the relevant dates. Those members outside the circulation area should contact the Association if they require further details.

Tuesday, 8 March
'News from the Gem Testing Laboratory of the Chamber of Commerce in Milan, Italy' by Dr Margherita Superchi, Italy.

Tuesday, 24 May
'The colour treatment of zircon oxide' by Jesus Garzon, B.Sc., Spain.

Tuesday, 11 October
'A review of inclusions in synthetic gemstones' by Clive R. Burch, England.

Tickets will be available for each of the above meetings at a cost of £2.50 per ticket per meeting.

The 1988 Annual General Meeting will take place on **Wednesday 15 June**. Full details will be published in the 1987 Annual Report and Accounts of the Association, which will be sent to all members residing in the United Kingdom. Copies are available to overseas members on request. A Gemmological Forum will be held following the AGM based on the successful meetings held in 1986 and 1987.

Whilst every endeavour will be made to adhere to the planned schedule of events, these may be subject to alteration without prior notice and we apologize for any inconvenience such an alteration may cause.

Letter to the Editor

From R. Keith Mitchell, FGA

Dear Sir,

I am wondering whether I have achieved a 'first' in the field of gemmology.

For a long time I have been aware that refractive indices are obtainable from only a limited area of my refractometer prism, and small stones need to be pushed along its length until such time as they arrive at the optimum position. When doing this with really small stones a certain degree of manual skill was called for.

Gradually I have noticed that stones with a low RI tend to give readings when placed towards the top end of the prism, i.e. farthest away from the eyepiece, while those with a high RI give the information when they are closer to the bottom end, nearer the user's eye.

Today, in a pioneering spirit, it occurred to me to see whether it was possible to test two stones of differing RIs at one and the same time. Accordingly I placed a small chalcedony on a Topcon refractometer, in the required position for a low reading, and a synthetic sapphire on the other end of the prism. Both readings were quite clearly visible, 1.535 for the crypto-crystalline quartz, and 1.76–1.77 for the sapphire. It was necessary to move the head a little to see them, but they were most definitely there at the same time.

As a check, I changed their positions around and found that while the chalcedony could be made to give a reading in the sapphire position, although it was not a very good one, and was possibly a little lower than that obtained in the optimum position, the sapphire would not 'read' at all in the far position.

It occurs to me that this could also account for the indistinct RI shadow edges seen in gem materials which are recognized as mixtures of minerals, e.g. nephrite or jadeite. The instrument is, in effect, reading for a large area of the stone and not just for a small spot.

This achievement will hardly revolutionize gemmology, but I do rather think it has to be a 'first', even if it has taken me some 55 years to arrive at it!

Yours etc.,
R. Keith Mitchell

PS I have just tried putting an emerald, a tourmaline and a spinel on the refractometer at one time. This was really crowding the instrument prism and readings were not as clear as one would have wished, but again with a little head movement three separate sets of RIs were to be seen. Again a rather useless achievement, but perhaps an amusing one.

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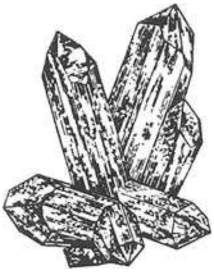

GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

The Arms and Crest of the Association, conferred by a grant of Arms made by the Kings of Arms under royal authority. The cross is a variation of that in the Arms of the National Association of Goldsmiths of Great Britain and Ireland. In the middle is a gold jewelled book representing the study of gemmology and the examination work of the Association. Above it is a top plan of a rose-cut diamond inside a ring, suggesting the scrutiny of gems by magnification under a lens. The lozenges represent uncut octahedra and the gem-set ring indicates the use of gems in ornamentation. The lynx of the crest at the top was credited, in ancient times, with being able to see through opaque substances. He represents the lapidary and the student scrutinizing every aspect of gemmology. In the paws is one of the oldest heraldic emblems, an escarbuncle, to represent a very brilliant jewel, usually a ruby. The radiating arms suggest light diffused by the escarbuncle and their tips are shown as jewels representing the colours of the spectrum.

Historical Note

The Gemmological Association of Great Britain was originally founded in 1908 as the Education Committee of the National Association of Goldsmiths and reconstituted in 1931 as the Gemmological Association. Its name was extended to Gemmological Association of Great Britain in 1938, and finally in 1944 it was incorporated in that name under the Companies Acts as a company limited by guarantee (registered in England, no. 433063).

Affiliated Associations are the Gemmological Association of Australia, the Canadian Gemmological Association, the Gem and Mineral Society of Zimbabwe, the Gemmological Association of Hong Kong, the Gemmological Association of South Africa and the Singapore Gemologist Society.

The *Journal of Gemmology* was first published by the Association in 1947. It is a quarterly, published in January, April, July, and October each year, and is issued free to Fellows and Members of the Association. Opinions expressed by authors are not necessarily endorsed by the Association.

Notes for Contributors

The Editors are glad to consider original articles shedding new light on subjects of gemmological interest for publication in the *Journal*. Articles are not normally accepted which have already been published elsewhere in English, and an article is accepted only on the understanding that (1) full information as to any previous publication (whether in English or another language) has been given, (2) it is not under consideration for publication elsewhere and (3) it will not be published elsewhere without the consent of the Editors.

Papers should be submitted in duplicate on A4 paper. They should be typed with double line spacing with ample margins of at least 25mm all round. The title should be as brief as is consistent with clear indication of the content of the paper. It should be followed by the names (with initials) of the authors and by their addresses. A short abstract of 50–100 words should be provided. Papers may be of any length, but long papers of more than 10 000 words (unless capable of division into parts or of exceptional importance) are unlikely to be acceptable, whereas a short paper of 400–500 words may achieve early publication.

Twenty five copies of individual papers are provided on request free of charge; additional copies may be supplied, but they must be ordered at first proof stage or earlier.

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