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OF GREAT BRITAIN

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THE JOURNAL OF GEMMOLOGY
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AN UNUSUAL STAR PERIDOT

By STEFAN BORG, Cand. Scient.
Copenhagen

The purpose of this report is to describe the unusual inclusion pattern in a 1.97 ct brownish-green cabochon-cut peridot from Norway in the author's possession. The refractive indices are measured with a Rayner Dialdex refractometer by the distant-vision method to be $n_\alpha = 1.650$ and $n_\gamma = 1.685$. This corresponds closely to values found for other peridots from Norway (Arem, 1977). Upon examination of the absorption spectra with a Krüss hand spectroscope only a band between the green and the blue is observed. This is perhaps due to the colour of the stone or the density of the inclusion to be described. The stone shows a 6-ray star and a sheen in the centre of the star when observed under a single strong light source (Figure 1a and b).

In the literature only one reference is found to 6-ray star peridots (Cavenago-Bignami, 1972). These, however, are supposed to be from the United States. Another reference mentions only

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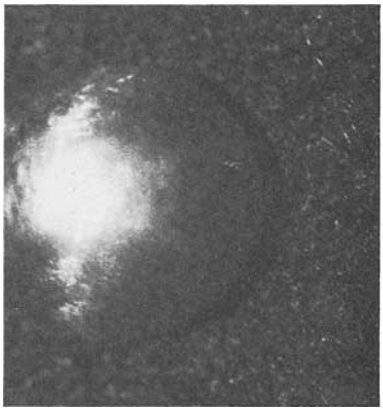

FIG. 1a. Star peridot showing sheen and star under single strong light source.

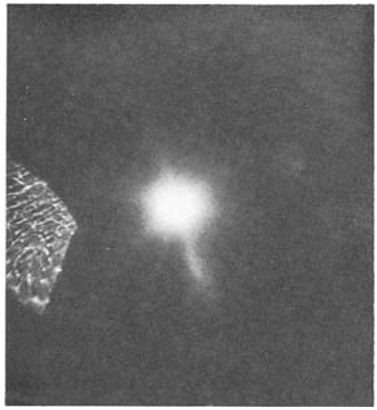

FIG. 1b. Star peridot slightly out of focus. 10×

4-ray star peridots with the rays at right angles to each other (Eppler, 1973). Those few other authors mentioning that peridot occurs as a star stone do not specify how many rays are present. Of the other gem minerals crystallizing in the orthorhombic system not one reference is found describing a cabochon-cut stone with inclusions creating a 6-ray star.

With the aid of a Leitz Ortholux microscope the different inclusions causing these effects are distinguished as seen in Figures 2 and 3. The photographs have been taken through the polished base of the cabochon. Under 100× magnification (Figure 2) a multitude of needles define three axes in a plane separated from each other by 60 degrees causing the 6-ray star. Furthermore strings of brown inclusions are directed along axes perpendicular to those of the needles. These inclusions create the sheen in the centre of the star. When the stone is seen close-up slightly out of focus, two of these perpendicular strings give rise to four additional but weak rays (Figure 1b). Under 250× magnification (Figure 3) the brown inclusions are recognized as many small biotite platelets by their colour and hexagonal habit (Gübelin, 1974) and the sides of the biotite platelets are parallel to the needles in all three directions. It

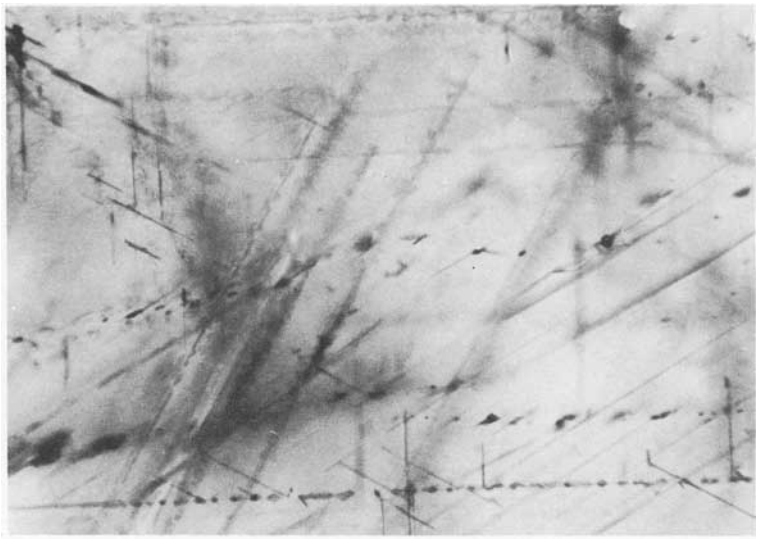

FIG. 2 Inclusions in star peridot. 100×.

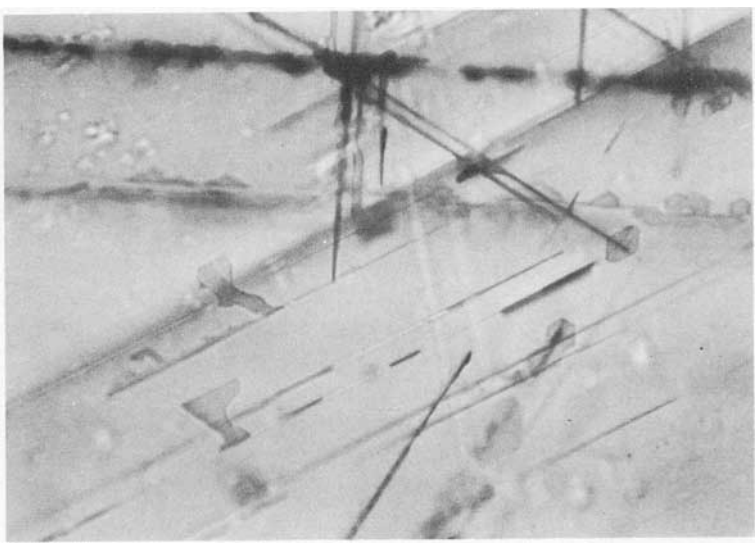

FIG. 3. Inclusions in star peridot. 250×.

is not clear what has caused the biotite to be assembled into long strings. In the same figure the needles are seen to be partly filled channels.

It is hoped that this short description will provide a supplement to the current knowledge on peridots.

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[*Manuscript received 1st August, 1979.*]

AN UNUSUAL TOURMALINE

By STEPHEN R. JONES, F.G.A.

Jewellery Valuation Centre, Sydney, N.S.W., Australia

The Jewellery Valuation Centre (or, to give it its full name, The Jewellery Valuation Centre and Gem Testing Laboratories of Australia) is a commercial laboratory set up in September 1978 to cater both for the trade and for the public. Accordingly the emphasis is not only on accuracy but also on speed, which can be frustrating for a gemmologist, particularly when a known gem is submitted which has uncommon inclusions or properties diverging slightly from the norm: instead of being able to devote many hours immersed in the wonders of research and discovery, the stone is whisked away by an eagerly awaiting client. Recently, however, the writer was able to spend some time examining an unusual gem simply for the love of it.

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A well known local lapidary, while in the laboratory one day, happened to have with him two pieces of unusual rough. At first glance they resembled small pieces of fused glass, misshapen with numerous concoidal fractures, the largest piece measuring approximately 1½″ × 1″ × ½″, and no sign of any crystal morphology. The colour was somewhat unusual, bottle-green with strong red overtones, similar to good green andalusite. Time was at a premium, so that only a cursory inspection was possible. Strong double refraction was noted on looking through the stones, edges of fractures were noticeably doubled, even without a 10× loupe. This, along with the bottle-green colour, suggested tourmaline, but the strong red gleams were confusing. According to the cutter, the stones had been in his possession for many years, and, although not remembering clearly, he was sure that they were originally procured from an African dealer friend.

Many weeks later, to the writer's joy, a stone cut from this material was presented for closer inspection. Details as follows:

Description: Round brilliant cut. Diameter, 9.1 × 9.2mm. Depth, 5.9mm, thick polished girdle. Weight, 2.77ct. The table facet had been placed at an angle of approximately 45° to the optic axis.

Colour: The appearance of this stone altered dramatically with the type of lighting. Under simulated north light (G.I.A. Diamondlite) the colour was a fairly even dark green or yellowish green depending upon direction, a common sight in cut tourmaline. The effect with an incandescent source was interesting. Looking down through the table of the stone an iron-coloured dark green with flashing orange, red and dirty yellowish green was observed. The red colour was less pronounced in this stone than in the rough. Light from a high intensity lamp was then transmitted through the stone with fascinating results. Strong red gleams were displayed, from small sections to almost completely saturating the stone. This colour was not directionally restricted as in the case of dichroism but seemed to envelope the gem under many different angles of lighting. An interesting feature was noted in that when the gem was observed in a direction looking down through the culet, a periphery of red light around a green centre was seen, not unlike the old garnet-topped doublets.

Several tests were carried out on the stone and resulted in the following information:

Refractometer: The refractive index was measured through the table facet and gave values of 1.619-1.64 to 1.623-1.64, showing a negative uniaxial birefringence of 0.017 to 0.021.
Chelsea Colour Filter: Strong red, reminiscent of vanadium coloured colour-change synthetic corundum.
Polariscope: Clear uniaxial interference figure.
Ultra Violet Lamp: Short Wave, Mustard Yellow. Long Wave, Inert.
Dichroscope: Distinct, strong pure green: dirty yellowish green.
Spectroscope: The specimen displayed a strong chromium spectrum. Fine strong line at 675nm, fine but diffuse line 640nm, broad absorption band 570-630nm, general absorption below 470nm.
Microscope: Under 126× magnification the stone (immersed in monobromonaphthalene) appeared clean with the exception of a single crack extending inwards for about 0.2mm from the surface near the culet.
Specific Gravity: Three separate weighings were performed, the mean value equalling 3.054.

Examination by electron microprobe was suggested in order to detect trace elements, particularly vanadium; however, once again shortage of time precluded such arrangements. For such a chrome-rich tourmaline the colour was dull compared to many of the African stones. The colour properties seem to compare with chromium/vanadium tourmalines from Tanzania except for the attendant strong red gleams. Another perplexing issue was the character of the rough. No sign of the normal prismatic striated faces, almost as though the piece had been chiselled out of a larger original crystal.

It would seem that as well as possible new gem finds in the future, and man's incredible hunger for better and better gemstone synthesis, nature has in store many surprises even in 'old timers' such as tourmaline.

[*Manuscript received 6th February, 1979.*]

SOME LESS COMMON GEMSTONES

By MICHAEL O'DONOGHUE, M.A., F.G.S., F.G.A.

The writer has acquired over the past few months a number of faceted stones, in some cases better known as minerals than as gemstones. Readers may be interested to hear about them while bearing in mind that my first thought on seeing a fine crystal is not 'Can it be fashioned?'.

Crocoite, the chromate of lead ($PbCrO_4$), is best known from the occurrence in the Dundas district of Tasmania, where it attains lengths of up to 80cm; no other crystal could easily be confused with it since the bright orange colour, together with the characteristic prismatic shape, is frequently seen in museums and in the stock of the higher-class mineral dealers. The crystal system is monoclinic, and crystals are longer in the direction of the *c*-axis, nearly square in cross section. Many museum specimens show a group of crystals pointing in all directions. The hardness is 2½-3, specific gravity about 6.00 and refractive index 2.29 (α) and 2.66 (γ). Crocoite occurs in oxidized areas of ore deposits (lead or chromium) with cerussite and wulfenite (both have from time to time been faceted) and other associated minerals. The first report of crocoite was from the Sverdlovsk area, Beresov district, in the Ural Mountains of the U.S.S.R.; in 1797 L. N. Vauquelin discovered that chromium was present in material from this area. Supplies from Tasmania are much less plentiful than formerly and collectors would do well to confine their searches to micromount material. Named from the Greek κρόκος (saffron).

Wulfenite, lead molybdate ($PbMoO_4$) is also found in the oxidation zone of ore deposits; it is orange-yellow to brown with a decidedly resinous lustre (most easily seen on the characteristic tabular crystals). It shares with crocoite a low hardness, 2½-3, high specific gravity, 6.5-7.0, and refractive index, 2.40 (ω) and 2.28 (ε). The crystal system is tetragonal. With crocoite, wulfenite shares a high dispersion which gives a very lively appearance to the cut stones, which are usually small. The best-known wulfenite comes from the Red Cloud mine in Arizona, though crystals from this area are generally too thin to facet; thicker crystals have been

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found at Tsumeb, South West Africa. Named after the Austrian mineralogist, Wülfen.

Hexagonite is a variety of tremolite ($Ca_2Mg_5Si_8O_{22}(OH)_2$ with Fe). It is lilac-pink and has only been found in New York State, particularly at Fowler. It is transparent, though crystals would only yield cut stones of 1 ct at the most. Up to 1% MnO has been found in hexagonite and no doubt this accounts for the colour. It is found in metamorphosed calcareous rocks, has a hardness of 5-6, specific gravity of 2.98-3.03 and (according to the literature) refractive index within the range (α) 1.560-1.562 (β) 1.613 (γ) 1.624-1.643 (for the whole series to actinolite); DR is given as 0.019-0.028 (for hexagonite). Pleochroism is strong with colours reddish-blue, violet blue and rose-red. A certain amount of luminescence has been observed; the colour is pink under long-wave and greenish-white under short-wave ultraviolet radiation. The name refers to the misconception that hexagonite belonged to the hexagonal crystal system (it is, in fact, monoclinic).

Pyroxmangite is $(Mn,Fe)SiO_3$ and crystallizes in the triclinic system. The faceted example under discussion is a bright pink, inclining to purple; it comes from Honshu, Japan, where it occurs in metamorphic or metasomatic rocks with rhodochrosite and spessartine. Crystals are always very small and cut stones correspondingly rare. The hardness is 5½-6, specific gravity 3.61-3.80 and refractive index (α) 1.726-1.748 (β) 1.728-1.750, (γ) 1.744-1.764 with a birefringence of 0.016-0.020. Pleochroism is insignificant and there is no luminescence. At one time pyroxmangite was thought to be a pyroxene, hence the name.

Eosphorite is the manganese end-member of a series $(Mn,Fe)AlPO_4(OH)_2.H_2O$. The iron-rich end-member is childrenite. It crystallizes in the monoclinic system forming pseudo-orthorhombic crystals and is pale pink; faceted stones are very bright though never large. The hardness is 5 and the specific gravity 3.05 (for the pure Mn end-member). Refractive index is given as (α) 1.638-1.639 (β) 1.660-1.664 (γ) 1.667-1.671 (for the whole series to childrenite) with a DR ranging from 0.029-0.035 (for eosphorite). A strong line can be seen at 410.0 nm and another at 490.0 nm. There is no significant luminescence but a pronounced pleochroism with yellowish, pale pink and colourless directions. Eosphorite is found in granite pegmatites often with manganese phosphates. Most cuttable material comes from Itinga, Minas

Gerais, Brazil. The name is from the Greek ἡωσφόρος, bringer of the dawn; childrenite from J. G. Children, English mineralogist.

Proustite, Ag_3AsS_3, forming crystals of a magnificent dark red, is found as a low-temperature hydrothermal vein mineral, usually with silver, galena, pyrite, etc. It is a member of the hexagonal crystal system; crystals from Andreasberg, Harz Mountains, Germany, are often scalenohedral and may rarely be sufficiently translucent to facet. Although the colour is so fine, unless proustite is kept away from light a surface tarnish will develop (this is a photochromic effect due to the silver content) so it should be ranked (with the others described above) as a stone for collectors. The hardness is 2-2½, specific gravity 5.5, refractive index (ω) 3.08 (ε) 2.79 with a DR of 0.296. Other features are not of great use in distinguishing proustite from, say, cuprite with which it shares its colour. The name is from the French chemist, J. L. Proust.

Opal variety 'contra luz' comes from Mexico and has the interesting property of displaying a play of colour by both transmitted and reflected light. I have seen only one example of this variety, which, like another illustrated in a book, is faceted; in my example the play of colour is exceptionally fine and the stone resembles a water opal more than any other variety, although it has a slightly bluish milkiness. This variety is said to be rare but would certainly make a most desirable specimen.

[*Manuscript received 25th August, 1978*]

A NOTE ON THE COMPOSITION OF JET

By HELEN MULLER, M.Sc., F.G.A.

SUMMARY

Samples of English, Turkish, Spanish, Russian and North American jet were subjected to x-ray emission spectroscopy. It would appear that the ratio of aluminium to silicon to sulphur is an indication of the provenance of the sample. This finding may be of interest to the archaeologist concerned with ancient trade routes. The significance of the results is limited because only one sample of each foreign jet was available.

INTRODUCTION

The name jet is derived from the ancient name Gagates through the old French Jaiet and old English Gayet. Pliny[1] says it is called Gagates after the town and river Gagae in Lycia (Turkey), where it was found in ancient times. Hagen[2] in her review of Roman jet maintains that the mineral referred to by Pliny was probably a type of lignite.

Jet is also found in Germany in the Poseidon slate of the Swabian and Frankish Alps[3], in the Danish island of Bornholm[3], the Jurassic near Czenstochau in Poland[3], in the greensands of the Upper Chalk formations in the Dept l'Aude in S. France[3] and in northern Spain in Aragon and Asturias[4]. Outside Europe it is found in the U.S.A.[3], Russia (Irkutzk) and in India.

In this country jet is obtained from the area around Whitby in North Yorkshire, where it is found in the Upper Liassic deposits of the Lower Jurassic in the stratum known as the Jet Rock Series. This is a layer of rock about 25 ft thick and composed mainly of a hard black bituminous shale in which the jet occurs in lenticular masses. The hard jet occurs in the upper 10 ft. Above the bituminous shales are the Alum Shales from which alum was manufactured until the late 19th century.

Jet is a form of brown coal which takes a high polish; it has a hardness of 3-4 and a SG ranging from 1.19 to 1.28. It gives a brown streak on porcelain and fractures conchoidally.

Both the ancient and the early 19th century writers thought it was a form of black amber. In 1811 it was referred to by Parkinson[5] as Succinum Nigrum and in spite of all evidence to the

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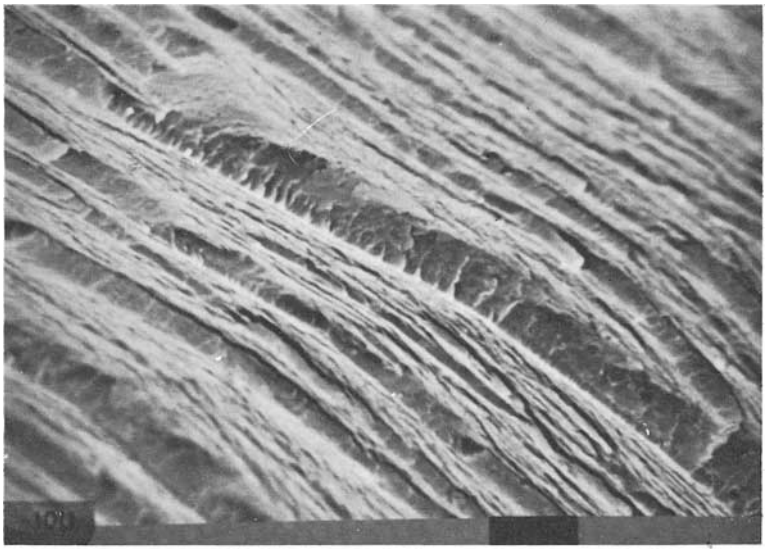

FIG. 1. S.E.M. Photograph of Whitby jet showing woody structure.

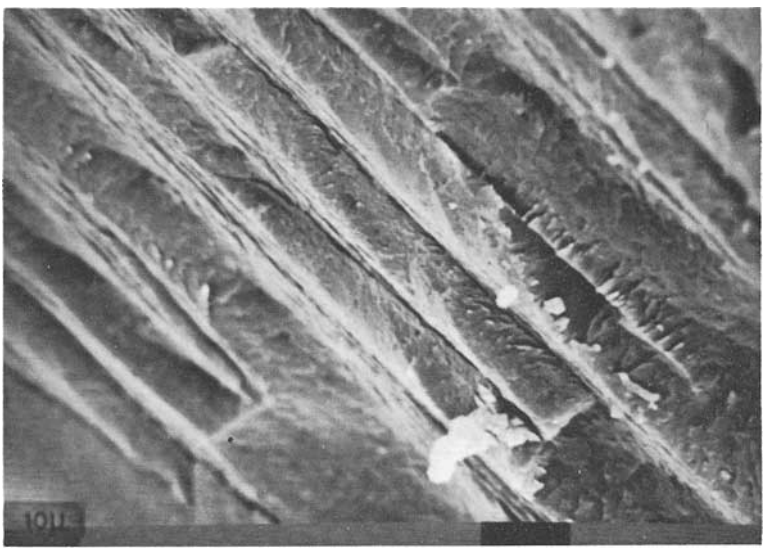

FIG. 2. S.E.M. Photograph of Whitby jet showing woody structure.

contrary the jet workers of Whitby were convinced that it was a form of solidified bituminous matter.

