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FURTHER NOTES ON MONO- AND BI-PHASE INCLUSIONS IN AMETHYST AND TOPAZ

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Lucerne

SINCE writing my paper on mono- and bi-phase filled negative crystals in an amethyst (J. Gemm., 1976, XV, 4, 165–171) I have been favoured by a welcome opportunity to examine another amethyst of unknown origin and a blue topaz from the St Anne's Mine, Miami, Rhodesia, the inclusions in which were large and clear enough for an exact investigation (Figs 1 and 2). The experimental process was the same as with the previously described amethyst, namely an interpretation of the results obtained from microthermometry.

The more recently explored AMETHYST contained two types of inclusions, (*a*) primary cavities, i.e. negative crystals which were aligned parallel to the c-axis of the host crystal and (*b*) pseudo-secondary inclusions with highly irregular shapes and predominantly filled with two phases (fluid and gaseous) (Fig. 3).

The amethyst was first cooled to – 150°C. During annealing and heating which ensued the following alterations were observed:

FIG. 1. Amethyst with a large distorted negative crystal containing a liquid and a gas vesicle. 30 ×

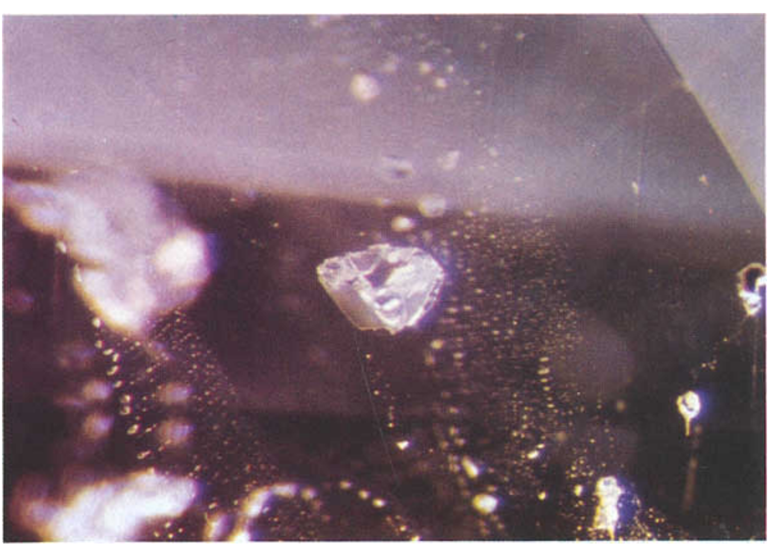
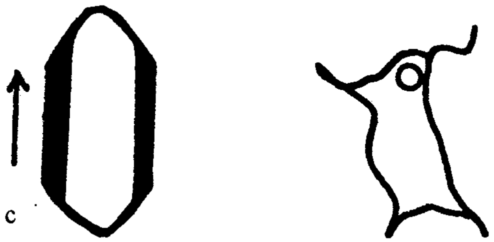


FIG. 2. Blue topaz from St Anne's Mine with a large negative distorted crystal accompanied by numerous tiny two-phase inclusions. 45 ×



(a) (b)

FIG. 3. Sketches of a primary negative crystal = type (*a*) and an irregular pseudo-secondary two-phase inclusion = type (*b*).

(1) the first sublimation occurred in the inclusions of type (*a*) at a temperature of −108°C;
(2) in the type (*a*) inclusions the ice melted at −1·6°C, in the type (*b*) inclusions at −0·2°C;
(3) homogenization took place in the pseudo-secondary inclusions at temperatures of +153 to 170°C.

The following table offers a comparison of the behaviour of analogous inclusions in the previous and the more recent amethyst:

Amethyst		*First sublimation*	*Melting* (*or sublimation*)	*Homogenization*
Previous sample	a_1	−99°C	−0·6°C	
	a	−90°C	−0·4°C	
New sample	a	−108°C	−1·6°C	
	b		−0·2°C	+153 to 170°C

From this it is obvious that the phase alterations in both amethysts are analogous. Hence one may rightly conclude that both amethysts occur from identical sources. Although microthermal observations are not entirely foolproof and cannot be interpreted with absolute certainty without accessory examinations, with reference to the (*a*) inclusions two deductions may today however be accepted with great probability:

(1) the inclusions contain some water;
(2) the pressure in the inclusions is very weak.

The (*b*) inclusions contain water, which is distinguished by a low content of some kind of salt, i.e. the water is but weakly saline. The temperature of homogenization corresponds approximately to the temperature of formation of the inclusions; yet, because the phenomenon of the "necking down" appears to have taken place, no exact temperature but merely an approximation can be indicated (viz. +153 to 170°C).

It is highly likely that both amethysts originated from a volcanic deposit, i.e. from druse-like cavities in lava flows. Their formation is due to a hydrothermal process: they crystallized from an aqueous solution at temperatures between +150 and 200°C and under low pressures varying from 20 to 30 bar. The slightly saline water in the type (*b*) inclusions was—at least for some time—at boiling point, so that a vapour bubble could separate which was later partly trapped in characteristic cavities (distorted negative crystals, i.e. type (*a*) inclusions) by the growing crystal. In the gaseous phase there was not only water vapour but also a second gas (perhaps CO_2), which sublimated between −90 and −110°C.

Fig. 4. Well shaped negative crystal with two-phase filling accompanied by minute pseudo-secondary two-phase inclusions. 45 ×

FIG. 5. Adjacent occurrence of primary and pseudo-secondary mono- and bi-phase inclusions in blue topaz. 45 ×

In consulting the literature it became evident that apparently no one has heretofore systematically investigated the inclusions in amethysts from volcanic deposits, so that comparison with other results of research are at present not possible.

In the blue TOPAZ from Rhodesia the inclusions betray a turbulent evolution of the host gem which is rich in two-phase inclusions. They either belong to the type (*a*) of negative crystals or to the pseudo-secondary type (*b*) with highly irregular shapes (Figs 4 and 5). Their investigation by means of microthermometry yielded equally informative results.

During the annealing process the following changes were noticed after the inclusions had been cooled down to − 180°C:

(1) at the temperature of − 2°C: the ice started melting;

(2) from + 20°C to + 100°C: daughter crystals, which had partially formed during the previous cooling, yet to some degree had already existed, dissolved completely;

(3) at +232°C: the majority of the solid phases in many inclusions dissolved, while, however, in other inclusions solid phases remained prominent (the topaz was not heated to over 232°C to avoid cracking);

(4) at approximately +250°C: the critical point of homogenization of the gaseous and fluid phase would most probably have been reached.

Repeated annealing and refrigeration allowed the observation of several recrystallizations within the inclusions. Strong as well as weak undercooling resulted in spontaneous nucleation as well as slow growth on existing seed crystals. Similarly, as in the case of the amethysts, the interpretation of these observations is rather difficult. The topaz seems to have sprouted from a hydrothermal formation—a conclusion which concurs with geological field observations at St Anne's Mine. The surmised temperature of homogenization (+250°C) would appear to be very low for topaz, especially so because in the literature values between 300 and 800°C are mentioned. The saline content is extraordinarily high; yet it was not possible to identify the nature of the salt. The solid crystals which precipitated and which were optically birefringent could be sulphates. In any case they were salts which caused only a very slight reduction of the melting point of the water content. Consequently they could not be chlorides.

Although these explanations may not perhaps yet be definite they may however serve as a plausible working hypothesis as well as a challenge to other workers to continue this research with more abundant material.

Acknowledgement: I wish to express my best thanks to Prof. H. A. Stalder of the Natural History Museum, Berne, for his technical assistance and valuable commentary.

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GEM MONAZITE FROM SRI LANKA*

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DURING the latter part of 1974 Miss G. Sri Nissanka, a keen Colombo gemmologist, was sorting through gem gravels from Sri Lanka and noted a reddish-orange pebble of gem-quality material of unusual appearance. The absorption spectrum was impressive and since there were strong bands in the red she assumed it was probably an unusual zircon. The specimen was brought to England by Mr H. J. Whitehead and shown to Mr R. K. Mitchell, who passed it to the Institute of Geological Sciences for further testing once he realized it was not zircon as was assumed originally.

The specimen is a small flattened pebble of rounded outline, approximately 6mm in diameter and weighing 0·2818 grams (1·41 carats). It is completely transparent, has a hardness approaching 6 on Mohs's scale and has a white streak (powder). The almost adamantine, but resinous lustre (seen on a small polished flat) is reminiscent of zircon, but the specific gravity of 5·247 is greater than that of high zircon (4·68). Seen through the dichroscope the pebble displays pleochroism from reddish-orange (colour 7B8) to golden-yellow (colour 5B7), the figures in brackets referring to standard colours shown in the *Methuen Handbook of Colour* (Kornerup & Wanscher, 1967). The refractive indices, determined on a Rayner sphalerite refractometer using sodium light, were α 1·795, γ 1·845 (both ±0·003) and the extinction between crossed polars was sharp. The clear, transparent material was almost free from inclusions but a few "healed feathers" were present. The pebble showed no fluorescent effects under ultraviolet light or between crossed filters. The mineral was noticeably radioactive when tested under a Geiger counter.

An x-ray diffraction film (X 7196) of powder scraped from the pebble showed that it was a member of the monazite group. The x-ray powder data set out in Table I were obtained from films taken with an 11·46cm diameter camera. The powder data were provisionally indexed by comparison with published data and were refined using the least squares program (BA1·0) developed by Dr

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TABLE I

Observed and calculated x-ray powder diffraction data for a gem monazite from Sri Lanka. CoKα radiation (λ=1·790207Å) *a* 6·761Å, *b* 6·966Å, *c* 6·478Å, β 103° 35′ (cell volume 296·5Å^3). Space group $P2_1/n$.

I/I_1	*d* obs	*d* calc	*hkl*
10	5·17Å	5·197Å	$10\bar{1}$
6	4·75	4·780	110
16	4·64	4·671	011
20	4·15	4·165	$11\bar{1}$
14	4·08	4·092	101
20VB	3·50	3·528	111
		3·483	020
35	3·285	3·286	200
80	3·078	3·078	120
12	2·973	2·972	210
100	2·862	2·864	$11\bar{2}$
18	2·598	2·598	$20\bar{2}$
25B	2·440	2·444	112
		2·435	$21\bar{2}$
4	2·335Å	2·336Å	022
25	2·182	2·179	031
40	2·151	2·151	$10\bar{3}$
25	2·123	2·120	$13\bar{1}$
		2·118	221
50	1·963	1·963	212
6	1·896	1·896	230
30	1·876	1·876	103
18	1·798	1·798	023
8	1·764	1·764	222
40B	1·738	1·741	040
		1·735	132
12	1·691	1·690	321

The intensities were estimated visually by comparison with an intensity scale.
B = broad, VB = very broad.

