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and

PROCEEDINGS OF THE GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN

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GOLDEN YELLOW TOURMALINE OF GEM QUALITY FROM KENYA

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Yellow and brown tourmalines are mainly reported from Sri Lanka, Burma and Brazil (Dunn, 1977), but are known from less important localities (Madagascar, Namibia, U.S.A., etc.) as well. Recently, tourmalines of very attractive golden yellow colour appeared in the trade, originating from Voi-Taveta area, Kenya. Although the rough material is found in rather small chips, it yields very pleasing gemstones after cutting. It is hoped that further findings will provide bigger fragments or whole crystals as well. On rough and cut specimens various mineralogical and gemmological investigations were performed. All results proved the tourmalines to be members of the dravite-uvite series with a ratio of 78:22.

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TABLE 1

Representative list of partial microprobe analyses of yellow tourmalines from Kenya (Voi-Taveta)

	a				b			c			d			
SiO_2	36.81	36.64	36.24	36.52	36.28	36.61	36.56	36.94	36.64	36.10	36.36	36.30	36.90	36.56
Al_2O_3	35.27	35.38	35.06	35.12	34.77	35.06	34.86	35.35	34.95	34.96	34.88	35.04	35.23	34.94
TiO_2	.74	.80	.21	.36	.61	.76	.66	.30	.31	.68	.80	.76	.80	.69
MnO	—	—	—	—	—	—	—	—	—	—	—	—	—	—
FeO_{tot}	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MgO	9.61	9.30	9.28	9.15	8.95	9.26	9.40	9.51	9.42	9.45	9.60	9.52	9.61	9.64
CaO	1.20	1.05	1.07	1.12	.98	1.05	1.04	1.02	1.15	1.02	1.19	1.10	1.20	1.30
Na_2O	2.02	2.06	2.03	2.00	2.06	2.07	2.06	2.00	2.01	2.08	2.07	2.03	2.02	2.04
K_2O	.06	—	—	—	.08	.08	—	.05	—	—	—	—	.05	.07
V_2O_5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cr_2O_3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
anhydrous total	85.71	85.23	83.89	84.27	83.73	84.89	84.58	85.17	84.48	84.29	84.90	84.75	85.81	85.24

—Elements as Mn,Fe,V,Cr are below detection limit of 0.05 oxide wt%.

—a,b,c and d stand for four different samples, on which the point analyses were performed. This shows the variability within one crystal.

CHEMICAL COMPOSITION

Carbon-coated specimens were analysed by an ARL-SEMQ microprobe combined with an energy dispersive detector system (Tracor Northern), using an acceleration voltage of 15 kV and a sample current of 15 nA. For standardization natural and synthetic minerals were used. Data reduction was performed using a ZAF-type matrix correction program. More analytical details are described by Schwander and Gloor (1980).

A representative list of partial microprobe analyses, done on four specimens, is given on Table 1. The results show that the crystals from Voi-Taveta area are Mg-Al tourmalines of the dravite-uvite series, with Na/Ca ratios ranging from 3.1 to 3.8. Recalculating the analyses to the general formula of tourmaline (Table 2), assuming 3 B atoms per formula unit, we obtained compositions close to ideal formulae. However, there is some deficiency of Mg, (Na,Ca) and some corresponding excess in Al which may suggest a substitution as Al $\rightleftharpoons$ Na,Mg.

No Mn,Fe,V or Cr could be detected by microprobe; these elements were checked too in the ppm-range by EDS-XRF-technique.* Only minor amounts of Fe (500-1000 ppm) were found. It is surprising that Ti is the dominant transition element in these crystals and that the saturation of yellow colour can be related with the Ti-content, ranging from 0.30 to 0.80 wt% of TiO_2. So far this is the first dravite-uvite tourmaline with such low Fe content.

On some rough crystal fragments there is sometimes a thin rim of green colour, this zone containing more Fe, as proved by XRF-analysis.

From the observed partial compositions and calculated atomic proportions we can exclude the presence of tsilaisite or elbaite components, although for that yellow colour one might have expected it. This confirms the assumption that no solid solution exists between dravite and elbaite as already reported in literature (Epprecht, 1953, Donnay and Barton, 1972, Sahama *et al.*, 1979).

X-RAY DATA

The lattice constants (Table 3) are calculated from x-ray powder diagrams (Bradley camera, Ni-filtered Fe Kα radiation).

*energy-dispersive x-ray fluorescence

The strongest lines have the following d-values in Å: 2.573(100), 3.973(90), 2.955(80), 4.218(60), 3.475(50), the estimated intensities in brackets. It is not possible to determine the type of tourmaline by its lattice constants alone. Together with chemical information, the constants fit with the observations of Epprecht (1953) and the diagrams of Sahama *et al.* (1979).

TABLE 2
Chemical composition of Dravite-Uvite tourmalines

	(Mg-Al-tourmalines)
Dravite	$NaMg_3Al_6((BO_3)_3Si_6O_{18})(OH)_4$
Uvite	$CaMg_3Al_5((BO_3)_3Si_6O_{18})(OH)_4$

golden yellow tourmaline Kenya (partial microprobe analysis)*

	wt%		
SiO_2	36.64	Si	5.83
Al_2O_3	35.38	Al	6.00
TiO_2	.80	B	3.00
MnO	.00		
FeO	.00	Al	.63
MgO	9.30	Ti	.10
CaO	1.05	Mg	2.21
Na_2O	2.06	Ca	.18
K_2O	.00	Na	.64
B_2O_3†	10.90		
V_2O_5	.00		3.76
Cr_2O_3	.00	Number of ions on the basis of 29 O per formula unit	
anhydrous total	96.13		

*for technical reasons Boron and other very light elements are not able to be analysed by microprobe technique.

†B_2O_3 calculated on basis of ideal formula containing 3 B.

TABLE 3

Physical and optical properties of Dravite-Uvite tourmalines

	Dravite*	golden yellow tourmaline	Uvite
$n\varepsilon$	1.617	1.619	1.619
$n\omega$	1.638	1.642	1.638
Δn	0.021	0.022	0.019
a_o	15.939Å	15.915	15.918
c_o	7.199Å	7.183	7.207
c/a	0.4517	0.4513	0.4509
SG	3.03	3.044	3.01
Dravite:Uvite ratio	80:20	78:22	4:96
Reference	Bridge *et al.* (1977)	this study	Dunn *et al.* (1977) NMNH #C5212

OPTICAL FEATURES

The refractive indices were obtained from oriented crystal sections on a Topcon refractometer, working with Na_D-light. The figures (Table 3) are consistent with the well known range of optical data for tourmaline. The axial image of a slice cut perpendicular to the *c*-axis, observed in a polarization microscope, is uniaxial negative, with a slight tendency to biaxial.

Inclusions are profiled negative crystals parallel to *c*-axis, curved growth tubes (trichites) and flat healing fissures consisting of long and short droplets of residual liquids.

Absorption spectra for both rays, registered on a Pye-Unicam SP8-100 spectrophotometer, show good transmission from red to yellow and a wide absorption band from blue to violet, followed by

*According to the analysis of Bridge *et al.* (1977) this sample does not represent a dravite end-member, but no other data were available a minimum at 378 nm and an absorption edge around 320 nm for $n\omega$ and 300 nm for $n\varepsilon$. Dichroism is stronger than can be recognized by visual inspection, with absorption $n\omega \gg n\varepsilon$. The strongly absorbing ray is responsible for the colour. The extraordinary ray is very pale yellow. For hue, saturation and degree of darkness the DIN 6164 indices are 3:5:1.5 (body colour) and 3:8:1 (internal reflexions).

Fluorescence is absent under long wave, and medium strong yellow under short wave violet radiation.

The absence of transition elements other than Ti and very little Fe, purity and small variation of the orange-yellow hue observed in these tourmalines are to be expected. The saturation of colour, as mentioned before, is governed by Ti content. A wide Absorption band centred around 440 nm appears to be caused by Ti alone.

ACKNOWLEDGEMENTS

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AN UNUSUAL PLEOCHROISM IN ZAMBIAN EMERALDS

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The Zambian emerald deposits (Miku-Kafubu-deposits), which were rediscovered in 1967/1968, have been up to now the subject of intensive scientific and commercial interest (Bank 1973, 1974; Campbell 1973, Kanis 1980). The emerald deposits were first discovered by Baker in 1931 and have been investigated later by Brock and Sharpe. But until the early sixties they were only of little commercial importance. According to Kanis (1980), the first mine (Miku) was given up in 1972. In the neighbourhood, however, there were discovered seven further deposits south and south-west of Miku in the Kafubu region. The production of the mines, coming to the gem market since 1977, make Zambia at present probably the most important producer of emeralds in the world.

The optical data of the emeralds are generally n_o 1.589-1.590, n_e 1.580-1.581, DR 0.008-0.010; the density is given as 2.74 g/cm^3 (Bank 1974). A dark green emerald of Zambian origin with unusually high refractive indices of n_o 1.602 and n_e 1.592, due to its high contents of Fe and Cr, is mentioned by Bank (1980). The colour of the stones is described as ranging from a turbid or barely visible shade to an intensive green, which is somewhat comparable to fine stones from Sandawana (Zimbabwe) and Muzo (Colombia). Some of the stones which are now on the market show a peculiar phenomenon: they look blue to bluish-green with a pleochroism $\parallel c$ blue, $\perp c$ yellowish-green. The authors had never seen such pleochroism in emeralds before. The recognition of this peculiar coloration, which differs very much from the green of emeralds from other localities and also from their pleochroism, which generally is $\parallel c$ green, $\perp c$ yellowish-green, was the reason for the following investigation.

To clarify the causes of the colour and pleochroism in the Zambian emeralds mentioned, microprobe analyses and absorption spectroscopical investigations were carried out. The microprobe

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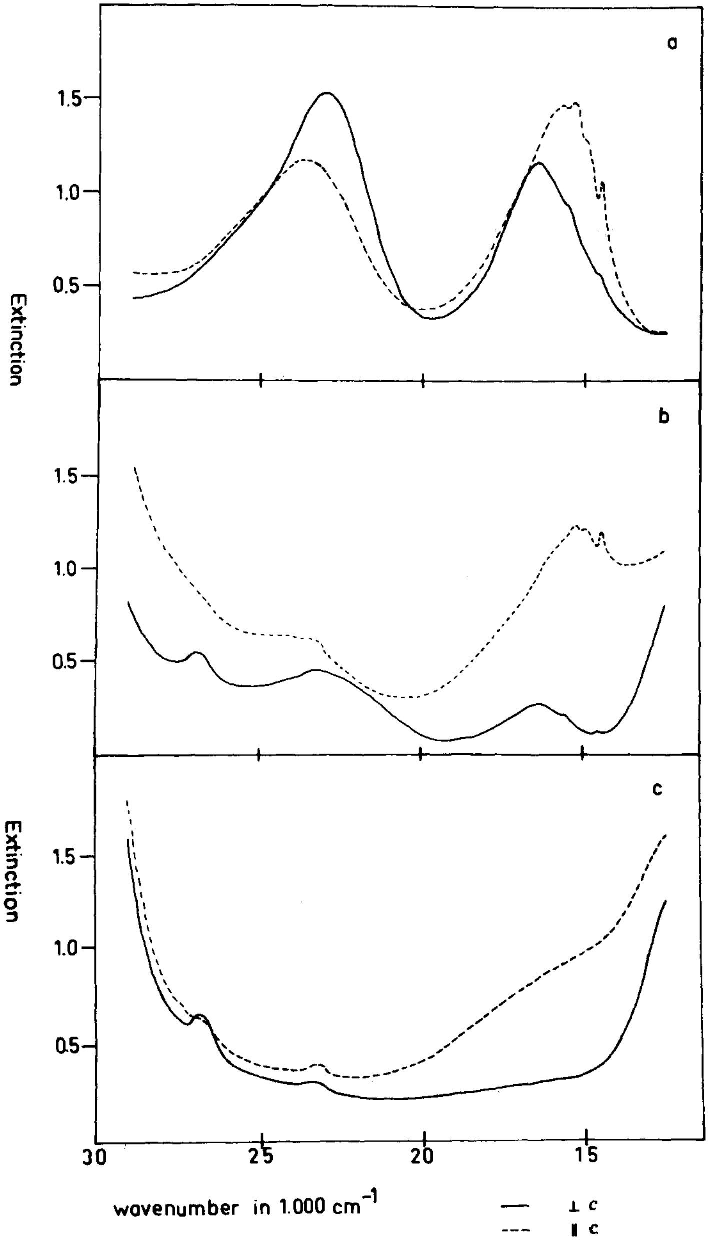

FIG. 1. Absorption spectra of beryls: (a) emerald, Muzo, Colombia. Pleochroism ∥ *c* green, ⊥ *c* yellowish-green; (b) emerald, Miku, Zambia. Pleochroism ∥ *c* blue, ⊥ *c* yellowish-green; (c) aquamarine, Tongafino, Madagascar. Pleochroism ∥ *c* dark blue, ⊥ *c* almost colourless.

investigation of the bluish-green emeralds from Zambia shows besides Cr and V as trace elements also a distinct Fe content, which, however, was also observed in emeralds from other localities (Table 1).

TABLE 1

Chemical data of emeralds (microprobe)

Locality	colour	V	Cr	Fe
Kwale District, Kenya	green	0.01	0.14	0.32
Lake Manyara, Tanzania	green	0.01	0.06	0.40
Miku, Zambia	bluish-green	0.01	0.07	0.73

The absorption spectra of the bluish-green emeralds from Zambia differ very distinctly from the spectra of green emeralds from other occurrences. They consist of a spectrum produced by the Cr bands of 'normal' green emeralds on which is superposed the spectrum of blue aquamarine caused by Fe bands [Fig. 1; for comparison see also Wood & Nassau (1968), Schmetzer *et al.* (1974), Parkin *et al.* (1977), Goldman *et al.* (1978), Platonov *et al.* (1979)]. The bluish-green emeralds from Zambia owe their unusual colour and spectra to the coincidence of an emerald component and an aquamarine component in the same crystal. Since the visible part of the absorption spectrum of the stones $\perp c$ is hardly influenced by the Fe bands of the aquamarine (aquamarines are generally colourless $\perp c$), emeralds from Zambia and emeralds from other localities show $\perp c$ a yellowish-green colour. However, in the spectrum $\parallel c$ the colour-determinating absorption minimum of 'normal' emeralds, which is in the green part of the spectrum, has superposed on it the Fe bands of the aquamarine component of the stone and is therefore shifted from the green to the blue part of the spectrum. Therefore, the stones $\parallel c$ are blue in colour. The coloration of the bluish-green emeralds from Zambia, therefore, is explained as due to a coincidence of an emerald and an aquamarine component in the same individual stone.

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SOME FALLACIES OF GEMMOLOGY

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

In two papers published in overseas gemmological journals in the past year or two some confusion has been found regarding the working of the diamond pen as a test between diamond and its imitants. I suspect that the second paper, in the *Australian Gemmologist,* which was printed as a working report on the instrument, took this part of its information from an earlier paper, published in *Gems & Gemology,* the American journal, without questioning its facts.

Both papers mention the 'surface tension of diamond'. This is a misuse of terms since surface tension as now understood is a property of liquids and not of solid crystals, though in the past it was sometimes used in respect of unsatisfied electron bonds at the surface of solids.

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Both also associate the 'ink' test with the hydrophobic (water repellant) property of diamond, with the water spot test and with the somewhat dubious breath test.

Unless I am greatly mistaken the test depends, not upon the diamond's non-wettability at all, but upon that mineral's other notable property, its affinity for hydro-carbons, the ink used being based on a glycol. Water is miscible with glycol and may be present to assist flow, but the continuous line or defined spot of ink is düe to the presence of the hydro-carbon.

THE BREATH TEST

For a great many years one has seen dealers and jewellers react to the sight of a diamond by breathing on it. This was done long before any seriously deceptive imitants were known and has the effect of masking the internal life of the stone in order that its actual colour can be assessed. It has probably been in use for that purpose since colour, or the lack of it, became recognized as a factor in diamond values.

Recently this very basic test has been 'promoted' to being a test between diamond and its imitants. It was even demonstrated in a TV programme on gemmology. It is said that misting resulting from breathing on the stones clears more quickly from diamond than from other stones.

Although there may be some slight scientific reasoning behind this belief, i.e. that diamond conducts heat to the misted surface more quickly, there is also the fact that it conducts heat away from the warm moisture more readily and so more, or larger, droplets are deposited.

Further, one has to be quite sure that all stones are breathed upon at the same moment and for the same length of time. Once misted the stones must not be subjected to any outside source of heat or draughts. Radiated heat from the face or hands while the stones are examined by lens is quite enough to vitiate the result. In the TV programme mentioned above, I seem to remember that the rings tested were hand-held. No reliable result could be expected even if the test were workable under more careful conditions. In my opinion the rather dramatic difference shown in the programme was obtained by other means.

In controlled experiments in which all stones tested were placed in a refrigerator to ensure an even starting temperature, and then placed on the stage of a microscope with no artificial lighting and with a cardboard shield between the operator and all but the oculars of the instrument in order to eliminate body heat and warm up-currents of air, it was found that the stones demisted at roughly the same rate or, where there were differences, these were not necessarily repeatable with the same stones in subsequent runs. In no case did I find that a diamond was misted for a markedly shorter time than most other stones, and in one case a paste demisted at the same time as the diamond.

Grahame Brown, of Queensland, has introduced a volatile spray test, using aerosol freon. This produces a cold fine spray, cold because of the sudden release of pressure, which presumably chills the stones tested. Does it chill all stones equally? Even if it does, the same sources of error must apply. Mr Brown has, himself, commented on the inconsistency of results obtained from such tests.

No, I must contend that the breath test as a means of proving diamond is at best hit or miss and at worst a bit of gemmological flummery which we can well do without. Keep it as it was originally intended, to assess colour in the diamond examined.

THE DICHROSCOPE

A textbook published in 1977 dismissed this instrument as 'having very little gem-testing value provided that other gem-testing instruments are at hand.' Yet a question on the dichroscope was set in the 1980 examinations. Examiners still think it sufficiently important.

In point of fact the dichroscope, where it applies, is less subject to error than is the polariscope, which the author in question rather persistently advocates. The polariscope will give a positive answer for strain birefringence and this could be misleading. The dichroscope would not show pleochroism in such a case. No one has suggested that either of these instruments in isolation can identify a stone beyond doubt. But, in practice, the dichroscope is the safer instrument where coloured stones are concerned.

THE CHELSEA COLOUR FILTER

The same textbook dismisses this as 'of little practical use on its own' and later, 'of precious little use in the identification of emerald today', basing his opinion on the fact that demantoid garnets, green zircons and green fluorite all appear reddish through the filter. He says that the filter was produced in answer to the 'soudé emerald'. The latter were first made many years before the Chelsea filter was introduced, and demantoids, green fluorite and zircon were all around at that time.

Intelligently used the Chelsea filter is still a powerful tool in gem identification and should not be dismissed out of hand. I do know of one instance where a stained chalcedony bead bracelet was sold as emerald because it showed a pinkish residual colour through the filter, but I did say that it needed to be used intelligently. No one familiar with the material would have mistaken the bracelet for anything other than what it was.

Having, hopefully, put right some gemmological misconceptions I will now try to add something to gem knowledge while again destroying a widely held belief.

Some time ago I was going through a large collection of fragmentary rough gem material when I came across a flattish chunk which had very marked dichroism, a distinct yellow-brown in one direction and a bright and pleasing green at right angles to it. Without identifying it I sent it away to be cut into two stones, one to give the green colour and the other the yellow-brown. I thought I had something quite out of the ordinary. The stones came back looking rather dark and with a less marked difference in colour than I had hoped, due to the reflections from back facets which effectively mixed the two dichroic colours. But I was amazed to find, on testing them, that the material was tourmaline, which is normally expected to have a dichroism consisting of light and dark of one colour.