As early as 1904 A. C. Steward[6] produced photomicrographs showing clearly the ligneous nature of jet by the presence of tracheids. It has since been accepted by the scientific world that jet is a form of fossilized Araucaria—like soft wood which has been compressed by long immersion in stagnant water.

The first part of this paper is a confirmation of the ligneous origin of jet by the use of Scanning Electron Microscope (S.E.M) photographs of Whitby jet showing clearly the woody structure. Although large areas of the specimen appeared relatively structureless the spiral arrangement of the original cellulose fibrils on the inner wall of the wood cells can be clearly seen (Figures 1 & 2).

Because of its ability to take a high polish and its velvety black lustre, jet has been used for the manufacture of amulets and jewellery since Neolithic times. Jet beads are frequently found in the tumuli of northern England and Scotland[7] and the Romans made a considerable amount of jewellery in Eburacum (York) much of which is said to have been exported to Germany and Rome[2,8]. Jet was used by the Celts of the Hallstatt and La Téne periods[9] and during the 15th and 16th centuries there was a moderate jet-working industry in Schwäbisch Gmünd in Germany. In Spain the industry flourished in the 14th and 15th centuries and declined in the 16th, although continuing spasmodically until the present day[10]. The height of the Whitby jet industry was in the 19th century.

Archaeologists have expressed an interest in the origins of jet artefacts found both in this country and in Europe, particularly in the Rhineland. For this reason an attempt has been made to determine whether there was any difference in the composition of jet from Whitby and that from other sources.

Materials and Methods

Mr E. A. Jobbins, of the Institute of Geological Sciences, kindly provided one specimen of jet from each of the four provenances Turkey, Spain, Russia and the U.S.A., and these were compared with samples of rough Whitby jet obtained locally. The Turkish jet sample consisted of a small bead. Readings for all samples were taken from the freshly broken surface except for the Turkish bead which was mounted as received. A reading was also

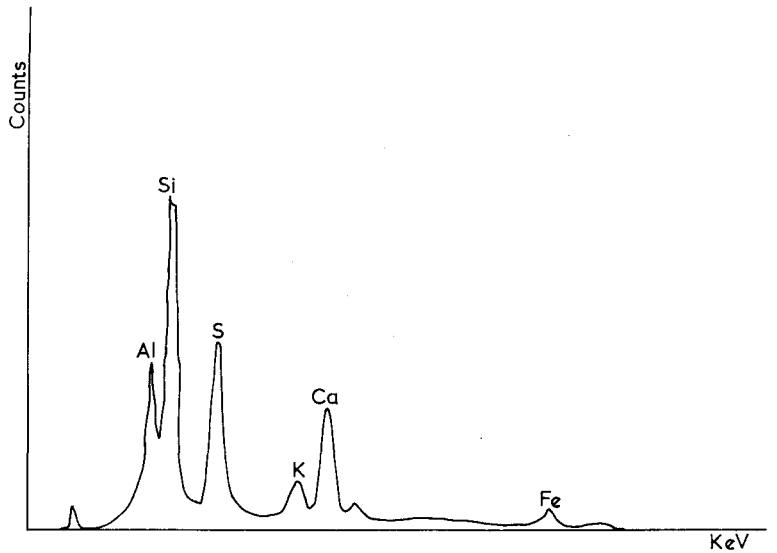

FIG. 3. X-ray emission spectrum of the outer surface of Whitby jet.

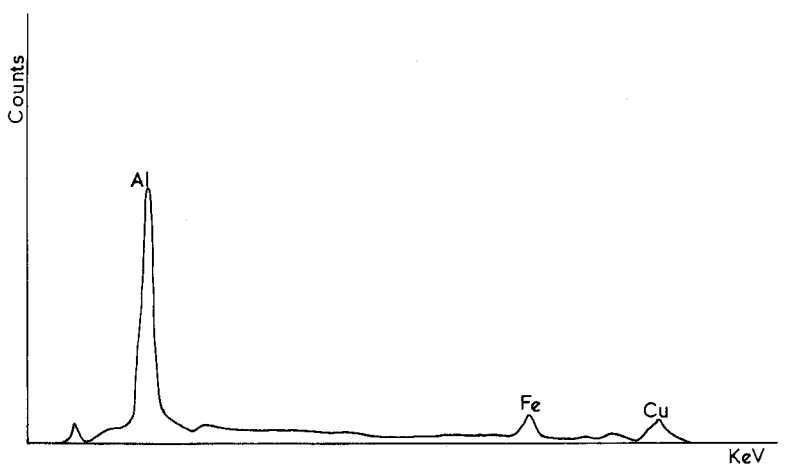

FIG. 4. X-ray emission spectrum of the internal surface of Whitby jet.

taken from the outer layer or 'skin' of the Whitby jet sample. Since the aim of this work was to indicate the provenance of manufactured artefacts from which the 'skin' had been removed during shaping and polishing it is the internal surface which is relevant.

The scanning electron microscope used was a Stereoscan 600 (Cambridge Scientific Instruments Ltd) fitted with a roll-film camera (C.B. 40). Before taking the pictures (Figures 1 and 2) the specimen was gold coated in the usual way, using a Polaron S.E.M. Coating Unit E 5000. For an analysis of the x-ray emission spectra the uncoated specimens were not mounted on the usual aluminium stubs. Since Whitby jet is often associated with alum[11], this stub was undesirable. For this reason all but one of the specimens were mounted on short stainless steel pegs by means of sealing wax. The exception was the Turkish bead. Here the peg was bent near its upper end by 45° and the bead placed upon it. In this way emission from the peg was avoided.

The x-ray data presentation unit (A.E.P. International Ltd) was used with an XY plotter. The areas of the peaks obtained were evaluated by triangulation (Area = Height of peak × width at half height in mm). As reported, the results are not quantitative, but the ratios of the peaks are (within the experimental error) in constant proportion.

Results and Discussion

1. *X-ray emission spectra.*

The results are shown in Figures 3 to 8. It appeared that the composition of the surface of the sample was different to the interior.

Whitby jet (Figures 3 and 4)

The surface was high in silicon and showed significant levels of aluminium, sulphur, potassium, calcium and iron. The internal surface contained a good deal of aluminium, very little sulphur and some iron and copper. Silicon, potassium and calcium appeared to be absent.

Spanish jet (Figure 5)

The internal surface showed both aluminium and sulphur as well as silicon, potassium, calcium, iron and copper. It is interesting to note that Bower[12] stated in 1873: 'the Spanish jet contains sulphur and no doubt this fact explains the reason of its breaking up under the influence of sudden changes of temperature.'

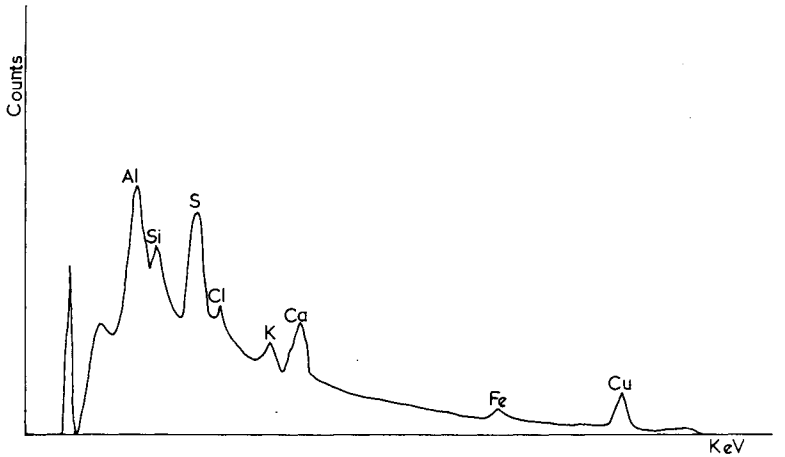

FIG. 5. X-ray emission spectrum of the internal surface of Spanish jet.

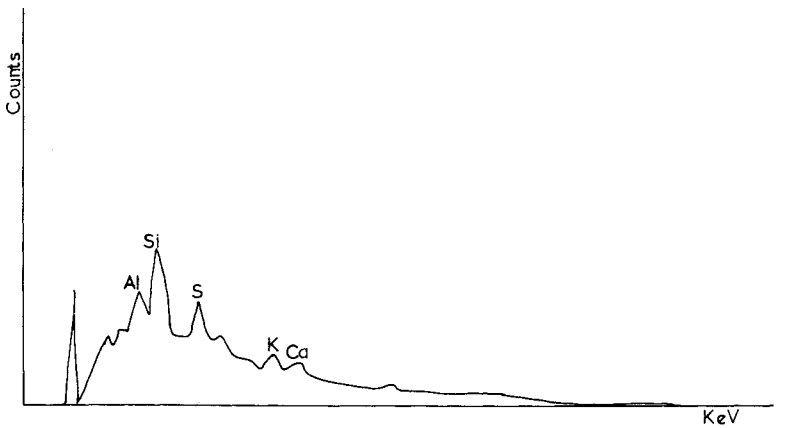

FIG. 6. X-ray emission spectrum of the internal surface of Turkish jet.

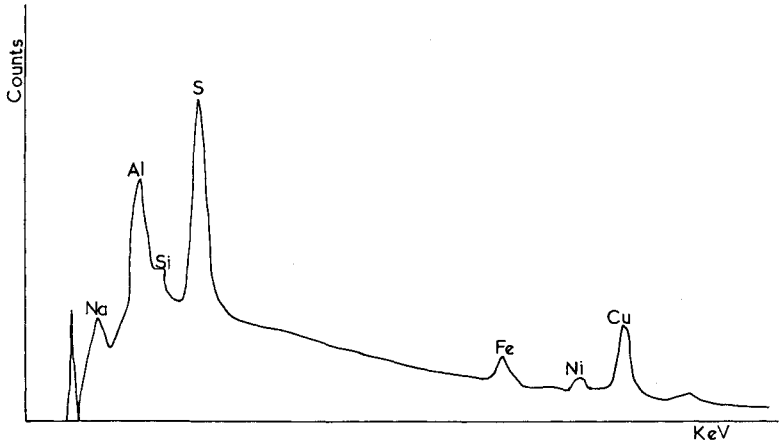

FIG. 7. X-ray emission spectrum of the internal surface of North American jet.

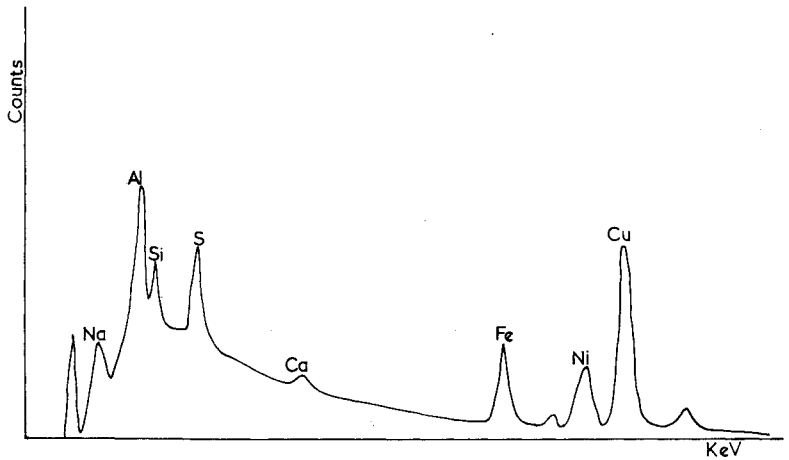

FIG. 8. X-ray emission spectrum of the internal surface of Russian jet.

Turkish jet(Figure 6)
The bead showed significant amounts of aluminium, silicon and sulphur as well as a little potassium and calcium.

2. *A COMPARISON OF ENGLISH, SPANISH AND TURKISH JET.*

Comparing the three types of jet of interest to the archaeologist, it would appear that the Whitby jet is high in aluminium but low in sulphur. The Turkish sample showed relatively high levels of silicon while those of aluminium and sulphur were similar. The Spanish jet contained little silicon and again the levels of aluminium and sulphur were similar. Iron and copper were present in both English and Spanish jet but not in significant amounts in the Turkish specimen.

Using triangulation, the peak surfaces of the jet samples for aluminium, silicon and sulphur appear to be in the following ratios.

	Al	Si	S
Whitby jet	30	0	0
Turkish jet	3	9	5
Spanish jet	12	2	2

This clearly distinguishes the three samples.

The value of these results to the archaeologist is of course limited, as only one sample of each foreign jet was available. No samples of French or German origin could be obtained. Nevertheless it is possible that the Al : Si : S ratio is characteristic of jet of a particular provenance. The author would be interested in testing further samples of jet of known origin.

3. *X-RAY EMISSION SPECTRA OF AMERICAN AND RUSSIAN JET.*

Although of no interest to the archaeologist the results on North American (Figure 7) and Russian (Figure 8) jets are given for the sake of completeness. Both showed significant levels of aluminium and sulphur together with silicon. A characteristic feature of both was significant amounts of iron, copper and nickel. The latter element was particularly noteworthy in the Russian sample.

ACKNOWLEDGMENTS

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EUCLASE*

By SUSAN M. ANDERSON, B.Sc.(Geol.), F.G.A.

I INTRODUCTION

The most significant gem-beryl producing area in Rhodesia is the Miami pegmatite field, situated a few kilometres north, east and south-east of the town of Karoi. Here, former argillaceous sediments of the mid-Precambrian Piriwiri Group have been converted, over successive metamorphic events, to sillimanite and staurolite schists with associated sillimanite gneisses. They form the country rock to pegmatites and late-phase quartz veins intruded at various times before and after the *circa* 500 Ma Miami metamorphic event. Economic minerals found in the younger pegmatites in this area include beryl, mica, tantalite and cassiterite; the quartz veins contain wolframite. Late-stage pneumatolytic processes, resulting sometimes in the kaolinization of the feldspar in

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the pegmatites, created an environment suitable for the growth and development of gem quality beryl, tourmaline and topaz (Stagman, 1978, p.56). These processes also appear to be responsible for the formation of euclase, which replaces earlier-formed beryl crystals.

The rarer beryllium minerals are more plentiful in the Miami area than in any other part of Rhodesia, and Wiles (1961, p.193) reports the presence of herderite, hurlbutite, phenacite, chrysoberyl and euclase. Most of these remain of academic interest although chrysoberyl is currently produced and the recently exploited euclase is of potential gem and specimen value.

Euclase has a general formula of $BeSiAlO_4(OH)$ and is a hydrated beryllium-aluminium silicate, with a common habit of stubby prisms terminated by prominent dome faces. Few of the published descriptions indicate its paragenesis, but it reportedly originates in granite pegmatites, quartz-topaz veins and greisens. Two authors (Sharp, 1961, p.1506, and Strand, 1953, p.4) consider its formation to be related to a late stage low-temperature replacement of beryl. This is thought to be the case for the Rhodesian material.

A prominent feature of euclase is the presence of a perfect cleavage (010) and the name derives from this characteristic. It was first introduced into Europe from South America in 1785 (Dana, 1892, p.509) and this first discovery, according to the available information, is today still producing crystal specimens and facetable material. Despite its comparatively early discovery, euclase has remained one of the classic rarities in the mineral kingdom.

II World Occurrences

Euclase has been recorded from the following countries: Brazil, U.S.S.R., Austria and other areas in the Alps, Guiana, East and West Germany, Tanzania, North America, Norway, England and Kashmir. Of these, Brazil, Tanzania and the U.S.S.R. have mined spectacular mineral specimens, including crystals up to 10cm in length (in McKie, 1955, p.86). The remaining occurrences are of academic interest, and crystals, generally of the order of 1-2mm, are usually colourless or pale blue.

Euclase from Brazil originates from the topaz-producing belt of the Ouro Preto, in the Minas Gerais region, and mention is made of occurrences at the Boa Vista and Capao do Lana Mines (Rolf, 1971, pp.1556-1562). It is probably fairly extensively associated

with the topaz, but in its colourless form it is easily overlooked. The euclase, found in kaolinized pockets within phyllites and dolomitic limestones of the Pre-cambrian Minas Series, which lie adjacent to a granite stock, is associated with yellow topaz, smoky and milky quartz, specularite and rutile together with secondary iron, manganese and titanium minerals. Although pegmatites containing beryl and mica are found in the general area, euclase is associated only with these hydrothermal kaolinized offshoots. Fluorite, another hydrothermal mineral, is reported in the limestones.

Euclase is also recorded from Brazil as an alluvial mineral, in diamond-bearing sands (Spencer, 1924, p.188).

Alluvial euclase occurs in the U.S.S.R.; the rolled crystals are found together with topaz, corundum and kyanite in the Orenburg District of the southern Urals (Spencer, 1924, p.188).

In Austria, euclase, together with albite, rutile and quartz, occurs in vugs within mica schists from the Gross-Glockner region of the Alps (Spencer, 1924, p.188), with other localities on the Salzburg and Carinthian sides of the Alps. Of minor interest is the euclase mentioned from granite pegmatites at Dobschutz, near Gorlitz in East Germany, and at Epprechtstein, Fichtelgebirge, Bavaria.

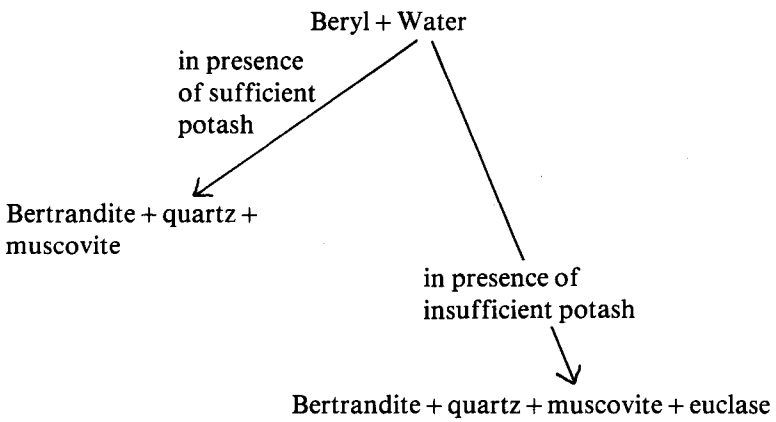
Two distinct habits of alluvial euclase are described from Guiana, as single isolated crystals of clear colourless material and radial aggregates of opaque crystals.

Euclase from Tanzania occurs, together with muscovite, in cavities in an offshoot of the larger Lukangasi pegmatite located in gneisses in the Morogoro District (Spencer, 1934, p.617).

The only record of euclase from North America is in Colorado where it is found in greisen pipes and related quartz-beryl deposits within two granite bodies (Sharp, 1961, pp.1505-8). In the Redskin Gulch area, vugs within greisen contain quartz, encrusted with euclase, associated with fluorite, muscovite and bertrandite. Within the greisen, local lens-shaped zones, composed of quartz, muscovite and bertrandite, contain hexagonal beryl pseudomorphed by fine-grained muscovite and cryptocrystalline bertrandite. In the Boomer Mine area, late-stage euclase, intergrown with quartz and muscovite, appears as clusters and coatings on fluorite crystals in vugs in a quartz-muscovite-fluorite greisen.

The euclase recorded from Norway is of academic interest

only; its paragenesis is similar to that described from Colorado. It occurs in vugs with bertrandite, muscovite and associated minor quartz and albite. The mica and bertrandite totally replace beryl which occurred in a marginal zone of a pegmatite from Iveland, situated about 50km north of Kristiansand in the southernmost part of Norway (Strand, 1953, pp.1-5). According to Strand the presence of cavities is the result of a decrease in volume caused by the replacement of the beryl. Although the bertrandite and rare euclase occupy about a third of the volume of the original beryl crystal no loss of beryllium is indicated. The formation of euclase is considered to be due to insufficient potash being available to convert the residual alumina to muscovite after the conversion of beryl to bertrandite.