R. J. Davis, Department of Mineralogy, British Museum (Natural History), for the refinement of cell dimensions and enumeration of all possible d-spacings. This refinement gave cell dimensions *a* 6·761Å, *b* 6·966Å, *c* 6·478Å, β 103°35′.

A quantitative analysis (Table II) using a "Geoscan" electron microprobe was then carried out using silicates, oxides and phosphates of known composition as standards for Mg, Al, P, Ca, La, Ce, Pr and Nd. Pure metal standards were used for the elements V, Cr, Fe, Y, Sm, Gd, Dy, Ho, Er, Pb, Th and U. All the elements were analysed using an accelerating potential of 20kV and the results were corrected for x-ray absorption, atomic number effect and secondary fluorescence using the computer program written by Mason, Frost and Reed. Analyses for silicon using the microprobe are complicated by the overlap of the third order neodymium Lα peak, for phosphorus by the third order cerium Lγ peak, for chromium by the lanthanum Lβ_2 and third order thorium Lβ peaks, and for gadolinium by the cerium $L\gamma$ peak. The contribution of the neodymium $L\alpha$ peak was calculated and subtracted from the silicon $K\alpha$ peak before computing. Likewise, allowance was made for the cerium $L\gamma$ peak under the phosphorus $K\alpha$ peak and for the lanthanum $L\beta_2$ and third order thorium $L\beta$ peaks under the chromium $K\alpha$ peak. Gadolinium $L\alpha$ and cerium $L\gamma$ peaks were distinguished using pulse height analysis. The data in Table II are the averages of three analyses. The numbers of cations on the basis of 16 oxygen ions have been calculated. The specific gravity calculated from the x-ray data is 5·496, compared with 5·247 as determined by hydrostatic weighing; calculated densities are commonly greater than the observed values, but a fine crack in the stone could account for some of the discrepancy.

TABLE II

ELECTRON MICROPROBE ANALYSIS OF GEM MONAZITE FROM SRI LANKA

SiO_2	0·4
ThO_2	11·6
U_3O_8	0·4
Ce_2O_3	28·7
La_2O_3	21·7
Nd_2O_3	6·0
Pr_6O_{11}	1·9
Sm_2O_3	0·6
Gd_2O_3	0·09
Dy_2O_3	0·2
Ho_2O_3	0·05
Er_2O_3	nt fd.
Y_2O_3	nt fd.
Al_2O_3	0·02
Fe_2O_3	nt fd.
Cr_2O_3	nt fd.
V_2O_3	nt fd.
CaO	1·0
MgO	nt fd.
Pb_3O_4	0·1
P_2O_5	27·4
	100·16

Number of ions on the basis of 16 (0).

P	3·783	3·849
Si	0·066	
Al	0·004	4·157
Th	0·430	
U	0·014	
Ca	0·174	
Ce	1·714	
La	1·305	
Nd	0·350	
Pr	0·110	
Sm	0·033	
Gd	0·005	
Dy	0·011	
Ho	0·003	
Pb	0·004	

nt fd. = not found.

The spectacular absorption spectrum of the gem monazite was the cause of its discovery in gem gravels by Miss Sri Nissanka in Sri Lanka, and when seen by Mr R. K. Mitchell it immediately reminded him of the very strong spectrum displayed by a tiny parisite crystal inclusion in a Colombian emerald discovered by Sir James Walton in 1950 (Walton, 1950). Parisite is a fluocarbonate of calcium and the cerium group of rare earths, $(Ce, La)_2 Ca (CO_3)_3 F_2$, usually with some didymium (neodymium and praseodymium). There are similarities between the monazite, parisite and some gem apatite spectra and the spectrum of didymium glass (MI 33205) in the IGS collections. The latter was qualitatively analysed by Dr M. T. Styles and contains cerium and neodymium with silicon, calcium and potassium as major constituents; lanthanum, samarium and sodium as minor constituents with traces of magnesium, aluminium, scandium, together with praseodymium, europium and terbium in some of the fragments analysed on an energy dispersive x-ray analyser attached to a scanning electron microscope. As will be seen from Table II this qualitative analysis bears a considerable resemblance in its constituent elements to the analysis of the gem monazite. However, the lines in the glass absorption spectrum are relatively fuzzy compared with the sharp lines displayed by the monazite.

The monazite and the didymium glass (the Institute has two cut stones) are reddish-orange and orange-brown respectively as seen in daylight; both show a bright green by mercury vapour lamp or fluorescent tubes and both take on a pinkish-brown appearance in tungsten lighting. These remarkable colour changes would appear to be related to the strong absorption bands in the yellow part of the spectrum, with the residual light energy adding up to different colours (as seen by the eye) when viewed under the various light sources. Incidentally the green colour of monazite by mercury vapour lamps has been utilized in the petrological study of monazite sands (Murata and Bastron, 1956).

Comparison of the three absorption spectra shown in Figure 1 shows the expected broad correspondence of the lines in the yellow and green parts of the spectrum caused by the rare earths, but there appear to be additional lines in the monazite spectrum in the orange and red; it seems possible that these lines may be caused by the uranium shown in the analysis and akin to the lines produced in the absorption spectrum of zircon by small amounts of uranium.

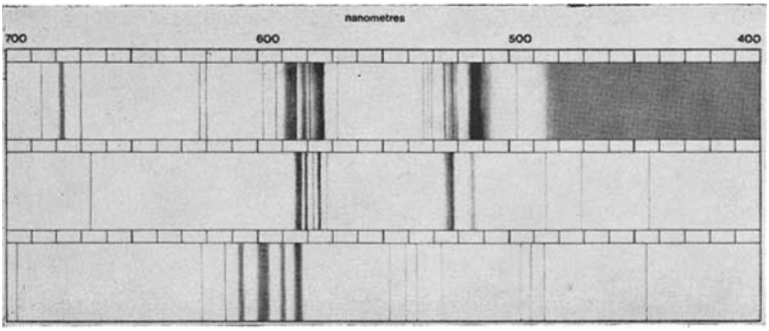

FIG. 1. Absorption spectra as seen through grating spectroscope:
Monazite gem material, Sri Lanka. (above).
Parisite, cf. material from Mineral County, Montana, U.S.A. (IGS registration number MI 35288).
Didymium glass. (IGS registration number MI 33205). (below).

The specimen has now been returned to Miss Sri Nissanka in Sri Lanka. It was earlier suggested that it should be fashioned into a gem stone since it appears to be the first cuttable specimen to be found. However, Miss Sri Nissanka preferred that it should remain as a rough stone. So yet another species is added to the long list of interesting gem minerals found in Sri Lanka.

It is a pleasure to acknowledge the ready help and assistance given by colleagues in the Petrographical Department of the Institute, Dr R. J. Davis and Mr J. G. Francis of the British Museum (Natural History) and Messrs R. K. Mitchell, H. J. Whitehead and others during the course of this work; and, of course, to thank Miss G. Sri Nissanka for allowing us to work upon this unusual specimen.

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UVITE, A NEWLY CLASSIFIED GEM TOURMALINE

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TOURMALINE is a group name applied to several species. These are schorl, ferrous iron tourmaline; dravite, magnesium tourmaline; elbaite, lithium aluminium tourmaline and buergerite, ferric iron tourmaline.

The gemmologist is primarily concerned with elbaite, the lithium aluminium tourmaline which occurs in so many pleasing colours. Of lesser gemmological significance is dravite.

The occurrence of gemmy brown tourmaline in the Uva Region of Ceylon (Sri Lanka) and several fine brown gem tourmalines from Brazil prompted the author's interest in examining the heretofore unknown nature of these gem tourmalines, to determine their correct species designation.

Five cut gems and 28 rounded pebbles were examined in the first run of analyses. Some non-gemmy pebbles were included but the majority were of gem potential. It was immediately apparent that the brown gem tourmalines were magnesium tourmalines and would be termed dravite by the conventional classification system, using the four known species cited above.

However, it was also apparent that these gemmy magnesium tourmalines were different from most dravite, for they had a very high calcium content, and, in some cases, almost no sodium!

Dravite has the chemical formula $NaMg_3Al_6B_3Si_6O_{27}(OH)_4$. The position of magnesium (Mg) in the formula is sometimes filled by other cations. For example, if the Mg position in the above formula were filled by Fe^{+2}, it would be schorl; if it were filled by (Li,Al) it would be elbaite, etc.

What made the composition of these gemmy magnesium tourmalines so unique is that there was a substitution of calcium for sodium in the first site of the formula. A theoretical molecule had been proposed by Kunitz (1929) to explain the then-known calcium-rich magnesium tourmalines and he named this hypothetical molecule uvite, but it was never accepted as a valid mineral species name.

A detailed study of the calcium-sodium ratio in magnesium tourmalines was in order and has been published (Dunn *et al*, 1977).

The species uvite was proposed to the International Mineralogical Association Commission on New Minerals and New Mineral Names, and it was the judgement of the Chairman of the Commission that uvite was already established in the literature and thus out of the Commission's jurisdiction. This paper will treat uvite in brief general terms, with the emphasis on gem material.

The chemical formula of uvite is $CaMg_3[Mg,Al_5]B_3Si_6O_{27}(OH)_4$. This is a departure from the general formula of the tourmaline group $(X)_1(Y)_3Al_6B_3Si_6O_{27}(OH)_4$ in that the substitution of Ca^{2+} for Na^{1+} in the (X) position of the formula requires a compensation elsewhere in the formula to ensure electrostatic charge balance. This is accomplished by the substitution of one Mg^{+2} for one Al^{+3} to generate an electrically neutral structure.

Uvite is not distinguishable from dravite by standard gemmological techniques. Although calcium (atomic weight 40·08) is heavier than sodium (atomic weight 22·99), as calcium increases there is a concomitant increase in magnesium (atomic weight 24·31) substituting for aluminium (atomic weight 26·98) which serves to decrease the total atomic weight of uvite as calcium is increasing it. Hence, the densities of these two species are very similar. In addition, the presence of iron in these specimens also increases the density. The density of the examined uvites and dravites varied from 2·97 to 3·06.

The refractive indices are likewise of no use in distinguishing between uvite and dravite. The refractive indices of tourmaline are known to depend on the content of Fe^{+2}, Fe^{+3}, and Mn^{+2}, and excellent graphs have been prepared to demonstrate this relationship (Deer *et al*, 1962). Eight non-gemmy samples with extremely low iron content (less than 0·25% FeO) were examined. Their refractive indices were indistinguishable from dravite, and neither the indices nor the birefringence increased or decreased with increasing calcium content. Pleochroism is distinct in uvite, as in all tourmaline, with absorption $\omega > \varepsilon$. Optical data for the purest (most calcium-rich) gem uvites from each known locality are presented as Table I.