Subsequently I tested about 80 tourmalines of different colours and found one other which had this unexpected contrast in its pleochroism. I mentioned this to Christopher Cavey, of Cavey McCallum Ltd, and he produced an even more startling example, a stone which appeared almost black when examined normally but which showed dichroic colours of a fine deep tourmaline green for the extraordinary ray and a deep garnet red for the ordinary ray. Complementary colours in fact, which accounted for its lack of colour as a gem i.e. it was practically black. Another point emerged during this investigation and that was the considerable variation in the degree of dichroism between different colours. It is already known that heat-treated fine green stones from S.W. Africa show little dichroism, but it was found that some of the light pinks also showed scarcely perceptible differences in the absorption of the two rays.

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AN INTERESTING FIND

By PHILIP JEROME, F.G.A.

About four years ago I was approached by an elderly German gentleman, in connexion with some laboratory apparatus he wished to sell. He told me that he was administering his recently deceased brother's estate as sole executor. At the time I was a student of gemmology and required a chemical assay balance. He informed me that his brother was an analytical chemist and he would like to have his equipment sold to someone who would use it and not to a dealer. We agreed on a date and time and met at his brother's house. I was guided upstairs and led into the laboratory. I was told that I could purchase anything that would be of use to me; in fact there was very little equipment of use, most of it being very old, or else there were bottles marked 'Radium Salts' that were covered in a heavy corrosion, and these I avoided like the plague!

However as I was about to leave, I had whispered in my ear 'How about the library?'. I could not resist the call, and in I went.

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The books were tied up in dusty bundles, and as far as I could see related to analytical and chemical microscopy—although of some interest, not really gemmological. I had browsed through a couple of boxfuls, when I came across a box full of geological and mineralogical editions. To my surprise the deceased gentleman had a keen interest in gemmology, and most of the books were printed at the turn of the century.

One book titled *Lehrbuch der Mineralogie und Geologie,* written by Dr Aug. Nies and Dr Ernst Dull, contained the most beautiful colour plates and illustrations of several minerals. To my surprise it contained a few folded newspaper cuttings, in English and dated around 1920-1933. The first cutting was dated October 1926, and revealed an advertisement for Greys (non-filter) cigarettes, ten for sixpence! The reverse side was an article on coloured diamonds from a publication called *The African World:*

COLOURED DIAMONDS

THE RED STONE OF ELANDSPUTTE

Among the gems recently found near Lichtenburg was a deep red port-wine coloured diamond, weighing eighteen carats and rather irregular in shape, which was discovered at Elandsputte early in August. This is only the second red stone found in South Africa, while another was found in Brazil some twenty years ago, states Mr. David Draper, the well-known geologist. These small stones (about a carat each) fetched very high prices. The African one was bought by a dealer for £50, and sold for £500, and £1,500 is the price put upon it by the present owner. The value of the Elandsputte stone depends entirely on the colour after cutting. As an instance of this, Mr. Draper mentions an ordinary diamond found in Brazil which was sold for $48, the price for the ordinary run of stones. After cutting it exhibited the peculiar kerosene tinge of light violet so highly prized by the Americans, and a well-known New York firm immediately offered $600 for it. On the Pretoria diamond mines—especially on the Montrose when first discovered—the red top soil yielded blue, green, pink, brown, and black diamonds, in addition to the white gems of all qualities; while similar stones were found in the Sonambula Forest diggings in Rhodesia over twenty years ago.—*The African World.*

The next article was dated 26th August 1933, and reported on the museum theft of unique gems stolen from the Jermyn Street Geological Survey Museum; the most interesting reading was under the section headed 'The Finest Specimens' as follows:

THE FINEST SPECIMENS

Among the stones stolen were fancy-coloured sapphires, tourmalines, zircons, a diamond, and specimens of green beryl and gold ore. This case of 'recent additions'—some 3ft long by 2ft deep—contained the cream of the museum's cut gem-stones.

A number of the missing stones are certainly among the finest known specimens of their kind, and some of them probably unique. But they are almost without exception of a class which holds far greater value and interest for the collector than for the practical jeweller.

Among the outstanding stones which the case contained were:

A large oval aquamarine of a wonderful blue colour;

A large round brilliant-cut kunzite—a lilac-pink stone of the spodumene variety—which disputed with an almost identical stone at South Kensington the claim to be the finest in the world;

A number of fancy coloured sapphires; and

Some half-dozen very fine tourmalines.

Two of the tourmalines—one a deep red, and the other showing five distinct colours (brown, yellow, white, green, and red)—were probably unique.

One cannot help but think and wonder whatever became of these stones, especially the last item, a five-colour tourmaline, something I have never seen.

And on to the third item dated 28th December, 1921, this time on a lighter note. This article is written by an anonymous person, who calls himself 'A Diamond Merchant'; it is headed 'Testing Precious Stones' and will make any respectable gemmologist raise a smile:

TESTING PRECIOUS STONES

By A DIAMOND MERCHANT

Although hardly a year passes without some new way of faking gems is discovered, comparatively few imitation stones succeed in passing the vigilant eyes of the experienced tester.

> When handling packets of gems from all sources every week one naturally acquires a·kind of intuition in detecting imitations. And this merely by passing the eye over a row of gems just to see how they glisten. Likewise after glancing at the facets on a stone one can usually hazard a good opinion as to the genuineness of the gem.
>
> As soon as a suspicious stone is detected it is tested by two, three, or even more individuals, each using some test he thinks most suitable.
>
> The five methods of testing in common use are known as 'brilliancy,' 'globule,' 'dot,' 'marking,' and 'facets.' A faked gem is less brillinat than a real one. As trusting to the naked eye is unsatisfactory, the gem is dropped in a bowl of water. If the stone is genuine it glistens through the liquid, whereas an imitation gem loses all its brilliancy.
>
> The globule test is almost as simple to perform and is just as efficient. A drop of water is placed upon the diamond's face. It is then touched with the point of a finely-sharpened pencil to see if the globule breaks or spreads. When the stone is genuine the globule keeps its form, while the surrounding parts of the face remain dry. The reverse happens in the case of a 'faked' gem.
>
> The dot method consists of looking through a diamond at a black dot on a sheet of white paper. If the dot appears in any way blurred the stone is held back for other tests as to its genuineness.
>
> In gems the degree of hardness also counts for much. A file will run smoothly over a genuine stone and leave no trace of marks. But the best of imitation stones rarely withstand the severity of this method and will splinter and fly in all directions.
>
> The last named test probably seems easier than any of the others. It is carried out by examining the facets of a genuine and an imitation stone side by side. With the latter extra care has been given to the grinding and polishing, so that there is no likelihood of irregularity in the reflection of the light. With a genuine gem this is unnecessary.
>
> In other words the facets of an imitation stone are often more accurate than in the genuine stone of quality.

It is no wonder that the writer remained anonymous, especially when we are told that 'a file will run smoothly over a genuine stone and leave no trace of marks, but the best imitation stones rarely withstand the severity of this method, and will splinter and fly in all directions.' One presumes at this point, that the splinters of the stone under test will be passed on to a gemmologist for positive identification! I know that this article was written in 1921, but we must be thankful for such men as Herbert Smith, Bristow Tully, Robert Webster, Basil Anderson and others, who have helped educate both gemmologists and (dare I say?) diamond merchants!

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A FIBRE-OPTIC REFLECTIVITY METER

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

Since the first electronic reflectivity meter was introduced in 1974,[1] a number of commercial gem test instruments have been marketed which use the Fresnel relationship[2] between refractive index and reflectivity as a means of identification. These instruments have ranged in sophistication from the relatively simple Hanneman 'Jeweler's Eye'[3] to the more complex Martin 'Gem Analyser',[4] the latter using a pulsed light source.

Once the requirements for a flat, clean and scratch-free test surface are taken into account, these instruments can provide a

1 Webster, R., A Report on the Gemeter '75, *J.Gemm.*, 1975, **XIV** (8), 378-81.

2 $$\text{Reflectivity} = \frac{\text{intensity of reflected ray}}{\text{intensity of incident ray}} = \frac{(n-a)^2}{(n+a)^2}$$

where n = RI of gemstone
a = RI of surrounding medium

3 Webster, R., The 'Jeweler's Eye': A Report, *J.Gemm.*, 1976, **XV** (1), 19-24.

4 Read, P. G., The Martin MGA-1 Gem Analyser: A Report, *J.Gemm.*, 1978, **XVI** (1), 50-4.

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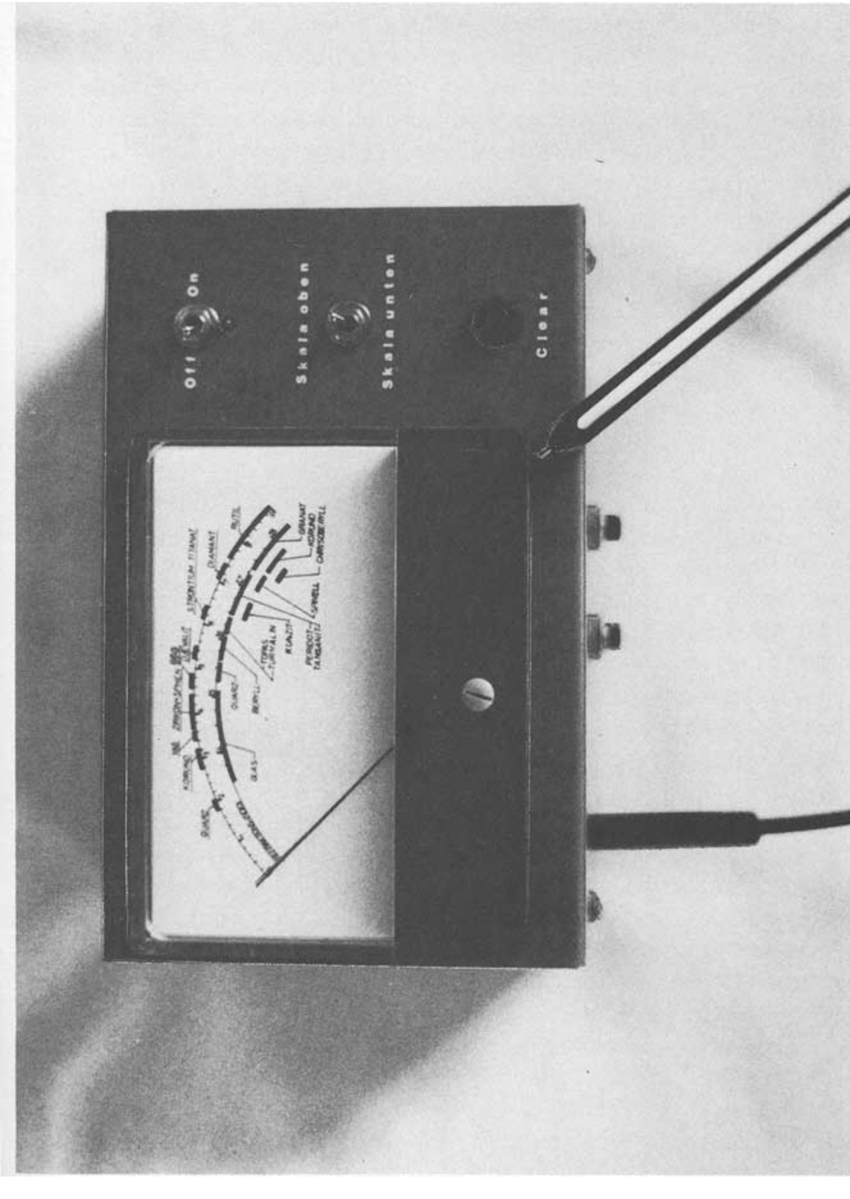

FIG. 1. The control unit and fibre-optic test probe of the new German reflectivity meter. The calibration presets for the instrument's two ranges can be seen in the front edge of the unit.

useful and portable means of gem identification, although they lack the precision and range of information available from the critical-angle refractometer (e.g., DR and optic sign).

One area in which the reflectivity meter excels is the identification of diamond and its simulants (in particular those man-made stones whose RI is above the range of the standard glass-prism refractometer). Even here, the instrument suffers from three limitations; one is the size of the gemstone's facet, which must be larger than the test aperture (usually 1-1.5mm diameter); the second is the need for the gemstone's test surface to be flat against the aperture (which rules out recessed stones), and the third is the instrument's inability to identify stones having a curved surface (i.e. cabochons).

For diamond identification, the first two of these limitations can now be overcome by the use of a thermal conductivity tester.[5] More recently, the second and third limitations have been eliminated in a new German reflectivity meter which is capable of identifying deeply recessed stones, and those with curved surfaces.

This new instrument (Figure 1) uses a bifurcated non-coherent glass-fibre light guide to transmit pulsed infrared energy to the gemstone's test surface, and to return the reflected energy to a photo-detector. Both the IR source (a light-emitting diode or LED) and the detector are mounted in the control box, and are optically coupled to the two end sections of the light guide. The light guide is terminated at the test probe end in a 1mm diameter metal ferrule which contains a miniature converging lens having a focal length of 1mm.

Before testing a gemstone, the instrument's 'Clear' button is pressed to reset the meter-reading to zero. The test probe is then held at right-angles to the gemstone's surface, and slowly brought into contact with it. When the probe tip approaches within 1mm of the stone's surface, the IR beam reaches its optimum focus and the reflected energy (as collected by the detector section of the light guide) rises to a maximum.

The peak value of this reflected energy is automatically fed into the instrument's memory circuits to produce a latched (i.e. steady) meter-reading. As a result of the very small dimensions of the IR beam at its focal point, the instrument is able to measure the reflectivity of a curved surface as well as that of a flat surface.

5 Read, P. G., Thermal Diamond Probes, *J.Gemm.*, 1980, **XVII** (2), 85-94.

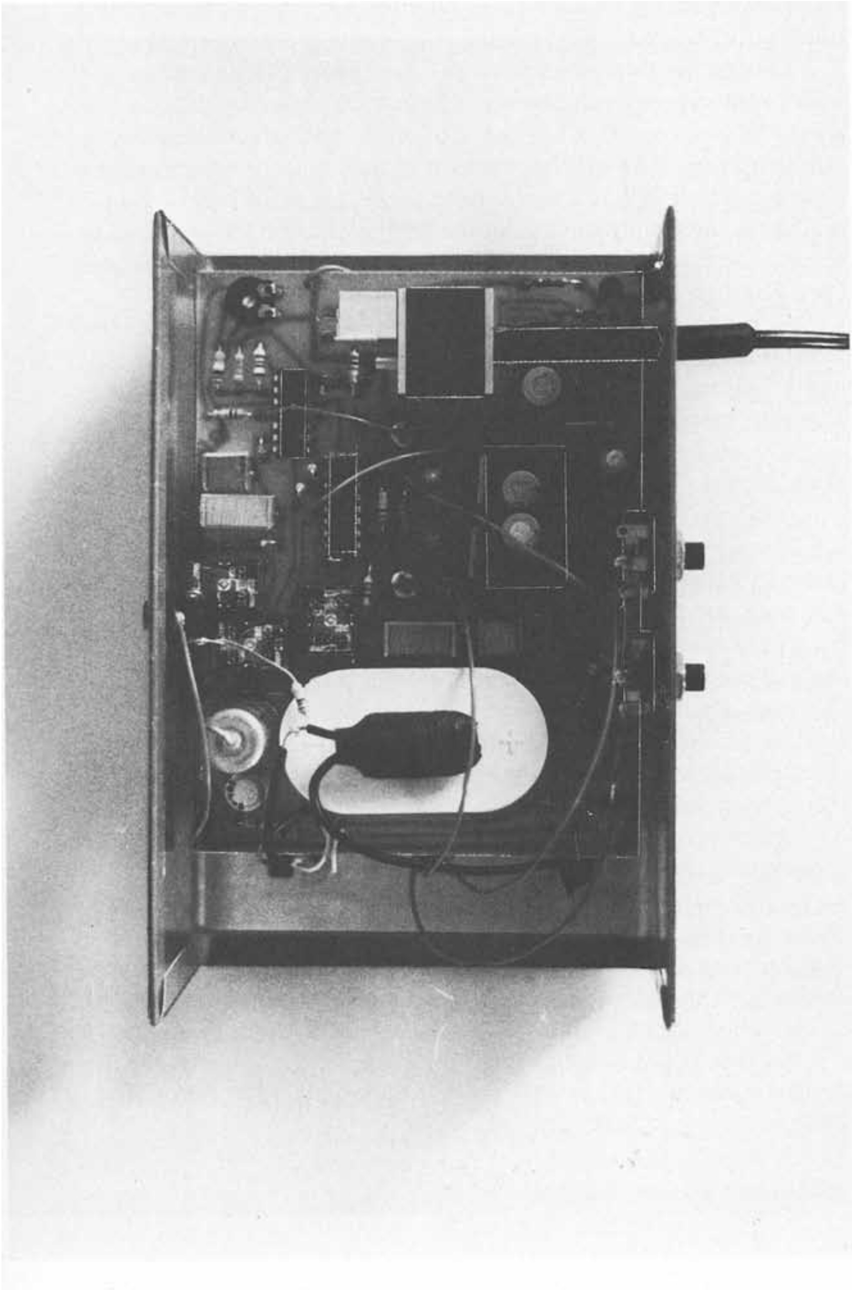

FIG. 2. Underside of the control unit showing the electronic components mounted on a double-sided printed circuit board. The re-chargeable battery is the white unit on the left. The LED/detector assembly is in the square fibre-optic connector on the right.

After each test, the latched meter-reading is displayed continuously until the 'Clear' button is pressed.

During the development of the instrument, some calibration drift problems were experienced. These were caused by the thermal sensitivity of the IR LED/detector unit, and are overcome by automatically feeding the detector's output into the memory circuits each time the 'Clear' button is pressed. This 'background' reading is then subtracted from the gemstone's reflectivity reading by the electronic circuits, thus providing continuous calibration compensation against thermal drift.

The unit has two ranges, the lower one covering materials from glass to corundum and the garnets. The upper range includes quartz, zircon, diamond and the man-made diamond simulants. The instrument's power source is a built-in re-chargeable battery which, together with the electronic components, is mounted on a double-sided printed circuit board (Figure 2).

Tests made by the writer confirmed the ability of the unit to identify gemstones having both flat and curved surfaces, the main problem experienced being that of touching the probe tip on the gemstone surface at approximately right-angles. Until this skill has been mastered it is necessary to make several tests and to take the highest reading (a sound precaution with any reflectivity meter). Occasionally, with small stones in a close-set mount, a false high reading was produced by the focal point of the IR beam passing through the stone, and the detector 'seeing' the high reflectivity of the surrounding metal.

Apart from its ability to identify recessed gems and cabochons, the instrument also appears to be less sensitive to surface scratches (probably because the very small beam makes it easier to find an unscratched area). However, as with the more conventional reflectivity meters, the normal gemstone cleaning and handling precautions still need to be strictly observed if errors of measurement are to be avoided.

Further details on this instrument can be obtained from the designer/manufacturer, Mr U. A. Aldinger, 7000 Stuttgart-1, Lenbachstrasse 1, West Germany.

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DEMISE OF THE BEILBY-BOWDEN THEORY OF POLISHING

By PETER J. CROWCROFT, Ph.D.

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Gemmology literature generally ascribes the nature of the polished gem surface to the formation of a 'Beilby Layer': the polishing process is viewed as generating heat sufficient to melt the surface of the material being polished so that it smears to form a thin amorphous layer. This is the Beilby-Bowden theory of polishing. It was first proposed by Beilby in 1901[1] and in more detail later.[2,3] The theory received experimental support by Bowden and co-workers in 1937.[4] Some electron diffraction experiments in the 1930s also gave the theory support (as it applied to the polishing of non-metals),[5] but some did not.[6] It is to be noted that Beilby actually proposed that a surface layer was formed not only during polishing but also by cutting, filing and grinding the surface of crystalline solids. However, these parts of his theory never received independent support.

Even at the time the Beilby-Bowden theory of polishing was not widely accepted,[7] and by the late 1950s the theory had been completely superseded. However, within the confines of the current gemmology journals and textbooks, the writer can find no reference to this fact and the Beilby-Bowden theory continues to be propagated. Discussion on the nature of the polished surface stops with experimental work of the late 1930s. The purpose of this paper is to present a brief summary of recent developments in the field of surface grinding and polishing and to give a comprehensive list of references to the relevant scientific literature, so that readers may follow up the topic for themselves.