The reaction envisaged by Strand is as follows:

$$12\ Be_3Al_2Si_6O_{18}\ (beryl) +$$
$$17\ H_2O + K_2O \rightarrow 9\ Be_4Si_2O_7(OH)_2\ (bertrandite) +$$
$$4\ K_2Al_4Si_6Al_2O_{20}(OH)_4\ (muscovite) + 30\ SiO_2$$

A crystal of euclase was discovered in a quartz vein within a greisen in the Cligga Head region of western England. This area has produced well-crystallized topaz from quartz-tourmaline veins and greisens and the occurrence of euclase in one sample indicates that the find could be repeated (Kingsbury, 1958, pp.815-16).

Euclase, occurring in a pegmatite vein with tourmaline, garnet and kyanite is reported from the Kanskar range in Kashmir. Associated with the pegmatites are kaolinized pockets which

contain sapphires. The country rocks are lenses of actinolite-tremolite within crystalline limestones (Webster, 1978, p.70).

Although some of these world-wide occurrences of euclase are of minor interest, the mineral association and paragenesis generally indicated is of late-stage, hydrothermal or greisen phase of pegmatite intrusion. A water phase is critical, euclase being a hydrated mineral.

III Rhodesian Occurrences

Some spectacular aggregates of euclase have been produced recently from mining claims held in the Miami area. These are: Last Hope, Last Hope 3 and M.W.M., located on Momba and Haselmere estates; Mishek, The Falls and Trim, all reputed to be in the Mukwichi Tribal area; and Rattis, situated on Farm 142 of Vuti Purchase Land. Disposal of the productions has been small and the bulk stockpiled while investigations to find the most lucrative market continue. Only one claim, the Last Hope, situated 13km north-north-east of Karoi has been examined. This mine formerly produced muscovite and the current excavations lie immediately west of one of the old mine shafts, some 500 metres south-east of Momba Farm homestead (Fey, 1978). The euclase has been extracted from a 2.5m wide pegmatite, striking parallel with the country rock at 088 degrees but dipping more steeply than the enclosing mica schists/gneisses. A crude zoning is recognized within the pegmatite; the marginal areas contain books of fish-tail muscovite, which are developed perpendicular to the strike of the pegmatite and, together with anhedral quartz, occur in iron-stained kaolin. Rare schorlite was also noted. Beryl crystals of a commercial grade are located in the centre, occurring in a matrix of iron-stained kaolin which contains muscovite and quartz. Larger 'blows' of quartz penetrate this zone from the marginal areas. The euclase occurs in association with the beryl and examples have been studied in which the sequence of replacement can be followed. Small aggregates of euclase crystals also occur in the marginal zone in association with quartz.

Some of the euclase crystals are transparent and of potential gem quality. Much of the material is dark indigo or cobalt blue, paling to peacock-blue. The striking coloration, which is intense in the prismatic zone, is often streaky, like that in kyanite. The overall blueness in the crystals is produced by these sharply defined

prismatic coloured zones within an allochromatic mineral. No differences were apparent in the x-ray diffraction patterns for the blue and colourless areas. Green tones are unusual, and attempts to alter the colour by heat treatment were unsuccessful.

Replacement of beryl crystals by euclase aggregates is often incomplete, but pseudomorphs by euclase and subordinate quartz with accompanying muscovite do occur with the hexagonal form of beryl well preserved. These coarse textured replacements are composed of anhedral crystals of euclase (which may attain prismatic lengths of several centimetres) between which cavities containing euhedral euclase and quartz occur. This vuggy texture is similar to the material described from Norway and Colorado. The replacement of the primary beryl is not limited to within the confines of the crystal: it would appear that the process is initiated on the crystal faces as evidenced by coarse-grained irregular encrustations of anhedral quartz, muscovite, and granular euclase. Additionally, a layer of quartz and pearly mica may form on the relict beryl faces. Beryl crystals showing partial replacement contain irregular patches of euclase developed in the angle between the beryl prisms. No other beryllium minerals were identified in the replacement assemblage.

A crystal was sectioned to observe the mineral change from beryl into euclase. The beryl, a single crystal 14cm in diameter, is irregularly fractured with quartz stringers penetrating the breaks. In places the quartz forms branching veinlets isolating areas of beryl which contain only the normal two-phase liquid inclusions. The beryl contact with the euclase patches is irregular and small areas of beryl are penetrated and surrounded by narrow veinlets of euclase originating from a larger euclase crystal. All these veinlets are in optical continuity with the parent crystal and both the parent and its offshoots are crowded with small randomly orientated quartz euhedra (see Figure 1). This form of quartz is not present in the beryl host.

It is proposed that the quartz euhedra are formed from the excess silica released during the replacement of beryl by euclase. Quartz is therefore regarded as forming an integral part of this replacement reaction since it is an early formed phase enclosed by euclase and occurs in the later stages as anhedral encrustations and cavity fillings.

It is possible that a reaction involving beryl, potash and water

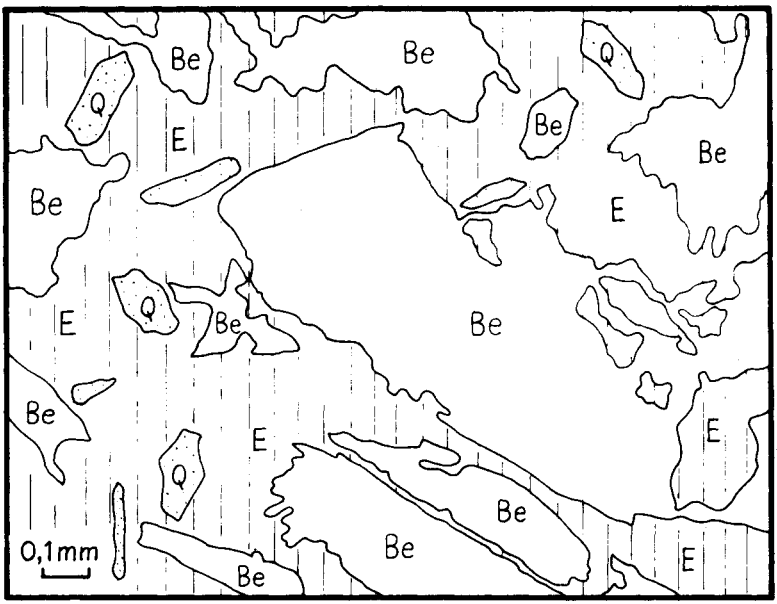


FIG. 1. Replacement of beryl by euclase.
Relict patches of a beryl crystal (Be) enclosed in a single euclase (E) crystal containing quartz (Q) euhedra.
(Drawn from thin section)

could produce euclase, quartz and minor muscovite in a closed chemical system, resulting also in a net volume decrease and hence vuggy texture.

IV Mineralogy of Rhodesian Euclase

Crystallography

A few perfect doubly-terminated crystals of euclase, up to 15mm in length, have recently been produced from Rhodesia. Larger, imperfect crystals showing well-developed faces are more common. Anhedral crystals, attaining prismatic lengths of several centimetres exist in the replacement aggregates.

Euclase crystallizes as stout prisms in the normal class of the Monoclinic System. These crystals are terminated by prominent clinodomes which are conspicuous on all samples examined. Clinopinacoids are prominent and usually well preserved and unmarked. The front and back faces of the crystals show a range in habits

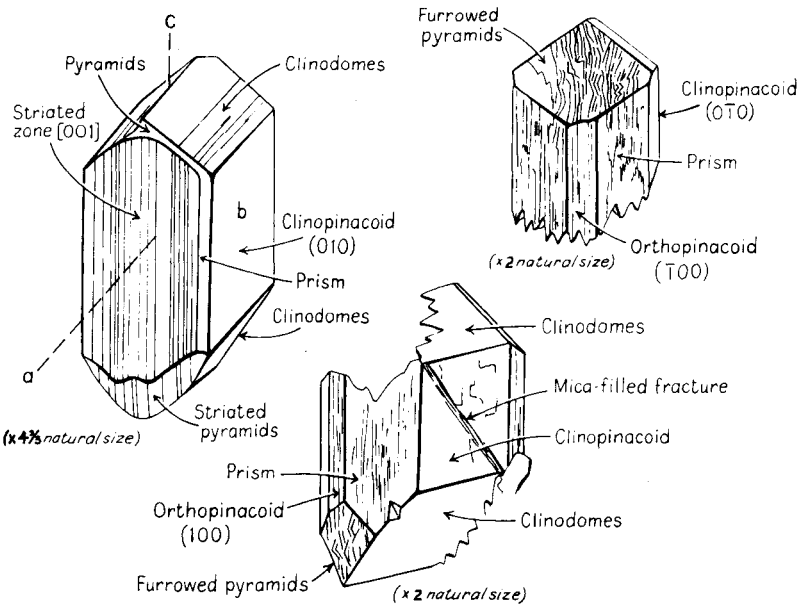


FIG. 2. Sketches of euclase crystal habits.

depending on the relative development of the prisms and orthopinacoids. In combination these faces cause a markedly striated [001] zone. Narrow unstriated orthopinacoids and prisms were observed. Pyramidal faces of the [010] zone are usually not conspicuous, often being small and unpatterned. However, in some examples, orthopyramids are well developed and often deeply furrowed by overlapping forms in a step-like divergent pattern (Figure 2). In contrast to the crystals from Brazil, the Alps and Tanzania, forms are simpler. Sketches showing some of the common habits of euclase from Rhodesia are depicted in Figure 2.

Chemistry

Only one chemical analysis of euclase is published, and it is presented in column A of Table I. The chemical analyses of the associated minerals bertrandite and beryl are also shown. Table II shows spectrographic analyses of euclase from Colorado and Rhodesia.

TABLE I
CHEMICAL ANALYSES OF EUCLASE, BERTRANDITE AND BERYL

	A	B	C
	EUCLASE $BeSiAlO_4(OH)$	BERTRANDITE $Be_4Si_2O_7(OH)_2$	BERYL $Be_3Al_2Si_6O_{18}$
BeO	16.97	42.00	13.39
Al_2O_3	34.07	—	17.99
SiO_2	41.63	49.26	65.23
FeO	1.03	—	0.57
Fe_2O_3	—	1.40	0.96
SnO_2	0.34	—	—
H_2O	6.04	6.90	1.23
K_2O	—	—	0.01
Na_2O	—	—	0.52
CaO	0.14	—	0.03
MgO	—	—	0.06
F	0.38	—	—
TOTAL	100.60	99.56	99.99

Localities: A. Brazil. Dana (1892, p.509)
B. Barbin, France. Dana (1892, p.546)
C. Missouri, U.S.A. Deer *et al.* (1962, p.260)

TABLE II
SPECTROGRAPHIC ANALYSES OF EUCLASE

	COLORADO	RHODESIA
	%	%
Si	major	major
Al	major	major
Be	7	major
Ca	0.005	less than 0.05
Fe	0.003	0.1
Cu	0.003	less than 0.002
Ge	0.15	0.025
Sc	0.003	n/v
Sn	0.015	less than 0.005
Mn	—	0.01
Na	—	—
Mg	—	less than 0.05
As	—	0.08

n/v not visible, less than 0.001%
Localities: Colorado. Sharp (1961, p.1508)
Rhodesia. Analyst, I. H. Green

Optical and Physical Data

The identification of euclase was confirmed by x-ray diffraction analysis. Table III shows data available from world-wide sources on euclase.

TABLE III
OPTICAL PROPERTIES OF EUCLASE

	A	B	C	D	E	F
	BRAZIL	GUIANA	COLORADO	U.S.S.R.	NORWAY	RHODESIA
SG	3.097	3.05	2.987(±005)	3.051	—	3.075
$n\gamma$	1.671	—	1.670(±001)	—	1.675(±003)	1.669
$n\beta$	1.6553	1.655(av)	1.655(±001)	—	1.655	—
$n\alpha$	1.652	—	1.652(±001)	—	—	1.653
2V	49° 37′	—	48°	—	45°	—

References: A. Dana (1892, p.509)
B. Spencer (1924, p.189)
C. Sharp (1961, p.1507)
D. Dana (1892, p.508)
E. Strand (1953, p.3)

V CONCLUSIONS

Insufficient data concerning the mineral stability field and geological environment for euclase were available to give a full understanding of its paragenesis. Euclase does occur as a primary hydrothermal mineral in miarolitic cavities in granites and pegmatites and as a product of greisenization in the late, low-temperature hydrated phase of pegmatite formation. Certainly there is good evidence to show that it forms as a replacement mineral after beryl by some process akin to autometasomatism within the late pneumatolytic stage of pegmatite development as exemplified in the occurrences from Norway, Colorado and Rhodesia. In these examples the presence of primary beryl is a common factor. It would seem that some basic initial chemical difference in the composition of the original pegmatite may be responsible for the preferential formation of bertrandite rather than euclase in the examples for Colorado and Norway.

The phenomemon of kaolinization of pegmatites is mentioned previously as providing an environment suitable for the development of the gem minerals, beryl and topaz. This process could also augment the pneumatolytic conditions in the replacement of primary beryl by euclase yielding kaolinite as a by-product. By

postulating that the original matrix for the primary beryl may have been potassium feldspar, a margin-core mineral for the Miami pegmatites (Wiles, 1961, p.91), it would therefore be possible, by reaction with water, to derive euclase, quartz, kaolin and potash.

$$2\,(Be_3Al_2Si_6O_{18}) + 10\,(KAlSi_3O_8) + 11\,H_2O \rightarrow$$
BERYL + FELDSPAR + WATER

$$6(BeSiAlO_4(OH)) + 2(Al_4Si_4O_{10}(OH)_8) + 28\,SiO_2 + 5\,K_2O$$
EUCLASE + KAOLINITE + SILICA + POTASH

The presence of euclase and quartz as an association has been described. Resultant kaolinite and potash could combine by the following reaction to produce muscovite mica, which is observed in the replacement association, viz:

$$3(Al_4Si_4O_{10}(OH)_8) + 2\,K_2O \rightarrow 2(K_2Al_6Si_6(OH)_4) + 8\,H_2O$$
KAOLINITE + POTASH MUSCOVITE + WATER

Given suitable conditions of temperature and pressure the water resulting from the above reaction could enter into reaction again with beryl and feldspar.

Unlike the St Ann's pegmatite where a kaolinitic phase is demonstrable (Grubb, 1976), this cannot be presumed in the case of euclase-bearing pegmatites. Although it is postulated that kaolinite is generated from the above reaction, the clay minerals in the pegmatite matrix may be the result of the present cycle of weathering and not the derivative of the pneumatolytic replacement process.

The suite of pegmatites containing economic minerals is considered by Wiles (1961, p.82) to be a younger group that are largely unaffected by the Miami metamorphism; it could follow therefore that the important pneumatolytic phase is merely a final stage of pegmatite genesis. In this case the replacement phenomenon is considered as occurring within a closed chemical system.

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VISUAL COLORIMETRY AND COMPARISON GRADING

By PETER G. READ, C.Eng., F.G.A.

Despite the use of sophisticated spectrophotometers in a few of the specialized diamond grading laboratories, and the introduction of relatively simple commercial instruments such as the Eickhorst Diamond Photometer[1] and the now obsolete Shipley colorimeter, the majority of polished diamonds are still colour graded by eye. A prime example of this can be seen in the international CIBJO colour grading system for diamonds, which is based on subjective comparison grading against a set of seven master stones chosen to define the boundaries between eight colour categories in the Cape series.

While the majority of diamonds cover only a very limited colour span, the grading of coloured gemstones presents the more complex problem of assessing a wide range of hues as well as variations in colour saturation and lightness[2]. In the few instances where this problem has been tackled, the simplest solution has

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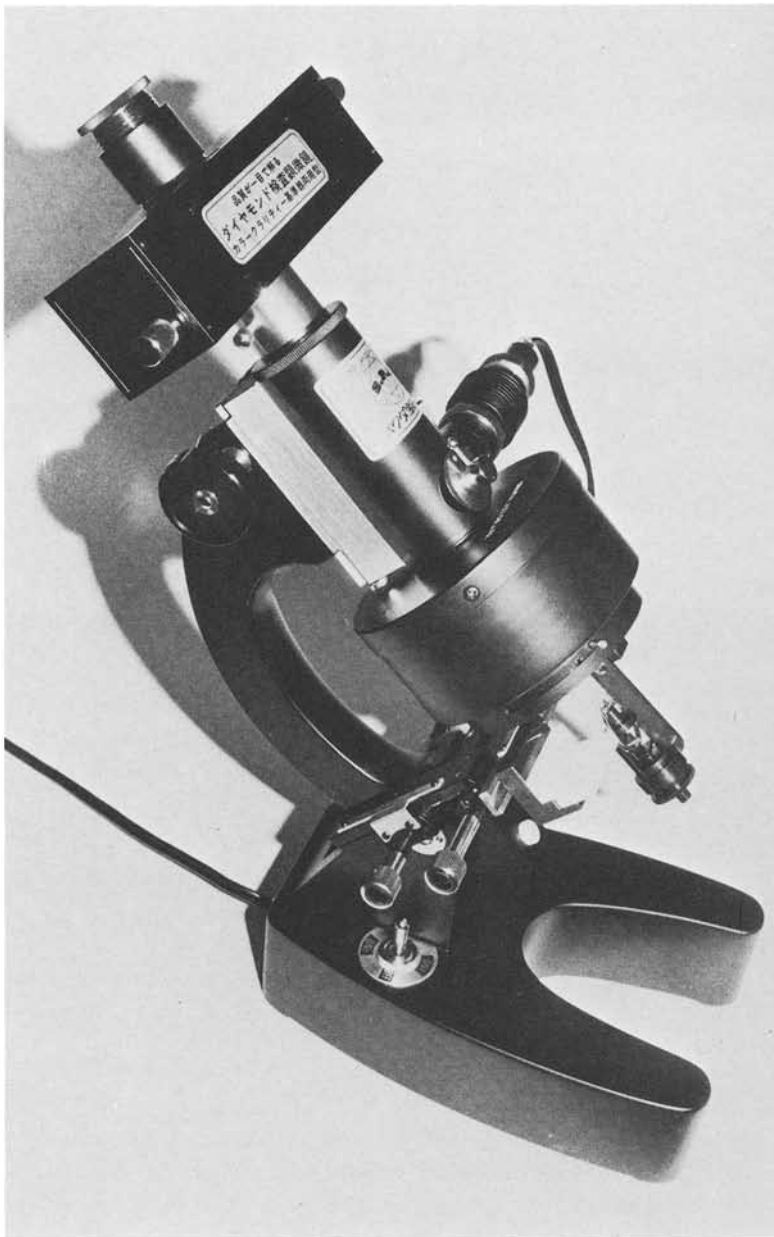

FIG. 1. The Okuda diamond grading microscope.

again been in the use of a set of master comparison stones appropriate to the particular colour variety.

Although comparison grading with the aid of master stones is undoubtedly effective, it can tie up a considerable sum of money in the value of the stones. The establishment of duplicate sets of stones for several grading laboratories can also be very difficult, usually necessitating a time consuming search through many hundreds of stones.

Recently, two instruments have been developed which provide an alternative to the use of comparison stones; one of these is designed for the colour grading of diamonds, and the other for the grading of coloured stones.

The first instrument is a new diamond grading microscope (Figure 1) designed by Okuda, the Japanese company who introduced the SPD printing-on-diamond service[1,3]. For colour grading purposes, the microscope uses a 10× wide-field eyepiece (giving an overall magnification of 20×). This forms an integral part of a simple visual colorimeter, or colour comparator unit. Colour comparison grading of Cape series stones is effected by means of a yellow-tinted glass slide, which is visible in the top

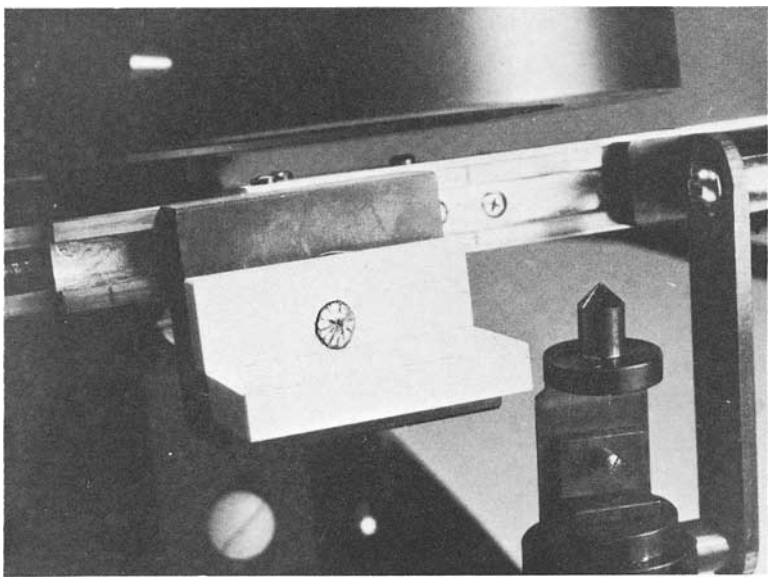

FIG. 2. A diamond positioned on the standard white grading surface.

section of the eyepiece's field of view. The slide is manufactured from a plate of yellow filter glass having a transmission peak at 585nm. This glass is polished into a wedge shape, the depth of the thicker end being adjusted to produce a colour saturation of 12% (equivalent to the G.I.A. grade 'J'), and that of the thinnest end to produce a colour saturation of 2% (equivalent to the G.I.A. grade 'E').