The Ceylon gem material is uniformly slightly turbid and lacks the brilliance of Burmese and Brazilian uvites.

Both uvites and dravites fluoresce a weak mustard-yellow under short-wave ultraviolet. There is no response to long-wave ultraviolet and no phosphorescence. The dispersion, always low for

TABLE I

OPTICAL DATA FOR UVITES

NMNH#	LOCALITY	ε	ω	BIREFRINGENCE	PLEOCHROIC COLOURS	
					ε	ω
C5212	Ceylon	1·619	1·638	0·019	light brown	dark brown
G2154	Brazil	1·619	1·638	0·019	light yellowish brown	medium brown
R18119	Burma	1·621	1·642	0·021	light yellowish brown	medium brown
G1107-1	Macomb, New York	1·612	1·632	0·020	light brown	medium brown

All determinations with Rayner Dialdex refractometer in sodium light (±0·003)

TABLE II

PARTIAL MICROPROBE ANALYSES OF UVITES AND DRAVITES FROM CEYLON

	NMNH #	SiO_2	Al_2O_3	FeO	MgO	CaO	Na_2O	TiO_2	Total	% Uvite	Locality
Uvite	134437	36·01	26·36	0·49	14·90	5·09	0·35	0·55	83·75	91	Ceylon
Uvite	134438	36·27	25·73	0·47	14·96	4·69	0·52	1·03	84·28	84	Ceylon
Uvite	B20712	35·57	28·18	1·01	13·16	4·40	0·62	0·69	83·63	79	Ceylon
Uvite	B20701	35·91	26·29	0·81	14·21	4·33	0·72	1·04	83·31	77	Ceylon
Uvite	B20709	35·64	27·82	1·31	13·22	4·23	0·70	0·92	83·84	75	Ceylon
Uvite	B14814	36·22	28·46	0·44	13·81	4·01	0·85	0·13	83·92	72	Ceylon
Uvite	B20708	35·28	28·50	1·76	12·27	3·98	0·82	0·50	83·11	71	Ceylon
Uvite	B20716	35·87	26·59	3·50	11·91	3·91	0·78	0·57	83·13	70	Ceylon
Uvite	B20718	36·54	26·34	0·47	14·26	3·87	0·90	1·57	83·95	69	Ceylon
Uvite	B20713	35·70	29·05	1·25	12·38	3·82	0·81	0·84	83·85	68	Ceylon
Uvite	B20717	36·00	28·17	1·27	12·91	3·77	0·90	0·42	83·44	67	Ceylon
Uvite	B20704	36·16	29·01	0·61	13·37	3·49	0·95	0·42	84·01	62	Ceylon
Uvite	B20702	34·86	29·33	3·99	10·21	3·33	0·89	0·61	83·22	59	Ceylon
Uvite	134436	35·28	28·42	1·27	12·52	3·25	1·15	1·16	83·05	58	Ceylon
Uvite	B20710	36·22	29·75	0·48	12·43	3·24	1·14	0·65	83·91	58	Ceylon
Uvite	B20705	35·33	30·96	0·23	12·51	3·16	1·27	0·26	83·72	56	Ceylon
Uvite	B20703	36·17	28·87	1·65	12·23	2·81	1·26	0·66	83·65	50	Ceylon
Uvite	B20698	36·18	29·67	0·39	12·13	2·63	1·21	0·92	83·13	47	Ratnapura, Ceylon
Uvite	B20700	35·95	28·74	0·77	12·43	2·58	1·38	0·88	82·73	46	Ceylon
Dravite	B14657	35·63	28·10	1·21	11·93	2·49	1·40	1·29	82·05	44	Ratnapura, Ceylon
Dravite	B20707	36·35	28·68	0·82	12·06	2·32	1·51	1·10	82·84	41	Ceylon
Dravite	B20699	35·06	26·65	5·50	9·52	2·25	1·46	2·05	82·49	40	Ratnapura, Ceylon
Dravite	B20706	35·90	30·10	0·33	11·71	2·25	1·36	0·35	82·00	40	Ceylon
Dravite	B20697	36·07	27·65	0·65	12·39	2·17	1·49	1·77	82·19	39	Ratnapura, Ceylon

Accuracy of data: ± 2% relative.

All samples have less than 0·05% K_2O, 0·03% Cr_2O_3.

TABLE III

ANALYSES OF UVITE FROM MOGOK, BURMA

NMNH#	SiO_2	Al_2O_3	FeO	MgO	CaO	Na_2O	TiO_2	Total	% Uvite
R18119	36·03	28·60	0·21	14·21	4·16	0·92	0·71	84·84	74
R18121	35·09	28·36	0·21	13·64	3·97	1·11	0·74	83·12	71
R18120	35·27	28·91	0·20	13·53	3·97	0 98	0 82	83·68	71
R18123	36·19	28·85	0·24	13·74	3·87	1·21	0·70	84·80	69
R18125	36·27	29·59	0·22	13·76	3·86	1·15	0·73	85·58	69
R18126	35·45	28·86	0·25	13·97	3·77	1·24	0·75	83·29	67
R18122	36·13	29·09	0·24	13·74	3·75	1·21	0·71	84·87	67
R18127	35·83	29·54	0·30	13·52	3·73	1·20	0·73	84·85	66
R18124	35·22	28·71	0·78	12·75	3·16	1·14	0·55	82·31	56

Accuracy of data: ±2% relative.

All samples have less than 0·05% K_2O, 0·03% Cr_2O_3.

magnesium tourmalines, varied from 0·019 to 0·018 (B-G) for both the uvites and the dravites examined.

Thirty-three specimens of brown tourmaline were analysed with the electron microprobe utilizing an operating voltage of 15kV and a sample current of 0·15 μA. Standards used were NMNH microprobe standards of high reliability. The analyses are partial, since the microprobe cannot detect boron, hydrogen, oxygen, and lithium.

Analyses of gem uvites and dravites from Ceylon are presented as Table II, in order of decreasing calcium content. Analyses of gem uvites from Mogok, Burma, are presented as Table III, in the same order.

The most sodium-deficient uvite found, among 170 analyses, is a magnificent 17·80 carat rectangular Brazilian gem on exhibit in the Hall of Gems at the Smithsonian Institution (Gem #2154). It was the extremely high calcium content of this gem that initiated the study of these uvites.

Next in relative purity was a Ceylon uvite of 20·05 carats (#C5212). This gem had reposed in our vaults for some time because it had been cut in two pieces many years ago. The bottom quarter of the gem had been sliced off roughly parallel to the table.

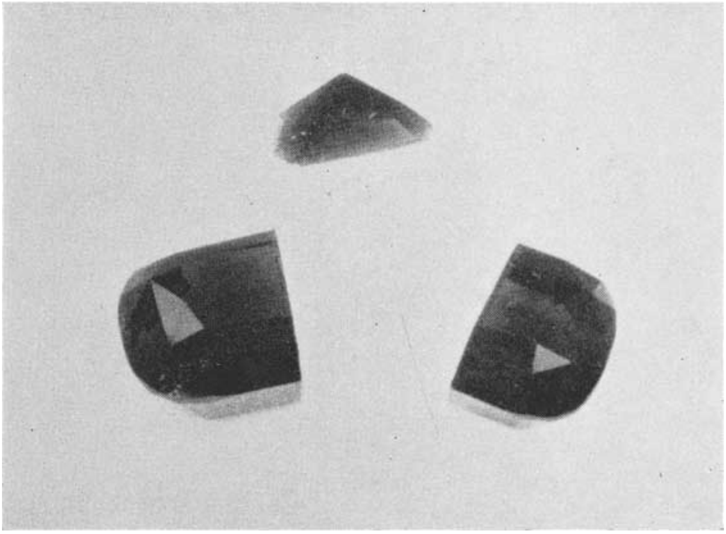

FIG. 1. Uvite from Ceylon: this gem, already marred, was sectioned for gemmological research. (NMNH C5212)

Inasmuch as there was no "type" material for uvite (type material is the very specimen used in the original mineralogical description of the species), one of the samples, this Ceylon gem, already marred by being sawn in two, was chosen to be the neotype material and is so designated. Since a wet-chemical analysis of this material would be necessary for the complete description of a new end-member, the gem was further subdivided (Fig. 1) and half of the larger fragment was subjected to wet-chemical analysis by Mr Joseph Nelen and Miss Julie Norberg, of the Chemical Laboratory, Department of Mineral Sciences, at the Smithsonian Institution. The results of this analysis are presented as Table IV.

TABLE IV

Analysis of Gem Uvite, NMNH #C5212

SiO_2	35·96%
Al_2O_3	26·80%
FeO	0·41%
MgO	15·20%
CaO	5·50%
Na_2O	0·13%
K_2O	0·00%
H_2O^+	2·70%
H_2O^-	0·04%
TiO_2	0·62%
Li_2O	0·00%
B_2O_3	11·49%
F	1·49%
TOTAL	100·34%
less O = F	0·63%
	99·71%

analysts: J. Nelen, J. Norberg.

It is obvious, from Table II, that brown gem tourmalines from Ceylon have varying compositions. Nineteen of the 24 samples from this locality have Ca > Na and are thus uvites. The statement Ca > Na refers to the number of atoms. Since the analyses in

Table II are given in terms of oxides, the calcium: sodium ratio is not immediately apparent.

Nine gemmy brown tourmalines from Mogok, Burma, were examined, and all are uvite. The compositions of these Burmese uvites, separated from boxes of gem gravel by Dr Brian Mason, are quite uniform, and allow the assumption that most, if not all, brown tourmalines from Mogok, Burma, are uvite.

Four of the 24 Ceylon samples were labelled as being from Ratnapura. These four gems have a TiO_2 content in excess of 0·92% and are all dravite, which might suggest a compositional identifying factor for Ratnapura stones. Since most Ceylon brown tourmalines are reported to be from the Uva Region in south-eastern Ceylon, and Ratnapura is in the south-western section, these gems may indeed be from separate localities. But given the status of Ratnapura as a gem-trading centre, such an assumption is very weak indeed.

No diagnostic absorption spectra were found for either gem uvite or dravite from Ceylon or Burma. Inclusions were not noted in the examined Ceylon stones, but many non-gemmy samples from other localities, not noted here, were seen to have rutile inclusions. Inclusions in the Burmese uvites will be the subject of a subsequent investigation.