EXPERIMENTS OF DR L. E. SAMUELS

Most of Beilby's experimental results came from observing the surfaces of metals after grinding and polishing. Thus it is appropriate that we should first look at what has happened subsequently in this field. In the 1950s, Dr L. E. Samuels repeated all of Beilby's experiments as well as carrying out electron

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diffraction experiments.[8,9,10,11,12] Samuels could find no evidence to support the Beilby-Bowden theory and advocated a return to the Classical Theory of polishing as held by Newton, Hooke and Herschel.

> 'The new view, then, is that metallographic polishing occurs primarily by cutting, the individual abrasive particles acting in a similar manner to a planing tool. Material is removed and scratches are produced, the better the polish the finer the scratches.'[11]

Polishing agents which polish in this way are diamond powder, alumina powder and emery and silicon carbide papers. Direct evidence for this mechanism was published in 1970.[13]

Experiments of Dr D. C. Cornish and Co-Workers

In the early 1960s, Dr D. C. Cornish and co-workers at the SIRA Institute, Kent, studied the polishing of glass in detail under many different conditions. For example, using different polishing powders calcined at different temperatures, using varying pressures and slurry temperatures, using different pH, using solutions other than water and using glass of different silica content. Most importantly, they studied with the electron microscope changes to the *same* area of glass during *successive* stages of polishing.[14]

Cornish concluded from these studies that no significant contribution to polishing was made by surface flow or redeposition of material on a scale greater than 50 Ångströms. The polish was formed by the *removal* of glass first from the high spots and then from the low spots as the surface was removed.

> 'Throughout this initial stage of polishing, pieces of glass flake out from the surface as strain is relieved in the layer immediately below the surface. This strained substructure is formed during the previous smoothing operation and its depth depends on the conditions then prevailing. To achieve a good finish it is imperative that the surface be lowered beyond this strained region.'[14, *Report* 348]

In Report 348, three sequences of electron microscope photos are published showing the polishing process in detail (see Figure 1). One sequence is continued to show the effect of subsequent etching on the polished surface. Physically they found the rate of material

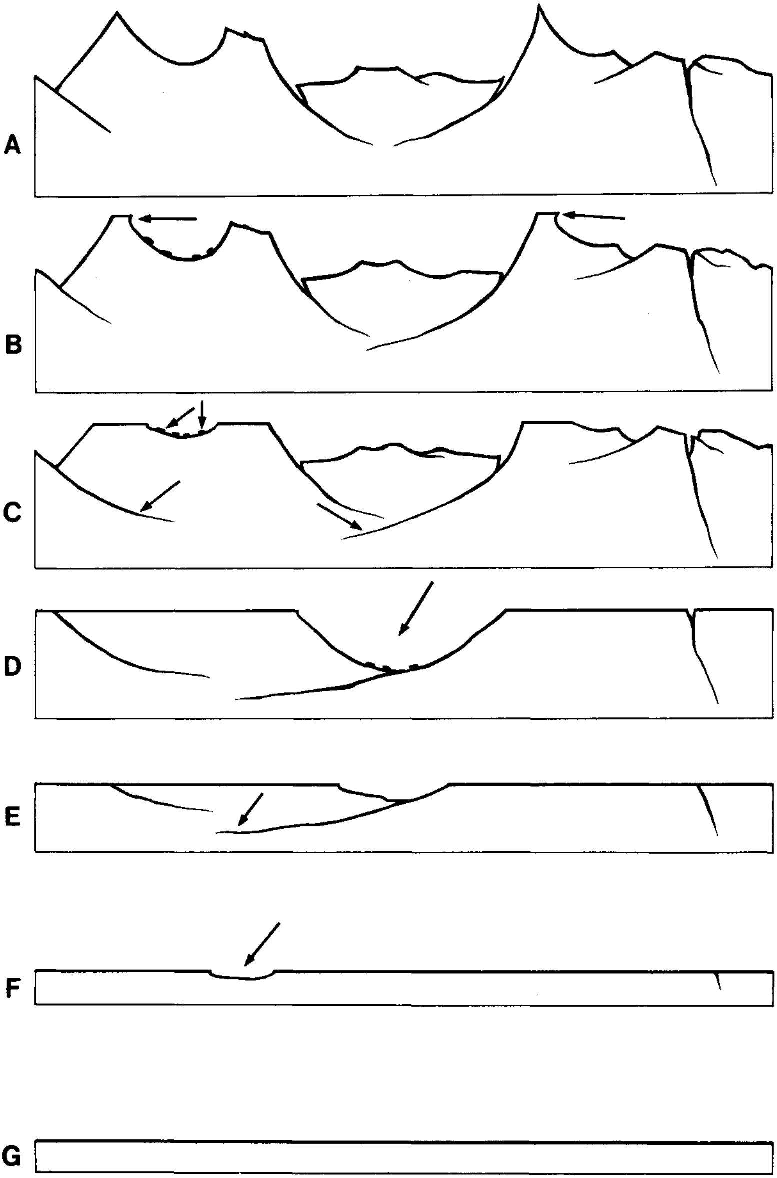

FIG. 1 Schematic illustration of the surface changes of glass during polishing.

A Pre-polished surface.
B Initial polishing removes glass from high points. Some shear-over (arrows).
C Continued polishing. Surface cracks extend and debris collects in surface depressions.
D Some chips flake out as surface cracks extend.
E & F Increased area polished. Continued flake out of glass from areas with deepest cracks.
G Polished, crack-free surface.

(Diagram after Figure 56, Report 348, Ref. 14. Used with permission).

removal depended directly on the applied pressure and the machine speed. It was temperature-independent. Chemically the rate depended on the activity of the polishing powder (as determined by its calcination conditions) and on the silica content of the glass. In a non-aqueous slurry the removal rate was decreased. The removal rate was independent of pH. Effective polishing powders were cerium oxide, chromic oxide, ferric oxide, cupric oxide, zirconium oxide, stannic oxide, plumbic oxide and zirconium silicate. With the exception of zirconium silicate all are the oxides of multi-valent metals.

A chemical mechanism of polishing was proposed which involved the adsorption of hydrated silica from the glass by the polishing powder following disruption of the surface Si-O-Si bonds. Note that this mechanism of glass polishing was not new: it was first put forward in 1931 and was the subject of further papers in 1937 and 1945. In the 1950s East German workers were actively promoting it. (For a full discussion see Ref. 14, Report 267). However, it was Cornish and co-workers who presented conclusive evidence for the theory (only a small portion of which has been mentioned here).

RE-EXAMINATION OF BOWDEN'S EVIDENCE

The work of Samuels and Cornish briefly presented above demonstrated directly that no Beilby Layer was formed during normal metal or glass polishing. But this still left the evidence of Bowden[4] to be explained, particularly as his laboratory produced additional evidence in 1954[15] and 1958[16] to support the Beilby flow theory.

Detailed examination of these papers, however, shows them to be capable of alternative explanation. The arguments will not be presented here, but readers who follow up these references should note the following points.

1. The 1954 paper by Bowden & Thomas[15] was repeated and reinterpreted by Heighway & Taylor in 1966.[17] Using more sensitive equipment and much lower masses (as low as 2 grams), Heighway & Taylor were able to examine the characteristics of *individual* hot-spots. They showed that Bowden & Thomas had generated *aggregate* hot-spots and had made conclusions all appropriate to them.

2. The pressures used by Bowden and co-workers are 2 to 3 orders of magnitude higher than that necessary to achieve a glass (or metal) polish. The conditions described are closer to those of burnishing and grinding rather than to polishing.
3. Typical values of the $v\sqrt{W}$ parameter[16] to achieve a polish in gemmological work are two orders of magnitude lower than that stated as being necessary.
4. Samuels[8] discusses the Bowden & Hughes 1937 paper[4] and does not find their evidence conclusive.

Recent Studies

The use of glass and ceramics for heat shields, missiles and electronics has ensured continuing research into the nature of non-metallic surfaces after abrasion and polishing. A recent publication gives an excellent survey of the state of much present-day research.[18] Some of the articles are of interest to gemmologists: several examine the characteristics of subsurface damage in glass after grinding, the *polishing* of glass by normal *grinding wheels* is reported (page 107), electron microscope photos of glass melted by grinding are shown (page 68) and the polishing of sapphire with superheated steam is reported (page 157). Several other recent studies have specifically examined the mechanism of glass grinding and the interface temperatures generated under various conditions.[19,20,21]

All of these four papers report that under certain conditions melting or softening of glass can occur during grinding in the zone immediately under the abrasive particles in the grinding wheel. This is shown very clearly in three electron micrographs published in another paper (see Figures 14, 15 and 16 of Ref. 22). In these figures the glass surface is one of conchoidal fracture except where plastic flow has occurred in the area where the abrasive particles have moved over the surface.

Conclusions

It has been shown that there is no evidence to support the Beilby-Bowden theory of polishing. The polishing process occurs beyond the resolution of the light microscope. It was only with the development of scanning and transmission electron microscopy that its direct study was possible. Polishing of both Classical and (in the case of silica-containing compounds) Chemical kinds involves the *removal* of material to below the damaged and deformed layers of material resulting from the prior pre-polishing operation. There is no reason to believe that these mechanisms do not also apply to the polishing of all gemmological material.

However, it still remains for a comprehensive theory of gemmological polishing to be put forward. Such a theory must embrace polishing by all techniques and must be consistent with the many rule-of-thumb procedures advocated currently. In addition there are numerous questions which require further scientific study—for example, polishing by tumbling and polishing of cabochons on leather.

It is hoped that this paper will contribute significantly towards the development of a new theory.

ACKNOWLEDGEMENTS

The writer wishes to thank Drs Cornish, Heighway, Hockey and Samuels for discussing their work with him.

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DIAMOND PRODUCTION IN GUYANA

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INTRODUCTION

In 1923 diamond production in British Guiana reached nearly a quarter of a million carats, averaging about 5.2 stones per carat. This was the peak in the colony's gemstone production and although there was a modest rush during the 1960s—112 000 carats in 1961—the industry has gone into a decline in recent years (see Figure 1). Some say that it will never fully recover.

In the 1920s and indeed in the early 1960s British Guiana was a typical colony, with trade (and in some respects the whole way of life) oriented towards Britain. Today Guyana is a Socialist Republic. Many of the industrial concerns and retail stores are now state owned and all foreign trade is carefully controlled by the state. The economy is based almost entirely on sugar, bauxite and rice, and, although the country has many precious stones together

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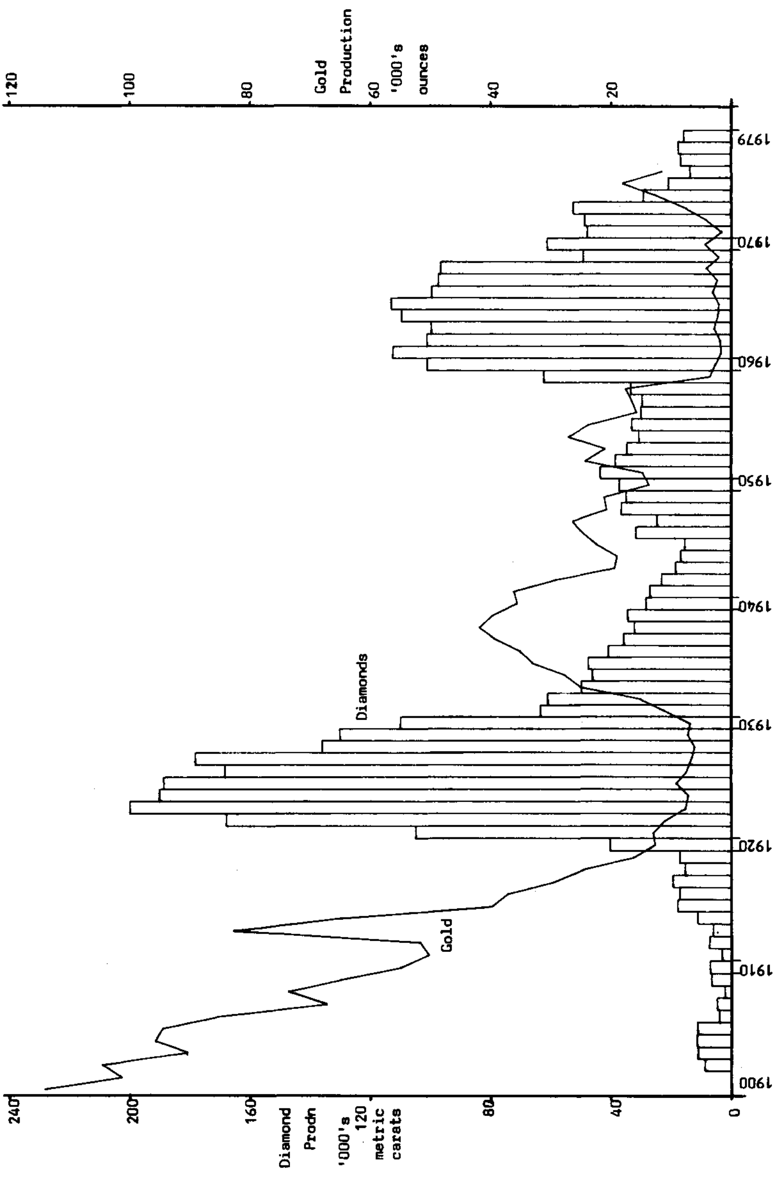

FIG. 1. Diamond and Gold Production.

with extensive gold deposits, the local jewellery industry is still in its infancy. There is little or no interest in design, and stones are generally sold unmounted to individual buyers. About a quarter of the gem material originating in Guyana is shipped to the Caribbean islands (Barbados and Trinidad) for cutting and disposal. The rest is cut and sold in Georgetown, but of this a high percentage finds its way onto the European and American markets.

Industrial stones, which presently account for about a quarter of the total declared production, are all exported to London, but there is a tax on all such exports in addition to the royalty of $5.00 per carat.

Geology

Diamonds in Guyana (see Figure 2) are all recovered from bands of gravel in alluvial deposits of which four different categories have been described[2]—

(1) The high alluvials, or hill deposits (between 100 and 150 metres above sea level), are thought to be the remnants of old flood plain deposits.

(2) Between the hill deposits and river channels there are terrace deposits which are related to the present drainage having been derived from channels cut in the older high alluvials.

(3) The third type of deposit occurs in the river flats themselves. They are obviously directly related to the present drainage and probably constitute the most important type of deposit for present day production.

(4) To the west of Guyana there is a plateau about 1000 metres above sea level and dotted with mesettas the highest of which, Roraima, reaches over 3000 metres. The plateau is made up of almost horizontally bedded sandstones and conglomerates and all diamond deposits have shown a striking relationship to this formation. Most of the workable deposits are found within a band, 25 km wide, around the delineating escarpment and it is suggested that these deposits are largely the result of the redistribution of the alluvial fans radiating from gorges in the escarpment. The fourth type of deposit is found on top of the plateau or directly associated with it.

The bulk of all the alluvial deposits is made up of smooth, sub-angular, water-worn quartz pebbles together with worn grains of rutile, tourmaline, limonite, jasper and quartz crystals.[5] Some

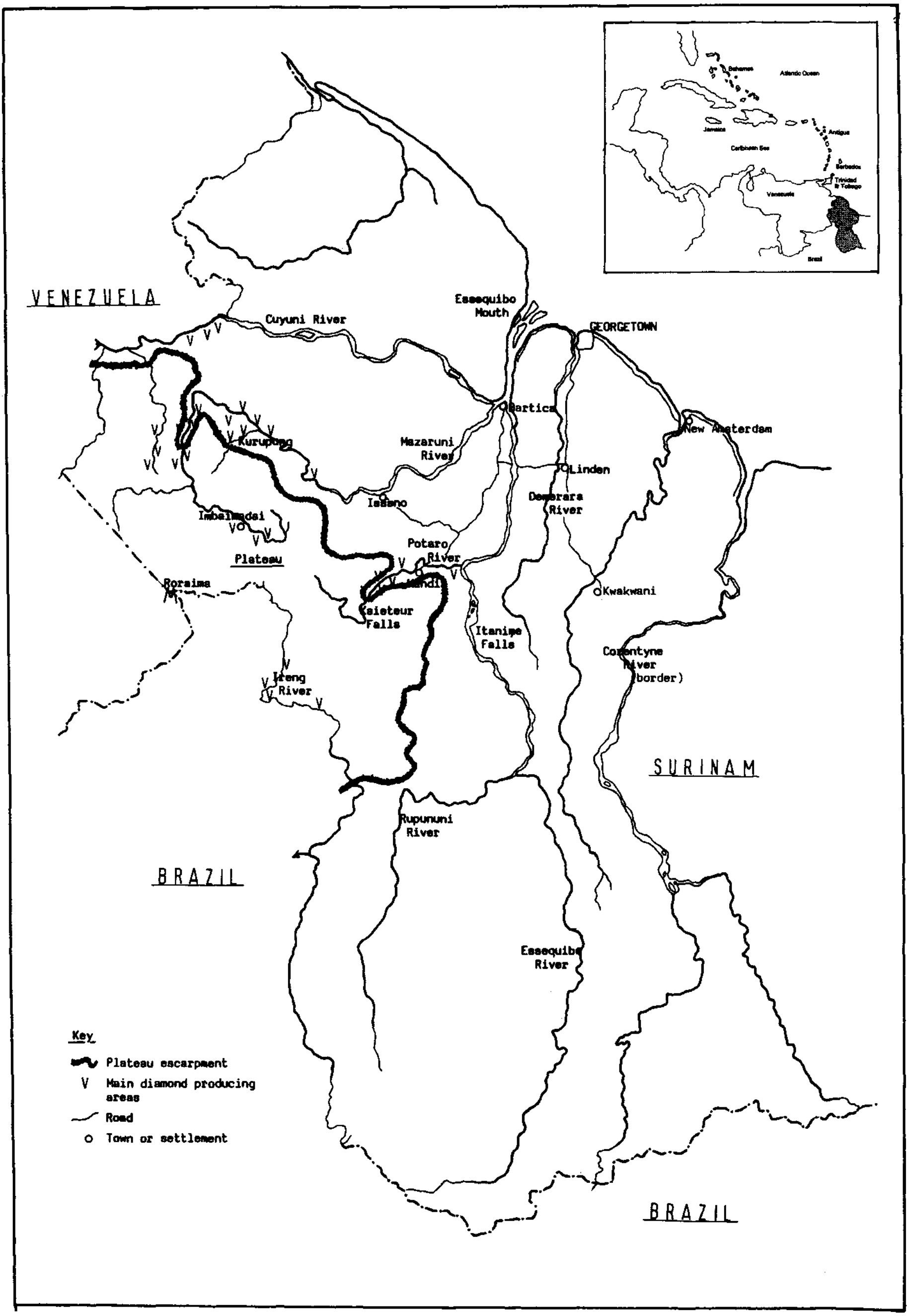

FIG. 2. Guyana: showing location of Diamond Workings (with inset—Caribbean map).

sapphire crystals have also been found. The richest diamond deposits are usually associated with the coarsest conglomerates.

It is a fair assumption that all of Guyana's diamonds have been derived from the sandstones of the Pakaraima Mountains, as the plateau is called. However, the sandstones themselves are secondary in origin. Where they came from and where the diamonds in them came from is still a matter for conjecture. Continental drift offers a very neat and convenient solution. If South America and Africa are fitted together, Guyana roughly coincides with Sierra Leone and there are indeed some similarities between the diamonds from both countries, but there are also many flaws in the argument and it is unlikely to stand up to severe criticism. Hence the search for diamondiferous pipes is continued by one or two academics. Pyrope garnets and other indicators have been found, but hampered by rain forests and the thick soil of such tropical climates, success in the search is unlikely.

History of Production

Gold and diamond production in Guyana are linked together by the nature of the alluvial deposits. Thus any discussion of the history of diamond-mining in the country must start with gold.