The unmounted diamond is placed on a standard white grading surface (Figure 2), and illuminated by a circular fluorescent grading lamp having a colour temperature and spectral distribution equivalent to the CIE standard illuminant C. The diamond is positioned so that it can be viewed through the side of its pavilion, and the grading surface is moved so as to bring the image of the diamond's table facet adjacent to that of the colour comparison slide. A control at the side of the colour comparator unit enables the slide to be moved laterally across the field of view until a colour match is obtained between it and the diamond.

The diamond's G.I.A. colour code is then read from a scale visible through a circular window immediately above the eyepiece (Figure 3). This scale is also calibrated 0-50. To allow for a more

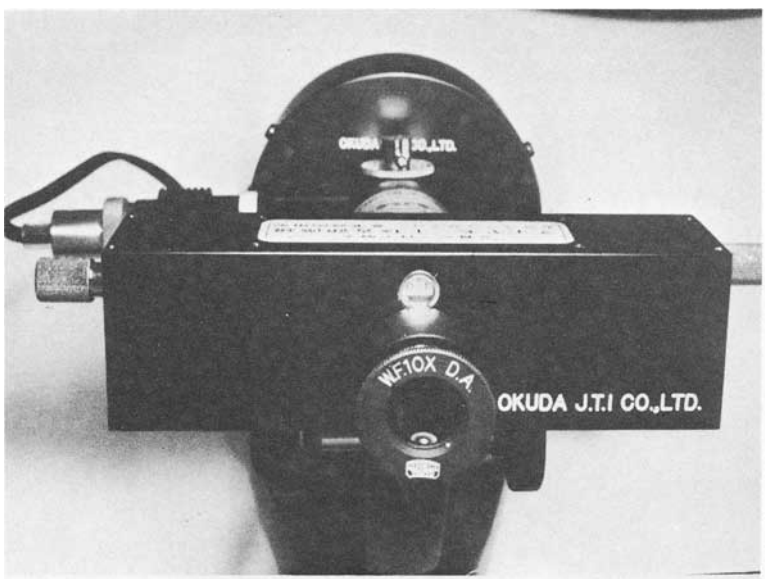

FIG. 3. Colour comparator unit showing colour saturation control (left), hue trimming control (right) and G.I.A. colour grade window (above eyepiece).

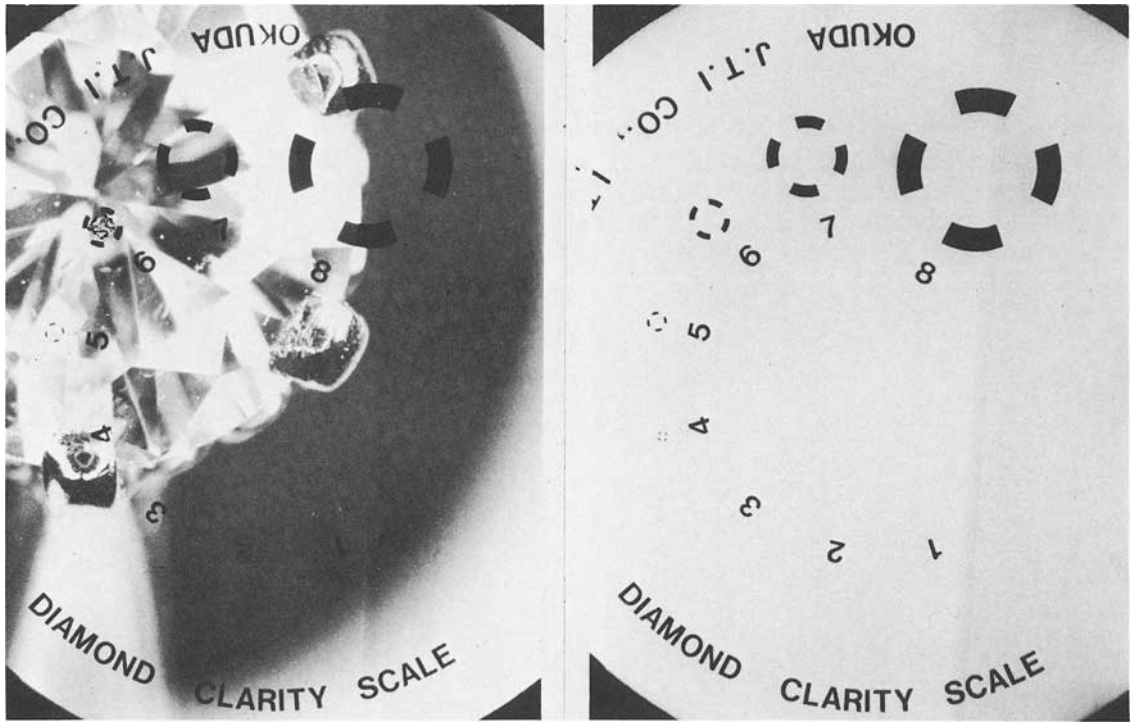

FIG. 4. Two views of the clarity grading graticule. On the left, a group of inclusions has been positioned within the clarity circle 6. No circle appears opposite the figure '1' as this represents a 'flawless' condition.

precise colour match with diamonds whose hue is slightly offset from 585nm, a hue trimming control is provided which allows the peak transmission of the wedge filter to be adjusted between the limits of 580nm and 590nm.

Provision is also made for clarity grading, the eyepiece optics containing a graticule on which is printed six circles numbered from 2 to 8 (Figure 4). Single inclusions, or groups of inclusions, are assessed for grading purposes by first noting the number of the smallest circle which completely encloses the inclusion, and then the number of the largest circle which can be fitted within the area of the inclusion. These two numbers are added together, and the appropriate CIBJO or National clarity grade derived from a table. If there is more than one inclusion or group, the individual numbers are added together. A weighting factor is also applied which depends on the reflecting or absorption properties of the inclusion, and its position within the stone.

To allow for easy inspection of mounted stones, the microscope stage is fitted with a spring-loaded holder (Figure 5), which can be rotated in two directions. An adaptor can be fitted to the

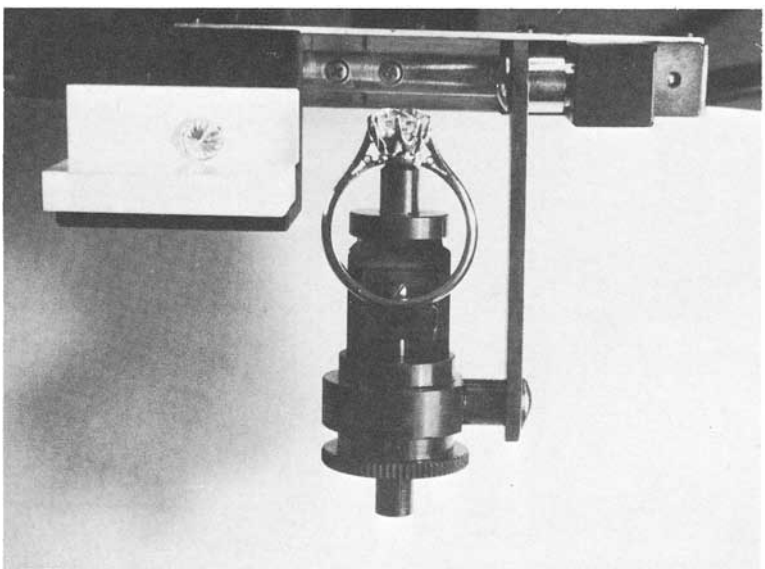

FIG. 5. Right: The spring-loaded ring holder (an adaptor can be fitted to hold unmounted stones). Left: A diamond on the standard colour grading surface.

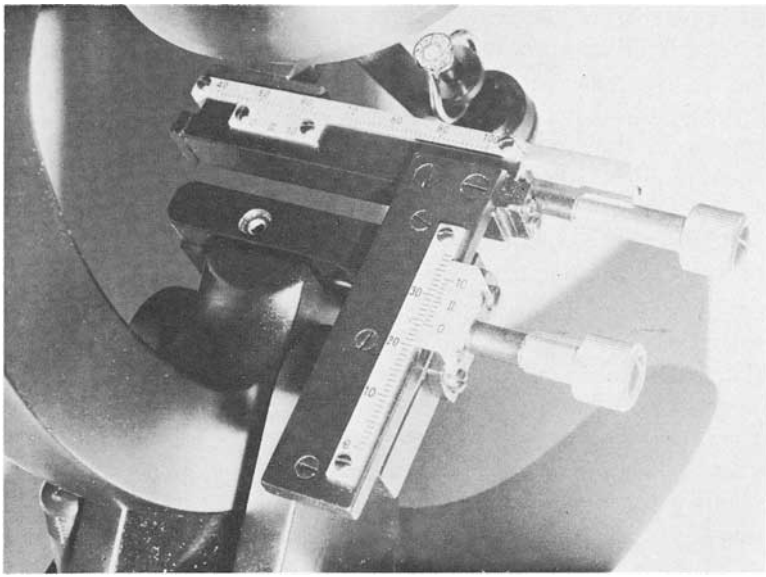

FIG. 6. The XY stage with vernier scales.

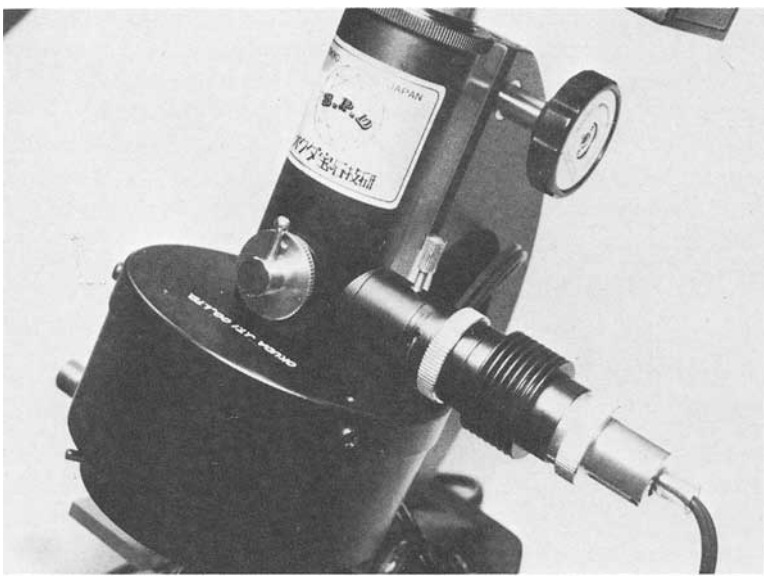

FIG. 7. The SPD illumination lamp is mounted at the side of the body tube alongside the control which adjusts the angle of the glass beam-deflector.

ring holder to provide a mount for loose stones. The stage can be indexed both laterally and vertically by means of two micrometer adjustments, each fitted with a vernier scale (Figure 6), which allow co-ordinate logging of inclusion sites. Both the ring holder and the grading platform can be moved independently along a common key-way cut in the front edge of the stage, and can be easily removed from the stage when necessary. The composite 10× eyepiece and colour comparison unit can be replaced by a 5× eyepiece to provide an overall magnification of 10× for non-grading work.

A three-position (centre-off) switch at the base of the microscope controls the circular fluorescent lamp, and allows an alternative source of illumination to be brought into use for inspecting the Okuda printed code on the table facet of a diamond. This 'SPD' illumination source comprises a small lamp unit (located at the side of the microscope's body tube) which is fitted with a green filter and an iris control (Figure 7). When in use, a rotatable glass beam-deflector in the microscope tube enables the green-filtered light to be set coaxially with the microscope optics, thus providing the increased contrast necessary for viewing the printed code against the mirror surface of the table facet.

The writer experienced two small difficulties when using this otherwise well-engineered instrument; one of these was caused by the inverted eyepiece image, although this was only apparent when it became necessary to position a stone other than by means of the XY controls. The other minor difficulty was associated with the circular lamp housing, which partially obscured the lateral vernier scale. This necessitated raising the microscope tube by means of the focus control in order to take a reading from the scale.

The microscope is designed for 100-volt and 240-volt, 50-60Hz operation, and is marketed by the Okuda Jewelry Technical Institute Co. Ltd, Fuji Bldg 2F, 30 -7 Taito-4-chome Taito-ku, Tokyo 110, Japan.

The second colour grading device[4] was developed in Professor H. P. Myers's Department of Solid State Physics at the Chalmers University of Technology, Gothenburg, Sweden, and is specifically designed for the colour grading of blue Sri Lankan sapphires. The work was carried out for the Sri Lankan State Gem Corporation and Via Star (Lanka) Ltd, both of which organizations required a simple and reproducible method for specifving and

grading sapphires which would not depend on the use of comparison stones.

Sri Lankan sapphires vary in colour saturation from a deep 'Royal' blue to a pale 'Cornflower' blue, the deeper colours containing a trace of red. As the appearance of colour in a sapphire is affected not only by its size, but also (because of dichroism and the way in which the colour is distributed within the stone) by the direction in which it is viewed, its colour is graded subjectively by inspecting it through the table facet.

In a search for a stable and easily available medium whose hue and colour saturation could be adjusted to match those of the Sri Lankan sapphires, the researchers at Chalmers University first measured the spectral response of a pale 2.5mm-thick disc of sapphire using a spectrophotometer (Figure 8). Despite the relative uniformity of this response curve, caused by the paleness of the specimen, two absorption peaks are noticeable at 390nm and 450nm, the latter being one of the iron bands characteristic for sapphire. A third much broader absorption band in the mid spectral range is the one mainly responsible for the colour of blue

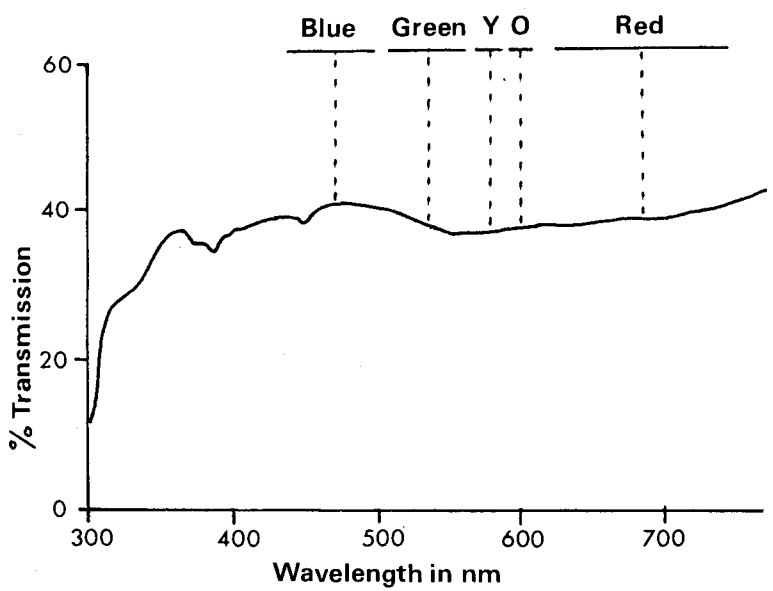

FIG. 8. Spectral transmittance of a 2.5mm-thick disc of pale sapphire.

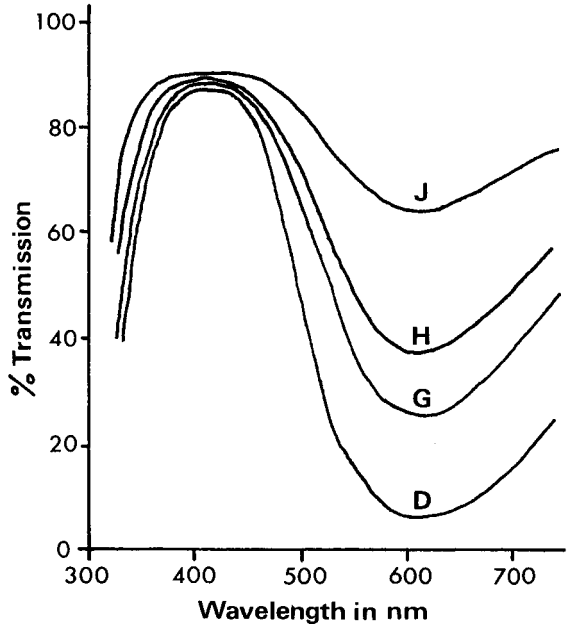

FIG. 9. Spectral transmittance of various strengths of copper ammonium sulphate solution.

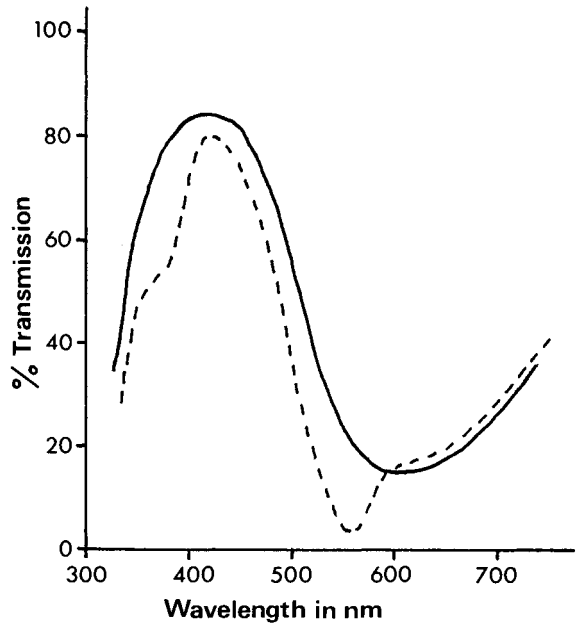

FIG. 10. The effect on the spectral transmission of copper ammonium sulphate (solid line) caused by the addition of a quantity of the standard solution of phenolphthalein is shown in the broken line curve, which has a strong absorption peak in the green at 560nm.

sapphire. The response curve confirmed that sapphire transmits green and yellow less well than it does blue and red, and indicated the type of spectral response necessary in a suitable comparison medium.

While investigating various liquids and dyes, it was discovered that the spectral response of blue sapphire was most closely matched by a solution of copper sulphate crystals in 2.5% ammonium hydroxide (Figure 9). With such a solution, the colour saturation could easily be adjusted by controlling the weight of crystals added to the solvent. To match the red tints present in Sri Lankan sapphires, it was found necessary to add to this solution appropriate quantities of a 'standard solution' made up from 50mg of phenolphthalein dissolved in 50ml of ethyl alcohol and 50ml of water. The increase in the red tint of the copper ammonium sulphate solution is due to an absorption band which appears in the green section of its spectra at 560nm (Figure 10).