Although it is less than satisfying to present a new gem species to the gemmological community without also presenting methods of detection and distinguishing characteristics, in this case there do not appear to be any of the usual gemmological techniques which can be employed.

Uvite is a legitimate species name and may be safely applied to Burmese brown tourmalines. It might be noted that only five of the 33 analysed brown tourmalines were dravite, and that none of these five had any gem potential. Hence, although it may be only circumstantial evidence, all gem-grade facetable brown tourmalines examined in this study are uvite.

ACKNOWLEDGEMENTS

The author is indebted to Mr Joseph A. Nelen and Miss Julie Norberg, of the Chemical Laboratory, Department of Mineral Sciences, Smithsonian Institution, for the wet-chemical analysis of sample C5212. Thanks are also due to Mr Mike Laskin for the preparation of the final manuscript.

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ANOMALOUS OPTICAL CHARACTERISTICS SEEN IN CALCIC PLAGIOCLASE FELDSPARS

By A. J. CLEWLOW, B.Sc., F.G.S., F.G.A.

INTRODUCTION

Labradorite is an intermediate member of the isomorphous plagioclase feldspar series with the anorthite content falling within the range An_{50} to An_{70}. It often shows a characteristic play of colour sometimes referred to as labradorescence or schiller. However, in recent years a gem-quality transparent yellow variety of this mineral has been obtained from several localities. The author recently had occasion to identify a faceted stone of this type at the London Chamber of Commerce Gem Testing Laboratory.

Calcium-rich labradorite has a specific gravity and refractive indices which also coincide with the range for yellow beryl. Therefore a careful study of the refractive indices was made to determine whether the stone was uniaxial (as would be the case with beryl) or biaxial (as in plagioclase feldspar). The results obtained showed the stone to be biaxial negative. All references consulted referred to labradorite as optically positive, although the optic sign of plagioclase feldspar changes at several points with increasing anorthite content (see Fig. 1). It was therefore decided to investigate the cause of this apparent anomaly, and ten specimens reputed to be

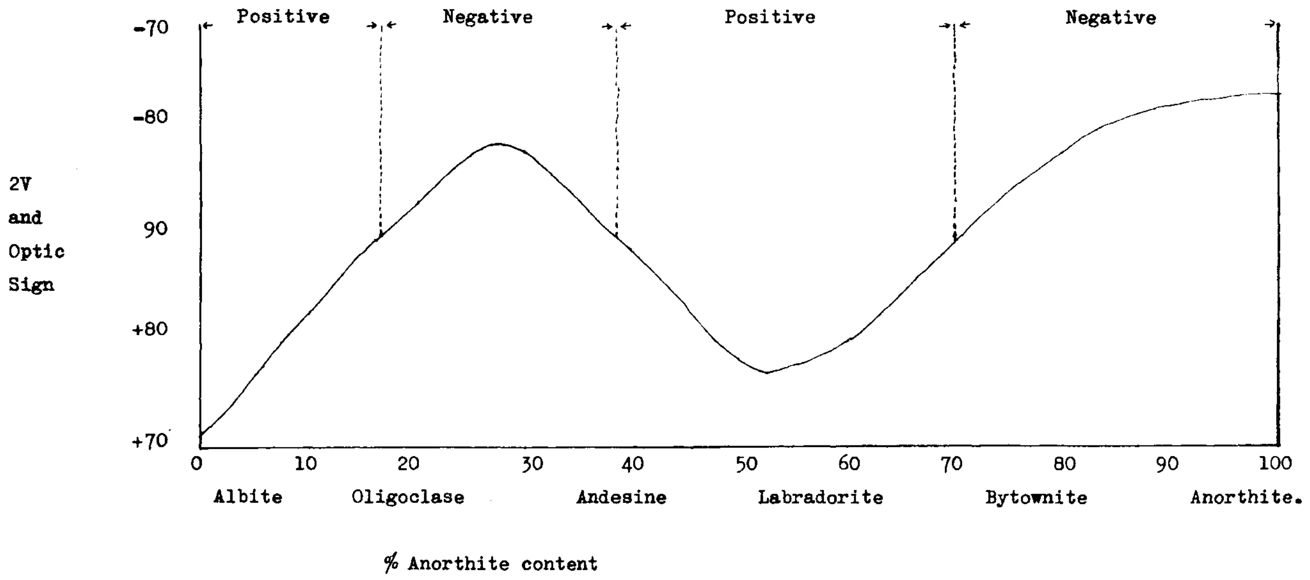

FIG. 1. The Plagioclase Feldspar series with a plot of percentage Anorthite content against 2V and Optic Sign. (After Dana).

Table I

Specimen Number	Presumed Origin	Weight and Cut	α	β	γ	Optic Sign	Specific Gravity
1	Canada	1·1679gm oval	1·563	1·569	1·572	Neg.	2·70
2	Hogarth Range N.S.W./Queensland border	0·9192gm rectangular	1·554	1·559	1·563	Neg.	2·68
3	Unknown	0·628gm round	1·563	1·568 –1·570	1·572	Neg.	2·71
4	S. Queensland	0·484gm round	1·559	1·562	1·568	Pos.	2·70
5	Millard Co. Utah, U.S.A.	0·544gm trapeze-cut	1·562	1·567 –1·568	1·570	Neg.	2·71
6	Malagasy Rep.	3·610gm fancy-cut	1·561	1·565 –1·566	1·570	Pos. or Neg.	2·71
7	Millard Co. Utah, U.S.A.	0·338gm rough	1·561	1·566	1·570	Neg.	2·70
8	Malagasy Rep.	0·872gm rough (with labradorescence)	1·555	1·559	1·562 +	Pos. or Neg.	2·69
9	Millard Co. Utah, U.S.A.	0·272gm rough	1·561 +	1·567 + –1·569	1·571 +	Neg.	2·72
10	Millard Co. Utah, U.S.A.	0·572gm rough	1·561	1·567 –1·568	1·570	Neg.	—

labradorite were obtained, originating from localities in North America, Australia, and the Malagasy Republic. Results obtained are outlined in Table I.

REFRACTIVE INDEX DETERMINATIONS

Measurements of the refractive indices of the stones were made using a Rayner refractometer (Spinel model). On faceted stones, readings were taken on the table facet and one other, and on the rough crystalline samples two optically flat surfaces were polished. This enabled a fairly accurate calculation of β to be obtained, using the method described by Anderson. Readings for α and γ were straightforward to obtain, taking the lowest point of the lower reading, and the highest point of the higher reading respectively. Then $\beta 1_1$ (highest point of lower reading) and $\beta 2_1$ (lowest point of higher reading) were obtained. Readings on another face gave $\beta 1_2$ and $\beta 2_2$, and thus in most cases β could be calculated either within very narrow limits or precisely. Only on two samples was the position of β fixed within limits such that the stone could be either optically positive or negative. Results obtained from the ten samples showed seven to be optically negative, one stone to be optically positive and two indeterminate.

BEHAVIOUR IN CROSS-POLARIZED LIGHT

Of the six faceted stones examined closely between crossed polarizers, five of the stones clearly showed curved bands of light passing through with a spectral play of colour (see Fig. 2). The only stone which did not show such an effect was specimen No. 4. In addition, twin planes were observed in four of the six faceted specimens. However, these tended to take the form of isolated planes crossing the stone, rather than the strong lamellar twinning under the Albite Law, which might have seriously affected the refractive index determinations.

The four specimens of rough material were also examined between crossed polarizers and all showed good extinction, although their uneven surfaces precluded the observation of strain bands or twinning very clearly (specimen No. 10 however did clearly show a twin plane running through the stone).

SPECIFIC GRAVITY DETERMINATIONS

The specific gravity of nine of the ten specimens was determined. Specimen number 10 had some other material adhering to the

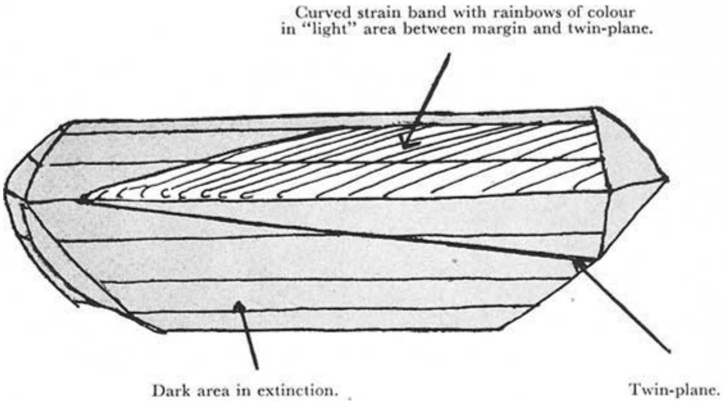

Fig. 2. Sketch illustrating appearance of specimen No. 6, in cross-polarized light.

crystal and therefore no determination of the feldspar alone was possible. The method used was by hydrostatic weighing in air and 1,2-Dibromoethane. Results obtained (to 2 decimal places) showed all specimens to fall into the range from 2·68 to 2·72, the specific gravity generally rising in proportion with the refractive index of α. However, when the values for specific gravity and α were plotted against one another (see Fig. 3), there did appear to be more scattering than expected and a simple line linking the two with increasing Anorthite content could not be drawn. Similar plots of specific gravity against values for the refractive indices of β and γ gave the same result.