It is almost impossible to say when gold was first discovered in Guyana, but ever since Raleigh's voyages in the sixteenth century, El Dorado was believed to lie here. One imaginative writer described 'a city of golden palaces and streets paved with precious stones which reflected their gorgeous beauty in the translucent waters of the parima.' Raleigh believed that after the conquest of Peru the Inca dynasty founded a new empire in the Guianas, and, although there is no real basis for this, Amerindian superstitions about the evils of gold have been linked to the cruelty of the Incas. The idea certainly provides food for thought.

It was in 1850 that the 'Royal Gazette' announced the discovery of gold in large quantities in the Caratal district of Venezuela, and in 1857 gold was reported in the border region of British Guiana. In October 1863 the British Guiana Gold Company was formed and the gold rush was on. Then in 1887 diamonds were discovered in the gold washings of the Potaro River and interest mounted to a fever.

Meanwhile, in the sugar industry of the colony there was a crisis in the 1880s. In 1884 exports fell by 30%, and the sugar estates responded by retrenchments and sweeping curtailments of expenditure. Wages to the labourer were cut by half, and a season of acute privation and destitution ensued among the creole population. There was unrest, but, instead of bloody revolution, many simply packed what few belongings they had and moved into the bush. They arrived in the diamond and gold fields without food or equipment, in search of the hidden riches they had dreamt of. To live, they had to obtain credit or 'knock' for the salt pork which forms the basis of a bush diet. The 'pork-knocker' was born and this name, for a miner or bush prospector, has remained to the present day—'those small bands of men with little money and much faith'.

However, in the early stages, diamond and gold workings were in the hands of various syndicates.[3] Americans, Germans and British came to the country with extensive plans and high hopes. They brought modern mining ideas and equipment together with the much needed capital, but they had little sound knowledge of the country or the nature of the deposits. Simple dredging techniques were well established by the turn of the century, and a European syndicate therefore established a dredge on the Barima River in 1901. The dredge was operated for only nine months and produced just 130 ounces of gold before it was abandoned. In 1912 a group of pork-knockers worked exactly the same area and recovered 1032 ounces in just 47 days. In 1909 there were five major syndicates working in the Mazaruni District and the largest, The Mazaruni Company Ltd, produced over 2000 carats. By 1912 the Mazaruni Co. Ltd was the only one left and it produced a mere 322 carats. By 1914 the pork-knocker was alone in the field, and, except for a few brief periods of outside interest, it has remained that way throughout the century. Today all of Guyana's diamonds are produced by pork-knockers from small-claim workings.

Methods of Working

The method of working a 'high alluvial' or 'terrace' deposit is obviously very different from the method used when the deposit occurs in river flats or in the bed of one of the country's main rivers.

(i) *The land claim* is opened up by digging a pit down to the gravel, once the bush has been cleared in the area (see Figure 3). Where to dig a pit is, of course, part of the skill—or luck—of the pork-knocker, but 'prodding' with a pole and small trial pits are used in prospecting.

The gravel bands are generally near to the surface, but even so a pit 6 or 7 metres deep is frequently necessary. The sides must be carefully shored up using timber cut and trimmed on site and a pump is usually necessary to drain the excavation. A team of three or four men will usually tackle a pit, and the 'spade-men' will have to move in the region of 250 cubic metres of sand and clay before reaching the 'pay ground'. The gravel is then removed and stored on the edge of the pit prior to the concentration and beneficiation. Depending on conditions, it will take the pork-knocker between one and two weeks to reach gravel from the day he decides where to dig.

The use of a Tom and Box which was first described in 1927,[1,6] remains the most popular basic method of concentrating the gravel from a land claim. The system is usually constructed on site and, except for the 'Tom iron', discarded when the area is worked out. The description used by Bracewell in 1927 is still quite applicable today: 'Gravel is thrown into the 'tom box' and puddled

FIG. 3. A small group of pork-knockers completing a pit on a land claim.

FIG. 4. A pork-knocker prospecting in the 'back-dam'. A set of three sieves is used to recover any diamonds, while the batel which he is holding is used to concentrate the gold.

by riddling against the 'tom iron' (a metal plate forming one end of the box, resting at an angle of 45° and perforated by holes ½″ in diameter). Finer material passes through the plate and is collected in a second 'box'. Coarse gravel is thrown out of the 'tom' after cursory examination. The finer constituents are removed from the box by shovel or bailer and placed in a circular sieve of ⅟₁₆″ mesh.'

In fact today it is usual to see three sieves in use—½″, ¼″ and ⅟₁₆″. The fine sand is usually collected in a batel—a prospector's 'pan'—where it is concentrated for any gold that might be present (see Figure 4). The sieves are circular, about 1 metre in diameter and locally referred to as Brazilian sieves. The pork-knocker holds all three together (in descending size) and bails the box onto the top sieve. The sieves are then immersed in water—either in a creek, a second pit or even a large wooden tub—and jigged. During jigging the sieves are given a rapid twist through a few degrees while keeping the base of the sieve quite horizontal. The heavy material slowly becomes concentrated in the centre of the sieve while the lighter material slowly moves out to the edge of the sieve from where it is gradually scraped away. When the bulk of the light material has been removed, the heavy minerals are re-examined for diamonds. This is either done in the sieve itself or by emptying the contents of the sieve quickly onto flat ground to form a neat pile. The heaviest minerals are then on top of the pile in the centre, and any diamonds are quickly picked out by the experienced eye. The operation of jigging/twisting is repeated about a dozen times before the top sieve is examined and having removed any diamonds the rest of the large material is discarded. The remaining two sieves are then worked together for a dozen more cycles and the search procedure is repeated for the second and finally the third grades of material. It is curious to note that most pork-knockers keep their diamonds in an empty 'Marmite' jar full of water while working the sieves, and, once sorted, the diamonds are stored in discarded 'Vick' inhaler tubes.

The only real modification to the tom and box system has been the introduction of a 'Baby' between the tom and box (see Figure 5). The 'baby' is just a ⅟₁₆″ mesh screen roughly triangular in shape, and it is placed so that fine material coming through the tom iron must pass through the baby before entering the box. Only the material retained by the baby is hand jigged for diamonds in the previous manner. The fine sand passing through the baby is

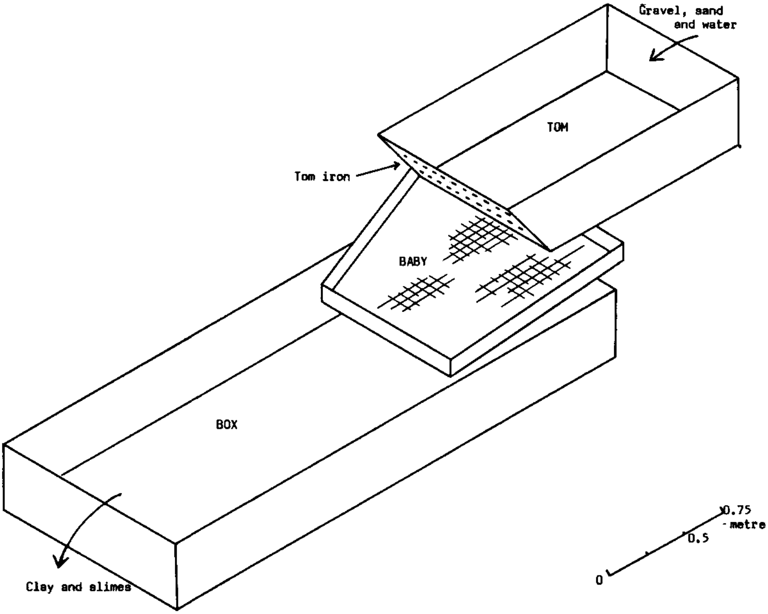

FIG. 5. The TOM and BOX, plus BABY.

concentrated to recover any gold either by panning in a batel or by converting the box into a sluice. The latter is the most common arrangement. The sluice is designed to suit the nature of the gold, and, when the gold is very fine, sluices of 5 metres or more in length are common. Various baffles or weirs are constructed down the length, and sacking is frequently nailed to the bottom of the sluice. The gold is recovered from the heavy mineral concentrate by adding mercury and forming an amalgam. The mercury is finally burnt off using a blow torch.

(ii) *The river claim* (see Figures 6, 7, 8, 9). When diamonds are found in the gravel in the bed of a river, the deposit is worked from a barge floating on the river. The barge is essentially just two wooden punts with a sluice slung between them. It carries a large suction pump with which to recover the gravel and a compressor to supply air to a diver. A pork-knocker wearing a mask and a rubber wet-suit (or frequently just old trousers and a shirt) enters the water using surface demand breathing equipment. He is weighted to sink to the bed of the river where he directs a 10 cm pipe into the gravels. He frequently takes down an electric bulb, and the cable from the generator acts as his life-line and means of communication. The diver's attendant signals instructions to the diver by pulling on the cable. The water of most tropical rivers is naturally a dark brown colour and frequently very muddy, thus making the light-bulb virtually useless. The diver usually locates gravel by groping with his toes. He uses the pipe just like a vacuum cleaner, but instead of going into a bag the gravel passes down the sluice on the barge. The bottom of the sluice is fitted with deep riffle plates which easily hold back any heavy minerals together with the gold. As soon as the barge operator feels that he is losing values in the waste from the sluice (essentially an arbitrary decision based on previous experience), the diver is recalled and the pump is turned off. The sluice is allowed to drain, the riffle plates are removed and the heavy minerals and coarser gravel held in the sluice are shovelled out and worked through sieves in a wooden tub on the side of the barge. The sieving/jigging operation with Brazilian sieves is basically the same as for the land operation—the only difference being that the material is all examined in the sieve and the under ⅙" material (the black sand) is allowed to accumulate in the wooden

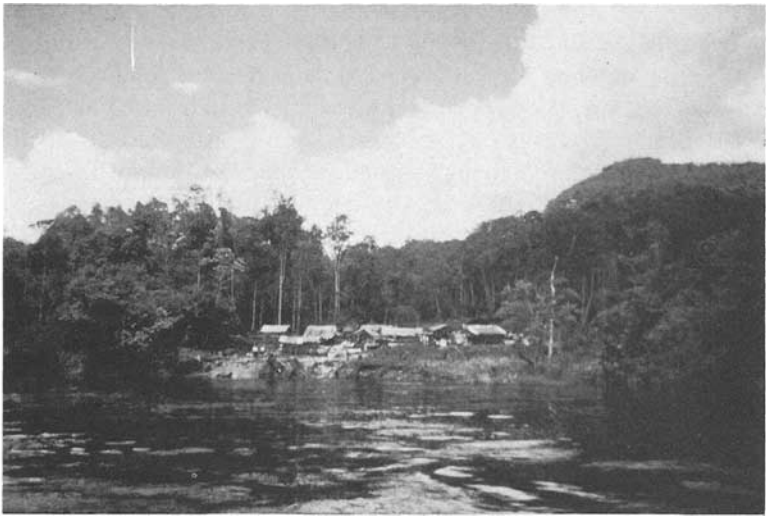

FIG. 6. Mapoura landing. A pork-knockers' camp on the Mazaruni River.

tub. At the end of a day, this sand is concentrated by panning, and the gold is again recovered using mercury amalgam.

These mining operations are hampered by two main factors; (i) the weather, and (ii) supply of fuel. During the rainy season, the tropical rivers become deep raging torrents and diving is impossible. Thus production can sometimes be restricted to just seven or eight months per year. The whole essence of the barge is the pump, and the pump operates on diesel fuel. Most of the mining areas are a long way from Georgetown, and fuel must be carried in by air. The Guyana Airways Corporation offers a limited cargo service to a few areas of the hinterland; otherwise supplies must be ferried in by charter flights, and this is available from only one or two private aircraft.

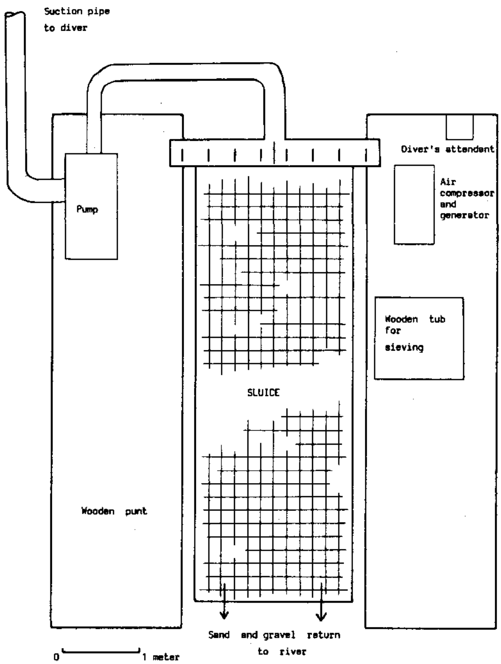

FIG. 7. Lay-out of Pork-knockers' Dredge.

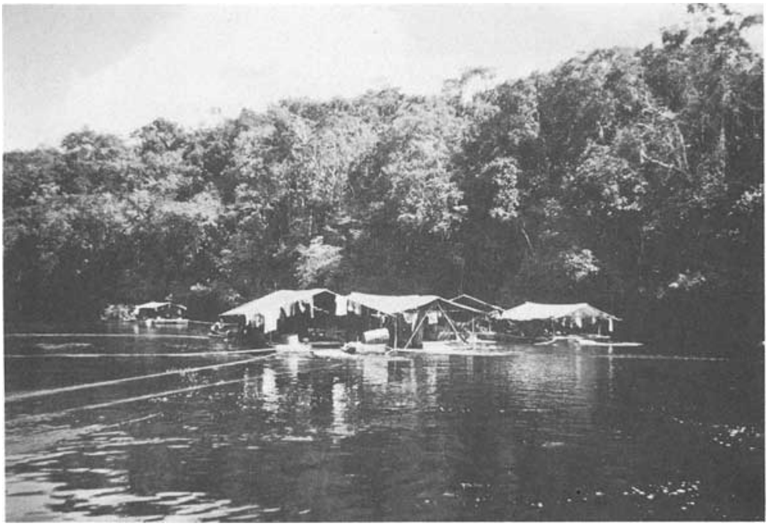

FIG. 8. A group of barges on the Mazaruni River about five miles west of Imbaimadi. They are held in place by ropes stretched across the river which is about 100 yards wide at this point.

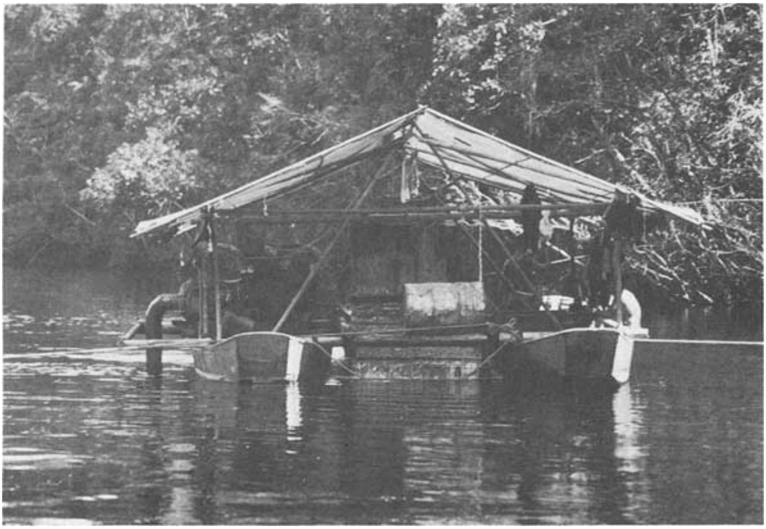

FIG. 9. A pork-knockers' barge on the Mazaruni River. Suction-pump and compressor can be seen on one pontoon, while a diver kits up on the other. The sluice for recovering the gold and diamonds is between the pontoons.

Control and Marketing

The development of the pork-knocker was absolutely dependent on the presence of the bush trader in the mining fields. The relationship continues today. The bush trader carries supplies of food, liquor and equipment in to the mining fields, which he sells to the pork-knocker at a nice profit to himself. Since many of the bush traders are also registered with the Ministry of Energy, Mines and Natural Resources, as traders in gold and diamonds, money rarely changes hands. The 'knocking' aspect of the pork-knocker is still very much in evidence. He will obtain credit from one particular trader to whom he will sell his diamonds and pay off his debts. If he has been very successful, he will have some spare cash. The trader will then either sell to another trader or will himself carry the stones to the Mines Division of the Geological Commission where they will be registered and royalty paid.

Occasionally the pork-knocker may decide himself to sell in Georgetown. This will happen either because he feels the price offered by the trader is unfair or because the stone or stones are so big that the bush trader does not want to handle them. In this case, the pork-knocker must declare his production to the police or local mines officer who seals the package, which is then carried to the mines division and royalty paid. Royalty had remained at G$1.00 per carat for many years but was increased to G$5.00 per carat in October 1979. It is still too early to see what effect this increase will have on declared production!

The diamonds eventually find their way to one of the three firms cutting and polishing diamonds in Georgetown. They generally take packages from the larger traders and only occasionally deal directly with individual pork-knockers. The cutters are obviously very reluctant to disclose too much detail about their operation, but a few observations can be made.

The type of stone being found in Guyana has not changed very much during the past 30 years, and a statement made in the early 1950s[4] ('Octahedra and rounded dodecahedra are common. Colours include white, yellow, brown and green but blue-white are very rare') is still a fair comment today. But perhaps it should be modified slightly to—'No blue-whites are found and whites are becoming rare'. This trend is also reflected in the quality and size of stones being received in Georgetown. Table I shows a definite movement away from first grade gem-quality stones. And whereas

TABLE I

% Make-up of a typical parcel of stones received in Georgetown

	1952	*1980*
First grade gems	59%	10%
Second grade gems	22½%	65%
Industrial stones	18%	25%

in the mid 1950s it was estimated that almost 10% of the stones arriving in Georgetown were one carat or larger in size, today such stones must account for only about 2% of the total by weight. Most of the cutting that takes place in Georgetown is on stones of ⅓ carat or less. When one cutter was asked what price would be paid for a '1 carat rounded white stone', the reply was, 'A rare stone indeed!', but a figure of G$15 000.00 was suggested. (£1 = G$6, July, 1980). In 1952 $65.00 would have been a typical price. Even allowing for world-wide inflation, this means that this type of stone is now commanding a significantly higher price than ever before (cf. Table II). In June, 1980, a typical mixed parcel of gem-quality stones would fetch an average price of about $2 290.00 per carat while about $80.00 per carat would be paid for industrial stones.

TABLE II

*The Price of Rough Stones, Sold in Georgetown, Compared with the UK Wholesale Price Index (WPI)**

	Av. Price per carat	WPI (1963 = 100)	Real value $= \frac{\text{Price}}{\text{WPI}} \times 100$
1910	$5.00	21	24
1915	10.00	30	33
1920	35.00	68	52
1925	21.00	37	57
1930	14.00	26	54
1935	11.00	23	48
1940	16.00	35	46
1945	30.00	43	70
1950	37.00	66	56
1960	51.00	96	53
1980	1,800.00	Dec 1979 = 440	410

*A fair comparison, since virtually all manufactured goods and food stuff were imported from the UK until quite recently.

Virtually all industrial stones are exported to London, but the fate of the gem-quality stones is much less certain. There is a trade in uncut stones—both legal and illegal!—and it is felt that most of the stones leaving the country find their way to North America rather than Europe. As for the stones that remain in Georgetown, at least half are sold locally to individual private buyers after cutting. What actually happens to these stones, in view of Guyana's strict currency regulations, would be a matter of pure speculation. The rest are sold to dealers who will certainly export, mainly to Trinidad and Barbados, where the stones find their way into the tourist market.

CONCLUSION

Guyana is still producing some fine diamonds, and even last year a 12 carat stone was found. But the industry is, without doubt, declining. Young men still leave Georgetown and head for the interior to become 'Diving Pork-knockers'. But with ever increasing opportunities in the capital, the numbers are decreasing every year and it is very rare indeed to see young men opening up a land claim. With decreasing numbers in the mining fields, the bush trader is finding life more difficult. So they too are pulling out. The pork-knocker cannot then obtain provisions easily, so he is reluctant to leave Georgetown. The industry is into a downward spiral. There is however one hope. After one pork-knocker had checked his bottom sieve for diamonds, the author went through the material and found six pieces of deep blue sapphire. When asked about it, the pork-knocker replied that he had seen lots, but nobody was interested in buying, so it was thrown back in the river. Perhaps, soon we will see Guyana sapphires on the market as well as the occasional diamond.