From the results, it is possible to specify a series of copper ammonium sulphate solutions (doped by the standard phenolphthalein solution) which match the required nine colour standards (see Table). These nine solutions are then made up and placed in small glass cuvettes (Figure 11) having accurately parallel and polished walls. The cuvettes are fitted with extension reservoirs so

TABLE

Colour Grade	Weight of $Cu_2 SO_4.5H_2O$ crystals in grams per litre of 2.5% NH_4OH.	Volume of standard phenolphthalein solution as a percentage of undoped solution
B	8.0 grams	13.0%
C	6.67 grams	9.0%
D	5.0 grams	6.0%
E	4.0 grams	3.5%
F	3.33 grams	2.3%
G	2.5 grams	1.4%
H	1.67 grams	0.8%
I	1.25 grams	0.5%
J	0.625 grams	—

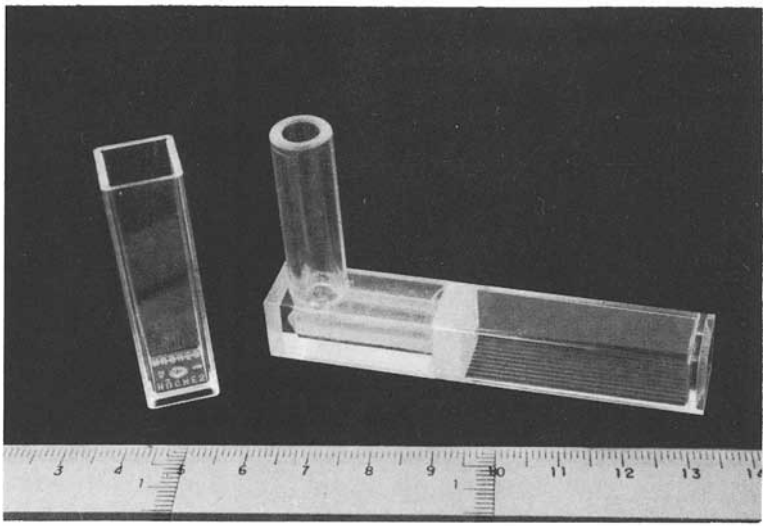

FIG. 11. The standard glass cuvette (left) fitted with a reservoir extension (right).

that they can be positioned horizontally in a light box containing a daylight fluorescent lamp and having fixed illumination geometry (Figure 12).

The colour grading of sapphires is carried out by direct comparison with the uniform colour of the liquid in the horizontal section of the cuvettes, the sapphires being placed in the illuminated area directly in front of the cuvettes (Figure 13).

The cuvettes are arranged and coded as follows:

B	C	D	E	F	G	H	I	J
Deep Blue			Medium Blue				Pale Blue	

For grading purposes, first the nearest and then the second nearest cuvette colours are identified. These are then used in the following way to produce a classification code. If a sapphire is nearest to F in colour, but is paler than E, it is classified as F_G. If a sapphire is nearest to D, but deeper in colour than E, it is classified as D_C.

As the liquids used in the cuvettes have a specific chemical composition, they can be easily duplicated in any grading laboratory which has access to the appropriate chemicals. Use of the light

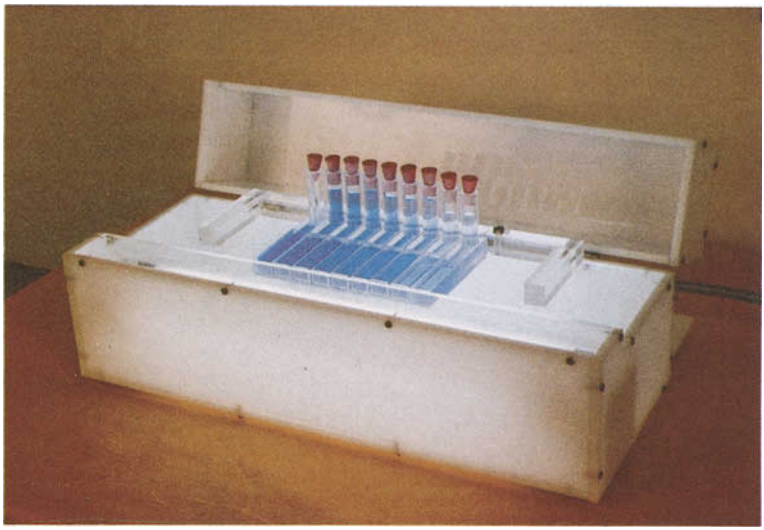

FIG. 12. Colour grading light box showing the nine cuvettes in position.

FIG. 13. Light box with lid closed. Comparison colour grading is effected on the transparent section in front of the cuvettes.

box will permit the colour grading of Sri Lankan sapphires without the need for comparison stones. The derived colour codes will also permit the unambiguous colour description of these sapphires.

The writer found the light box easier to use than a set of comparison stones, and this was probably due to the larger area of colour available for matching purposes. While this particular project was initiated for the colour grading of Sri Lankan sapphires, it is anticipated that with the appropriate solutions it will be possible not only to match the colour range of sapphires from other sources, but also that of rubies, emeralds and diamonds.

REFERENCES

1. Read, P. G., New Gemmological Instruments and Techniques, *J Gemm.*, 1979, **XVI** (6), 386-407.
2. Yu, R. M., Gemmological colorimetry, *J. Gemm.*, 1978, **XVI** (4), 259-69.
3. The code is visible under contrast lighting at 20× magnification, but because of the thinness of the printed symbols they are not visible under normal illumination. The original printed code was very much smaller and required a magnification of 400× (see Figure 16 in Reference 1. above).
4. Myers, H. P. *Report on Colour Classification of Sapphires from Sri Lanka,* Chalmers University of Technology, September 1978.

[*Manuscript received 27th July, 1979,*]

GEMMOLOGICAL ABSTRACTS

AKIZUKI(M.), HAMPAR(M. S.), ZUSSMAN (J.). *An explanation of anomalous optical properties of topaz.* Mineralog. Mag., **43**, 237-41, 4 figs, 1979.

Some topaz crystals show a sectorial texture which is related to the growth of the crystal. Fluorine/hydroxyl sites in topaz are symmetrically equivalent in the solid crystal, but this balance is sometimes lost at growth surfaces so that the crystal symmetry is reduced. Topaz heated to about 950°C loses the optical anomalies resulting from the reduction in symmetry. M.O'D.

BANK (H.). *Gemological notes.* Gems & Gemology, **XVI**, 4, 123-5, 1978.

Describes blue gem quality haüyne from Eifel, Germany; demantoid garnet of deltoid-icositetrahedral habit (usually a form found only in combination, according to Dana) from Korea and various blue/red colour-change garnets of the pyrope/spessartite group from Tanzania are reported and compared with similar stones from Sri Lanka. R.K.M.

BARLOW (F. J.). *Red beryl of the Wah Wah's.* Lapidary Journal, **32**, 12, 2540-70, 16 figs (15 in colour), 1979.

Describes the finding and fashioning of a manganese-bearing type of beryl found in the Wah Wah Mountains of Utah. M.O'D.

BECK (R. J.). *Jade and gemstones from Southern New Zealand.* Lapidary Journal, **33**, 1, 186-90, 4 figs, 1979.

Deals mainly with nephrite but mentions some less important ornamental materials including several varieties of quartz. M.O'D.

COLLINGS (A. T.). *Investigating artificially coloured diamonds.* Nature, **273**, 654-5, 1 fig., 1978.

It is suggested that the absence of an absorption line at 595 nm (used by many gem-testing laboratories to decide the pedigree of yellow-coloured diamonds) does not unambiguously categorize a diamond as untreated. This line disappears completely when annealing temperature is increased from the normal range of 700-800°C to 1000°C. R.A.H.

GALWEY (A. K.), JONES (K. A.), REED (R.), DOLLIMORE (D.). *The blue colouration in banded fluorite (Blue John) from Castleton, Derbyshire, England.* Mineralog. Mag., **43**, 243-50, 2 figs, 1979.

Microscopic examination of lightly etched and cleaved (111) surface of Blue John seems to show that coloured lamellae are not associated with dislocations in the lattice. It is suggested that the blue colour is caused by colloidal calcium which results from radiation damage; this may be caused by the intermittent deposition of radioactive material on the surfaces during growth. M.O'D.

GIANNOTA (V. P.). *Precious amber in the Simeto River, Sicily.* Lapidary Journal, **33**, 1, 32-4, 1979.

Amber with a wide variety of colours is found in the Simeto River area of Sicily. Much of the material is fluorescent. Brief details of recovery are given. M.O'D.

GÜBELIN (E. J.). *Sapphire-blue euclase, a new collector's gem.* Gems & Gemology, **XVI**, 4, 104-10, 1 map, 1 fig, 1978.

Euclase, referred to here as the epigone (later generation) of beryl, has been found near Miami in Zimbabwe-Rhodesia. It is in a deep blue colour reminiscent of sapphire. RI 1.652—1.671, DR 0.019 positive. SG 3.06 to 3.13. H 7½. Colour often in bands alternating deep blue and colourless. R.K.M.

HENRY (J. H.). *Pink diamonds.* Lapidary Journal, **33**, 1, 35-54, 4 figs (2 in colour), 1979.

A short account of a number of pink diamonds with historical notes. M.O'D.

HUANG (C. K.), YEH (C. L.). (Taiwan cat's-eye). J. Gemm. Soc. Japan, **5**, 4, 13-20, 3 figs, 1979. (In Japanese with English summary).

Taiwan cat's-eye is found to be a chatoyant tremolite which occurs in veins at the contact of graphite-sericite schist and serpentinite sills in association with nephrite, asbestos, talc and a diopside skarn in the Fengtien area south of Hualien, Taiwan. The colour is greenish-, pale- or honey-yellow, dark green, dark brown or black, translucent to opaque. H6-7, SG 3.045, RI 1.613, 1.626, 1.637. X-ray examination shows that the material is close to that found in the St Gotthard area of Switzerland. M.O'D.

IISHI (K.), SALJE (E.), WERNEKE (Ch.). *Phonon spectra and rigid-ion model calculations on andalusite.* Physics and Chemistry of Minerals, **4**, 173-88, 8 figs, 1979.

Al-O bond strength of about 70% ionic and SiO_4 tetrahedra bonded mostly covalently with about 40% ionicity have been established by polarized Raman and infrared spectra in andalusite. M.O'D.

JONES (R. W.). *Chrysocolla, Arizona's premier gem.* Lapidary Journal, **33**, 1, 6-16, 12 figs (11 in colour), 1979.

Chrysocolla is found at the Cobre Valley, Arizona, close to the towns of Miami and Globe. Specimens are still being recovered. M.O'D.

KOMATSU (H.), AKAMATSU (S.). (Studies on differentiation of true and artificial coloured black and blue pearls). J. Gemm. Soc. Japan, **5**, 4, 3-8, 40 figs (31 in colour), 1979. (In Japanese with English summary).

Black pearls have been cultivated recently in the Ishigaki Islands, Okinawa and in the Tahiti Islands. Blue pearls have also been encountered among ordinary cultivated pearls. True and artificially coloured black pearls can be distinguished by a combination of four different methods or by comparing different colouring on infrared film. Further study is needed on the blue pearls. Methods of cultivation of the black pearl are described. M.O'D.

LEITHNER (H.). *Sherrybraune Topase von Ouro Preto in Brasilien.* (Sherry-brown topaz from Ouro Preto, Brazil). Lapis, **4**, 5, 26-29, 5 figs (3 in colour), 1979.

A brief account with fine illustrations of the topaz found in the classic locality of Ouro Preto, Brazil. An early map of the district is reproduced. M.O'D.

NASSAU (K.). *Distinguishing diamond from cubic zirconia.* Gems & Gemology, **XVI**, 4, 111-17, 3 figs, 1978.

Summarizes in detail the assessment of the two substances by infrared reflectometer, by diamond wetting pen, and by thermal conductivity probe. All three methods are approved, but each has some slight limiting factor. Dr Nassau points out that some felt-tipped pens will also be suitable for the diamond wetting test. R.K.M.

NASSAU (K.). *An examination of the new Gilson 'Coral'.* Lapidary Journal, **33**, 1, 42-49, 4 figs (2 in colour), 1979.

A coral imitation consisting largely of calcite has been made by the firm of Gilson. The density is lower than for the natural material (2.44 as against 2.6-2.7); the material is slightly porous and some extra phases are revealed by x-ray diffraction and thermal analysis. M.O'D.

NASSAU (K.). *A test of the Ceres diamond probe.* Gems & Gemology, **XVI**, 4, 98-103, 2 figs, 1978.

A thorough assessment of a new diamond testing instrument depending on the very high thermal conductivity of diamond when compared with its simulants. Tests down to sizes of about 0.03 ct. In general this is a new test for diamond and works admirably. R.K.M.

O'DONOGHUE (M.). *Scandinavia to Russia.* Gems, **11**, 3, 47-49, 1979.

The second part of an account of a mineralogical tour to Norway, Sweden, Finland and the U.S.S.R.; includes notes of visits to institutions in Moscow and Leningrad. In all museums visited synthetic crystals were on display. The Diamond Fund in Moscow showed very large, well-formed diamond crystals as well as set pieces. (Author's abstract) M.O'D.

ROBERTSON (A. D.). *Lowmea amethyst deposit.* Queensland Govt. Mining J., **79**, 380-1, 1 fig., 1978.

Amethyst occurs in vugs having an outer sheath of milky quartz. These occurrences are found in quartz veins in an adamellite. Radiation from the adamellite is thought to have caused the colour development and colour zoning. Fractures and annealed fractures are common, and rutile rods, feldspar, and magnetite dust have been observed. D.J.D.

SAHAMA (T. G.), KNORRING (O.), TÖRNROOS (R.). *On tourmaline.* Lithos, **12**, 109-14, 4 figs, 1979.

Chemical analyses and physical properties are given for a group of 10 tourmalines from Mozambique, one from Afghanistan and one from Madagascar. The colours of the stones examined vary. Isomorphism in the tourmaline group is reviewed. M.O'D.

TURNER(N.) *et al. Gemstones of New Zealand.* Lapidary Journal, **33**, 1, 116-41, 17 figs, 1979.

A survey of the main ornamental materials to be found in New Zealand, with a map and guides for rockhounds. M.O'D.

VAN LAER (W. C.). *Tourmalines of the Homestake Pass.* Lapidary Journal, **33**, 1, 58-64, 6 figs, 1979.

Tourmaline has been found at the Homestake Pass, Butte, Montana, U.S.A. Crystals are black and found in association with smoky quartz and perthite. M.O'D.

WILL (G.), NOVER (G.). *Influence of oxygen partial pressure on the Mg/Fe distribution in olivines.* Physics and Chemistry of Minerals, **4**, 199-208, 3 figs, 1979.

Mg/Fe ordering in olivines appears to be affected by prevailing pressure of oxygen. Natural crystals of volcanic origin were studied by x-ray diffraction. M.O'D.

WINDISCH (H.). *Polishing material in Southern Africa.* Lapidary Journal, **33**, 1, 18-30, 8 figs, 1979.

A survey of the ornamental material available from the southern part of Africa. Stones described include tiger's-eye, agates, amethyst, rose quartz, petrified wood, hydrogrossular garnet, amazonite, aragonite, sodalite, stichtite and verdite. M.O'D.

YU (R. M.), HEALEY (D.). *A new refractometer.* Lapidary Journal, **33**, 1, 288-91, 6 figs, 1979.

A refractometer using the principle of total internal reflection and involving the movement of the eyepiece is described. Birefringence can also be measured but the RI of cabochon-cut stones cannot. Accuracy to within ±0.02 (Rayner ±0.001) is claimed. M.O'D.

ZEITNER (J. C.). *From Russia—a new gem.* Lapidary Journal, **33**, 1, 208-14, 7 figs, 1979.

The new gem, not (strictly) Russian but Siberian, is charoite, which is described. Some details of the appearance of charoite on the Western market are given. M.O'D.

ZEITNER (J. C.). *Gems of Brazil.* Lapidary Journal, **33**, 1, 142-55, 15 figs, 1979.

A general account of the main gem materials found in Brazil, with a map. M.O'D.

ZEITSCHEL (W.). *Tektite-die rätselhaften Gläser.* (Tektites, the mysterious glasses). Mineralien Magazin, **3**, 172-5, 8 figs in colour, 1979.

A short introduction to tektites with a map and bibliography. M.O'D.

BOOK REVIEWS

ARIYARATNA (D. H.). *Gems of Sri Lanka.* 3rd revised edn. D. H. Ariyaratna, Colombo, 1978. pp.47. Illus. in black-and-white and colour. Price on application.

A pocket-sized and pleasantly-written book whose main value is in the account of gem working in Sri Lanka. A number of Sinhala words are explained and details given of the operation of the State Gem Corporation. Only the more important stones are described but the matter is clear and accurate. M.O'D.

ELWELL (D. H.). *Man-made gemstones.* Horwood, Chichester, 1979. pp.191. Illus. in black-and-white and in colour. £15.00.

This is a badly-needed book in which the emphasis is placed upon the history and development of crystal growth as it affects gem-quality materials. It does not set out to be a student's guide and for this reason does not include notes on or illustrations of inclusions (although they are mentioned where relevant). There is a short table of the major constants of the better-known gemstones, a glossary, a guide to growing your own rubies and a short general bibliography, more detailed papers being listed at the end of the appropriate chapters. The details of the various processes used to grow gem-quality crystals are lucidly described and the information is up-to-date. One weakness of standard gemmology texts is that crystal growth processes are not well described and tend to be dated. This book fills that gap and is very welcome on that account. M.O'D.

FYNN (G. W.), POWELL (W. J. A.). *The cutting and polishing of electro-optic materials.* Hilger, Bristol, 1979. pp.xv, 215. Illus. in black-and-white. £25.00.

Those with an interest in polishing man-made transparent materials will find parts of this book very useful, although it is not intended for the lapidary or gemmological market. Tables at the end of the book list a variety of substances and their behaviour under various conditions of polishing; agents are also listed. M.O'D.

GILL (J. O.). *Gill's index to journals, articles and books relating to gems and jewelry.* Gemological Institute of America, Santa Monica, California, 1979. pp.xiii, 420. $24.50.

This unusual book is divided into four sections covering gems and gem materials, gem locations, gemmology and jewelry. Within each section various topics are listed alphabetically and referred to six journals (*Minerals Yearbook, Gemmologist, Gems and Gemology, Journal of Gemmology, Lapidary Journal* and *Australian Gemmologist*). There is also a section headed 'Gem Library Bibliography' which includes monographs. So far so good. In the section on gems there is little difficulty since the reader would expect to find the materials listed alphabetically; but some parts of this section are a little unexpected, for example 'group gem descriptions' (mostly including works on synthetics) is not referred to from the term 'synthetic' anywhere else in the book (there is no general index). 'Wonderstone' is included but its identity is not given; alternative names for some substances are given in brackets with the main name chosen but again there are no

cross-references. In each journal section references are given in date order; a few include the name of the author but choice of this (and of capitalization) is capricious.

Similar inconsistencies appear in the locality section; South-west Africa is alternatively called German South West Africa rather than Namibia; British Isles is not a recognized geographical name; on the other side Botswana's former name is omitted although that for Lesotho is given. A school atlas would have cleared all this up. Moldavite and its fellows are given at the end of the section under the heading 'Gems from Space'.

Part 3, Gemmology, has the most capricious choice of sub-headings and it is admittedly hard to see how this can be avoided if this particular arrangement is adopted. Thus we find 'assembled stones' with no cross-reference from composites or doublets; 'fraud in gemmology' with no reference from 'forensic'; 'phenomena' (to include chatoyancy, asterism, etc.); 'refractive index' (to include polarized light) and many other inconsistencies and downright annoyances.

Annoyance is the prevailing feeling after using this book, whose conception is good. Like so many amateur productions (for this is quite unprofessionally done) the conception is not assisted by any skill or forethought. Not to include a general index or cross-references is a major blunder (or even cynical cost-cutting) by author and publisher; it would have been better to wait until all loose ends had been tidied up; until the text had been read by someone more familiar with gemmology and publishing and until headings had been agreed by a number of people rather than by just one. None the less many will find the book useful—but why not strive for excellence too? M.O'D.

MARFUNIN (A. S.). *Physics of minerals and inorganic materials: an introduction.* Springer, Berlin, 1979. pp.xii, 340. $(US)53.90.

This is an important book for students of the electronic structure of atoms in minerals and for those with interests in the area where mineralogy and the physics of the solid state meet. This area covers such topics as the effect of chemical bonding on spectroscopy, the energy band theory and the reflectance spectra of minerals, and the origin and nature of mineral coloration Mathematics 'has been kept to a minimum' as almost all books of this nature now seem compelled to say; but it is also true that a number of concepts are not understandable except in mathematical terms. This is particularly true of quantum mechanics, the study of which is vital to an understanding of atomic behaviour.

Readers of the *Journal of Gemmology* would probably find the sections on types of optical absorption spectra and selection rules especially interesting. (Selection rules cover the various transitions theoretically possible for electrons and explain why some transitions are impossible). Although the spectra associated with transition metal ions are explained, those wishing to know more about the spectra associated with rare-earth ions should refer to a work by the same author (*Spectroscopy, luminescence and radiation centres in minerals,* to be reviewed later). The conceptions and their associated observations are especially elegant and show (at least to this reviewer) the beauty of the physical side of mineralogy. M.O'D.