Conclusion

It has been known for many years that zoning is common in plagioclase feldspar. A eutectic melt containing, for example, plagioclase of the composition An_{50} would first produce high-calcium plagioclase crystals of approximately An_{82}. Crystallization with further cooling causes both liquid and crystals to change composition until at 1285°C the crystals reach a composition of An_{50}

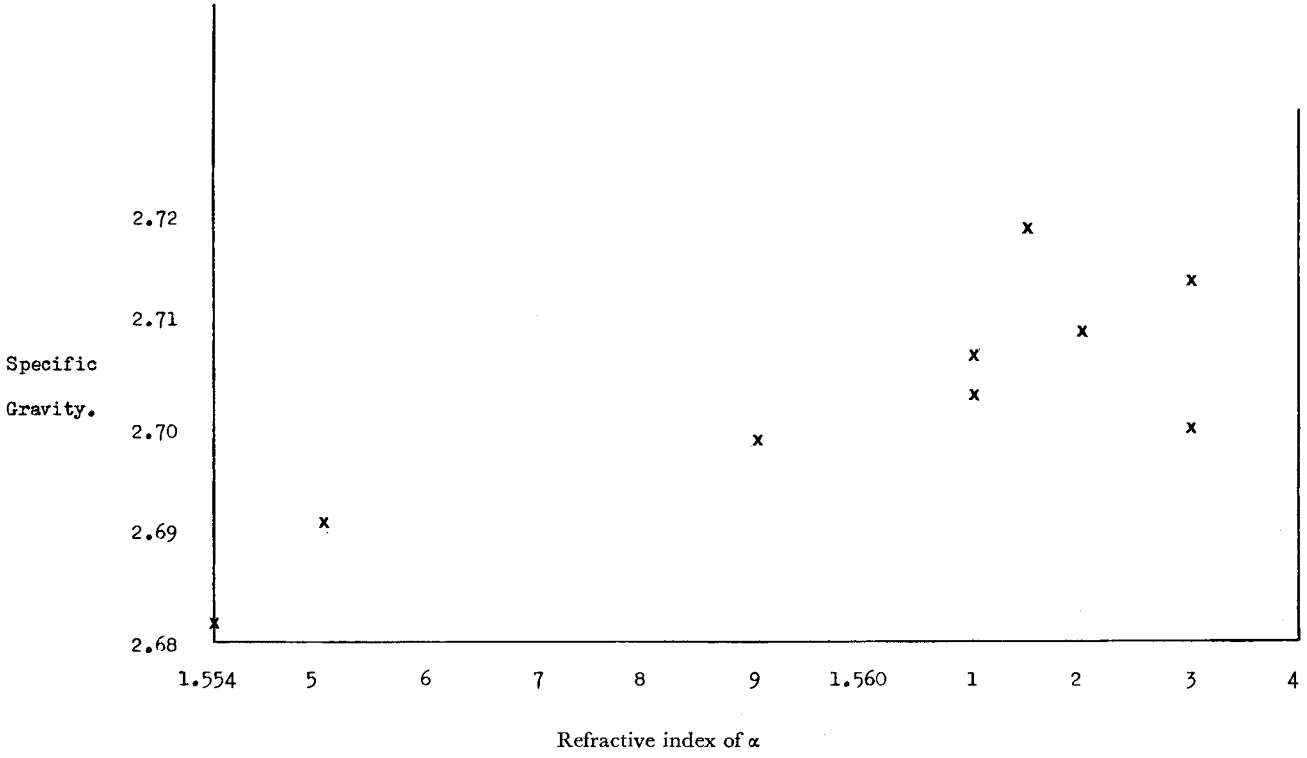

FIG. 3. Plot of the determined Specific Gravities of samples against the observed refractive index of α.

as the last of the liquid is used up. If the crystals have formed with time to react with the liquid and change their composition accordingly, they will be homogeneous. If there has been insufficient time to react, the composition of the crystals will be zoned, having a calcium-rich core with progressively more sodium-rich outer layers.

Zoning of this type in plagioclase will produce differing refractive indices and densities with lowering of anorthite content in each succeeding layer (the refractive indices and density becoming progressively lower). Since the refractometer measures the refractive index of the surface in contact with it, all measurements taken will be of the outer, less calcic, zones of the plagioclase crystals. However, the optic sign of the crystal will be a function of the optical character of the whole crystal. Furthermore, the effect of the zoning on the optics will be correspondingly much greater than on the density, which is dependent upon the relative volume taken up by each zone. The scattering produced when the specific gravities of the specimens were plotted against α readings is thought to be due to the differential effect on refractive indices and density caused by zoning in plagioclase feldspars.

Since the boundary between the labradorite and bytownite at An_{70} composition is also a boundary between optically positive (labradorite) and optically negative (bytownite) it seems likely that zoning in such stones would be more liable to result in a negative optic sign than positive, especially in crystals whose surface compositions give refractive indices in the high-labradorite range (An_{65+}), and whose inner zones would all be in the bytownite range or higher.

The presence of strain in nearly all of the faceted stones when viewed between crossed polarizers is indicative of zoning within these specimens. It should be noted that the only faceted stone which did not display this internal strain (specimen No. 4) was the only stone which was found to be optically positive. These facts indicate that specimen No. 4 was not zoned and thus composed wholly of labradorite, whereas the remainder were zoned and contained an appreciable proportion of plagioclase feldspar with a more calcic composition than the An maximum of labradorite.

It should be possible to obtain more evidence of this critical relationship between optical characteristics and zonal composition by an electron-probe study of calcium content together with optical determinations, and it is hoped that someone with facilities to undertake this study will do so. The question which now remains is as to the nomenclature of such stones. Although they are of little importance commercially, many stones are being sold as "Labradorite Feldspar" which from this study would indicate that the description may be an over-simplification, especially where the average percentage composition is likely to fall well into the bytownite range. The author suggests that the term "Labradorite/Bytownite Feldspar" or "Calcic Plagioclase Feldspar" would be more appropriate.

ACKNOWLEDGEMENTS

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NOTES ON SOME OF THE CAUSES OF COLOUR IN GEMSTONES

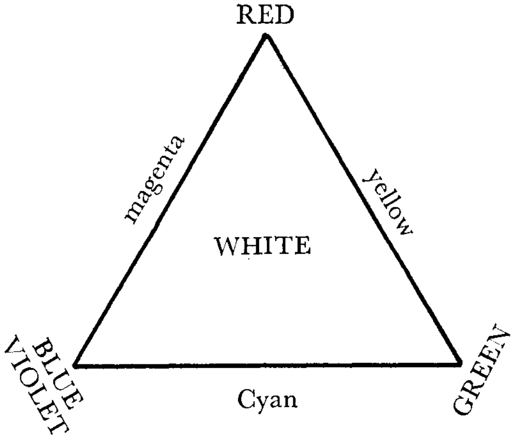
By K. W. FINDLAY, B.Sc.(Eng.), C.Eng., F.I.Chem.E., F.I.Mech.E., F.G.A.

THE word "colour" signifies a different concept for different disciplines: to the artist it means pigment, to the psychologist it means perception, to the physiologist it means a response by the optic cones and rods: it means an electromagnetic radiation to the physicist and splendour to the gemmologist.

Of all the physical constants, the velocity of light in free space is the most accurately known, determined by Michelson and Morley in 1933 to be $2{\cdot}997925 \times 10^8$ metres per second, a figure which is the product of the frequency times the wavelength. Visible light is a narrow band in the continuous series of electromagnetic radiation ranging from over 10 megametres (10^7 m) in wavelength and 30 Hz in frequency to less than 1 femtometre (10^{-15} m) in wavelength and greater than 3×10^{23} Hz in frequency. The frequency range of visible light is from 4×10^{14} Hz at the red end to $7{\cdot}5 \times 10^{14}$ Hz at the violet end. When light passes from an optically rare medium, such as air, to an optically dense medium, such as glass, its wavelength is reduced, the ratio of reduction being the refractive index of the dense medium and because the frequency remains the same the velocity is reduced by the same ratio. Our eyes perceive the frequency or oscillations of light and not the wavelength, as has been customarily regarded.

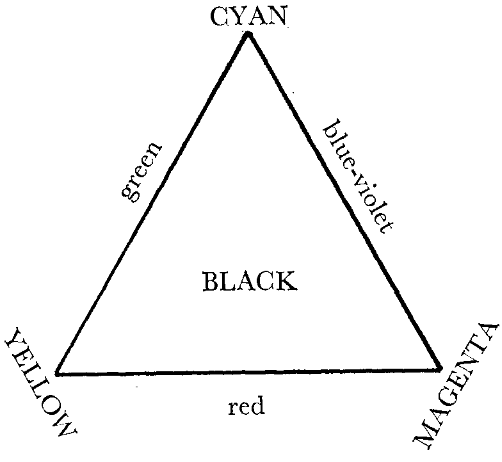
In air our flesh appears pinkish, an optical phenomenon produced by a combination of colours resulting in a blend of wavelengths about 600 nanometres (600×10^{-9} m) and frequency about 5×10^{14} Hz. When our eyes are immersed in water the light reaching them is slowed down by a factor of 1·3 so that while the frequency of the light from our flesh remains the same at 5×10^{14} Hz, the wavelength would be about 460 nanometres. Thus, if we perceived by wavelength, our flesh would appear blue: this not being so confirms that our optic nerves respond to the frequency of light and not the wavelength. It is therefore incorrect to say that we see colours of a certain wavelength or group of wavelengths unless we specify the medium in which we make the observation, but it would be scientific to say we perceive colours of certain frequencies regardless of the medium.

Each frequency of light produces a different colour sensation and although monochromatic light is never truly attained in practice it is virtually produced by several light sources. Our eyes cannot distinguish whether the light perceived is monochromatic or consists of certain frequency combinations that produce colour sensations indistinguishable from monochromatic light. When our eyes are stimulated by the frequencies of all the colours simultaneously we are conscious of white light, but this effect may be produced by specific combinations of only two or three bands of frequencies. Red, green and blue-violet are the three colours that combine to form white light and are therefore called the primary colours and when combined in suitable proportions are capable of producing light of any colour.



The diagram is a simplified concept of colour by addition, the corners of the triangle representing the three primary colours and the sides joining each pair of corners representing the colour produced by that pair of primary colours, for example red and green produce yellow. The sides also represent the complementary colour of the primary shown at the respectively opposite corner, for example yellow is the complementary of blue.

The three complementary colours yellow, cyan and magenta form an efficient set for colour by absorption.



The corners of the triangle represent the three complementary colours and the sides joining them show the colour produced by the absorption of one respective complementary by the other, for example cyan absorbed by magenta produces blue-violet which on absorption by yellow leaves no visible light.

In general, when white light falls upon a gemstone, the result would be one or other of the following four principal effects or combinations thereof:

1. The light is completely reflected, that is to say there is no transmission and no absorption of any of the frequencies—the gem is then white and opaque, e.g. carrara marble.
2. The light is completely transmitted, there is no reflection and no absorption of any of the frequencies—the gem is colourless and transparent, e.g. diamond.
3. Some frequencies of light are absorbed at the surface and the remainder reflected—the gem is coloured and opaque, e.g. turquoise.
4. Some frequencies of light are absorbed in transmission—the gem is coloured and transparent, e.g. ruby.

Diaphaneity or transparency is a feature of a gemstone dependent on the quantity of light transmitted and ranges from transparent to opaque. A gem is described as:

(*a*) Transparent, when the outline of an object seen through the gem is perfectly distinct.

(*b*) Semi-transparent, when considerable light penetrates the gem but an object seen through it would appear blurred.

(*c*) Translucent, when some light passes through but no object can be seen.

(*d*) Semi-translucent, when there is a slight transmission of light through the thin edges of the gem.

(*e*) Opaque, when no light passes through the gem.