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[*Manuscript received 9th August, 1980.*]

GEMMOLOGICAL ABSTRACTS

ABEL-RÉMUSAT (M.). *Histoire de la ville de Khotan.* (History of the town of Khotan.) Bulletin of the Friends of Jade, **1**, 1, 1-50, 1980. (In English with French title.)

This is a translation of the first major work in a Western language on the topic of jade and forms the second part of a larger work. The original was published in 1820. Much of the study is taken up with a discussion of what was meant by 'jade' in early times and in this connexion there is a discussion of the use of the word usually romanized as 'yu'—now taken to mean almost any precious object but at one time reserved for jade. M.O'D.

AKIZUKI (M.), SHIMADA (I.). (Texture and minerals in opal from Hôsaka, Fukushima Prefecture, Japan.) J.Geol.Soc. Japan, **74**, 274-9, 9 figs, 1979. (Japanese with English abstract.)

Precious and common opal from the Hôsaka mine were studied optically and by TEM. The precious opal consists of amorphous silica spheres 400-500 Å in diameter. Common opal contains acicular crystals of diameter ~200 Å, but which vary in length from 1000 to 100 000 Å; their electron diffraction pattern shows these to be disordered high tridymite. R.A.H.

BANCROFT (P.). *A great gem and crystal mine: St John's Island, Egypt.* Lapidary Journal, **34**, 10, 2138-46, 12 figs (7 in colour), 1981.

An account of a visit to the Island of St John in the Red Sea, one of the classic peridot locations. No mining takes place there now, but some crystals may be found on the dumps. M.O'D.

BANK (H.). (a) *Geschliffener durchsichtiger roter Klinozoisit aus Arendale, Norwegen.* (Cut transparent red clinozoisite from Arendale, Norway.) Z.Dt.Gemmol.Ges., **29**, 3/4, 186-8, 1980; (b) *Schleifwürdiger manganhaltiger durchscheinender roter Zoisit (Thulit) aus Norwegen.* (Cuttable manganese-containing translucent red zoisite (thulite) from Norway.) Id., 188-189, 1980; (c) *Neues Vorkommen von Euklas in Brasilien.* (New occurrence of euclase in Brazil.) Id., 190, 1 fig. in colour, 1980; (d) *Geschliffener smaragdgrüner Kyanit (=Disthen) aus Tansania.* (Cut emerald-green kyanite (disthene) from Tanzania.) Id., 191-2, 1 fig. in colour, bibl., 1980; (e) *Rosaopal von Idaho (USA).* (Rose-coloured opal from Idaho, U.S.A.) Id., 193, bibl., 1980; (f) *Granate aus Mexiko.* (Garnets from Mexico.) Id., 194-5, 1 fig. in colour, 1980; (g) *Niedriglichtbrechender mit synthetischem Smaragd überzogener Beryll nach Lechleitner.* (Low refractive beryl covered with a synthetic emerald skin according to Lechleitner.) Id., 197, bibl., 1980; (h) *Glas für schwarzen Onyx ausgegeben.* (Glass offered as black onyx.) Id., 200, 1980; (i) *Blaues Glas mit n = 1.615 für blauen Topas angesehen.* (Blue glass with n = 1.615 thought to be blue topaz.) Id., 201, 1980; (j) *Angebliche grünliche Berylle als Quarze identifiziert. Problematik der 'zerstörungsfreien Diagnostik'.* (Green stones apparently beryls, identified as quartz. Problems of the 'non-damaging diagnostic'.) Id., 202, 1980.

(a) The stone is described, RI and double refraction given, as well as density and pleochroism. It is compared with red thulite, epidote and piemontite. (b) RI 1.695-1.701, double refraction 0.006, density 3.09. (c) Up to now euclase found in Ouro Preto and Santana de Encoberto, now also in Diamantina, Minas Gerais. The stones are colourless to pale yellow or pale green and some crystals yield up to 50 ct large stones, if cleavage can be overcome. (d) The green crystal was found to have the following trace elements: Cr, Fe, V, Ti. Density 3.68±0.02. RI: n_x 1.714, n_y 1.725, n_z 1.732. Definite pleochroism. (e) Some time ago a pink opal was offered on the market, but proved to be palygorskite. This material from Idaho is real rose-coloured opal. (f) The garnets were shown to be grossularite, andradite and uvarovite. (g) Report on a lechleitner emerald, which is a colourless beryl under a synthetic emerald skin, with—for hydrothermal products—an exceptionally low RI (1.565-1.569) and very low double refraction (0.004). (h) (i) and (j) In these three articles Dr Bank relates that black onyx imported from the East was found to be glass, blue glass with n = 1.616 was wrongly assumed to be a blue topaz, and some green beryls were identified as quartz. E.S.

BANK (H.) and (M.). (a) *Spezialphänomene bei der Refraktometerablesung von synthetischen Smaragden (nach Lechleitner) mit überzogenen Beryllkernen.* (Special phenomena observed with synthetic emerald-covered beryls, (according to Lechleitner) when reading the refractometer.) Z.Dt.Gemmol.Ges., **29**, 3/4, 198, 1980; (b) *Sehr hoch lichtbrechender mit synthetischem Smaragd nach Lechleitner überzogener Beryllkern.* (Very highly refractive beryl covered with synthetic emerald according to Lechleitner.) Id., 199, 1980.

(a) Lechleitner emeralds were examined and some found with very high RI and double refraction (1.601-1.610; double refraction 0.009; density 2.71) as opposed to the very low values described in the article by H. Bank on Lechleitner emerald abstracted above. (b) The Lechleitner stones were further examined and examples found showing various lines when viewed through the refractometer. When the stones were repolished this phenomenon vanished and reappeared when the stone was re-heated. It seems to be caused by the Cr_2O_3 content and is purely a surface phenomenon. E.S.

BARKER (B.). *Aschentrekker.* Gems & Gemology, **XVI**, 11, 375-8, bibl., 1980.

Old Dutch name for tourmaline given because a crystal could be used to remove the ashes from a long clay tobacco-pipe (which could not be knocked out, for obvious reasons). Pyroelectricity and piezoelectricity are discussed briefly. R.K.M.

BROWN (G.). *How pearls form.* Wahroongai News, 10-14, 2 figs, December 1980.

This account of the pearl oyster in its several species suggests that deposition of 'calcific material' in the form of calcite (prismatic layer) or aragonite (nacreous layer) is controlled by the protein nature of conchyolin, α-conchyolin causing calcite and β-conchyolin giving rise to nacreous aragonite, and also suggests that conchyolin is deposited before the inorganic calcium carbonates, i.e. the latter act as a filler. [It does seem more logical to expect the organic material to be the filler.]

R.K.M.

BROWN (G.). *The genesis of a pearl—an unlikely fairy-tale.* Wahroongai News, 17-20, 3 figs, December 1980.

A further account of pearl formation repeating much of the information, again assuming 'priorly secreted conchyolin'. [The two papers raise interesting and well thought-out theories on a subject which has yet to be fully understood.] R.K.M.

BROWN (G.). *The colour of cultured pearls.* Wahroongai News, 9-12, 5 figs, January 1981.

Colour is due to a combination of orient and of intrinsic colour of the conchyolin structure. The latter may be due to the type of oyster used, e.g. *P. margaritifera,* the black-lipped oyster, which gives black [cultured] pearls. Most [cultured] pearls are produced in *P. martensi* and have a bluish or greenish hue which is bleached out and a more pleasing colour substituted by dyeing. Black is obtained artificially by soaking in silver salt and developing the colour as one would a photographic negative. In all cases the colour is absorbed by the conchyolin layer or by interstitial conchyolin in the surface layers of aragonite. R.K.M.

BROWN (G.), SNOW (J.). *The Regency created emerald.* Wahroongai News, April 1981 (Information Sheet, pp.A-D).

This synthetic emerald* is the old hydrothermal version as developed by Linde Air Products from the work originally done by Lechleitner, the patents having been taken over by Vacuum Ventures Inc. Describes the process of synthesis in some detail. A comprehensive table is included which underlines the differences between natural emerald, hydrothermal synthetic emerald and the more usual flux-grown synthetic emerald. Briefly the important identifying features of these hydrothermal stones are very bright red fluorescence under longwave ultraviolet light and through the Chelsea filter, and 'dagger shaped' inclusions, which are quite unlike those seen in natural stones or in flux-grown synthetics. [Authors have not mentioned the infrared spectrum test which identifies flux-grown stones, but, of course, would not differentiate the hydrothermal material from natural emeralds.] R.K.M.

CASSEDANNE (J. P.) and (J. O.). *A new find of crystallized rose quartz in Minas Gerais.* Mineral. Record, **11**, 6, 377-9, 3 figs, 1980.

Rose quartz has been found at a location known as Laranjeira (or Pegmatito) on the right side of the Jequitinhonha river near the township of Itinga, Minas Gerais, Brazil. The rose quartz forms 'crowns' on rock crystal; some elbaite is also found but only as broken pieces; these are, however, sometimes of gem quality.

M.O'D.

CASSEDANNE (J. P.) and (J. O.), SAUER (D. A.). *The Cruzeiro mine, past and present.* Mineral. Record, **11**, 6, 363-70, 9 figs (1 in colour), 1980.

The Cruzeiro mine is north-west of Governador Valadares in the centre of the Brazilian state of Minas Gerais. Tourmaline is found in a pegmatite in the area which was originally worked for mica. M.O'D.

*See M. O'Donoghue, 'Regency Emerald', A New Synthetic from the U.S.A., *J.Gemm.*, 1979, XVI(7), 463-4.—Ed.

CHRONIC (J.). *Diamond-bearing Palaeozoic diatremes in Colorado and Wyoming. In* Epis (R. C.) & Weimer (R. J.), eds, *Studies in Colorado field Geology.* Prof. Contr. Colorado School Mines, **8**, 101-9, 6 figs, 1976.

Diatremes containing fossiliferous limestones of Silurian age, other Early Palaeozoic sedimentary rocks, and kimberlitic materials have been found in the Precambrian granitic core of the Front and Laramie Ranges. The kimberlite has yielded a few diamonds less than 1mm in diameter. Palaeontological and mineralogical studies suggest that the diatremes were emplaced in Devonian time along a N-S trend and that they represent intrusive activity from great depth. R.G.L.

CORNWALL (J. H.). *That's only garnet?* Lapidary Journal, **34**, 10, 2114-63, 43 figs (27 in colour), 1981.

A lengthy review of all the gem varieties of the garnet family and their locations. Inclusions and some crystals are illustrated in colour. M.O'D.

CROWNINGSHIELD (R.). *Developments & highlights at GIA's Lab in New York.* Gems & Gemology, **XVI**, 315-23, 32 figs in colour, (Summer) 1980.

More 'overlayered' orange yellow corundums seen, the coating often partly removed in polishing. One stone gave anomalous RI 1.765-1.800; time factor prevented more exhaustive testing. Several heat-treated sapphires discussed and a synthetic with healed-crack type 'fingerprint' inclusions, which a Bangkok student reports are being induced during heating. Boules reportedly being cut to natural-looking bipyramids, fingerprints induced, and sold as natural rough. Such flaws always reach the surface. A natural star ruby (Burmese) had radically altered in colour when heated to remove silk. Blue 'natural' sapphires seen with surface colour, like the orange ones above, again with some facets having lost their coating in polishing. There is still confused thinking and little factual evidence of the methods and results of heating corundum. The scene needs clarification by actual experiment. Thai heating of geuda sapphire from Sri Lanka is apparently as hit-or-miss as any other. Considerable heat is generated using large steel drums filled with charcoal. Synthetic-backed/natural-topped doublets of ruby and sapphire are again being found. Identification of Chatham and Kashan flux-grown rubies emphasized as difficult but (obviously) important. Not all Kashan synthetic rubies show the normally expected high fluorescence. A natural corundum cabochon, half white and half red with a slight star in the red section, is illustrated. A purplish sapphire with exceptionally coarse silk is also illustrated. More orangy-yellow sapphires; natural Thai stones of this colour show strong iron absorption and no UV fluorescence. The coated stones have no iron absorption but show chromium absorption lines, fingerprint and silk inclusions or angular growth lines. Writer was indecisive in view of many treatments now being carried out on corundums.

An 18 pound crystal of chrysoberyl (not gem quality) and a fine 207 carat yellow apatite cat's-eye are depicted. A pair of black rose diamonds with identical 'iron cross' inclusions and an aquamarine of blue-green colour with strong blue/yellow-green dichroism and both chromium and iron absorption lines are also described, the latter being considered emerald on its chromium absorption, although of unusual colour. [There is a case for an emerald to be so called only when it is of emerald colour and has the required chromium spectrum.]

Reddish potch honey-comb structure, seen in a natural opal, resembled synthetic opal structure. A red cat's-eye chrysoberyl is described as being dark red with no green phase in daylight, hence not alexandrite. [But it has photographed dark green: an example of the delicate balance of colour involved in stone and in colour film?] Dolphin, rabbit and rectangular inclusions in diamond have been found. Finally, a 'malaya' garnet of 18 ct is illustrated. R.K.M.

DEINES (P.). *The carbon isotopic composition of diamonds: relationship to diamond shape, color, occurrence and vapor composition.* Geochim. Cosmochim. Acta, **44**, 943-61, 10 figs, 1980.

Together with published data, 330 new ^{13}C analyses of diamond indicate a range of ~30‰ in the C isotopic composition of diamonds. The frequency distribution of diamond $\delta^{13}C$ analyses show a pronounced mode at −5 to −6‰ (*vs* PDB), a large negative skewness, and a sharp boundary at ~−1‰. Analyses of diamonds from the Premier and Dan Carl mines, South Africa, demonstrate that: (1) difference in ^{13}C that can be related to diamond colour and shape are <1‰; (2) the mean ^{13}C content of kimberlite carbonates is 1-2‰ lower than that of associated diamonds; (3) significant differences in ^{13}C content exist between the mean isotopic compositions of diamonds from these two pipes; (4) the variability of $\delta^{13}C$ differs from one mine to another. Computations were carried out evaluating the effect on the ^{13}C content of diamonds of: (i) various precipitation processes; (ii) abundance of species H_2, H_2O, CH_4, CO, CO_2, and O in the vapour; (iii) the initial isotopic composition of the source C; (iv) effects of P and T on C isotopic composition; and (v) reservoir effects (Rayleigh fractionation). The presence of methane during diamond formation is compatible with the C isotopic composition data, possible fO_2 in the mantle, and with the composition of gases liberated from diamonds. C isotope effects in the diamond formation process were probably small, and the very large range in $\delta^{13}C$ observed was most likely inherited from the source C. C.M.B.H.

FU (H.), ZHU (C.). (Morphological peculiarities of synthetic diamond and a preliminary discussion of its fine crystal growth field.) Geochimica, 23-30, 5 figs 1 pl., 1980. (Chinese with English abstract.)

The crystal habit and morphological peculiarities of synthetic diamond have been studied at various T and P. A model is presented of the optimum P-T conditions for fine diamond synthesis. P.Br.

GILL (J. O.). *Where have all our answers gone?...or...let me introduce you to Gill's Index.* Gems & Gemology, **XVI**, 11, 366-8, 1980.

An author in praise of his own work, which was reviewed before in this journal (Gems Gemol., 1979, XVI (6), 190). The 'Index' is restricted to English language publications. R.K.M.

GREEN (H. S.), SMITH (A. H. V.), YOUNG (B. R.), HARRISON (R. K.). *The Caergwrle Bowl: its composition, geological source and archaeological significance.* Rept Inst. Geol. Sci., **80/1**, 26-30, 1 fig, 1 pl., 1980.

This decorated boat-shaped object of possible Bronze Age date was discovered in 1823 near Caergwrle Castle, Powys. It is composed of gel-like kerogen-rich material resembling Kimmeridge oil shale, giving an XRD pattern with lines of goethite, quartz, mica, and possibly siderite and lepidocrocite. Its decorative elements were made partly by incision on gold leaf and partly by wrapping gold leaf around a white substance identified now as a mixture of romarchite (SnO) and cassiterite (SnO_2), presumably originally metallic tin. R.A.H.

GÜBELIN (E. J.). *Le diamant et ses imitations.* (Diamond and its imitations.) Schweizerische Uhrmacher und Goldschmiede Zeitung, **103**, 2, 12-17, 28 figs (24 in colour), 1981.

Illustrations of inclusions and reviews of other tests are given to indicate the differences between diamond and its imitations. M.O'D.

GÜBELIN (E.). *Seberged—Die Peridot-Insel im Roten Meer.* (Zeberged—the peridot island in the Red Sea.) Lapis, **5**, 11, 19-26, 14 figs in colour, 1980.

The Island of Zeberged (or St John) is described with particular reference to the deposits of gem-quality peridot found there. Numerous references to historical reports of the stone are given, in addition to geological and mineralogical data. M.O'D.

GÜBELIN (E.), SCHMETZER (K.). *Alexandritartige Edelsteine.* (Alexandrite-like gemstones.) Z.Dt.Gemmol.Ges., **29**, 3/4, 126-34, 2 diagrams, bibl., 1980.

The name alexandrite-effect is given to the colour change of certain minerals which are blue, blue-green to violet during daylight and red to red-violet under artificial light. This effect was discovered during the last century in chrome-containing chrysoberyls from the Urals; lately it has been observed in certain varieties of garnet, corundum, spinel and fluorite. The absorption spectrum of all alexandrite-like minerals is characterized by lines in the blue-green and red zones of the visible spectrum as well as some lines in the yellow. The colour of such stones is determined by the transmission of the violet and blue-green of the daylight and under candle light or the light of a red-rich light bulb by the relation of the transmission in the red to the transmission in the blue-violet. E.S.

HAACK (E. M.). *Collecting gems and minerals in South Africa.* Lapidary Journal, **34**, 9, 1936-47, 12 figs in colour, 1980.

The author gives an account of a tour to the Republic of South Africa and Namibia. The tour appears to have been devoted as much to places of interest as to serious collecting. M.O'D.

KAMINSKIY (F. V.), GALIMOV (E. M.), IVANOVSKAYA (I. N.), KIRIKILITSA (S. I.), POLKANOV (Yu. A.). *Isotopic distribution in carbon of small diamonds from the Ukraine.* Dokl. Acad. Sci. USSR, Earth Sci. Sect., **236**, 174-5, 1977. Transl. from Dokl. Akad. Nauk SSSR, **236**, 1207-8, 1977.

Comparative analysis of geological information on small diamonds from sandy sediments in the Ukraine led to the conclusion that they were polygenetic, but probably not derived from kimberlites. Several varieties of small diamonds from the Dnieper region were selected for comparative study: (1) amorphous colourless chips probably kimberlite-derived; (2) and (3) yellow and black cubes of kimberlite and/or meteorite origins; and (4), (5) and (6) violet cubes and 'shaly' yellow and black grains of probable non-kimberlitic origins. The heavy carbon isotopic distribution in the diamonds and associated graphite were analysed. The data indicate the isotopic distribution in all varieties of small diamonds from Ukrainian placers differs clearly from kimberlite diamonds and shows that they were probably formed by shock metamorphism. V.S.G.

KANDA (H.), YAMAOKA (S.), SETAKA (N.), KOMATSU (H.). *Etching of diamond octahedrons by high pressure water.* J. Crystal Growth, **38**, 1-7, 9 figs, 1977.

A natural diamond octahedron was etched using water at 1100 °C to 1500 °C and 50 kbar for 5-30 min. The etch figures were almost the same as the trigons seen on natural diamonds. P.H.

KANE (R. E.). *The elusive nature of graining in gem quality diamonds.* Gems & Gemology, **XVI**, 10, 294-314, 75 figs (70 in colour), (Summer) 1980.