ASSOCIATION NOTICES

GIFTS TO THE ASSOCIATION

The Council of the Association is indebted to the following for their gifts:

Mr J. R. H. Chisholm, M.A., F.G.A., Lytham St Annes, for a book entitled 'A History of Fossils' by John Hill, London, 1747 (being the first volume of that author's 'A General Natural History: or, Descriptions of a knowledge of the Animals, Vegetables, and minerals of the different parts of the World.').

The Gemological Institute of America for a small refractometer which is included in the Gem Instruments Corporation 'Mini-Lab' set.

Mr R. Holt, F.G.A., London, for two step-cut stones—a blue kyanite weighing 2.58ct and a colourless petalite weighing 4.32ct.

Mr Per Paulin, B.Sc., F.G.A., Uppsala, Sweden, for a gift of money for the purchase of specimens for students.

NEWS OF FELLOWS

On 20th September, 1979, Mr F. A. Fryer, B.Sc., F.G.A., gave a lecture entitled 'The Chemistry of Colour' to the Chemical Society of the German Democratic Republic at Wilhelm-Pieck University, Rostock, E. Germany.

On the 5th October, 1979, Mr M. J. O'Donoghue, M.A., F.G.S., F.G.A., gave a talk entitled 'Finding Gemstones' to the Sussex Lapidary and Mineral Society. Mr O'Donoghue also gave a two-day course to Liberty & Co., London, on gem identification with particular reference to synthetics and jade.

MEMBERS' MEETINGS

London

On 12th October, 1979, at the Central Electricity Generating Board Theatre, London E.C.1., Dr Jacques Sabbagh, M.B., B.Ch., M.I.C.S., gave an illustrated talk entitled 'Promoting and Merchandizing Coloured Stones'. A full report will appear in a future issue of the *Journal.*

Midlands Branch

On the 30th September, 1979, a Gem Teach-In was held at the School of Jewellery, Birmingham. Messrs D. Price, D. Morgan and P. Balin gave advice and assistance to members on their personal gemstone collections.

On the 25th October, 1979, at Central Hall, Birmingham, two films were shown entitled 'Diamonds' and 'The Magic of Diamonds'.

North-West Branch

On 11th October, 1979, at Church House, Liverpool, the Annual General Meeting of the Branch was held. Mrs M. P. Gayton, F.G.A., and Mrs D. M. Brook, F.G.A., were elected Chairman and Secretary respectively.

South Yorkshire Branch

On 4th October, 1979, at the Sheffield Polytechnic, the Revd S. B. Nikon Cooper, B.D., F.G.A., gave a talk entitled 'Precious Stones of the Bible and Their Significance'.

FORTHCOMING MEETING

On Wednesday, 26th March, 1980, there is to be a talk in London by Mr P. G. Read, C.Eng., F.G.A., on 'Modern Developments in Gem Testing'.

COUNCIL MEETING

At a Meeting of the Council held on Wednesday, 3rd October, 1979, at Saint Dunstan's House, it was agreed that with effect from 1st January, 1980, the annual subscription for Fellows and Ordinary Members shall be £10.00. The annual subscription for the *Journal* for non-members is increased to £12.00. The following were elected to membership.

FELLOWSHIP

Atapattu, Nirmala K., Mt Lavinia, Sri Lanka. 1978
Beech, Trevor A., Blackpool. 1979
Beeks, Johannes F. M., Valkenswaard, Netherlands. 1979
Breden, Robert J., Liverpool. 1979
Brohier, Kenneth G., Wirral. 1979
Callaghan, Gerard J., Liverpool. 1979
Clark, Alan J., Croydon 1979
Crossland, Julie H., London. 1979
Cukier, Gerard, London 1979
Deste, Roberta A. E., London. 1979
Franks, John W., Altrincham. 1979
Good, Amanda G., London. 1979
Gunatilake, Abaya G., Colombo, Sri Lanka. 1978
Herbert, Janet E., Northampton. 1979
Hidaka, Masano, Silver Spring, Md, U.S.A. 1979
Holdsworth, Ian, Stafford. 1979
Howarth, Janet, Bolton. 1979
Jayawardena, Palihawadana A. J. L. P., Colombo, Sri Lanka. 1979
Jones, Michael D., Flyford Flavel. 1979
Langoulant, Margaret J., Subiaco, W.Australia. 1978
Lewis, Robert G., London. 1977
Mercade Galles, Jamie A., Barcelona, Spain. 1970
Midgley, Ronald C., Leeds. 1979
Mundin, Kenneth W., Leicester. 1979
Okayasu, Kuni, Hokkaido, Japan. 1979
Perry, Charles J., London. 1979
Pethiyagoda, Upali K., Nugegoda, Sri Lanka. 1978
Pietruska, Julia E. J., London. 1979
Pluckrose, William H., Herne Bay. 1979
Pulle, Amara N. S., London. 1979
Pulle, Bernard T. B., London. 1979
Sinclair, Netta, Enfield. 1979
Smit, Neil C., Pietersburg, S.Africa. 1979
Styles, Jonathan A., Enniskillen, N.Ireland. 1979
Taank, Ashok P., London. 1979

Taylor, John B., Brisbane, Qld, Australia. 1979
Theobald, Robert, Leighton Buzzard. 1979
Tindall, Anthony P., Ilkley. 1979
Tubella Llurba, Carlos, Tarragona, Spain. 1978
van der Geest, Eduard E., Heemstede, Netherlands. 1979
van Roojen, Tobias, Amsterdam, Netherlands. 1979
Virtanen, Anne M., Helsinki, Finland. 1978
Whittaker, Kenneth R., Widnes. 1979
Wright, Stephen R., London. 1979
Zelley, Michael J., Great Dunmow. 1979

TRANSFERS FROM ORDINARY MEMBERSHIP TO FELLOWSHIP

Akiyama, Masashi, Hokkaido, Japan. 1979
Ali, Syed J. A., London. 1979
Asagai, Osamu, Osaka, Japan. 1979
Barker, Maxwell, Sandton, S.Africa. 1979
Barot, Nandkishor R., Nairobi, Kenya. 1979
Boyd, Warren F., Willowdale, Ont., Canada. 1979
Bromwich, Graham S., Reigate. 1979
Brownlow, Arthur H., Needham, Mass, U.S.A. 1979
Bürk, Ralph, Pforzheim, W.Germany. 1979
Chadwick, John H., Clacton-on-Sea. 1979
Charlesworth, Anthony R., Southport. 1979
Chosokabe, Yukuto, Aichi Pref., Japan. 1979
Darcy, John P., Dun Laoghaire, Ireland. 1979
de Knecht, Petrus B., Strijen, Netherlands. 1979
Derry, Catherine E., Nottingham. 1979
Douglas, John J., Cardiff, N.S.W., Australia. 1979
Dupuis, Ronald J. R., Toronto, Ont., Canada. 1979
Fagg, Primrose M., Wallington. 1979
Farnham, Julian R., Haslemere. 1979
Fernando, Bathiya D., Colombo, Sri Lanka. 1979
Fookes, Mark H., Brentwood. 1978
Fung, Tsee H., London. 1979
Gion, Hirotaka, Sapporo, Japan. 1979
Glenister, David A., Stellenbosch, S.Africa. 1979
Gower, Wendy, Brisbane, Qld, Australia. 1979
Green, James E. W., Albrighton. 1979
Harding, Roger R., London. 1979
Hirst, Rosalind, Johannesburg, S.Africa. 1979
Jayendran, Ariacutty, Colombo, Sri Lanka. 1979
Jealouse, Roy G., Crewe. 1979
Jennings, Harold F., Jr, Roanoke, Va, U.S.A. 1979
Jibiki, Emiko, Tokyo, Japan. 1979
Jørgensen, Svend E., Nordborg, Denmark. 1979
Kaleel, Ameena, Mt Lavinia, Sri Lanka. 1979
Kimura, Shinichi, Kyoto, Japan. 1979
Kimura, Takashi, Tokyo, Japan. 1979
King, Larry G., Grand Prairie, Tex., U.S.A. 1979
Kitahara, Nobuko, Kobe, Japan. 1979
Kohara, Sachiko, Tokyo, Japan. 1979
Kojima, Michinaka, Tokyo, Japan. 1979

Lee, Dennis P., Leatherhead. 1979
Lien, Jan P., Norrköping, Sweden. 1979
Lindsay, Kathryn S., Salisbury, Zimbabwe-Rhodesia. 1979
Lurie, Joseph, Randburg, S.Africa. 1979
Minster, David, Pretoria, S.Africa. 1979
Morimoto, Towa, Kyoto, Japan. 1979
Murray-Jones, Pauline A., Hong Kong. 1979
Nathanson, Daniel P., London. 1979
Neo, Nobushige, Osaka, Japan. 1979
Nishino, Tomoji, Tokyo, Japan. 1979
Nott, Shelley N., London. 1979
Palmer, Joanna G., London. 1979
Rasborn, Jeannine M., Hong Kong. 1979
Roos, Raimo H., Nairobi, Kenya. 1979
Roper, Thomas C., Glenorchy, Tas., Australia. 1979
Salakian, Silva, Salisbury, Zimbabwe-Rhodesia. 1979
Samarajiwa, Eulalie, Reading. 1979
Smart, Denis O., Kettering. 1979
Streight, Gordon S., Mississauga, Ont., Canada. 1979
Takahashi, Junko, Urawa City, Japan. 1979
Tarbuck, William B., Manchester. 1979
Tateishi, Masateru, Tokyo, Japan. 1979
Tilley, Melinda V., Kowloon, Hong Kong. 1979
Vale, Shelagh V., Exeter. 1979
van Lieu, Mai, Brussels, Belgium. 1979
Verch, Ulla, London. 1979
Watts, Terrence J., Newcastle-upon-Tyne. 1979
West, Clive G., London. 1979
Wilson, Hiroko, Hong Kong. 1979
Winter, Julie, Leatherhead. 1979
Withycombe, Darroch B., St John's, Newf., Canada. 1979
Zimmer, Alvin F., Tucson, Ariz., U.S.A. 1979

ORDINARY MEMBERSHIP

Acheson, Michael A., Geneva, Switzerland.
Ahmad, Zaheer, Nairobi, Kenya.
Akaishi, Shinichi, Chiba Pref., Japan.
Almazan Gurumeta, Francisco J., Madrid, Spain.
Amarasena, Sepala De Silva, London.
Arnold, Martin J., Edgware.
Ashton, Michael, Luton.
Attapattu, Nimal G., Mt Lavinia, Sri Lanka.
Aylward, Peter S., Westonaria, Transvaal, S.Africa.
Bacon, John E. T. S., Cape Town, S.Africa.
Balordi, Corrado, Lusaka, Zambia.
Barker, Janet E., Santa Monica, Ca, U.S.A.
Beard, Thomas E., Jr, Atlanta, Ga, U.S.A.
Bell, Robert F., Honolulu, Hawaii, U.S.A.
Booth, Anna E., Leven.
Bowles, Susan M., London.
Brown, Eric G., Geneva, Switzerland.
Burch, Clive R., Sunderland.
Burns, Kenneth W., Miami, Fa, U.S.A.
Buser III, Charles G., Mechanicsburg, Pa, U.S.A.
Butler, Fredrick W., Tokyo, Japan.
Carno, Dennis, Mount Vernon, N.Y., U.S.A.
Carrera Publet, Jaime, Barcelona, Spain.
Carrette, Philippe, Brussels, Belgium.

Castillo, Ramon G., New York, N.Y., U.S.A.
Cheshire, Carey S., Billericay.
Chiu, Carol C., Hong Kong.
Chooi, Siew-Cheong, London.
Colaprete, Arthur, St Marys, Pa, U.S.A.
Conrad, Robert, Marina Del Rey, Ca, U.S.A.
Cooper, David J., Bedfont.
Cowling, Denise E., Northampton.
Crawford, Douglas J., Betchworth.
Cudworth, Patricia J., Mansfield.
Czarnetzky, Edward M., Springfield, Va, U.S.A.
Czernys, Madeline F., Ottawa, Ont., Canada.
Dassenaike, Alastair C. A., Colombo, Sri Lanka.
Davis, Robert J., Margate, Tas., Australia.
De Rezende, Octavio L., Parana, Brazil.
Devich, Charles A., Milwaukee, Wis., U.S.A.
Dickey, Marlin L., Alta Loma, Ca, U.S.A.
Dolleslager, James T., Houston, Tex., U.S.A.
Donnelly, Bernard, Blackburn.
Doughty, Eva, Wembley.
Dufay, Gail F., Ludlow Castle.
Duque Munoz, Marta I., Madrid, Spain.
Eddelin, Frank H., Southend-on-Sea.
Edmund, Hapuwalanage D., Kadawata, Sri Lanka.
Edwards, Kenneth F., Luton.
Elliott, David, London.
Elzinga, Vivienne, Cape Town, S.Africa.
Evison, Robert A., Pukalani, Hawaii, U.S.A.
Fell, Allan L., New Malden.
Fernandez, Luis, Geneva, Switzerland.
Fiore, Peter W., Aldershot.
Flanagan, Kevin, San Mateo, Ca, U.S.A.
Folkes, Trevor R., Epsom.
Forman, Morris, Johannesburg, S.Africa.
Fradkin, Howard E., Huntington Beach, Ca, U.S.A.
Freeman, Ronald, Middlesbrough.
Fujii, Michiru, Yokohama, Japan.
Gailterie, Marie-Claire, Geneva, Switzerland.
Gammon, Yvonne H. L., West Cowes.
Gardner, Ellen W., Boston, Mass, U.S.A.
Gaudy, Monica E., Stockholm, Sweden.
George, Silvester O., London.
Gideon, Lester P., Vandenberg, Ca, U.S.A.
Giermek, Grzegorz M., Skawina, Poland.
Glogowski, Wladyslaw H., Middlesbrough.
Goatly, Andrew M., London.
Good, Phyllis D., Butler, N.J., U.S.A.
Goosen, Heather M., Bulawayo, Zimbabwe-Rhodesia.
Gosswinn, Nicholas S., Newport.
Gough, Raymond G., Bristol.
Gros, Fabrice, New York, U.S.A.
Grundy, Jonathan S., Sheffield.
Gunn, Phyllis, Spokane, Wash., U.S.A.
Hall, Clive D., Edgware.
Hamza, Mohamed C. M., Beruwala, Sri Lanka.
Handoll, Trevor J., Eastbourne.
Heiberg, Axel L., Copenhagen, Denmark.
Hill, Ann F., Fairview Park, S.Australia.
Hirokawa, Sumiko, Tokyo, Japan.
Ho, Alice J., Kowloon, Hong Kong.
Holahan, Michael J., Johannesburg, S.Africa.

Hung, Lillian, Santa Monica, Ca, U.S.A.
Hutchinson, Marjorie E., London.
Ingle, Henriette E., Aberdeen
Irwin, Simon A., Stockport.
Jackson, Robert M., Calgary, Alta, Canada.
Jacobsson, Rolf, Jarfalla, Sweden.
Jain, Yudhvir S., Delhi, India.
Jetha, Akbarali H., Bombay, India.
Jones, Winfield G., Jr, Boise, Idaho, U.S.A.
Joz-Roland, Michel, Sannois, France.
Kalnin, Daniel S., Toronto, Ont., Canada.
Karpel, Geoffrey, London.
Karpel, Lance S., London.
Kawasaki, Shizue, Tokyo, Japan.
Kerr, David J., Northcote, Auckland, New Zealand.
Kimura, Mariko, London.
Kingsley, Ann S., Sidmouth.
Kinoshita, Shigeyoshi, Osaka, Japan.
Kitney, Gordon T. J., Maidstone.
Klener, Kenneth S., Santa Monica, Ca, U.S.A.
Knutson, Donald S., Denver, Colo., U.S.A.
Kodaka, Katuyoshi, Tokyo, Japan.
Kothari. Rajan S., Bombay, India.
Lam, Freddy, Singapore.
Lam, Tat Hong F., Kowloon, Hong Kong.
Lam, Thao Shiou S., Singapore.
Lambley, Jenifer G., Hong Kong.
Langlois, Jean-Guy, Montreal, Que., Canada.
Laurie, Amanda, Bicester.
Lavinder, Ann N. L., Kuala Lumpur, Malaysia.
Lee, Doreen S. S., Singapore.
Lee, Sammy H. Y., Kowloon, Hong Kong.
Leigh, John E., Stockport.
Leong, Daniel K. T., Macau.
Leung, Lap-yan, Kowloon, Hong Kong.
Liccini, Mark L., Laurel, Md, U.S.A.
Lilley, Keith A., Pontllanfraith.
Littlejohn, Gordon H., Tunbridge Wells.
Lo, Philip Hing-Kwong, Hong Kong.
Lueking, Edward N., Costa Mesa, Ca, U.S.A.
Lynch, Mary C., Kildare, Ireland.
MacKellar, Christine H., Stafford.
Maitland-Kimzey, Gretchen, Santa Rosa, Ca, U.S.A.
Marriott, Stuart C., Stanmore.
Mayor, Norah, Diss.
Milne, Nigel P., London.
Miniati, Roberto, Rome, Italy.
Minowa, Shinichi, Gumma, Japan.
Mitchell, Simon J., Leeds.
Mojzes, Igor, Downsview, Ont., Canada.
Moore, Roderich R., Solihull.
Morgan, Richard J., Carlisle.
Morgan, William H., Carlisle.
Morris, Kelsey, Hayling Island.
Mourad, Huguette, Jeddah, Saudi Arabia.
Moury, Armand J., Brussels, Belgium.
Neale, Lorna, Gloucester.
Newton, Kevin S., British Columbia, Canada.
Ngai, Ken, Kowloon, Hong Kong.
Nithianandan Selladurai, Nithianandan, Schwenningen, W.Germany.
Nooten-Boom II, Apollonius, Kingsland.
Okayasu, Tetsuya, Tokyo, Japan.
O'Sullivan, Dennis J., Poole.
O'Sullivan, James, Boca Raton, Fla, U.S.A.
Ozawa, Chikako, Woking.
Pala, Suresh, Birmingham.
Parcel, Rodney F., Jr, Perris, Ca, U.S.A.
Parker, Michael A. J., Old Portsmouth.
Parks, Jeremy J., London.
Parr, Dorothy M., Toronto, Ont., Canada.

Pattni, Narendra P., Leicester.
Paxton, Jeremy M., Fordingbridge.
Peralta Pastor, Miguel, Barcelona, Spain.
Perrella, Loto, Barcelona, Spain.
Perren, Llewellyn J., Worthing.
Philipou, Philip, Byfleet.
Pickford, Michael G., Bicester.
Pitts, Carl C., Huntington Beach, Ca, U.S.A.
Podsiadly, Maria, Birmingham.
Polichar, Grace S., San Francisco, Ca, U.S.A.
Pomphret, Eric W., Salford.
Ponzano, Stefano, Rome, Italy.
Poultney, Alan M., Sandton, Transvaal, S.Africa.
Pouncey, Jean M., Solihull.
Price, Michael H., Sutton.
Pusey, Chikako, London.
Quincey, Mary E., Rugby.
Quinn, Patrick D., Miami, Fla, U.S.A.
Rajapakse, Rajapakse K. N. L., Ratmalana, Sri Lanka.
Riegler, Walter G., McGuire, N.J., U.S.A.
Robertson, Thorington B., Oakhurst, Ca, U.S.A.
Robinson, Stuart A., Norwich.
Robson, Ellen M., Nairobi, Kenya.
Ross, Robert J. C., Sharjah.
Rubin, Leon, Sr, Brussels, Belgium.
Rufli, Lisbet, Sollentuna, Sweden.
Sanchez-Lafuente Mariol, Jose, Barcelona, Spain.
Schlussel, Joseph L., New York, N.Y., U.S.A.
Schmid, Marlene, Rio de Janeiro, Brazil.
Seah, Stephen S. K., Singapore.
Seeger, Peter R., Wirral.
Shaw, Clive M., Odendaalsrus, S.Africa.
Shaw, Josephine N., Aspen, Colo., U.S.A.
Shima, Kiyohiko, Osaka, Japan.
Shimizu, Teruo, Kyoto, Japan.
Shimoura, Seisku, Hiroshima Pref., Japan.
Shiraishi, Makoto, Tokyo, Japan.
Shiwa, Haruki, Fukuoka City, Japan.
Shiwa, Seiichi, Fukuoka City, Japan.
Shone, Nicholas R., Ringwood.
Sinha, Purushottam, Agra, India.
Smith, Robert A., Shoreham-by-Sea.
Smith, Robert R., Westfield, N.J., U.S.A.
Smythe, Richard H., St Catherines, Ont., Canada.
Spence, John D., Thornton Dale.
Sultan, Rukhsana A., London.
Surgeoner, David R. H., Beaconsfield.
Suzuki, Takako, London.
Swain, Anthony P., Llandudno.
Swersky, Ann H., Ramat Hasharon, Israel.
Swersky, Barry R., Ramat Hasharon, Israel.
Taher, Tasneem A., Dubai.
Tanaka, Kentetsu, Tokyo, Japan.
Taylor, Alec E., Port Seton.
Thompson, H. D. R., Town of Mount Royal, Que., Canada.
Thompson, Reginald F., St Charles, Missouri, U.S.A.
Thompson, Reva E., St Charles, Missouri, U.S.A.
Thunas, Richard, Rugby.
Torres, Louis, Rego Park, N.Y., U.S.A.
Tracey, Neil J., London.
Trotter, Stuart M., Edinburgh.
Villars, Uif E., Stockholm, Sweden.
Walford, Michael J., Wickford.
Walker, Doreen M., Leigh-on-Sea.
Weeden, Richard G., Dorking.
Weil, Maurice K., Shreveport, La, U.S.A.
Weishaupt, Ulrich, Clermont, Qld, Australia.
Whitrow, Patricia A., Dunedin, N.Z.
Wickramasinghe, Upasena, Colombo, Sri Lanka.