These descriptions refer to ordinary thicknesses, because in very thin sections practically all substances transmit some light; for example, gold-leaf appears translucent green.

Apart from the play-of-colour in opals and iridescence in some feldspars caused by the interference of light, the majority of gemstones would be colourless, were it not for the presence in the crystal lattice of ions which are non-essential for the chemical and structural identity of the mineral. Those which owe their colour to the presence of such impurities are known as allochromatic gems to distinguish them from a smaller group which are self-coloured (that is, in which the colour is due to an element forming part of the molecular structure); such gems are referred to as being idiochromatic. There are only four elements of the ninety-two that give rise to colour in the idiochromatic gems. They are:

Chromium — green e.g. uvarovite
Copper — green e.g. dioptase
Copper — blue e.g. azurite
Iron — green e.g. peridot
Iron — red e.g. almandine
Manganese — pink e.g. rhodochrosite

The elements causing colour in the allochromatic gems as impurities are:

Chromium — red e.g. ruby
Chromium — green e.g. emerald
Nickel — green e.g. chrysoprase
Titanium — blue e.g. sapphire
Vanadium — is known to influence the green colour in certain emeralds and in transparent green grossular garnet.

A further element, cobalt, does not appear in natural gemstones, but is a well-known blue colouring agent in synthetic spinel and in glass.

These eight elements, titanium atomic number 22, vanadium 23, chromium 24, manganese 25, iron 26, cobalt 27, nickel 28 and copper 29 are part of a group called the transition elements. All are metals and have two or more unpaired electrons in their 3d orbitals with the exception of copper which has one unpaired electron in its 4s orbital. The five 3d orbitals are split into two high energy levels and three low energy levels and it is this energy difference ΔE that an electron absorbs on promotion from a lower level to a higher level. In the case of the transition metal compounds ΔE corresponds to a quantum in or near the visible region of the spectrum. The Crystal Field Theory offers an explanation of the source and interactions of the electrostatic fields originating from the negatively charged anions and dipolar groups or ligands situated on the lattice surrounding the transition metal ions. ΔE is mainly dependent on the symmetry and intensity of the field and thus explains why the energy differs for the different cations of the same transition metal, as examples the metal oxides Ti_2O_3 is purple; TiO is bronze; V_2O_5 is yellow; VO_2 is blue; Cr_2O_3 is emerald green; CrO_3 is red. This means that certain specific frequencies of light are absorbed by the energy change of electron promotion. The transmitted or reflected light that characterizes a gemstone is the complementary colour of that absorbed by the atom of the particular transition element. By noting the nature and position of the absorption bands when reflected or transmitted light is observed through a spectroscope, one can, in most cases with confidence, name the element causing the absorption. A more important fact for the gemmologist is that the disposition and nature of the absorption bands caused by a given element vary considerably according to the crystal lattice of the host mineral. It is the characteristic pattern of absorption bands shown by many gemstones which enables the gemmologist to identify the stones by means of the spectroscope.

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PORTABLE POLARISCOPE

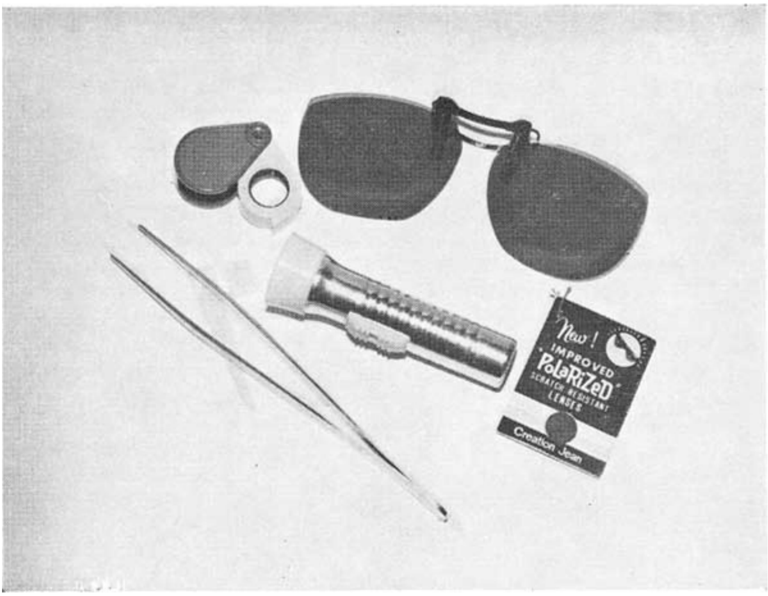
By HAMILTON STITT, F.G.A.

THE identification of a cut stone, or piece of rough, in a well equipped laboratory is usually a matter of a few minutes routine inspection. However, we have all been confronted with the necessity of an educated guess, when examining a stone in some situation with a hand lens our only resource. The polariscope is a valuable aid in these circumstances. With it, we can differentiate between amorphous or isometric and doubly refractive materials, detect strain in glass, tabby extinction in synthetic spinel, indicate cryptocrystalline materials, find the optic axis in uniaxial materials, with a 10 × hand lens develop the optic figure of doubly refractive stones, and, not the least important, provide illumination for examination under a hand lens.

A simple polariscope can be constructed, in a few minutes, from a pair of polaroid sun glasses (or clip-ons) and a small flashlight. Many of the polaroid glasses come with a tag, comprising a small piece of polaroid material in a paper mount. This tag can easily be trimmed to fit firmly into the front of the flashlight and simply pushed into place. If the tag is not supplied, a piece of material can be cut from a second pair of polaroid glasses. It is important to place the polaroid material (polarizer) over the plastic flashlight lens, not under it. The type of flashlight is, of course, not critical, but the model illustrated is convenient for several reasons. It has a well in the nose which holds the stone in a relatively spill-proof manner. The single cell type fits easily into the pocket. The base is flat, so that the flashlight will sit in a vertical position. It should be powered by an alkaline cell; this is considerably more expensive, but much more reliable than an ordinary AA dry cell.

In use, the polaroid glasses or clip-ons (analyser) are worn normally. The flashlight is held in the vertical position with the switch on. It is then rotated in the fingers, until the extinction position is reached. The use of the polariscope is too well explained in the standard texts to require repetition here. There is however, one slight deviation. If, when examining a doubly refractive stone, the interference colours appear, then in order to develop the optic figure, with the flashlight in the crossed polar position, rotate the stone to achieve the maximum intensity of colours: hold the 10 × lens about 18 inches from the eye, and manipulate it above the specimen until the figure is seen. It is not always possible to develop a full perfect figure. Very often a portion only can be seen. The device can also provide the illumination needed to examine the interior of a stone with a hand lens. It is most useful when used with a doubly refractive gem; the interior can be examined, brilliantly illuminated against the dark field of the crossed polarizers. But with any stone, it is a portable variable intensity source of (often much needed) illumination.

With pockets bulging only slightly, but with a great deal more confidence, I now carry stone tongs, a 10 × lens, and my portable polariscope.



Gemmological Abstracts

Alexander (A. E.). *Jade—China's contribution to the fine arts.* Gems and Gemology, 1976, XV, 5, 145-152. 10 figs.

A brief discussion of Chinese fine jade carvings both ancient and modern, with dynasties listed. The author's account of the dealer who bid for the Four Seasons screens, each 25″ × 13½″ × ½″ in size, with the intention of cutting them into ring-sized cabochons is a horror story in its own right. He also reports a necklace of beads showing intense green and colourless crystals of jadeite alternating. R.K.M.

Bank (H.). *Ein Jahrhundert Lapidärie in Idar-Oberstein.* (A century of lapidary in Idar-Oberstein). Z.Dt.Gemmol.Ges., 1976, 25, 3, 125-129. Bibl.

An interesting little article on the history of the lapidaries in Idar-Oberstein. Although it seems that stones were already worked in Idar-Oberstein during Roman times, but certainly at the latest in 1521, it is just over 100 years ago, in June 1875, that minutes of a meeting give details of a lapidary school and its board. One of the founder members was Wilhelm Purper. The school went through some difficult times: even towards the end of 1875 there was some talk of closing it down. E.S.

Bank (H.). *Citrin.* (Citrines). Z.Dt.Gemmol.Ges., 1976, 25, 4, 189-194. Bibl.

Citrine is a variety of quartz; the name derives from the French *citron* (lemon) because of its colour, which is produced by iron. It is found in its natural yellow-brown colour in varying intensities and shades; it is produced by heating brown smoky quartz, by heating amethyst to 420-560°C and by irradiating rock crystal and subsequent heating. The natural-coloured stone is found in Brazil (Goyaz, Bahia, Rio Grande do Sul), Madagascar, Russia, Spain, Scotland (Cairngorms) and France. It is often imitated by cheaper stones or glass, made into doublets or triplets and has been synthesized hydrothermally and sometimes imitated by other synthetic products, such as lithium niobate. Towards the end of the last century the heated product was called "topaz" and it is difficult to get rid of this wrong nomenclature. Heated and natural citrines can be distinguished one from another, but only with great difficulties. E.S.

Bank (H.). *Euklase von Santana do Encoberto, Minas Gerais, Brasilien.* (Euclase from Santana do Encoberto, M.G., Brazil). Aufschluss, 1974, 9, 445-448.

Euclase is found with feldspar, quartz, calcite, apatite and other minerals near the town of São Sebastião do Maranhão in Minas Gerais. The S.G. was 3·09 and the R.I. 1·649, 1·656, 1·674, with a D.R. of 0·025. M.O'D.

Bank (H.) and Gübelin (E.). *Das Smaragd-Alexandritvorkommen von Lake Manyara, Tansania.* (The emerald-alexandrite deposit near Lake Manyara in Tanzania). Z.Dt.Gemmol.Ges., 1976, 25, 3, 130-147. 22 illus. Bibl.

Deposits of emerald and alexandrite found in the metamorphic rocks of the crystalline mother-rocks in East Africa, near Lake Manyara in Tanzania, are now being worked. A plan of the mine as well as its location is shown and the geological, mineralogical and petrological aspects discussed. During the visit of the authors about 50 workers were employed: there were bulldozers, compressors, washing and sorting facilities. Some veins were very thin (1-10 cm) in places. Emeralds varied from pin-head size to 20 mm length. Some examples of 20 and 150 g weight had been found. Colour of the emeralds varied. Chrysoberyl was found as well as alexandrite. Details of crystallographic, physical, optical, R.I., colour, absorption, inclusion and luminescence characteristics of emeralds and alexandrites described as are also the parageneses. E.S.

Bank (H.) and Schmetzer (K.). *Geschliffener Bronzit aus Ceylon.* (Cut bronzite from Ceylon). Z.Dt.Gemmol.Ges., 1976, 25, 3, 153-155. Bibl.