A very full account of visible grain in faceted diamonds, extensively illustrated. This can be surface or internal and is often elusive—coloured in some instances, with changes of colour with slight alteration of viewing angles. Author suggests connexion between graining and glide planes, both being in some way caused by patches of strain present in almost all diamonds, which also cause anomalous birefringence which may be seen between crossed polars.

[An important paper which would be improved if the sequence of the figures followed that of their mention in the text. It serves to underline the very considerable work load in the G.I.A.'s diamond-grading laboratories.] R.K.M.

KANE (R. E.). *Developments & highlights at GIA's Lab in Los Angeles.* Gems & Gemology, **XVI**, 12, 391-400, 32 figs (30 in colour), 1980.

Natural emeralds reported with 4270 Å absorption spectrum line, normally seen only in iron-rich Gilson type III synthetics. The natural stones exhibit this more faintly and have RI above 1.583, higher than the synthetics. A natural grey fancy diamond had a narrow absorption line at 5510 Å, fluorescing strong blue with yellow zones in long UV light. A mobile gas bubble was found in an emerald. Such bubbles are normally held in one position, restricted by the very flat inclusion typical of emerald. The present negative crystal was not flat and the bubble was therefore able to move. A negative crystal in corundum is demonstrated to have a mobile bubble of CO_2 and a loose crystal of haematite. Several epigenetic inclusions in diamond are illustrated and explained, also cloud-like formations in various well-known configurations, maltese cross, octahedron, etc. A fine tricolour tourmaline is illustrated. R.K.M.

KAPLAN (G. R.). *A new view of diamond's beauty—the 'cone of brilliance'.* Gems & Gemology, **XVI**, 10, 324-5, 4 figs (3 in colour), (Summer) 1980.

Brilliance and 'fire' of two diamonds at different viewing angles are compared, one with a 55% table and the other with a 65% table [viz. % of girdle diameter]. The first gave a 36° cone of brilliance while the other, with a wider table, gave only a 20° cone. R.K.M.

KIRK (P. D.). *Cutting and polishing 'Victoria Stone'.* Lapidary Journal, **34,** 9, 1978-9, 2 figs, 1980.

'Victoria Stone' [composition close to glass] can be fashioned into a wide variety of shapes. The colour varies within each specimen, and care is needed when slabbing begins since after removal of a 'rind' the stones may need to lose stress.

M.O'D.

KNISCHKA (P. O.), GÜBELIN (E.). *Synthetische Rubine mit Edelstein-qualität, isometrischem Habitus und hoher Zahl unbeschädigter Kristallflächen.* (Synthetic rubies of gem quality with isometric habit and large number of undamaged crystal faces.) Z.Dt.Gemmol.Ges., **29,** 3/4, 155-85, 50 figs (16 in colour), bibl., 1980.

These rubies are produced by P. O. Knischka and the method of production is not explained. They are termed ꟼK rubies, [the sign being a reversed P and K (for P. Knischka)]. They are grown by methods which are characterized by resulting in a large number of growth faces. By modifying the parameter the number of the faces can be influenced. The synthetic rubies can be single crystals, twins, triplets and other multiple crystals and also cluster formations. They are compared with Verneuil and natural rubies. The new ꟼK synthetic rubies need careful examination: they are slightly violet; absorption similar to natural rubies; strong dichroism (similar to the natural product); density 3.976 ± 0.001, although a cluster showed only 3.941 ± 0.001, RI n_ε 1.760-1.761, n_ω 1.768-1.769, $n_\varepsilon - n_\omega = -0.008$. Only by microscopic examination can one really distinguish this product. The article is well illustrated to explain difficulties. E.S.

KOIVULA (J. I.). *Brief notes on Chatham flux sapphires.* Gems & Gemology, **XVI,** 12, 410-11, 5 figs in colour, 1980.

Faceted flux synthetic sapphires recently examined were of much better quality than earlier products. Platinum flakes and splinters were present with some residual flux. Fingerprint inclusions, curved, cloud and veil-like were also observed. Colour zoning in straight layers was seen in two stones. X-ray fluorescence ranged from white to bluish to yellowish white, no phosphorescence. [Author does not mention whether x-rays produced any normally expected temporary yellowing of the colour.] Fluorescence under long and short-wave UV produced whitish-yellow and brownish colours respectively, with two stones having patches of bright yellow. R.K.M.

KOIVULA (J. I.). *Carbon dioxide as a fluid inclusion.* Gems & Gemology, **XVI,** 12, 386-90, 7 figs in colour, bibl., 1980.

CO_2 in liquid form is the second most common liquid inclusion in minerals, the first being water. Either may contain contaminants. They are immiscible. Discovered by Sir David Brewster, the nature of the inclusion was long a mystery. At a critical temperature of about 31.2 °C the liquid becomes a gas and fills the whole inclusion, the former bubble effect becoming invisible. Hollow inclusions contain CO_2 under very considerable pressure even at room temperature. Heating in colour treatment or in repair work may cause the stone to crack or to shatter explosively.

R.K.M.

KOIVULA (J. I.). *Citrine-amethyst quartz—a gemologically new material.* Gems & Gemology, **XVI,** 10, 290-3, 8 figs in colour, (Summer) 1980.

This form of Brazil twin, with its alternate triangular segments of amethyst and colourless quartz in the prism section, has been known for upwards of two hundred years and is now found in gem quality with citrine and amethyst alternating. Brazilian in origin, it gives cut stones of pleasing, if confused, appearance. Nassau attributes colour in citrine to Fe^{+3} placed in a particular position in the lattice where irradiation, artificial or natural, will change the colour to amethyst. Experiment suggests that the positive rhombohedra attract iron more readily and, with more iron present, this form is more likely to irradiate to amethyst. [This infers that the phenomenon could occur in untwinned quartz, but all such stones are alternations of right- and left-handed quartz in the form of interpenetrant twins, and the explanation may be an over-simplification.] Interesting uniaxial interference figures, showing three different versions in the one stone, are illustrated. R.K.M.

KOIVULA (J. I.). *More news on citrine-amethyst quartz.* Gems & Gemology, XVI, 12, 409, 1980.

Kurt Nassau, Ph.D., has produced amethyst-citrine twinned intergrowth from amethyst-colourless material by radiation. Further and larger sources of material are being investigated. R.K.M.

KOIVULA (J. I.). (a) *Diopside as an inclusion in peridot.* (b) *Negative crystals ? in synthetic Verneuil spinel.* Gems & Gemology, **XVI,** 10, 332-3, 3 figs (2 in colour), (Summer) 1980.

Very short accounts of diopside crystal inclusions in Arizona peridot and of a cubo-octahedral negative inclusion (bubble) in blue synthetic spinel. R.K.M.

K[OIVULA] (J. I.). *Gübelin identifies apatite in taaffeite.* Gems & Gemology, **XVI,** 12, 409, 1 fig. in colour, 1980.

A photograph of this euhedral inclusion is published. [No indication of magnification.] R.K.M.

KOIVULA (J. I.). *Inclusions in andalusite—a comparison of localities.* Gems & Gemology, **XVI,** 12, 401-4, 8 figs in colour, bibl., 1980.

Identifies inclusions of limonite, apatite, quartz, rutile, biotite and andalusite in andalusite from various localities. Rutile and apatite are typical of Brazilian material, while quartz and limonite are found in stones from Sri Lanka. R.K.M.

KOIVULA (J. I.). *Observations on an imperfect (?) diamond.* Gems & Gemology, XVI, 12, 410, 1 fig. in colour, 1980.

A large brilliant diamond, which had to be graded I_1 for clarity, contained an exceptionally perfect octahedral cloud inclusion. Author considers that the natural perfection here should receive some recognition in the grading system. R.K.M.

KOIVULA (J. I.). *'Thin films'—elusive beauty in the world of inclusions.* Gems & Gemology, **XVI,** 10, 326-30, 14 figs (13 in colour), (Summer) 1980.

A clear explanation of the optics thought to be involved in iridescence at thin films (Newton's rings) seen in gems with ultra thin cracks or inclusions in overhead lighting. [Succeeds in making possibly reject stones interesting and beautiful when lighting is right.] R.K.M.

KOIVULA (J. I.). *The three-phase inclusion—a product of environment.* Gems & Gemology, **XVI,** 11, 338-42, 15 figs, bibl., 1980.

Three-phase inclusions prove natural emerald. They are the product of a natural hydrothermal or pegmatitic growth environment. Hot liquid holds salts to saturation. Emprisoned in a closed cavity, this cools and salts crystallize out; the liquid contracts, leaving gas or vapour bubble—a three-phase inclusion, solid, liquid and gas. Fluorite, quartz, pink beryl, topaz, spodumene, tourmaline, spessartine garnet, blue sapphire and others are illustrated, the solids ranging from rock salt to haematite. All prove natural origin. R.K.M.

KUZVART (M.). *Industrial minerals and rocks in Czechoslovakia.* Industrial Minerals, 162, 19-35, 4 figs, 1981.

Pyrope is recovered from the Quaternary alluvia on the southern slopes of the Caské Středohoří mountains near Třebívlice. Precious opal was worked up to the present century from andesite of the Dubník deposit near Prešov. M.O'D.

KVASNITSA (V. N.), KHAR'KIV (A. D.), VISHNEVSKY (A. A.), AFANAS'EV (V. P.), ARGUNOV (K. P.). (Small diamonds (sparklers) from kimberlites and placers.) Min. Zhurn, **2,** 3, 40-52, 8 figs, 1980. (In Russian.)

A description is given of the crystallography of plane-face, plane-face—curved-face, and curved-face small diamonds from kimberlites (Yakutia), eclogite xenoliths (Yakutia), and placers (Ukraine and Yakutia). The small diamonds from these sources are found to have impurity centres of a nitrogenous nature, which is normal for diamonds from kimberlites and eclogite xenoliths. D.A.B.

LANG (A. R.). *Defects in natural diamonds: recent observations by new methods.* J. Crystal Growth, **42,** 625-31, 7 figs, 1977.

Impurity platelets precipitated on {100} planes and dislocations have been observed using TEM and various topographical methods (ultraviolet absorption, x-ray, cathodoluminescence). The available evidence supports the hypothesis that the impurity platelets are composed of nitrogen rather than of interstitial carbon. P.H.

LEITHNER (H.). *Die Topase der sächsischen Könige.* (Topaz from the Kingdom of Saxony.) Lapis, **5,** 12, 9-12, 8 figs (3 in colour) 1980.

Topaz from sites in Saxony is described; Schneckenstein is one of the best-known of these and some representative crystals are illustrated. M.O'D.

LESH (C.). *Gemlure: born in the depths: the perfect pearl.* Gems & Gemology, **XVI,** 11, 356-65, bibl., 1980.

An account of the myth, history, legend and poesy of the pearl. Gives needless publicity to some outrageous and nonsensical beliefs but confirms the expected fact that pearl is among the earliest of gems known to man. [The last sentence—'A woman clasps a strand of pearls around her neck...and Aphrodite weaves her magic once again.'—is a fair indication of the gemmological content.] R.K.M.

LESH (C.). *Remodelling the ivory tower.* Gems & Gemology, **XVI**, 11, 370-2, 1980.

Conservation of elephants (and whales) restricts ivory imports. Author suggests alternative materials, bone, deer antlers, antique sources (imported before the ban), plastics, plaster of Paris and vegetable ivory (described as 'unexpected'). R.K.M.

McCAWLEY (E. L.). *Cubic moissanite, a gem material of the diamond family.* Lapidary Journal, **34**, 10, 2244-7, 1981.

Artificial cubic moissanite, SiC, has a hardness of 9½, specific gravity of 3.218, RI 2.651 and dispersion 0.044. Crystals are grown from materials heated in electric furnaces. Colours can be made and it is expected that these will reach the gem market in due course. M.O'D.

McCOLL (D. H.), WARREN (R. G.). *First discovery of ruby in Australia.* Mineral. Record, **11**, 6, 371-5, 6 figs (2 in colour), 1980.

Ruby has been found in an amphibolitic complex formed on a limestone in the Harts Range of the Northern Territory. Crystals are found as well-formed tabular hexagons, the best colour being shown by the smaller pieces. RI is 1.760-1.768 and SG 3.98, this rather low figure being due, possibly, to the presence of gas-filled fissures. A notable iron content darkens the colour and weakens the luminescence. So far only cabochon grade has been found. M.O'D.

MALKIN (S. A.). *Gemology as a profitable sales tool.* Gems & Gemology, **XVI**, 11, 372-4, 1980.

Discusses introducing gemmology in sales patter. R.K.M.

MILEY (F.). *An examination of red beryl.* Gems & Gemology, **XVI**, 12, 405-8, 2 figs in colour, bibl., 1980.

Specimens were examined from the Wah-Wah and Thomas Mountains, Utah, and the Black Range, New Mexico. RIs of 1.561-1.569 obtained were at variance with the G.I.A. Gem Identification Course figures of 1.585-1.594 [which surely are those for morganite?]. The SG was also lower than the quoted value. Largest stones are still from the Wah-Wah Mountains of Utah. Stones heavily included with healed cracks. [Again this rather insignificant and scarcely gem-quality red beryl is given publicity which it scarcely warrants.] R.K.M.

MORENO GOMEZ (J.). *La reflectividad, nuevo concepto en la identificación de piedras preciosas.* (Reflectivity, a new concept in gemstone identification.) Boletín del Instituto Gemológico Español, **20**, 42-6, 1 fig., 1980.

The principles behind the use of reflectivity meters are discussed. M.O'D.

MRÁZEK (I.). *Gemstones found in the Jabal al Hasáwnah and Jabal as Sawdá' mountains, Libya.* Z.Dt.Gemmol.Ges., **29**, 3/4, 135-48, 18 figs, 1980.

Geological and mineralogical conditions of gemstone occurrences in the region of the Jabal al Hasáwnah and Jabal as Sawdá' mountains, Libya, are described. Technological properties of the raw materials and possibilities of their utilization are given. Cherts and silicates represent raw material of good quality suitable for use. Olivines were not found to be suitable for cutting because of intensive joining of grains. Quartz geodes containing chalcedony or agate, quartz or rock crystal are good collectors' pieces. Libyan chalcedony was used for cabochons and slabs, specially those showing pleasant colour shades and delicate striping. E.S.

MÜLLENMEISTER (H. J.). *Neue Chrysoberyll-Varietät entdeckt.* (New chrysoberyl variety discovered.) Z.Dt.Gemmol.Ges., **29**, 3/4, 196, 1980.

The stone weighed 2.13 ct, with RI n_x 1.740, n_z 1.750, n_y 1.745, and double refraction 0.010. X-ray examination confirmed suspicion that it was white chrysoberyl, source Sri Lanka. According to an editorial note it is not sure whether the stone is natural or synthetic. E.S.

NASSAU (K.). *Irradiation-induced colours in gemstones.* Gems & Gemology, **XVI**, 11, 343-55, 5 figs, 2 tables, 1980.

A summary of irradiation sources; stability of colour centres to light or heat; and identification of irradiation in stones other than diamond. Visible light, UV, x-rays, gamma rays, electrons, protons and neutrons will each change colour in certain gemstones.

Dr Nassau explains the effects of various radiations on colour centres and makes the point that some fading in very brilliant light can be due to heat rather than light. Materials are listed under I. Colour centres with shallow energy traps, producing phosphorescence and fluorescence; II. Colour centres with medium energy traps in which colour is bleached by light or heat over a variable period of time; III. Colour centres with deep energy traps in which change is permanent at room temperatures, but bleached by heating; IV. Irradiation effects which do not involve colour centres.

[Author shows an enviable understanding of his subject and an equal ability to explain it clearly.] R.K.M.

NASSAU (K.). *The optical constants of GGG.* Gems & Gemology, **XVI**, 11, 370, 1980.

Gadolinium gallium garnet RI, measured by Dr D. L. Wood, is established at 1.970 with dispersion 0.045, with slight variations with composition. [This is the paper previously published in *J. Gemm.*, 1980, XVII (3), 148.] R.K.M.

NASSAU (K.). *Synthetic emerald: the confusing history and the current technologies.* J.Crystal Growth, **35**, 211-22, 8 figs, 1976.

A critical review of methods used at present and in the past to produce emerald of gem quality. P.H.

O'DONOGHUE (M.). *Cameos.* Gems, **12**, 5, 35-8, 3 figs, 1980.

A short history of the cameo with notes on the substances used and the methods of fashioning adopted. (Author's abstract.) M.O'D.

O'DONOGHUE (M.). *Characterization of crystals with gem application.* Progress in Crystal Growth and Characterization, **3**, 2/3, 193-209, 10 figs, 1981.

This paper reviews a number of man-made crystals and describes their internal characteristics. Substances are arranged under method of growth with a separate section on the simulants of diamond. Line drawings illustrate various points.

(Author's abstract.) M.O'D.

O'DONOGHUE (M.). *Coral.* Gems, **12**, 6, 8-9, 3 figs, 1980.
Gives a short résumé of the formation, properties and uses of coral with illustrations from recent sales. (Author's abstract.) M.O'D.

O'DONOGHUE (M.). *Gemmology in Paris.* Gems, **12**, 4, 22-3, 1980.
An account of a visit by the author to a number of Parisian establishments, including the Gem Testing Laboratory and the Museum of the École des Mines. (Author's abstract.) M.O'D.

O'DONOGHUE (M.). *Great mineral locations: East Africa.* Gems, **12**, 2, 27-8, 1 fig. in colour, 1980.
East Africa has come into prominence as a gem producing area in the past few years. A number of species are reviewed including the various colours of zoisite. (Author's abstract.) M.O'D.

O'DONOGHUE (M.). *Great mineral locations: Mogok, Burma.* Gems, **12**, 1, 17-18, 1 fig. in colour, 1980.
A brief description of the Mogok stone tract is given with notes on the gem species found there. Diamond is one of the more unusual minerals quoted. (Author's abstract.) M.O'D

O'DONOGHUE (M.). *Great mineral locations: The Thomas Range, Utah.* Gems, **12**, 6, 32-3, 1 fig in colour, 1980.
The Thomas Range is celebrated for topaz and the manganese-bearing red beryl. (Author's abstract.) M.O'D.

O'DONOGHUE (M.). *The literature of gemmology.* Gems, **12**, 5, 20-1; **12**, 6, 30-1; 2 figs in colour, 1980.
Basic gemmological texts are reviewed, including monographs and journals. (Author's abstract.) M.O'D.

O'DONOGHUE (M.). *Poland as a mineral and gem locality.* Pt. 1. Gems, **13**, 1, 8-9, 1981.
Introduces the gem and mineral potential of Poland with special reference to the Krakow region. (Author's abstract.) M.O'D.

PLOTNIKOVA (S. P.), KLYUEV (Yu. A.), PARFIANOVICH (I. A.). (Longwave photoluminescence of naturally-occurring diamonds.) Min. Zhurn., **2**, 4, 75-80, 6 figs, 1980. (In Russian.)
The long-wave photoluminescence (PhL) of natural diamonds was studied in the 550-850 nm range. The properties of PhL systems with 578, 603.8, 700, 788 and 793 nm loading lines are described. The 603.8, 700 and 788 nm systems are shown to be characteristic of diamonds with mixed cube-octahedral growth, with increased content of nitrogen A-centres. The 793 nm system is related to known S2 and S3 PhL centres. Natural plastically-deformed diamonds of brownish colour are found to have a broad structureless PhL band with a maximum at 730 nm. A similar band, but with a structure, has been found in diamonds of crater origin and in a

polycrystalline variety from the Yakutian placers. The structure against the background of the broad band is considered to result from the presence of lonsdaleite. D.A.B.

PREST (Michael). *De Beer's diamond search.* The Times newspaper, No. 60,915, p.26, 30th April, 1981.

De Beer's production in 1980 was 14.7m carats, 4.51m being from Kimberley Division, 1.43m from Namaqualand Division, 2.04m from the Premier Mine, 1.56m from Consolidated Diamond Mines (Namibia), and over 5m from Orapa and Letlhakane (Botswana). The Jwaneng pipes (southern Botswana) could be bigger than previously supposed and on present plans will treat 4.8 tonnes of material a year: the proportion of gemstones is high, but size and quality appear at present not to match the best from other mines. J.R.H.C.