Williams, Bruce M., Walla Walla, Wash., U.S.A.
Wootton, William J., Goring-by-Sea, Worthing.
Yenson Chu, Mabel, Kowloon, Hong Kong.
Yip, See Yin, Kowloon, Hong Kong.

GEM DIAMOND EXAMINATION 1979

Fifty candidates sat for the 1979 Gem Diamond Examination, of whom forty-two qualified, two with distinction. The following is a list of successful candidates arranged alphabetically.

QUALIFIED WITH DISTINCTION

Seal, Richard MacGregor Park, Bridlington.
Stern, Marion Judith, London.

QUALIFIED

Amoros Angel, Julio, Valencia, Spain.
Baldock, Edward James, South Wirral.
Bates, Adrian John, Sutton Coldfield.
Bennett, Russell K., Cheltenham.
Biernet Albaladejo, Rosario, Barcelona, Spain.
Byfleet, Anne Patricia, Doncaster.
Catala Marti, Joaquin, Valencia, Spain.
Celades Colom, Roberto, Barcelona, Spain.
Chang, He Ok, London.
Davis, Jonathan Vincent, Edgware.
Domenech Plo, Juan, Valencia, Spain.
Faulder, John, Purley.
Girbes Faba, Adolfo, Valencia, Spain.
Haugh, Breda, London.
Hitchen, Alan, Walsall.
Hodgkinson, John Alan William, Glasgow.
Holmes, Graham John, Tenterden.
Houlgrave, Peter Baron, Rickmansworth.
Israel, Nigel Brian, London.
Jerome, Philip S. Woodford Green.
Jimenez Tormo, Vicente, Valencia, Spain.
Lander, Charmian Elizabeth Mary, London.
Lewis, Ian Rhys Morien, Sheffield.
Lyall Grant, Ian Hallam, Dartmouth.
Mayling, Clifford George, Slough.
Moller Duran, Rodolfo, Barcelona, Spain.
Noble, Patrick, Cleckheaton.
Piech, Olwen, Bushey Heath.
Poel, Melvin Christopher, Solihull.
Proctor, Sarah-Jane L., London.
Ros-Jones, Catherine Anne, South Ascot.
Saez Perez, Ma Alicia, Barcelona, Spain.
Seoane Garcia, Ma Encarnacion, Valencia, Spain.
Sosna, Boris, Wembley Park.
Tattersall, Simon, London.
Taylor, John, Chislehurst.
Turner, Michael James, Chester.
Turner, Michael James, Sheffield.
Vargas Perez, Manuel de, Barcelona, Spain.
Weissler, Chaggai, London.

EXAMINATIONS IN GEMMOLOGY 1979

In the 1979 Examinations in Gemmology a total of 1239 candidates entered for the two Examinations.

There were 748 candidates who sat for the Preliminary Examination, of whom 363 passed. The Rayner Prize in the Preliminary Examination was not awarded this year.

For the Diploma Examination, 491 candidates entered (one more than the record number for 1977), of whom 198 passed, including ten with Distinction—a marked improvement on recent years. In the opinion of the Examiners, Dr Roger R. Harding (London) should be congratulated for submitting the best set of papers, but no candidate reached a sufficiently high standard to warrant the award of a Tully Memorial Medal.

The following are lists of successful candidates, arranged alphabetically.

DIPLOMA EXAMINATION

QUALIFIED WITH DISTINCTION

Glorioso, John T., Baltimore, Md, U.S.A.
Harding, Roger Robertson, London.
Hidaka, Masano, Silver Spring, Md, U.S.A.
Kimura, Takashi, Tokyo, Japan.
Leith-Smith, Jean Elizabeth, Hong Kong.
Lindsay, Kathryn Sharon, Salisbury, Rhodesia.
Shimaoka, Mitsuaki, Osaka, Japan.
Sweaney, James Leo, Santa Monica, Ca, U.S.A.
van Lieu, Mai, Brussels, Belgium.
Vashishtha, Shekhar, Delhi, India.

QUALIFIED

Abayasingha, Amaranath, Colombo, Sri Lanka.
Akiyama, Masashi, Hokkaido, Japan.
Ali, Syed J. A., London.
Andersson, Arild, Oslo, Norway.
Asagai, Osamu, Osaka, Japan.
Avasia, Rohinton Kersasp, Bombay, India.
Bahl, Neela, Bombay, India.
Bahl, Sujata, Bombay, India.
Barker, Maxwell, Sandton, S. Africa.
Barot, Nandkishor Raojibhai, Nairobi, Kenya.
Beech, Trevor Alan, Blackpool.
Beeks, Johannes F. M., Valkenswaard, Netherlands.
Berggren, U. B. Marie, Oslo, Norway.
Blondel, Nigel Capener, Guernsey, C.I.
Bontekoe, Maryke, Steenwyk, Netherlands.
Borreda Perez, Federico, Paterna, Spain.
Boyd, Warren Frederick, Willowdale, Ont., Canada.
Bradoch, Robert V., Tokyo, Japan.
Breden, Robert John, Liverpool.
Brohier, Kenneth Gordon, Wirral.
Bromwich, Graham Stanley, Reigate.
Brownlow, Arthur Hume, Needham, Mass, U.S.A.
Bürk, Ralph, Keltern, W.Germany.
Callaghan, Gerard Joseph, Liverpool.
Castello, Torres, Ma Dolores, Valencia, Spain.
Chadwick, John Harlow, Clacton-on-Sea.
Charlesworth, Anthony Robert, Southport.
Cheung, Kai Yuen, Hong Kong.
Chosokabe, Yukuto, Nagoya, Japan.
Clark, Alan Joseph, Croydon.

Clarke, Donald Hugh, Marbella, Spain.
Cleiman, Catherine Griffin, Silver Spring, Md, U.S.A.
Costell Ibanez, Manuel, Valencia, Spain.
Cowling, Denise Elizabeth, Northampton.
Crossland, Julie Hall, London.
Cukier, Gerard, London.
da Costa, Michael Stuart, Toronto, Ont., Canada.
Darcy, John Patrick, Dun Laoghaire, Ireland.
de Knecht, Petrus Bernardus, Strijen, Netherlands.
Derry, Catherine Eleanor, Nottingham.
Deste, Roberta Aline Elissa, London.
Dolz Adell, Carmen, Valencia, Spain.
Douglas, Brian Sydney, Toronto, Ont., Canada.
Douglas, John James, Cardiff, N.S.W., Australia.
Dupuis, Ronald J. R., Toronto, Ont., Canada.
Edmunds, Roger Alan, Accrington.
Esteve Fernandez, Jaime, Barcelona, Spain.
Fägerstig, Björn Olot, Saltsjöbaden, Sweden.
Fagg, Primrose Mary, Wallington.
Farnham, Julian Reginald, Haslemere.
Fernando, Bathiya Dhammika, Colombo, Sri Lanka.
Franks, John Wilson, Altrincham.
Franks, William, Bowdon.
Fung, Tsee Hung, London.
Geikler, Patricia Jean, Sewickley, Pa, U.S.A.
Gion, Hirotaka Zuiho, Sapporo, Japan.
Glenister, David Athol, Stellenbosch, S.Africa.
Good, Amanda Grahame, London.
Gower, Wendy, Brisbane, Qld, Australia.
Green, Edward Maurice, London
Green, James Edward Wooldridge, Albrighton.
Groenenboom, Peter, Arnhem, Netherlands.
Hartzman, Mark J., Bronx, N.Y., U.S.A.
Hayashi, Hidenori, Tokyo, Japan.
Herbert, Janet Elizabeth, Northampton.
Hernandez Ordonez, Arturo, Valencia, Spain.
Hirst, Rosalind, Johannesburg, S.Africa.
Holdsworth, Ian, Stafford.
Howarth, Janet, Bolton.
Ibrahim, Mamat Mukhtar bin, Ipoh, Perak, W.Malaysia.
Inamdar, Geeta, Newmarket, Ont., Canada.
Jayawardena, Palihawadana A. J. L. P., Colombo, Sri Lanka.
Jayendran, Ariacutty, Colombo, Sri Lanka.
Jealouse, Roy George, Woore, Crewe.
Jennings, Harold F., Jr., Roanoke, Va, U.S.A.
Jibiki, Emiko, Tokyo, Japan.
Jones, Michael Derrett, Flyford Flavel, Worcs.
Jørgensen, Svend Erik, Norborg, Denmark.
Julia Miralles, Nuria, Barcelona, Spain.
Kaleel, Ameena, Mt Lavinia, Sri Lanka.
Kimura, Shinichi, Kyoto, Japan.
King, Larry G., Grand Prairie, Tex, U.S.A.
Kita, Keiko, Osaka, Japan.
Kitahara, Nobuko, Kobe, Japan.
Kizirian, Vahe, London.
Kleibrink, Marion, Middelburg, Netherlands.
Ko, Yiu Wai Richard, Hong Kong
Kohara, Sachiko, Tokyo, Japan.
Kojima, Michinaka, Tokyo, Japan.
Lalonde, Ernest Richard, Bangkok, Thailand.

Langeraar, R. C., Oegstgeest, Netherlands.
Lee, Dennis Philip, Leatherhead.
Lien, Jan Peter, Norrköping, Sweden.
Lurie, Joseph, Randburg, S.Africa.
Machlup, Peter Mark, Johannesburg, S.Africa.
Melhus, Per Kristian, Skudeneshavn, Norway.
Midgley, Ronald Charles, Leeds.
Minster, David, Pretoria, S.Africa.
Moody, Kenneth Olaf, Cheltenham.
Moore, Roderich R., Solihull.
Morimoto, Towa, Kyoto, Japan.
Munas, Carmel Leonie, Morden.
Mundin, Kenneth William, Leicester.
Murray-Jones, Pauline Ann, Hong Kong.
Nathanson, Daniel Philip, London.
Neo, Nobushige, Osaka, Japan.
Nieto Reynoso, Luis, Barcelona, Spain.
Nilsen, Tore, Oslo, Norway.
Nisbet, Alistair Scott, London.
Nishino, Tomoji, Tokyo, Japan.
Norberg, Rolf Bernhard, Drammen, Norway.
Nott, Shelley, West Harrow.
O'Donnell, Francis Xavier Desmond, Liverpool.
Okayasu, Kuni, London.
Onozawa, Katsumi, Tokyo, Japan.
Osborne, Annie W. S., Hong Kong.
Ou Yang, Chiu Mei, Hong Kong.
Palmer, Joanna Grace, Guildford.
Pastor Alapont, Juan Jose, Catarroja, Spain.
Perera, Ajith G. H. P., Mt Lavinia, Sri Lanka.
Perry, Charles John, London.
Pietruska, Julia Elizabeth Jane, London.
Pluckrose, William Henry, Herne Bay.
Pomar Llado, Ma Antonia, Barcelona, Spain.
Puiggali Fabregas, Jose Ma, Barcelona, Spain.
Pulle, Amara Nilkamal Sirima, London.
Pulle, Bernard Terence Bastian, London.
Rakke, Brit, Oslo, Norway.
Rasborn, Jeannine Madeleine, Hong Kong.
Roos, Raimo Helmer, Nairobi, Kenya.
Roper, Thomas Charles, Glenorchy, Tas., Australia.
Rowe, Regina, Torquay.
Rufli, Lisbet, Sollentuna, Sweden.
Salakian, Silva, Salisbury, Rhodesia.
Samarajiwa, Eulalie M. S. K., Sri Lanka.
Santos, Americo Sancho Dos, L. Marques, Mozambique.
Scells, Gerald Victor, Collinsville, Qld, Australia.
Schilling, Andreas Georg Wilhelm, Stuttgart, W.Germany.
Schippers, Maria Johanna Carolina, Velp, Netherlands.
Schotborgh, Ilse Hedwig, Willemstad, Curaçao, N.A.
Seed, Moira Jean, Toronto, Ont., Canada.
Senaratne, Upali Nimal, Nugegoda, Sri Lanka.
Shelley, Jessica, Toronto, Ont., Canada.
Shima, Kiyohiko, Osaka, Japan.
Sinclair, Netta, Enfield.
Smart, Denis Owen, Kettering.
Smit, Neil Conrad, Pietersburg, S.Africa.
Sorolla Maupoey, Marinela, Valencia, Spain.
Streight, Stewart Gordon, Mississauga, Ont., Canada.
Styles, Jonathan Appleby, Enniskillen, N.Ireland.
Taank, Ashok P., London.
Takahashi, Ikuo, Kyoto, Japan.
Takahashi, Junko, Saitama, Japan.
Tan, Carmela, Hong Kong.

Tarbuck, William Benjamin, Manchester.
Tateishi, Masateru, Tokyo, Japan.
Taylor, John Bruce, Brisbane, Qld, Australia.
Teraura, Shin, Yoshimo, Japan.
Theobald, Robert, Leighton Buzzard.
Thompson, H. D. R., Mt Royal, Que., Canada.
Thompson, Sharon Elaine, Glendale, Ca, U.S.A.
Thornton, Peter, Newcastle, N.S.W., Australia.
Tilley, Melinda Vera, Hong Kong.
Tindall, Anthony Peter, Burley-in-Wharfedale.
Truyens, Simone Maria Caecilia, Schoonhoven, Netherlands.
Vale, Shelagh Vivienne, Exeter.
van der Geest, Eduard Ernst, Heemstede, Netherlands.
van Roojen, Tobias, Amsterdam, Netherlands.
Vazquez Pavon, Rafael, Valencia, Spain.
Velthoven, Nicolaas, Bergschenhoek, Netherlands.
Verch, Ulla, London.
Verma, Rajiv, Dehra Dun, India.
Vonk, Philippe André Jean, Rotterdam, Netherlands.
Watson, Timothy Lincoln, Cape Town, S.Africa.
Watts, Terrence Joseph, Newcastle-upon-Tyne.
Wechgelaar, Didrich Johannes H., Zaandam, Netherlands.
West, Clive Graham, London.
Wezel, Renée, Maasland, Netherlands.
Whittaker, Kenneth Raymond, Widnes.
Wilson, Hiroko, Hong Kong.
Winter, Julie, Fetcham.
Withycombe, Darroch Blair, St John's, Newf., Canada.
Wright, Stephen Richard, London.
Yamagishi, Shoji, Kanagawa, Japan.
Yokowo, Naoya, Tokyo, Japan.
Yost, Dara Elizabeth, San Diego, Ca, U.S.A.
Zelley, Michael John, Bishop's Stortford.
Zimmer, Alvin F., Tucson, Ariz., U.S.A.

PRELIMINARY EXAMINATION

QUALIFIED

Abdul Majeed, Mohamed Sulltanul A., Colombo, Sri Lanka
Aiiso, Miki, Tokyo, Japan.
Amasaki, Tetsuya, Osaka, Japan.
Ammerlaan, George Martin, Rotterdam, Netherlands.
Anderson, Joseph Maxwell, London.
Anderson, Fred Birger, Oslo, Norway.
Anderson, Mona, Oslo, Norway.
Anver, Mohamed Shibly, Matara, Sri Lanka.
Apall-Olsen, Martha Beate, Lopik, Netherlands.
Archer, Kenneth Argen Goulden, London.
Asakawa, Mamoru, Fukuoka, Japan.
Askew, Mark Alan, Bournemouth.
Askey, Doria Leslie, Burlington, Ont., Canada.
Athauda, Weerasinha A. N. S., Kandy, Sri Lanka.
Attwood, Alan Stuart, Blandford Forum.
Aylward, Peter Seymour, Westonaria, S.Africa.
Bacon, John Edward Thomas S., Cape Town, S.Africa.
Badger, Anthony John Charles, High Wycombe.
Baird, Myra Letricia, Auckland, N.Z.
Balthasar, Greta, Bournemouth.

Bannon, Lewis A., Baton Rouge, La, U.S.A.
Barlow, Peter Charles, Kidderminster.
Benham, Michael Frederick, Chatham.
Bennett, David William, London.
Bennett, Elaine, Stockport.
Berkowitz, Joseph, Toronto, Ont., Canada.
Best, Reina Unita, Liverpool.
Bill, David Nigel, Cannock.
Bjørner, Bo, Bagsværd, Denmark.
Blatch, Kim, Newhaven.
Bongers, Johannes Theodorus H. M., Schoonhoven, Netherlands.
Bonisoli, Giovanna, London.
Bramwell, William John, Durham.
Brown, James Edward, Louth.
Browne, Jess Elizabeth, Dalkeith, W.Australia.
Buhl, Robert Anthony, W.Vancouver, B.C., Canada.
Bullock, Gail Kathleen, Walsall.
Burnett, Julie L., Nottingham.
Butterfield, Ernest B., Albuquerque, N.M., U.S.A.
Camelinat, Valma Mary, Jersey.
Campbell, Sandra, Venice, Ca, U.S.A.
Cannon, Jayne Rosemary, Spalding.
Carre Pan, Gabriel, Barcelona, Spain.
Castellote Mas, Guiliermo Fernando, Barcelona, Spain.
Charlton, Maurine, Scarborough, Ont., Canada.
Chauhan, Rajendra, London.
Cheng, Elaine, Sheffield.
Cheung, Veronica, Hong Kong.
Chin, Chong-Meng, Singapore.
Chiu, Carol C., Hong Kong.
Chu, Miu Hing, Hong Kong.
Clare, Vanessa Jayne, St Albans.
Clements, Julie Ann, Erith.
Clibbens, Peter Christopher, Ruislip.
Coelho, Susan Osborn, Richmond.
Cook, Graham Andrew, Dundee.
Coombes, Martin Lewis, Crewe.
Cooper, Judith Margaret, Colchester.
Cornwell, Russell John, Bury.
Courtliff, Steven Paul, Ford, Liverpool.
Coward, Fiona, Ringwood.
Cramer-Langoha, Monique Marie Edouard, Verviers, Belgium.
Cuadras Pons, Montserrat, Barcelona, Spain.
Cudworth, Patricia June, Mansfield.
Culpin, Ivor David, Weston-super-Mare.
Darracott, Britt-Marie, London.
Dawson, Jane, London.
Deascenti, James Harry, Accrington.
de Bure, Ursula, Hong Kong.
de Grefte, Glaudina Joanna Maria, Tilburg, Netherlands.
de Mey, Nigel Robert, Dordrecht, Netherlands.
Derry, Catherine Eleanor, Nottingham.
Deste, Roberta Aline Elissa, London.
Diack, Adrian Lindsay, Eastbourne.
Dickey, Marlin L., Alta Loma, Ca, U.S.A.
Dickson, Amanda Jane, London.
Dolphin, Margaret, Birmingham.
Donohoe, Edward Groves, London.
Eger, Christine Ryon, London.
Eide, Gry Vibeke, Oslo, Norway.
Emms, Eric Charles, Brentwood.
Fairlie, Alison Helen, Cheltenham.
Faizer, M. S. M. A., Idar-Oberstein, W.Germany.
Falkus, Geoffrey Charles, Woodford Green.
Faux, Teresa Mary Frances Ann, Winslow.
Ferguson, Deborah Anne, Pirbright.
Fernandaz, Patricia, London.
Fernando, Warnakulasooriya Justin, Columbo,Sri Lanka.
Forbes, Maureen Rose, St Albans.
Ford, Hermione Dolores, Hereford.
France, Jeremy Peter, Birkenhead.
Frankel, Markham Joel, London.
Franks, William, Bowdon.