For the crystal series enstatite-bronzite-hypersthene various R.I.s are known; the iron content for bronzite should be between 5 and 13%. A bronzite from Ceylon is tested and details given. E.S.

Bastos (F. M.). *Imperial topaz from Brazil.* Lapidary Journal, 1976, 30, 8, 1836-38.

Pink, peach and red-orange coloured topaz crystals have been found in the Ouro Preto area of the state of Minas Gerais, Brazil. Especially fine stones have been found near Saramenha where they occur with limonite and specular haematite; there is no mica nor kaolin in this deposit as there is in most others in the Ouro Preto area. Nine crystals of exceptional colour and clarity, the largest weighing 333 grams, are illustrated in colour. All stones from the area are deeply striated. M.O'D.

Brown (G.). *Horn—some aspects of interest to the gemmologist.* Australian Gemmologist, 1976, 12, 11, 331-338. 10 figs.

Rhinoceros horn, deer antlers and bovine horns are dealt with in detail together with a number of simulants and methods of distinguishing between them. Misprints and misspellings (e.g. longditudinal) mar an otherwise good paper. R.K.M.

Carlson (E. H.) and Kircher (M. A.). *A pleochroic variety of gem labradorite from the Rabbit Hills area, Lake County, Oregon.* Gems and Gemology, 1976, XV, 6, 162-167. 8 figs.

Pleochroic transparent plagioclase labradorite occurs in the area in yellow, red-orange, blue-green (and combinations of the last two), yellowish-green, orange and parti-coloured bluish-green/violet all in varying depths of colour. R.I.s average α 1·562, γ 1·570, S.G. 2·713, suggesting a two to one anorthite/albite ratio. No U.V. fluorescence or absorption spectrum seen. R.K.M.

Carbonnel (J. P.). *A visit to the Mingaora emerald mine, Swat, Pakistan.* Lapidary Journal, 1976, 30, 5, 1236-38.

The mine was discovered in 1958 and lies about 1km north-east of the town of Mingaora. It consists of a trench lying north-east at an altitude of about 3,000 feet. Emeralds occur at the contact of talc-schist and calc-schist and the presence of fuchsite is a guide to their presence. Lenses of quartz associated with calcite, hydrothermal in origin, may also contain emeralds in the form of fine needles, often cracked. Emeralds also occur in fissures cutting serpentine and talc-schists. Between 450 and 900 ct a month have been recovered from the mine during part of 1973. M.O'D.

CASSEDANNE (J. P. and J. O.). *La cordierite de Virgolândia, Bresil.* (Cordierite from Virgolandia, Brazil). Revue de Gemmologie, 1976, 48, 4-5.

Stones from this locality were at first believed to be blue sapphires and there was a rush to the area which lies north-west of Governador Valadares, about 500 km north-north-east of Rio de Janeiro. Cordierite is found in nodules ranging in size from a few centimetres to 0·4 metre; they are covered by a micaceous skin; the cordierite has a hardness of 7, S.G. of 2·57, R.I. 1·532, 1·540, 1·545, with a double refraction of 0·013. Above 400°C the cordierite became grey in colour but the blue reappeared on cooling. M.O'D.

CROWNINGSHIELD (R.). *Developments and highlights of GIA's Lab in New York.* Gems and Gemology, 1976, XV, 5, 153-157. 8 figs.

An opal-like glass showed swirls and spherules of other glass. R.I. 1·456, S.G. 2·25; probably a slag glass. A natural sapphire with a curved "veil of needles" is illustrated. Carroll Chatham is reported to have said that his flux-grown synthetic sapphires will soon be available. Jade-like green stones proved to be the Rhodesian (cryptocrystalline) quartz "mtorolite". Among gifts acknowledged was a granite, stained turquoise-blue by the process used for the howlite imitation, and a small crystal of red beryl from Utah. R.K.M.

CROWNINGSHIELD (R.). *Developments and highlights at GIA's Lab in New York.* Gems and Gemology, 1976, XV, 6, 181-189. 24 figs.

A cut bevelled cube of diamond, 8·55ct, containing a cube-shaped dark cloud of inclusions forming a cross is rightly described as intriguing. A fancy brown diamond with a roughly hexagonal white cloud, another with bright green inclusion (chrome diopside or enstatite?) are also described. Another inclusion is said to be "indescribable". A range of red spinels fine enough to look like synthetic rubies was seen and the term "soft rubies" heard for such stones. GGG diamond simulant is reported used in the classic "broken engagement" confidence trick, the word "diamond" not mentioned in the transaction. A diamond, turned yellow by deposits from well-water, was cleared by hydrochloric acid when all else failed. Small, apparently spherical, bubbles seen in a diamond. A circular spiral scratch running round the table of a brilliant-cut diamond defies explanation. A moss-like inclusion in dyed agate is thought to have been electrically induced. Slocum opal-imitations reported in pink, blue and orange body colours, some faceted; colour seems to come from thin flakes within the body of the material. Dyed green quartzite cabochons gave an absorption band centred at 6700Å, no fluorescence. Hot hydrochloric acid turned these black. A brilliant-cut diamond notched to form a six sided star shape and another, green treated, notched to give a Christmas tree shape are described and illustrated. Comments on frangibility of diamond are illustrated by several pictures; one stone shattered as cutting was being finished. Unusual cuts consisting of from one to five facets polished onto natural octahedra of diamond are shown with a reminder that American Federal Trade Commission rules state that there must be 17 or more symmetrically placed facets on a diamond before it can be called "diamond" without other qualifying terms.

R.K.M.

DANNER (W. R.). *Gem materials of British Columbia.* Montana Bureau of Mines and Geology, Special publication 74 of 1976.

Nephrite is the most important of the gem materials found in the Province and rhodonite is also found. Argillite from the Queen Charlotte Islands is used for Indian carvings. Some fire opals and gold nuggets are also found. Pegmatite minerals are rare. M.O'D.

DARRAGH (P. J.), GASKIN (A. J.) and SANDERS (J. V.). *Opals.* Scientific American, 1976, 234, 4, 84-95.

An expanded version, illustrated in colour, of articles by the same authors published in other journals. Reference is made to the use of tetraethyl orthosilicate to give spheres of the required size for diffraction of light to take place. Sodium/sols, also used for this purpose, in the form of aqueous solutions of sodium silicate by treatment with ion-exchange resins, proved much longer in settling into the ordered layers needed. M.O'D.

DE MATTEI (R.), HUGGINS (R. A.) and FEIGELSON (R. S.). *Crystal growth by the electrochemical Czochralski technique (ECT).* Journal of Crystal Growth, 1976, 34, 1, 1-10.

Large single crystals of sodium tungsten bronze, Na_xWO_3, up to 2·5 cm in diameter and 11 cm in length have been grown by electrochemical crystallization from molten salt solutions combined with crystal pulling. M.O'D.

ELBE (M.). *Brillianten-Krieg?* (War around brilliants?) Z.Dt.Gemmol.Ges., 1976, 25, 3, 148-152. 1 illus. Bibl.

Pros and cons of an argument about maximum brilliance in brilliant-cut diamonds. Table illustrates tolerances of the angles of the crown facets as compared with the angles of the pavillion facets of the various types of brilliant cuts. The author advocates not cutting the stone on the traditional octagon principle, but using an odd number of corners in the table. E.S.

ENGLAND (B. M.). *Quartz polyhedroids in Australia.* Australian Gemmologist, 1976, 12, 10, 303-306. 5 figs.

Multi-sided agate nodules found in S. Australia. Thought to be quartz infilling of spaces between blades of tabular calcite which later weathered out. R.K.M.

FUJISAKI (Y.). *Glass made imitation jade and its inclusions.* Journal of the Gemmological Society of Japan, 1976, 3, 3, 99-105. (In Japanese.)

Material circulating in Japan under the name of Siberian or reformed jade is made from glass. It is dark green, translucent to opaque, with a hardness of between 5 and 5½; the S.G. is 2·67 and the R.I. 1·523 ±0·005. Broad absorption bands are seen at 4600-4000Å and 7000-6000Å. Three types of inclusion have been distinguished; one type consists of needle-like structures identified as hydroxyl apatite; another type, in dendritic form, is believed to be either vapour or liquid and the third type consists of four groups of structures none of which have so far been identified. The material shows pseudo-optical anisotropy. M.O'D.

GAINES (A. M.) and HANDY (J. L.). *Mineralogical alteration of Chinese tomb jades.* Nature, 1975, 253, 433-434. 3 figs.

White chalky areas on nephrite tomb jades from the period 1766 B.C. to A.D. 220 are caused by leaching along grain boundaries by ammoniacal solutions of high PH produced during decay of the corpses with which the jade was buried. There is no change in mineralogical composition. F.B.A.

GAINES (R. V.). *Beryl—a review.* Mineralogical Record, 1976, 7, 5, 211-23. Illus. in colour.

The beryl minerals are described with illustrations and geochemical data. The red variety, bixbite, has recently been found in the Wah Wah Mountains of Utah, making four locations in all. The beryl structure is illustrated. M.O'D.

GAINES (R. V.). *Los berilos.* (The beryls). Boletin del Instituto Gemologico Español, 1976, 15, 23-34. Illus. in colour.

This article deals with emerald, other green beryls, aquamarine, heliodor, morganite, goshenite, red beryls and synthetic productions. M.O'D.

GILL (J. G.). *An easy method of measuring the depth of a mounted transparent stone in a closed-back setting.* Gems and Gemology, 1976, XV, 6, 178-180. 2 figs.

The old "real and apparent depth" R.I. method adapted by multiplying the apparent depth by the known R.I. of the stone to obtain a close approximation to its actual depth. Describes adding millimetre scale to microscope not equipped with one. R.K.M.

GÜBELIN (E.). *Scorodite—a new gemstone from Tsumeb, South-West Africa.* Gems and Gemology, 1976, XV, 5, 130-136. .6 figs.

A full account of a strongly pleochroic dark blue gem mineral which has been reported before in this journal. A hydrated ferric arsenate with R.I. α 1·785, γ 1·816, birefringence 0·031 positive, S.G. 3·29, H. 3½ to 4, this is a rare orthorhombic mineral known so far in about five world localities. A collector's gem rather than commercial owing to extreme softness and to rarity of gem material. This paper is prepared with all the great care and scientific detail one has come to expect from one of the world's foremost gemmological scientists. R.K.M.

GÜBELIN (E.). *Über eine neue Opal-imitation.* (About a new opal imitation.) Z.Dt.Gemmol.Ges., 1976, 25, 4, 199-203. 3 illus. Bibl.