READ (P.). *Better reflectivity meters.* Retail Jeweller, **20**, 479, 6, 2 figs, 5th February 1981.

Describes the new Gemlusta 400X which has an expanded sensitivity over the previous model and is claimed to differentiate between polished natural and synthetic corundum. Different polishing procedures are thought to account for this discriminatory factor; the natural stones, having the better polish, give the higher readings (but there is slight overlap possibly due to some natural stones being polished with diamond dust today). Similar discrimination is claimed between natural and synthetic emerald possibly due to lower RI of the synthetic. Other reflectivity meters were then found to give similar discriminatory readings. The Japanese Diamond Checker uses a pulsed infrared lamp and detector and its readings are unaffected by high ambient light. Both meters are expensive. R.K.M.

READ (P. G.). *Separating diamond from its simulants by thermal conductivity.* Industr. Diamond Rev., 288-9, 4 figs, 1980.

At room temperatures, the thermal conductivity of diamond single-crystal ranges from 10 (Type I) to 26 Wcm^{-1} $°C^{-1}$ (Type IIa), whereas cubic ZrO_2 has a very low value (0.1) and of other simulants corundum has the highest value ($\sim$0.4). Brief notes are given on three instruments using thermal conductivity to distinguish diamonds: the Ceres diamond probe, the 'Dipro' tester, and the 'Rayner Diamond Tester'. This type of instrument can be used on stones which are recessed in their mounts. R.A.H..

ROTHSTEIN (J.). *Stilbite, stevensite, arandisite, touchonite (four unusual gems) and some ideas on gem nomenclature.* Lapidary Journal, **34**, 9, 2042-54, 1980.

Interesting account of the materials cited with notes on how they were first encountered. The author describes the occasional confusion over nomenclature arising when new materials are introduced. M.O'D.

SARMIENTO CARPINTERO (L.). *Imitaciónes de diamante.* (Imitations of diamond.) Boletín del Instituto Gemológico Español, **20**, 11-35, 15 figs in colour, 1980.

A general overview of the various materials which have been used to imitate diamond. M.O'D.

SAVKEVICH (S. S.). *Physical methods used to determine the geological origin of amber and other fossil resins; some critical remarks.* Physics and Chemistry of Minerals, **7**, 1, 1-4, 2 figs, 1981.

Succinite has been identified by infrared and mass spectrometry though thin-layer chromatography and emission spectrometry did not yield significant results. Succinite may be located in the area comprising the Black Sea, Carpathian Mountains, South Baltic, Sweden, Denmark and Great Britain. M.O'D.

SCHMETZER (K.), BANK (H.). *Smaragde aus Sambia mit ungewöhnlichem Pleochroismus.* (Emeralds from Zambia with unusual pleochroism.) Z.Dt.Gemmol.Ges., **29**, 3/4, 149-51, 1 diagram, bibl., 1980.

The colour of the Zambian emeralds can be comparable to stones from Sandawana, Zimbabwe or even Muzo. Lately some stones have come on to the market which show a blue-green colour with a blue/yellow green pleochroism never before seen in emeralds. These emeralds were examined, and it was found that they combine an emerald and an aquamarine component in the same stone. E.S.

SCHMETZER (K.), BANK (H.). *Eine Untersuchung der Türkissynthese und Türkisimitation von Gilson.* (An examination of the synthetic and imitation turquoise of Gilson.) Z.Dt.Gemmol.Ges., **29**, 3/4, 152-4, 2 tables, bibl., 1980.

The synthetic turquoise produced by Gilson contained one or several crystalline phases. The name 'synthetic turquoise' does not correspond to the composition of the material. The turquoise imitation of Gilson consists mainly of calcite. E.S.

SCHULTZ (Paul R.). *Colorado lapis lazuli from the Blue Wrinkle Mine in Gunniston County.* Lapidary Reporter, 255, 8/10, 2 figs, 1st February, 1981.

A further report (see Truebe, H. A., *Lapis lazuli in the Italian Mountain area of Colorado,* abstracted in J.Gemm., 1978, XVI (1), 56) on the Blue Wrinkle claims, worked since 1939 but sold in 1979, and stated now to be producing lapis in sizable quantity and good quality, varying in colour from azure blue to royal blue to a deep purple blue, with pyrite ranging from large to exceedingly fine in all shades (but exceedingly fine mostly in the deep purple blue). Mining (at present by stripping off the over-burden) may change in the next few years to an underground operation. Weather limits operations to three or four months a year. J.R.H.C.

STONE (J.). *Australia likely to be major supplier of jade.* Gems & Gemology, **XVI**, 10, 331, (Summer) 1980.

An Australian publicity report on nephrite workings on Eyre Peninsula, S. Australia, with estimated reserves of 49 000 tonnes. R.K.M.

SUPERCHI (M.). *La gemmologia come scienze accademica a sè stante, non una parte della mineralogia: principi generali e concetti.* (Gemmology as an academic science on its own, not a part of mineralogy: general principles and concepts). Rend. Soc. Italiana Min. Petr., **35**, 199-215, 2 figs, 1979.

A general index of a gemmological compendium is considered, divided in three parts: general principles, descriptive theoretical part, and a practical part. Facsimiles for the arrangement and listing of samples are given. A scientific expression of colour or chromaticity is recommended. F.B.

TISDALL (F. S. H.). *Reminiscences.* Gems, **12,** 5, 6-7, 1 fig., 1980.

The writer tells of some of his experiences during a lifetime spent with gemstones. M.O'D.

VACEK (J.). *Blueberries! In Arizona?* Lapidary Journal, **34,** 9, 1942-4, 10 figs in colour, 1980.

The blueberries referred to are in fact nodules containing crystals of azurite found at the Blueball Mine on the northern slopes of the Pinal Mountains in Arizona. Malachite crystals are also found. M.O'D.

VOGT (H.-H.). *Nachbildung oder Fälschung?* (Imitation or false?) Mineralien Magazin, **1,** 34-9, 6 figs (2 in colour), 1981.

A brief summary of the methods used to manufacture gem materials. M.O'D

WALTERS (D.). *Polishing agates 150 years ago.* Gems, **12,** 5, 8-9, 1 fig., 1980.

The traditional method of agate polishing with water as the source of power has changed little from early times, except for the use of electric motors. M.O'D.

WÜTHRICH (A.), WEIBEL (M.). *Optical theory of asterism.* Physics and Chemistry of Minerals, **7,** 1, 53-4, 2 figs, 1981.

The scattering of light by thin cylinders and refraction by curved surfaces are the two processes involved in the observation of asterism. A star can be obtained from a stone with a plane surface. M.O'D.

YADA (K.), TANJI (T.), SUNAGAWA (I.). *Application of lattice imagery to radiation damage investigation in natural zircon.* Physics and Chemistry of Minerals, **7,** 1, 47-52, 11 figs, 1981.

High, low and intermediate zircons were examined with a 1000kV high resolution electron microscope. Lattice images thus obtained were in accordance with existing theories of the metamorphism of zircon. M.O'D.

YAMAOKA (S.), KOMATSU (H.), KANDA (H.), SETAKA (N.). *Growth of diamond with rhombic dodecahedral faces.* J. Crystal Growth, **37,** 349-52, 7 figs, 1977.

Diamonds with {110} habit were synthesized using Ni, Co, or Ni-Cr alloy as a catalyst metal. The {110} faces were flat and smooth while small adjacent {111} faces showed no trace of dissolution, so {110} is considered to be formed by growth. The *P-T* conditions where {110} occurs are restricted to a narrow region adjacent to the graphite-diamond equilibrium line. P.H.

YU (R. M.), HEALEY (D.), WING (Y.). *The jade trade in Hong Kong.* Lapidary Journal, **34,** 10, 2256-64, 13 figs, 1981.

An interesting account of the methods, largely traditional, of selling rough jade in Hong Kong. M.O'D.

YUSHKIN (N. P.), SERGEYEVA (N. Ye.). *Textures of amber from the Yugorskiy Peninsula.* Dokl. Acad. Sci. USSR, Earth Sci. Sect., **216,** 151-3, 1 fig., 1974. Transl. Dokl. Akad. Nauk SSSR, **216,** 637-40, 1974.

Internal structures of both brittle and viscous ambers from a deposit at the Preschanaya River, Yugorskiy Peninsula, were studied in detail by thin section, scanning, and transmission microscopy. Three types were distinguished from Cretaceous age resins that were redeposited in a metre thick bed, yielding 2 kg/m^3 of amber, in Pleistocene sand and gravel. Conclusions from the work show: (1) the various types differ substantially in quantity, distribution and shape of pores, (2) the size of pores decreases from transparent to osseous varieties, but their quantity increases, (3) the largest pores originated in early stages from addition of plant sap to oleoresin; the various generations of micropores are products of periodic evaporation of volatile components of oleoresin after its secretion: and pores were redistributed and deformed during plastic flow and contracted upon oxidation of the amber. W.J.F.

ZAPATERO (L.), BARBOSA (J. E.). *Dumortierita transparente en Minas Gerais, Brasil.* (Transparent dumortierite from Minas Gerais, Brazil.) Boletín del Instituto Gemológico Español, **20**, 37-9, 3 figs in colour, 1980.

A transparent variety of dumortierite from Minas Gerais is described. The hardness is given as 7½-8, gravity specific gravity as 3.35 and refractive index 1.668-1.688 with a birefringence of 0.020. The colour is bluish-green. No absorption spectrum was detected; some of the crystals showed fibrous inclusions. M.O'D.

ZHIKHAREVA (V. P.), SHTURMAN (V. L.), KULAKOVA (I. I.), RUDENKO (A. P.). (The morphology of catalytically-etched natural diamonds.) Min. Zhurn, **2**, 4, 80-3, 2 figs, 1980. (In Russian.)

Etching of plane-faced octahedral and curvifaced rhombdodecahedral diamonds with water vapour shows that the patterns obtained are morphologically and geometrically identical to those in rare natural crystals and are crystallographically different from the etch-pattern obtained in oxygen-rich media. D.A.B.

Australian opal standard proposed. Wahroongai News, 5-7, January 1981.

A reprint of a Public and Consumer Affairs proposal to standardize opal classification. The suggestion seems to be to classify on a basis of—A. All natural opal, cut or uncut; A1. Natural opal laminated to natural materials as doublets or triplets; A2. Natural opal laminated to other than naturally occurring materials; B. Naturally occurring matrix opal; B1. Matrix opal which has been treated [stained?]; Synthetic opal; Imitation opal. [It is not clear whether the proposal is to sell opal as 'A1 opal' without further description, or other such coded descriptions. If so then they are not solving the problem, only compounding it.] R.K.M.

Diamond Exploration Hopes in Ontario. The Times newspaper, No. 60,853, p.18, 16th February, 1981.

Further tests will be needed to determine whether any of the pipes near Hearst, Ontario, contain diamonds and, if so, whether a commercial deposit exists. J.R.H.C.

Interview: Allan Caplan. Mineral. Record, **11**, 6, 351-60, 14 figs (6 in colour), 1980.

Allan Caplan has prospected for gem and good quality mineral specimens in Brazil for many years. He describes how a number of important purchases were made, with particular reference to topaz crystals. M.O'D.

Utah red beryl available at Tucson. Lapidary Reporter, 253, 34, 1 fig., 1st December 1980.

Ruby-red beryl, found along narrow seams in rhyolite quartz matrix in the Wah Wah Mountains of western Utah, U.S.A., is offered by Cathay Corporation. A few two-phase inclusions are mentioned. The crystals turn black on heating to 2500 °F but return to original colour on cooling. The colour is attributed to caesium and manganese. A 31 ct crystal of 23 × 13 mm, 4.3 ct emerald-cut stone of 9.3 × 8.9 mm and 3.8 ct round cabochon of 9 mm [diameter?] are illustrated. J.R.H.C.

NOTE: to avoid confusion, the Summer 1980 number of Gems & Gemology is so described above, because, although in fact part 10 of volume XVI, it carries the number 9. Parts 11 and 12 were correctly numbered.

BOOK REVIEWS

BANK (H.). *Meine kleines Diamantenbuch.* (My little diamond book.) Pinguin Verlag, Innsbruck, 1979. pp.85. Illus. in black-and-white and in colour. Price on application.

This pocket-sized book succeeds in giving the lay reader a complete picture of the genesis, recovery, fashioning and testing of diamond and a translation into English would be worth while. M.O'D.

COCKS (A. S.). *Courtly jewellery.* Victoria & Albert Museum, London, 1980. pp.48. Illus. in colour. Price on application.

A short, well-illustrated book giving a history of jewellery from the fifteenth to the seventeenth centuries, this account was timed to coincide with an exhibition of Renaissance jewellery held at the Victoria and Albert Museum in 1980/81. There are many fine pictures (all are in colour) and the text is authoritative. A short bibliography is appended. M.O'D.

HUNT (H.). *Lapidary carving for creative jewelry.* Desert Press, Bouse, Arizona, 1980. pp.144. Illus. in black-and-white. Price on application.

This book concentrates on the carved ringstone and carved pendant, two fields of the lapidary art which have been neglected in recent years. The illustrations of carved pieces are most interesting and considerable detail of the methods is given. Ten stones are selected for detailed discussion of high-quality faceting. This is a well-written book which contains much more than the title suggests. M.O'D.

KAMINSKII (A. A.). *Laser crystals, their physics and properties.* Springer, Berlin, 1981. pp.xiv, 456. DM128.

This book is devoted to the properties and characteristics of those crystals with some degree of laser application. Since most crystals need to be doped before they can be used for laser work the possibility of some of them having an ornamental application is clear, and although much of the detail given in this book is outside the field of the average gemmologist it is none the less worth while looking through it to see how the laser action takes place in a particular crystal and what type of doping gives the best results. There is a first-class list of references, many of them to Soviet journals. M.O'D.

LENGELLÉ (M.). See TARDY, LEVEL (D.). *Les Pierres Précieuses,* below (p.499).

PAMPLIN (B.), ed. *Crystal growth.* 2nd edn. Pergamon Press, Oxford, 1980. pp.xviii, 609. Illus. in black-and-white. £45.

This second edition of what quickly became a standard work on crystal growth is of similar size to the first without re-running any of the material. This shows how quickly the science (or art?) of the crystal grower has developed in the five years since the original text. Less is given here on the flux-melt method (which was exhaustively treated previously), but, as if to make up, a good deal of information on chemical vapour deposition and molecular beam epitaxy is provided. There is, too, much useful data on crystal growth environment and equipment and as always copious references are attached to each chapter. M.O'D.

SACHANBINSKI (M.). *Kamienie szlachetne i ozdobne Slaska.* (Precious and ornamental stones of Silesia.) Zaklad Narodowy im. Ossolinskich, Wroclaw, 1980. pp.238. Illus. in colour. 50Zl.

This is a well-produced introduction to the gem minerals with particular reference to those found in Poland. Maps are provided which clearly indicate the extent and location of Polish gem deposits (these include chrysoprase, cornelian, turquoise, tourmaline, amethyst and other varieties of quartz). A good bibliography of works in Polish is given and should prove most useful to those working on minerals from this area. M.O'D.

SACHANBINSKI (M.). *Polnische Edel- und Schmucksteine im Barockschloss Moritzburg.* (Polish gem and jewellery stones in the Baroque castle of Moritzburg.) Sekretariat für Kunstausstellungen des Bezirkes, Dresden. Unpaged. 1M.

This is a set of five postcards with a short introductory and descriptive booklet issued on the occasion of an exhibition displayed from 27th June to 12th July, 1980. The postcards depict nephrite from Jordanow, agate from Queisser Bergland, rock crystal from the 'Stanislaw' mine at Isergebirge, and quartz from Strzegom. M.O'D.

STALDER (H. A.), SICHER (V.), LUSSMANN (L.). *Die Mineralien der Gotthardbahntunnels und des Gotthardstrassentunnels N2.* (The minerals of the Gotthard railway tunnel and of the Gotthard road tunnel no. 2.) Repof AG, Gurtnellen, 1980. pp.160. Illus. in colour. Price on application.

Among a number of fine quartz minerals found during excavation of the various Gotthard tunnels is a beautiful pink fluorite. Titanite is also found in small sizes. This book, which includes a number of maps, is a fine example of a work commissioned to cover a particular project. M.O'D.

TARDY [identified in preparatory matter as Maurice Lengellé], LEVEL (D.). *Les pierres précieuses.* (Precious stones.) 5th edn. Tardy et Dina Level, Paris, 1980. pp.504. 34 colour plates. 300 Fr.

The bulk of this book consists of an alphabetical listing of stones, prefaced by introductory chapters on gem testing. Much if not all of this section remains unchanged from the 4th edition, published in 1965. Some additions have been made to the alphabetical section (cubic zirconia gets a hurried mention under zircon). A large amount of each descriptive section is devoted to a listing of discredited names which are thereby given an extension of life—this is scarcely a scholarly way of producing a book and indeed a good deal of the matter is inaccurate or carelessly researched. This is a pity for the book is well-produced and the coloured pictures, though largely taken from H.-J. Schubnel's *Pierres précieuses dans le monde,* are none the worse for a second airing. The whole text needs revision by someone familiar with present-day gemmology. M.O'D.

ASSOCIATION NOTICES

BASIL WILLIAM ANDERSON

On 3rd July, 1981, Mr B. W. Anderson attained the age of eighty. On behalf of the readers of this *Journal* and confident of their unqualified approval, the Editor has great pleasure in wishing Britain's premier gemmologist **Many Happy Returns of the Day.**

NEWS OF FELLOWS

On 17th February, 1981, Mr Peter C. Read, C.Eng., F.G.A., gave an illustrated talk on 'New Gem Test Instruments' to the Gemmological Association of Hong Kong in the Knowle's Building of the University of Hong Kong, and on 24th February, 1981, he presented an illustrated seminar to the China Arts and Crafts Corporation in Peking (Peiping), China, on 'Diamond Mining in Southern Africa', 'Gemstone Mining in Sri Lanka' and 'Gem Test Instruments'.

On 25th February, 1981, and again on the following day, Mr E. Stanley, F.G.A., gave lectures on hallmark identification and gemstone recognition at a Retail Jewellery Practical Seminar in Manchester.

On 28th March, 1981, Mr Michael O'Donoghue, M.A., F.G.S., F.G.A., gave a talk on 'Gemstones of Central and East Africa' at the British Mineral and Gem Show, Leicester.

On 7th April, 1981, Mr Alan Hodgkinson, F.G.A., gave an illustrated talk on the major precious stones to a large mixed audience of retail jewellers, gemmologists and those involved in the manufacturing side of the trade at the North British Hotel, Glasgow. He indicated some simple tests available with a minimum of equipment but stressed the importance of the microscope in determinative gemmology: in a selling situation he advocated applying gemmology in a positive way and not 'having to make unnecessary apologies for something that is Nature's guarantee that the stone is natural'.

On 28th-29th April and again on 30th April-1st May, 1981, Messrs Alan Hodgkinson and David Kent, FF.G.A., were the lecturers at two-day gem identification courses organized by *Retail Jeweller.*

OBITUARY

Mr Richard M. Pearl, M.A. (Colorado), A.M. (Harvard), C.G., F.G.A. (D.1946 with Distinction), Colorado, U.S.A., died on 28th November, 1980, in his 68th year. He was a Professor at Colorado College from 1962 until his retirement in 1978 and was the author of many books on geological and mineralogical subjects, including *Popular Gemology* (1948) and *Gem Identification Simplified* (1968).

On 20th March, 1981, Mr Edgar W. MacDonald, F.G.A. (D.1949 with Distinction), Cheddar, Somerset, died. He was for more than 20 years the mainstay of gemmological instruction in Glasgow and the West of Scotland. In 1952 he was a founder member of the West of Scotland Branch (later to become the Scottish Branch) and as a committee member his knowledge and guidance were invaluable.

GIFTS TO THE ASSOCIATION

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

Mr R. Holt, F.G.A., London, for the following specimens: a Blue John slice, a ruby in schist, a quartz crystal, an amethyst slice, a hessonite garnet crystal and two jadeite cabochons.