Froeling, Robertus Maria A.G., Schoonhoven, Netherlands.
Fünfschilling, Jakob Heinrich, Rünenberg, Switzerland.
Furse, Anna Antonia, London.
Gabriel Pascual, Jose, Barcelona, Spain.
Gallardo Bravo, Matilde, Barcelona, Spain.
Gajanayake, Don Stanley Dananda, Moratuwa, Sri Lanka.
Garcia Hector, Julia, Barcelona, Spain.
Garcia Nebot, Manuel, Barcelona, Spain.
Garfinkel, Derek Andrew, Pretoria, S.Africa.
Giacone, Anna, Norwich.
Gimple, Michael Dennis, Rochester, N.Y., U.S.A.
Glorioso, John T., Baltimore, Md, U.S.A.
Goatly, Andrew Martin, London.
Goldberg, Reuven, London.
Goldstein, Sam, New York, N.Y., U.S.A.
Gomis Sorribas, Juan, Barcelona, Spain.
Gomis Sorribas, Luis, Barcelona, Spain.
Goodman, Mark, London.
Gordon, C. R. I., Brisbane, Qld, Australia.
Gorham, Josephine Eva, London.
Graus, Jeremy Ze'ev, London.
Gray, John Stephen, Pontefract.
Green, Richard Douglas, Dudley.
Greene, Horace Arthur, Elmhurst, Ill., U.S.A.
Greeson, Gordon, Carmel, Ca, U.S.A.
Groom, Peter John, Dunstable.
Guinot Sierra, Agustin Ignacio, Barcelona, Spain.
Guinot Sierra, Carlos Ma, Barcelona, Spain.
Gupta, Arun Kumar, Toronto, Ont., Canada.
Hall, Michael Geoffrey, Birmingham.
Hammad, Hammad Ahmad, Peshawar, Pakistan.
Hanataka, Jitsuo, Kobe, Japan.
Hardewall, Per, Geneva, Switzerland.
Harding, Bruce L., Holden, Md, U.S.A.
Harris, Edward, Grimsby.
Harrison, Kathryn, Doncaster.
Hata, Kenichi, Kyoto, Japan.
Hausman, Karen, Willowdale, Ont., Canada.
Hayakawa, Chieko, Osaka, Japan.
Heath, David Graham, Worcester.
Heeney, Barbara Ann, Hong Kong.
Helne, Mary K., Rome, Italy.
Herriott, William Alexander, Winchester.
Hetherington, George, Ashton-under-Lyne.
Hettena, Andre, London.
Hinde, Rosemary Gill, Hong Kong.
Hiraoka, Satoshi, Tokushima, Japan.
Hirokawa, Sumiko, Tokyo, Japan.
Ho, Chow Kee, Singapore.
Hodge, Peter, Christchurch, N.Z.
Holahan, Denise Mignon, Johannesburg, S.Africa.
Holahan, Michael John, Johannesburg, S.Africa.
Howden, Mark Frazer, London.
Huizinga, Jeroen, Rotterdam, Netherlands.
Hunger, Giselle Hulda, Lugano, Switzerland.
Inatsugi, Shiko, Osaka, Japan.
Indrebø, Solveig, Oslo, Norway.
Iniesta Barbera, Justo Rafael, Barcelona, Spain.
Iobal, Tahir, Peshawar, Pakistan.
Ishii, Hajime, Kyoto, Japan.
Jayawardana, Uttara Perera, Boralesgamuwa, Sri Lanka.
Jennings, Harold F., Jr, Roanoke, Va, U.S.A.
Joling, Hendrik, Ter-Apel, Netherlands.

Johnson, Colin Michael, Birmingham.
Jones, Barry, Southport.
Jones, Joyce, Walsall.
Jones, Mark Leonard, Cromer.
Jørgensen, Erik, Nordborg, Denmark.
Joshima, Tetsuo, Fukuoka, Japan.
Kagita, Mayumi, Kyoto, Japan.
Kajita, Yukio, Tokyo, Japan.
Kanapathipillai, Kanapathipillai C., Trincomalee, Sri Lanka.
Kasliwal, Uday Brijendra, Bombay, India.
Katz, Sophie, Toronto, Ont., Canada.
Kelly, John Stephen, Cardiff.
Kelly, Marlene Cecilia, Salisbury, Rhodesia.
Kerr, David Jaison, Auckland, N.Z.
Khancharoensuk, Somsri, Bangkok, Thailand.
Kit, Oksana, Toronto, Ont., Canada.
Kizirian, Vahe, London.
Knight, Anthony John, Chippenham.
Koelle, Ursula, Ulm, W.Germany.
Kongsgaard, Tone S., Oslo, Norway.
Kraayeveld, Magna Anita Suzanna, Alphen ald Rÿn, Netherlands.
Krystic, Jovanka, Beograd, Yugoslavia.
Kuki, Tohru, Yokohama, Japan.
Lafontaine Bellet, Christiane, Barcelona, Spain.
Lakdawalla, Darayus Noshir, Bombay, India.
Lakdawalla, Zubin Noshir, Bombay, India.
Lal, Daulet Russy Beheramji, Bombay, India.
Lalonde, Ernest Richard, Bangkok, Thailand.
Lamb, Revital, Chipinga, Rhodesia.
Langford, Michael Leslie, Hereford.
Langley, Paul Ceredig, Newcastle-upon-Tyne.
Larcombe, David Brian, Wincanton.
Latty, Mark William, Harrogate.
Lau, Theodora, Hong Kong.
Laurie, Amanda, Bicester.
Lee, Anthony Harold, London.
Leria Bernaus, Magdalena, Barcelona, Spain.
Levine, Carolyn Ellis, Hong Kong.
Leybourn-Needham, Gerald, Knutsford.
Liccini, Mark Louis, Laurel, Md, U.S.A.
Lindstorff, Nina Elisabeth, Curaçao, N.A.
Linko, Ilpo Ilkka Kalevi, Espoo, Finland.
Loaso Vierbucher, Jose Carlos, Barcelona, Spain.
Lopez Garcia, David, Barcelona, Spain.
Louw, Everhardus Johannes, Cape Province, S. Africa.
McCallum, Marcus Alexander, London.
Mackellar, Christine Helen, Stafford.
McWilliam, Carole Ann, Canberra, A.C.T., Australia.
Maeda. Kohsaku, Fukuoka, Japan.
Maeda, Setsuko, Tokyo, Japan.
Maguire. Martin Patrick, Liverpool.
Maha Indra, Stilal Raviraj, Columbo, Sri Lanka.
Mai, Lionel, St Martin, D'Heres, France.
Malik, Pervez Elahi, Peshawar, Pakistan.
Mans, Josephine, Wembley.
Martin, Paul, Nuneaton.
Martinez Lopez, Nicholas, Barcelona, Spain.
Martinez Manent, Salvador, Barcelona, Spain.
Martuccio, Celeste, Leamington Spa.
Masako, Kita, Fukuoka, Japan.
Matsunobu, Hiroshi, Tokushima, Japan.
Matthys, Nigel John, Ickenham.
Mattinga, Agnes Paulina, Curaçao, N.A.
Meckoni, Prafulla H., Bombay, India.

Mercer, Vivienne Daphne, Bexleyheath.
Miga Moliner, Agustin, Barcelona, Spain.
Miyake, Yashiro, Kyoto, Japan.
Moreton, James Clive, Crewe.
Moury, Armand J., Brussels, Belgium.
Naebers, Joseph Leon Marie G., Hulsberg, Netherlands.
Nakajima, Minako, Birmingham.
Nambuwasam, Sarath Ariyapema, Pannipitiya, Sri Lanka.
Neall, Patricia Ann, Romford.
Ng, Shirley Sui-Yee, Hong Kong.
Nichols, Robert Townley, Albuquerque, N.M., U.S.A.
Noach, Louis, London.
Nojiri, Masatomi, Fukuokasi, Japan.
Noyawa, Hidekayu, Tiyo, Japan.
Nuthall, Aikaterini Baritimi, Addington.
Nyland, Torunn, Oslo, Norway.
Oosterwaal, Fransiscus Thomas G.J., Loon op Zand, Netherlands.
Ozaki, Naoko, Yamanote, Japan.
Paramalingam, Jayanthi, Mt Lavinia, Sri Lanka.
Parr, Dorothy Mary, Toronto, Ont., Canada.
Pascual Armengou, Jose, Barcelona, Spain.
Patel, Pravin Javraj, Bombay, India.
Payne, Nicholas George, London.
Peiris, Kurukula Suriya S.P., Dehiwela, Sri Lanka.
Pena Saez, Luis, Barcelona, Spain.
Perera, Priyani Anne Marion, Colombo, Sri Lanka.
Perez Ramos, Ma Paloma, Barcelona, Spain.
Perkins, Joanna Cathryn, London.
Perrella Estelles, Loto, Barcelona, Spain.
Pietroboni, Carlo, Forch, Switzerland.
Pine, Ann Michelle, London.
Pittam, Alec John, Parkstone, Poole.
Platon Davila, Susana, Barcelona, Spain.
Poff, Stephen Gerard, Invercargill, N.Z.
Pollitt, Anne Elizabeth, Manchester.
Poulston, Betty Phyllis, Cheltenham.
Premanwardhana, Henerath H.D.I., Kandy, Sri Lanka.
Precott, Peter Cornelius, Newcastle-upon-Tyne.
Pridan, Gad, Antwerp, Belgium.
Prince, Edwin John Brian, Plymouth.
Puviharan, Mylvaganam, Colombo, Sri Lanka.
Pyle, Leslie, Blackpool.
Ramakrishnan, Namasivayam, Colombo, Sri Lanka.
Ranganathan, Kidnar, Wattala, Sri Lanka.
Raw, Susan Elizabeth, Whitby.
Reeks, Graham Walter, Linden, S.Africa.
Richards, David, Nottingham.
Ricketts, Alan David, Birmingham.
Riedl, Inge, Barcelona, Spain.
Rigby, Ian William, Wolverhampton.
Ripoll Espinalt, Ma Rosario, Barcelona, Spain.
Robbins, Susan Carol, London.
Rodriguez Garcia, Jose, Barcelona, Spain.
Rogers, John, Portrush, N.Ireland.
Rome, Martin Leslie, London.
Rosen, Elly, Brooklyn, N.Y., U.S.A.
Rosenberg, Ian David, Chester.
Ross, Rosemary Daphne, London.
Rutzler, Nigel P., Twickenham.
Ruÿten, Andreas Gerardus, Woerden, Netherlands.
Ryan, Margaret Ellen, Hong Kong.
Sanghvi, Kayvan Hemendra, Bombay, India.
Sarries Ulzurrun, Oscar, Barcelona, Spain.
Sato, Koji, Miyagi, Japan.
Satou, Atsuko, Tokyo, Japan.
Schilling, Andreas G.W., Stuttgart, W.Germany.

Schutt, Edgar Frederick, Ottawa, Ont., Canada.
Schutt, Karl Robert, Manotick, Ont., Canada.
Seabrook, Karen Elizabeth, Northwood.
Shah, Paresh Navnit, Bombay, India.
Shah, Sunil, London.
Shanmuganathan, Kathirithamby, Colombo, Sri Lanka.
Shaw, Clive Mylchreest, Odendaalsrus, S.Africa.
Sheed, Sally Ann, Betchworth.
Singarayer, Anton Hugh, Greenford.
Slimming, Nigel Brett, Oxted.
Smith, Alan James, Birmingham.
Smith, Ian James, Westhill.
Smith, Robert Anthony, Shoreham-by-Sea.
Smith, Robert Rich, Westfield, N.J., U.S.A.
Smith, Shirley May, St Albans.
Solans Huguet, Ma Teresa, Barcelona, Spain.
Spence, Lynette Marie, Hong Kong.
Srishanmugarajan, Subramaniam, Mt Lavinia, Sri Lanka.
Stalman, Margareth Annette E., Schoonhoven, Netherlands.
Stanley-Davies, Barry, Auckland, N.Z.
Steiner, Domitilla, Geneva, Switzerland.
Stoops, Jonathon, Liverpool.
Streight, Stewart Gordon, Mississauga, Ont., Canada.
Subky, Thaha Albar Mohamed, Colombo, Sri Lanka.
Subramaniam, Manoharan, London.
Sursock-Accad, Rosine, Beirut, Lebanon.
Sweaney, James Leo, Santa Monica, Ca, U.S.A.
Sweeney, Patrick James, Amsterdam, Netherlands.
Sweet, Kevin Mark, Birmingham.
Symons, Bettina Anne Louise, Weybridge.
Tajika, Kazutaka, Tokyo, Japan.
Tam, Fung-Lin Marianne, Hong Kong.
Tarrasa Lopez, Enrique, Barcelona, Spain.
Tarre Hermosilla, Jorge, Barcelona, Spain.
Tateishi, Masateru, Tokyo, Japan.
Telford, Robert Arnold, Southampton.
Thorbjørnsrud, Ase-Marit, Oslo, Norway.
Tillotson, Inger, West Kirby.
Tolin, Harvey Stuart, Hallandale, Fl., U.S.A.
Tomas Soler, Ma Rosa, Barcelona, Spain.
Toti, Patricia Angela, Southampton.
Toughlouian, Gregoire, Chaville, France.
Trenidad, Jeannette Barbolina, Curaçao, N.A.
Troth, Peter David, Jersey.
Underwood, Barbara Catherine, Manchester.
van den Berge, Tania Alida Pierre, St Amandsberg, Belgium.
van der Ent, Mhairi Irene, Ruiru, Kenya.
van Muyden, Lucia Agatha Maria, Rotterdam, Netherlands.
Vashishtha, Shekhar, Delhi, India.
Venning, Ronald Owen, Toronto, Ont., Canada.
Versendaal, Johannes, Hendrik Ido Ambacht, Netherlands.
Vilaseca Nualart, Jose, Barcelona, Spain.
Villars, Irja Anna Karin, Stockholm, Sweden.
Vlaun, Mirela Christina Evelyn, Curaçao, N.A.
Wall, Stephanie, Alcester
Wallin, Mohamed Iftikhar, Colombo, Sri Lanka.
Weinberg, Joan Doreen, London.
Weiser, Robert Patrick, Bangkok, Thailand.

Wickramaratna, Pasculhandige Don Henry, E. Croydon.
Wilkinson, Ben Richard, Nanaimo, B.C., Canada.
Wilson, Andrew Robert, Cambridge.
Witharane, Wilfred, Dunagaha, Sri Lanka.
Wong, Kwai Poon Martin, Hong Kong.
Woodward, Christine Marie, London.
Wright, Candace Diana Gillies, Purley.
Wright, Elaine Catherine, Purley.
Wright, Michael William, New Malden.
Yamamoto, Kazui, Fukuoka, Japan.
Yamamoto, Keiko, Osaka, Japan.
Yamashita, Hisao, Kofu, Japan.
Yates, Sharon Lynne, Bakewell.
Yee, Yung Shing Jimmy, Singapore.
Yeo, Seng Chye David, Singapore.
Yielding, Daniel Norman, Don Mills, Ont., Canada.
Yoshida, Katsuji, Wakayama, Japan.
Zimmermann, Ursula Theresia, Hong Kong.
Zoysa, Edirimuni Gamini G., Waskaduwa, Sri Lanka.

LETTER TO THE EDITOR

From Mr R. KEITH MITCHELL, F.G.A.

Dear Sir,

The paper on Visual Optics in the January issue of the *Journal*[1] contains some fundamental errors of fact which I, as Mr Hodgkinson's instructor in 1960-61, find surprising, and feel should be corrected if and when he again lectures on the subject. Personally, I experimented pretty thoroughly with the method in 1936, but came to the conclusion that, although spectacular, the effects seen were too empirical and unreliable to warrant publication. The January paper does nothing to make me revise that opinion.

There is nothing new in the idea of squinting through a faceted stone held close to the eye. Bauer, Dieulafait, Kluge and Brard[2] all mention it, the latter as early as 1808. It is noticeable that none of these eminent writers claim more for it than the detection of the presence of birefringence.

Mr Hodgkinson's paper contains more than one basic misunderstanding. He twice says that the greater separation of pairs of spectra, and their increased length, seen through facets nearer the girdle, is due to the light travelling a longer distance through the gem. This just is not so. In the majority of stones light entering by facets near the girdle will have a shorter path through the stone than will light entering near the culet. But the important point is that this increase in separation and spectrum length is due entirely to increases in the angle of incidence both at the point of entry and at the underside of the table facet. These changes are directly due to the fact that facets are cut steeper the further they are from the culet. At no point does the author mention an angle of incidence; indeed he ignores Snell's laws of refraction completely.

Later, a quadrilateral arrangement of four images, 'seen' through a tourmaline, is illustrated, and it is assumed that they provide an example of the multiple RI (Kerez) effect which I first reported.[3] One of the two laws of refraction states that

1. J. Gemm., 1979, XVI (5), 301-9.—Ed.
2. Bauer (M. H.), *Edelsteinkunde*, 1896; Dieulafait (L.), *Diamants et Pierres Précieuses*, 1871; Kluge (K. E.), *Handbuch der Edelsteinkunde*, 1860; Brard (C. P.), *Traité des Pierres Précieuses*, 1808.
3. J. Gemm., 1967, X (6), 194.—Ed.

the incident ray, the normal at the point of incidence, and the refracted ray must be in one plane. This precludes the possibility of a rectangular display of images from any one facet. I suggest that the four images illustrated are the result of camera, stone, or light-source movement during exposure. Did Mr Hodgkinson take the elementary precaution of checking this stone (and others) by refractometer? I still have one of my original specimens of tourmaline which shows the multiple RI effect and can assure him that it gives only two spectra for each facet.

Early in the paper we are told that RI can be assessed only from images 'nearest the centre of the stone'. Later he illustrates a peridot in which these facets do not give the required effect, and elects to use the fourth row instead. This is supposed to be a test for an unknown stone. Why on earth should the user suddenly start selecting spectra from a different set of facets to obtain his identification?

Throughout the paper the author has taken *known* stones and tried to prove them by stone-to-eye methods. There are, however, four variables; the unknown RI of the stone, the angle of incidence (controlled by that of the facet in relation to the light source), the position of the optic axis or axes in a birefringent stone, and the size of the stone. With higher RI it is necessary to tilt the stone to see the pairs of spectra. This changes the angle of incidence and must invalidate the result. The Crowningshield & Ellison paper in *Gems & Gemology* for Winter 1951/2[4] falls into the same error of dealing with effects seen through *known* stones. That paper is also a little vague in that it sometimes talks of 'results as expected' instead of describing those results. I find it significant that a gemmologist of Robert Crowningshield's undoubted ability has never followed this close-vision method through.

The authors of neither paper appear to have noticed another phenomenon which I saw more than forty years ago. If a round stone (it works with other shapes, but is more difficult to manipulate) is rolled on its girdle, and a single pair of spectra is watched throughout a complete rotation, it will be found that the two spectra slowly girate around each other. Observing this obviates the need for the use of polaroid to separate closely aligned spectra as suggested in the American paper and as copied by Hodgkinson. Way back before the War I experimented hopefully with the idea that this particular phenomenon might allow me to distinguish between uniaxial and biaxial stones, but unfortunately both spectra of a pair appear to move, even in uniaxial stones.

In the Visual Optics paper the later illustrations of the spectra seen in cubic zirconia and in diamond are not a fair comparison. The ^{3}Z picture is of a 'flared' spectrum obviously obtained by tilting the stone. That of the diamond spectral images is taken without such tilt. It is possible that the method does provide a test between these two stones, but it must be applied identically to both. A similarly flared spectrum can be obtained from diamond if it is tilted enough.

Yours etc.

R. KEITH MITCHELL.

5th October, 1979. Orpington, Kent.

4. Gems Gemol., 1951, VII (4), 120-4.—Ed.

CORRIGENDA

In J.Gemm., 1979, XVI(5), on p.319 (in l. 20) for 'west-south-west' read 'west-north-west', and on p.320 (in l. 17) for 'Black Bridge' read 'Black Ridge'.

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).

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The Editor is 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 Editor.

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Although not a mandatory requirement, it is most helpful if articles are typed (together with a carbon copy) in double spacing on one side of the paper, with good margins at sides, top and foot of each page. Articles may be of any length, but it should be borne in mind that long articles are more difficult to fit in than short ones: in practice, an article of much more than 10 000 words (unless capable of division into parts or of exceptional importance) is unlikely to be acceptable, while a short note of 400 or 500 words may achieve early publication.

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