Korite Ltd of Calgary, Alberta, Canada, for a very attractive piece of 'Korite'* on rock background, and four cut and polished oval specimens.

Mr John L. Pyke, F.G.A., Birkenhead, for 28 colour slides dealing with mining of gems in Burma, Sri Lanka, Tanzania, Thailand and Zimbabwe.

Mr R. C. Trigg, F.G.A., Capetown, S. Africa, for assorted emerald crystals and garnet-dioptase minerals for research and students' use.

RETIREMENT OF MR A. E. FARN

Mr A. E. Farn, F.G.A., retired as Director of the London Chamber of Commerce and Industry Gem Testing Laboratory on 17th March, 1981. There follows an appreciation of Mr Farn written by Mr David Callaghan, Chairman both of the Association and of the Diamond Pearl and Precious Stone Trade Section of the LCCI.

'One of the best-known and longest serving gemmologists, Alec Farn of the London Chamber of Commerce and Industry's Gem Testing Laboratory retired on 17th March.

'He started his working life in the retail jewellery and pawnbroking trade nearly fifty years ago and joined the LCCI Gem Laboratory following war service in 1946. This was to be the beginning of a 35-year career, which culminated in his promotion to director of the Laboratory in 1972. He obtained his F.G.A. with distinction in 1947. His early career at the Gem Laboratory was dominated by three men who had achieved world recognition in the field of gemmology. B. W. Anderson and C. J. Payne were both graduates of Kings College (University of London), while Robert Webster was the author of a pocket compendium which is still in demand today.

'By joining the Laboratory staff in 1946, Alec Farn became the fourth member of a team that was to work together for twenty-five years. It is probable that this team was the most influential gemmological diagnostic team that has ever been formed.

'For twenty-seven years Alec Farn worked alongside these giants until their retirement, which happened in fairly quick succession. His appointment as director

*For the nature of 'Korite' see pp.406-15 above.—Ed.

coincided with a period of rapid expansion and unprecedented change.

'In June 1977 he was made a Freeman of the Worshipful Company of Goldsmiths and a Freeman of the City of London, a fitting tribute to one whose career had done much to enhance the reputation of the City.'

GEM TESTING LABORATORY: NEW DIRECTOR

Mr K. V. G. Scarratt, F.G.A., has been appointed as Director of the Gem Testing Laboratory by the Standing Committee of the Diamond Pearl and Precious Stone Trade Section of the London Chamber of Commerce and Industry in succession to Mr A. E. Farn.

Mr Scarratt joined the Laboratory staff in June 1974 after some four years in the retail jewellery firm of Austin Kaye & Co. While there, he studied gemmology, passed the Diploma Examination and became F.G.A. in 1973 and passed the Gem Diamond Examination in the next year. He had previously seen service with the First Battalion Grenadier Guards in Cyprus, the Middle and Far East, and Northern Ireland.

While carrying out the general commercial gem testing provided by the Laboratory for the Trade, he has specialized in the recognition of the modern synthetic gemstones* and has developed the highly skilled technique required to detect radiation-induced colour in diamonds, using the equipment installed in the Laboratory for the study of absorption spectra in diamonds using liquid nitrogen, which he has described in his paper, 'Investigating the visible spectra of coloured diamonds', in the *Journal of Gemmology,* 1979, XVI (7), 433-47.

RETIREMENT OF HARRY WHEELER

The Chairmen of the N.A.G. and G.A. have announced that after serving both Associations since 1934 Mr Harry Wheeler has decided to retire in December 1982 at the age of 65. A successor is now being sought and a firm of Management Consultants has been appointed to deal with all applications on behalf of both Associations.

MEMBERS' MEETINGS

London

On 24th March, 1981, at the Central Electricity Generating Board Theatre, London E.C.1., two films were shown. The first, a new film produced by the Los Angeles County Museum of Natural History and the G.I.A., entitled 'Gems of the Americas' told of the evolution, mining, fashioning, and marketing of the gems. The second film was 'Orapa', the story of establishing a new diamond mine in a new area in Botswana.

Midlands Branch

On 27th March, Mr Robert Deans, of the Friends of Jade, gave an illustrated talk on jade and the aims of the Friends of Jade, at the Society of Friends, Dr Johnson's House, Colmore Circus, Birmingham.

*See his 'Notes on Gilson synthetic white opal (September 1975)', *J.Gemm.,* 1976, XV (2), 62-5; 'Study of recent Chatham synthetic ruby and synthetic blue sapphire crystals with a view to the identification of possible faceted material', *J.Gemm.,* 1977, XV (7), 347-53; and, with E. A. Jobbins and P. M. Statham, 'Internal structures and identification of Gilson synthetic opals', *J.Gemm.,* 1976, XV (2), 66-75.—Ed.

On 24th April, 1981, also at the Society of Friends, the Annual General Meeting of the Branch was held, when Mrs S. E. Spence, F.G.A., and Mrs J. S. Leek, F.G.A., were re-elected Chairman and Secretary respectively. The A.G.M. was followed by an illustrated talk by Mr D. H. Ariyaratna on 'The Gem Industry of Sri Lanka'.

North-West Branch

On 26th March, 1981, Mr R. V. Huddlestone gave an illustrated talk on 'Diamonds', at Church House, Hanover Street, Liverpool.

On 30th April, 1981, Mr A. E. Farn, F.G.A., gave an illustrated talk on 'Jade and Jade-like Substances', at Church House.

On 7th May, 1981, Mr P. G. Read, C.Eng., F.G.A., gave an illustrated talk on diamonds, including a feature on mining, at Church House.

South Yorkshire and District Branch

On 19th March, 1981, at the Sheffield City Polytechnic, Dr Stanley Holgate, F.G.A., gave a talk entitled 'Let's make a Solitaire'. Dr Holgate was until recently lecturer for the Gem Diamond and Practical Diploma classes at Liverpool and has been experimenting with different stone-mounting techniques. A collection of stones was circulated for identification purposes. Dr Holgate's detailed description of the methods of making a simple prong setting was of particular interest to the student members present.

COUNCIL MEETING

At the Meeting of the Council held on Tuesday, 10th February, 1981, at Saint Dunstan's House, the following were elected to membership:

FELLOWSHIP

Attanayake, Walter, Ratnapura, Sri Lanka. 1978
Bennett, David W., Ware. 1980
Bill, David N., Cannock. 1980
Bonanno, Kathryn L., Fredericksburg, Va, U.S.A. 1980
Bramwell, William J., Tynemouth. 1980
Carlsson, Bjørn, Täby, Sweden. 1980
Cartier, Richard H., Toronto, Ont., Canada. 1980
Charlton, Maurine, Scarborough, Ont., Canada. 1980
*Chinkul, Manwit, Jeddah, Saudi Arabia. 1970
Cooper, Judith M., Colchester. 1980
Day, Ghislaine H., Arlington, Va, U.S.A. 1980
Day, William H., Arlington, Va, U.S.A. 1980
de Grefte, Glaudina J., Tilburg, Netherlands. 1980
Ford, Karen J., Annapolis, Md., U.S.A. 1980
Fraquet, Helen R., Frinton-on-Sea. 1980
Gallardo Bravo, Matilde, Valencia, Spain. 1980
Gowling, Leslie G., Toronto, Ont., Canada. 1980
Graus, Jeremy Z., London. 1980
Harris, Barbara, Toronto, Ont., Canada. 1980
Heiskanen, Erkki T., Helsinki, Finland. 1980

*Manwit Chinkul qualified in 1970 under the name of Minn Wai

Hellmark, Thorsten, Örebro, Sweden. 1980
Hunger, Giselle, Lugano, Switzerland. 1980
Jackson, John G., Sunderland. 1980
Johnson, Colin M., Birmingham. 1980
Jones, L. Bruce, Seattle, Wash., U.S.A. 1980
Jones, Mark L., Cromer. 1980
Kämäri, Arvi N., Helsinki, Finland. 1980
Krapenc, Terry S., Concord, Ohio, U.S.A. 1980
Laine, Paul D., Vale, C.I. 1980
Lakdawalla, Darayus N., Bombay, India. 1980
Lakdawalla, Zubin N., Bombay, India. 1980
Lamb, Revital, Salisbury, Zimbabwe. 1980
Linko, Ilpo I., Espoo, Finland. 1980
Naebers, Joseph L., Hulsberg, Netherlands. 1980
Nakajima, Minako, Tokyo, Japan. 1980
Nichols, Robert T., Albuquerque, N.M., U.S.A. 1980
Oosterwaal, Fransiscus T., Loon op Zand, Netherlands. 1980
Pascual Armengou, José, Barcelona, Spain. 1980
Perera, Priyani A., Colombo, Sri Lanka. 1980
Piunno, John C., Washington, D.C., U.S.A. 1980
Reynolds, Roderick H., La Moye, C.I. 1980
Riedl de Argiles, Inge, Barcelona, Spain. 1980
Robbins, Susan C., London. 1980
Ross, Rosemary D., London. 1980
Ruÿten, Andreas G., Woerden, Netherlands. 1980
Samaratunga, Edith K., Heidelberg, West Germany. 1980
Shackley, Ian W., Christchurch, New Zealand. 1980
Shah, Paresh N., Bombay, India. 1980
Shanmuganathan, Kathirithanby, Colombo, Sri Lanka. 1980
Stalman, Margareth A., Susteren, Netherlands. 1980
Takada, Fujio, Osaka, Japan. 1980
Tan-Bouman, Els, Schoonhoven, Netherlands. 1980
Tolin, Harvey S., New Canaan, Conn., U.S.A. 1980
Tomas Soler, Ma Rosa, Valencia, Spain. 1980
van Muyden, Paulus M., Rotterdam, Netherlands. 1980
Versendaal, Johannes, Hendrik Ido Ambacht, Netherlands. 1980
Wall, Stephanie, Alcester. 1980
Waller, John R., Scarborough, Ont., Canada. 1980
Welch, Mark G., Cardiff. 1980
Wijesuriya, Guthila, Colombo, Sri Lanka. 1980
Wilkinson, Ben R., Nanaimo, B.C., Canada. 1980
Yielding, Daniel N., Markham, Ont., Canada. 1980

TRANSFERS FROM ORDINARY MEMBERSHIP TO FELLOWSHIP

Carrera Poblet, Jaime, Barcelona, Spain. 1975
Carson, Constance, London. 1980
O'Donnell, Francis X., East Greenbush, N.Y., U.S.A. 1979
Osborne, Annie, Hong Kong. 1979

ORDINARY MEMBERSHIP

Abrami, Aurelio, Milan, Italy.
Ainsworth, Nicola L., London.
Albuquerque, Antonio R., São Paulo, Brazil.
Ali, Narin, London.
Ariyaratna, D. H., London.
Atsumi, Ikuo, Tokyo, Japan.
Auerbach, Louis, Long Island, N.Y., U.S.A.
Bennett, Norman P., Plymouth.
Berkowitz, Joseph, Toronto, Ont., Canada.
Berndt Arfstrom, George, Bro, Sweden.
Birkinshaw, David W., Edmonton, Alta, Canada.
Bolton, Robert G., Leeds.
Bonetti, Ettore, Rome, Italy.
Brown, Ian A., Hoppers Crossing, Vict., Australia.
Brugnoli, Giacomo F., Barry.
Bushnell, Nicola G., Taunton.
Buss, Marinda M., Hong Kong.
Chan, Cecilia, Hong Kong.
Chan, Peter K., Kowloon, Hong Kong.
Chi Yung, Jim, Reading.
Choksi, Chandrakant C., Dubai, U.A.E.
Chokyu, Kozo, Osaka, Japan.
Clark, Patricia A., Wrotham.
Cornioley, Jean-René, Fribourg, Switzerland.
Couston, John F., Kerala, India.
Cramer-Langohr, Monique, Verviers, Belgium.
Crossley, Simon W., Harwich.
Cvetkovic, Borjanka, Kerala, India.
Damboritz, Alfred L., Bayonne, N.J., U.S.A.
Darracott, Britt-Marie, London.
Davies, Angela, Gerrards Cross.
Davies, Garry, Hyde.
Denton, John M., Corbridge.
De Ridder, Herwig, Rijmenam, Belgium.
Diaz-Legorburu, Federico, Caracas, Venezuela.
Dixon, Leonard W., Wolfenbüttel, W. Germany.
Ebine, Junichi, Tokyo, Japan.
Eckley, Gareth D., Brecon.
Edelstam, Ingrid K., Stockholm, Sweden.
Ehrenborg, Charlotte, Gex, France.
Elias, Abdul H., Mombasa, Kenya.
Ellis, Maurice E., Evesham.
Enger, Antoinette C., Voorburg, Netherlands.
Fukushima, Tsukasa, Yokohama City, Japan.
Gemayel, Farid, Ante Lias, Lebanon.
Gerrard, Charles, London.
Giraldo Cuellar, Rodrigo A., Bogota, Colombia.
Gobla, Michael J., Westminister, Colo., U.S.A.
Gono, Teruko, Tokyo, Japan.
Gooneratne, Sinhamuni M., London.
Guy, Peter M., Solihull.
Haggarty, Ronald T., Edinburgh.
Hakoune, Jacques, Antwerp, Belgium.
Ham, Elizabeth R., Rondebosch, Cape, S. Africa.
Hamamoto, Keiko, Tokyo, Japan.
Hibino, Osamu, Kyoto City, Japan.
Ho, Henry, Los Angeles, Ca, U.S.A.
Houseago, James A., Lowestoft.
Imazawa, Satoru, Yamanashi Pref., Japan.
Inches, Deirdre M., Wembley.
Inoue, Yoshiaki, Asahigawa City, Japan.
Ishii, Koji, Chiba Pref., Japan.
Ishiwatari, Tamotsu, Saitama Pref., Japan.
Isowa, Keiko, Oita Pref., Japan.
Ito, Yasuo, Nagoya City, Japan.
James, Isabel E., Aberdeen.
Jason, Neville H., Prestwich.
Jedrzejewski, Mark J., Gdynia, Poland.

Kageyama, Chiyomi, Hyogo Pref., Japan.
Kamidoi, Yoko, Hiroshima Pref., Japan.
Kano, Shinzo, Osaka, Japan.
Karpelowsky, Raymond, London.
Kasagi, Nobuko, Hyogo Pref., Japan.
Kato, Kenzo, Tokyo, Japan.
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Mikami, Tatsuo, Tokyo, Japan.
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Tremblay, Mousseau, Le Plessis-Robinson, France.
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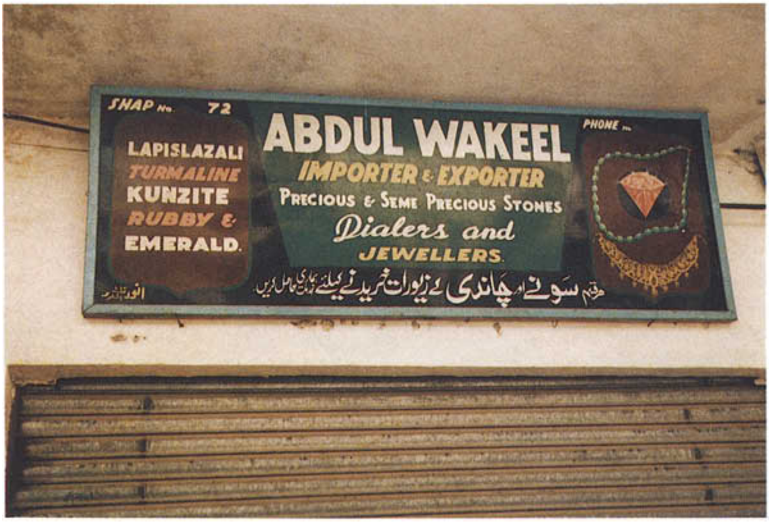
Wayne, Barry, Hornchurch.
Wright, Beatrice, Coventry.
Yamashita Catter, Junko, Tokyo, Japan.
Yamazaki, Koji, Tokyo, Japan.
Yapp, Russell J., Mansfield.
Yin Eng Haw, Carlson, Singapore.
Yoho, Gerald A., Crown Point, Ind., U.S.A.
Yokoo, Kenji, Tokyo, Japan.
Yoshida, Takeshi, Osaka City, Japan.
Yoshino, Mariko, Tokyo, Japan.
Yoshiyama, Masaru, Chiba Pref., Japan.
Yoshizawa, Keiko, Tokyo, Japan.

GOLDEN JUBILEE CELEBRATIONS

The response to the special arrangements being organized for October has been overwhelming. All the places for the Boat Cruise on Tuesday, 6th October, and the Celebration Dinner in the Captain's Room at Lloyds on Wednesday, 7th October, have been allocated, but an additional 'Celebration Dinner' has been arranged, again at Lloyds, for Friday, 9th October. There are a limited number of places available which will be filled in strict order of receipt of application.

GEM & MINERAL SOCIETY OF ZIMBABWE

The Rhodesian Gem and Mineral Society (affiliated to the Association) has changed its name to the Gem and Mineral Society of Zimbabwe.



Abdul Wakeel's shop sign.

Main street of Landi Kotal.

LETTER TO THE EDITOR

From Mr M. J. C. Brocklehurst, F.G.A.

Dear Sir,

A month or two ago I was travelling in the North West Frontier Province of Pakistan, right up along the Afghan border. I went to Torkham, the crossing point between the two countries, and on the way back I spent several hours in Landi Kotal, the last town on the road from Peshawar to Kabul. Thinking it might interest readers of the *Journal* to see how a leading local 'dialer in seme precious stones, rubby, lapislazali' and others advertises his wares I photographed the sign over his 'shap' *(sic)*. Unfortunately the 'shap' was shut so I could not call to pay my respects to Abdul Wakeel, take tea with him (quite probably it would have been 70% proof but camouflaged by being poured from a teapot!) or discuss his stock. To put it all in better perspective I also photographed the main street in which he has his business. It may be safely assumed that Abdul Wakeel dresses in a way similar to the man in the foreground.

Landi Kotal is a name to evoke many memories in the minds of those who were familiar with that part of the world in the days of the Raj, when so many soldiers of the British and Indian armies were trained and received their baptism of fire in encounters with the Pathan tribesmen. The Khyber Pass is now dotted with large new mud forts, the homes of dozens of those same tribesmen who in recent years have acquired immense wealth through smuggling—though there is little in their appearance to distinguish them from the local goatherds and lorry drivers. Smuggling is a flourishing industry to which the Government turns a blind eye; indeed, unofficially it is encouraged because of the prosperity, and therefore peace, it brings to a harsh and arid area which was lawless for hundreds of years. It is interesting that even the Russians have apparently made no serious attempt to curb the widespread two-way traffic, presumably because, in the one direction, it is a source of a wide range of expensive Western household goods otherwise unobtainable and, in reverse, secures foreign currency, however illegally, by the export of such commodities as rugs and a variety of gemstones. It was also extremely interesting to find, particularly in the wilder parts of Pakistan, what a very warmhearted welcome is extended to the now rare visitor from the U.K.—and primarily *because* he is British.

Yours etc.,
M. J. C. BROCKLEHURST.

20th February, 1981.
4 Fulham Park Road, London SW6 4LH.

CORRIGENDA

On p.201 above, line 18, for 'Hartshorn' read 'Hartshorne'.

On p.330 above, 4th line below Table 1, for '$\theta_c > v$, i.e. ring-negative' read '$\theta_c < v$, i.e. ring negative'.

On p.417 above, line 5, for *'lichtbrechung-sindizes'* read *'lichtbrechungsindizes'*.

On p.428 above, line 7, for 'in October' read 'on 5th August'.

On p.430 above, line 6 from bottom, for 'them' read 'the two firms'.

Historical Note

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

Affiliated Associations are the Gemmological Association of Australia, the Canadian Gemmological Association and the Gem and Mineral Society of Zimbabwe.

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

Notes for Contributors

The 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.

Articles published are paid for, and any number of prints of individual articles may be supplied to authors provided application is made on or before approval of proofs. Current rates of payment for articles and terms for supply of prints may be obtained on application to the Secretary of the Association.

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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