The author describes the Slocum-stones (produced by John Slocum, of Royal Oak, Michigan) which give a very good first impression, but when viewed with a loupe one can see thin, variously coloured, irregularly shaped splinters which reflect the light. Lustre is vitreous and fracture conchoidal. The white imitations contain elements of Na, Si, Mag (Al) and (Ti), the black specimen is a mixture of two phases which are intergrown consisting of Na, Si, Ca, Mag and (Al) and are also silicate glasses. The coloured splinters seem to be very thin pieces of heated and metal-covered silica gel. R.I. 1·49 to 1·52; S.G. 2·41 to 2·51 and Mohs hardness 5·5 to 6·5. Sizes of produced material allow production of cabochons and use in doublets and triplets. E.S.

GÜBELIN (E.). *Djevalith—eine neue Diamant-Imitation.* (Djevalite—a new diamond imitation.) Z.Dt.Gemmol.Ges., 1976, 25, 4, 204-210. 2 illus. 1 graph. 2 tables. Bibl.

The author describes a new diamond imitation produced by Hrand Djevahirdjian in Monthey, Kanton Wallis, Switzerland. It is colourless, transparent, cubic and has the chemical composition $ZrO_2 + CaO$ and is very difficult to distinguish from diamond. R.I. $2{\cdot}1775 \pm 0{\cdot}005$, no birefringence. The material is completely isotropic. Dispersion 0·0627 (higher than diamond), adamantine lustre; Brewster's angle = 65°20′; the critical angle of total reflection = 27°20′. The spectrum shows no absorption lines or bands. Mohs hardness about 8-8½, i.e. harder than most diamond imitations. Under x-rays the djevalite is opaque, as opposed to diamond which is transparent. Table compares the new product with diamond and other diamond imitations. E.S.

HORIUCHI (N.). *Relation between proportion and yield of brilliant diamond.* Journal of the Gemmological Society of Japan, 1976, 3, 3, 106-113. (In Japanese.)

Various calculations were employed to assess the possible yield from the following cases: off-centred and centred brilliant-cut diamond from ideal octahedron; brilliant from ideal dodecahedron; re-polish of brilliant into Tolkowsky cut. M.O'D.

KHORASSANI (A.) and ABEDINI (M.). *A new study of turquoise from Iran.* Min. Mag., 1976, 40, 640-2.

Specimens from various locations in Iran have been analysed on a powder diffractometer and agree in general with the formula $Cu(Al,Fe)_6(PO_4)_4(OH)_8.4H_2O$. The finest sky-blue coloured specimens are the lowest in iron content. Turquoise from Nishapur and Damghan shows strong absorption bands in the range 3560–3000cm^{-1}, characteristic of OH, and strong bands in the range 1180–1000cm^{-1}, characteristic of PO. A sample heated to 800°C showed a new absorption band at 715cm^{-1}, perhaps due to the formation of a pyrophosphate.
M.O'D.

KRAUS (P. D.). *Topaz and citrine, birthstones for November.* Lapidary Journal, 1976, 30, 8, 1841-1852.

A review of the occurrence, properties and legendary accounts of topaz and citrine. M.O'D.

LAL (K.). *Characterization of dislocations in gadolinium gallium garnet single crystals by transmission x-ray topography.* Journal of Crystal Growth, 1976, 32, 357-362.

Growth bands due to thermal variations were found in almost all specimens examined and growth facets observed were found to be the traces of (211), (121) and (112) lattice planes. Some wafers cut parallel to (111) showed dislocation loops of dodecagon shape and these are associated with iridium inclusions.
M.O'D.

LAL (K. P.). *Corundum deposits in India.* Gem World, 1976, 3, 3, 31-36.

Corundum has been found recently near Janwali in Rajasthan. The rubies are found in a cordierite rock lacking in quartz, and other varieties are found as disseminated crystals in Aravali schist intruded by aplitic and pegmatitic rocks. Corundum of a variety of colours is found in Madhya Pradesh at Pipra in Sidhi district, where it occurs in a sillimanite schist associated with hornblende and intrusive granite gneiss. Corundum also occurs in Tamil Nadu at Coimbatore, where it is found in syenite in the Sivamalai hills. In Assam corundum occurs in a sillimanite rock at Sonapahar. At Soomjam, in Jammu and Kashmir state, ruby and sapphire are obtained from a kaolinized pegmatite intruding into garnetiferous biotite and other rocks. M.O'D.

LIDDICOAT (R. T.). *Developments and highlights of GIA's Lab in Los Angeles.* Gems and Gemology, 1976, XV, 5, 138-142. 8 figs.

An 0·20ct jeremejevite, a 3·73ct eosphorite are recorded as resembling aquamarine and topaz respectively, and a supposed synthetic powellite turned out to be synthetic scheelite; testing details are not given. A white cabochon pectolite gave R.I. 1·59-1·62 by the spot (distant vision) method; S.G. 2·8. It was confirmed by x-ray powder diffraction. A sinhalite in an old bracelet was identified (although recognized as a separate mineral only in 1952, sinhalite has been cut probably for as long as Ceylon has been producing gems). A new synthetic emerald with veil-like healed cracks, flux inclusions and phenakite crystals, R.I. 1·560-1·565, birefringence 0·005, S.G. 2·65, medium red fluorescence, is described and illustrated. Treated turquoise of poor quality tested for paraffin (wax) by hot point test proved to have been treated with some type of plastic. A large light green beryl showed growth features characteristic of trapiche emeralds but colour was due to green dye. Cultured pearls are sometimes drilled eccentrically and additionally via the stringing hole to reach backs of dark conchiolin blisters so that these may be bleached. A radiograph is illustrated showing pearls with up to three or more drillings through the M.O.P. bead for this purpose. A cluster of blue sapphire "crystals" proved to be synthetic sapphire cut to simulate natural hexagonal crystals and cemented together with blue plastic. The latter showed bubbles and a cobalt absorption spectrum. R.K.M.

LIDDICOAT (R. T.). *Developments and highlights at GIA's Lab in Santa Monica.* Gems and Gemology, 1976, XV, 6, 170-177. 16 figs.

A chrysoberyl showing a four-rayed star, two-phase irregular inclusions in natural ruby and natural-looking inclusions in synthetic ruby and sapphire are described and illustrated. A cyclotron-treated emerald-cut green diamond is described with comment that such a stone is rarely seen today. It showed colour zoning due to directional irradiation. A reddish-purple diamond, 0·44ct, showed characteristic spectrum for treated pink; absorption is described. A cicada "in amber" proved to be entombed in plastic. A Mabe pearl (half-cultured, or "Jap" pearl) with an imitation pearl centre, large rutile needles in emerald, monoclinic crystal inclusions in Mexican opals and a combined flux-melt and flame-fushion synthetic ruby are also described and illustrated. R.K.M.

MAGRYN (H.). *Calculating radiopacity.* Australian Gemmologist, 1976, 12, 11, 323-326. 1 fig. 2 tables.

An explanation of a mathematical method of predicting the probable degree of opacity to x-rays in mineral and other substances. R.K.M.

MALES (P. A.). *Ruby corundum from the Harts Range, N.T.* Australian Gemmologist, 1976, 12, 10, 310-312. 1 illus.

Red material originally thought to be ruby has been identified as garnet. This area, north-east of Alice Springs, has now produced pink corundum similar to Madagascan material. (Corundum formula is incorrectly quoted). R.K.M.

MATHUR (S. M.). *Shallow diamond mines of Panna (India).* Gem World, 1976, 3, 6, 13-20.

The mines are in conglomerates or in gravels, diamond-bearing conglomerates occurring towards the top of the Upper Rewa sandstone, the Lower Rewa sandstone and towards the base of the Jhiri shale formation. The gravels exist either on the top of the Kaimur and Rewa plateaus, as detritus caught in fissures in the Kaimur quartzite, in the stream gorges cutting the Kaimur and Rewa scarps or as recent detritus in stream beds. All working is manual, quantities recovered being very variable. M.O'D.

MATHUR (S. M.). *The historical background of Koh-I-Noor.* Gem World, 1976, 3, 10, 21-32.

The history of the diamond is told with illustrations of sketches by Tavernier of the Great Moghul diamond, believed to be the Koh-I-Noor. M.O'D.

MEYER (H. O. A.) and TSAI (H.-M.). *The nature and significance of mineral inclusions in natural diamond: a review.* Min.Sci.Eng., 1976, 8, 242-261. 6 figs,. 12 colour photos.

The history of the identification and realization of the significance of inclusions in natural diamonds are reviewed, together with a discussion of their detailed mineralogy and major-element chemistry. The categorization of inclusions into primary (pre- or syngenetic) and secondary (epigenetic) is considered, as well as the subdivision of primary inclusions into those representing ultramafic and eclogitic suites. The contribution of work on diamond inclusions to the problems of the genesis of diamond and the formation of kimberlite and associated xenoliths, and to the mineralogy of the upper mantle, is reviewed. Data presented include new analyses of olivine (2), enstatite (2), clinopyroxene (3), chrome-pyrope (2), pyrope-almandine, and chromite (2). R.A.H.

MOREAU (M.). *Nong Bon ou le rubis de Thailande.* (Nong Bon or ruby from Thailand). Revue de Gemmologie, 1976, 47, 10-12.

Nong Bon lies in the extreme south of Thailand, close to the Cambodian frontier. Production of cuttable stones amounts to approximately 300ct a year; stones are frequently included, fassaite being the commonest intruder. M.O'D.

MORNARD (H.). *De la biologie . . . à la gemmologie.* (From biology to gemmology.) Bulletin, Société Belge de Gemmologie, 1976, 3, 5-8.

Contains notes on coral, amber, petrified wood and opal. M.O'D.

MUMME (I. A.), SEIBRIGHT (L.) and BALL (R.). *The origin of volcanic opal from Houghlahan's Creek (near Teven).* Australian Gemmologist, 1975, 12, 8, 235-240. 2 figs. 2 maps.

Deals in detail with an occurrence of opal in New South Wales. Some of the gem material is said to resemble Mexican opal. R.K.M.

NARASIMHAN (V. K.). *Sparkling sales. The Times* newspaper, 26th January, 1977, no. 59917 (India Supplement, XIII).

This report gives figures of exports of Indian-made jewellery and ornaments, rising from Rs 224 m in 1963/4 to Rs 718·8 m in 1972/3 and to Rs 1300 m in 1975/6. Diamond exports constitute more than 80% of gems and jewellery exports, and other gemstones about 15%. Exports of cut diamonds rose from Rs 24·3 m in 1963/4 to Rs 990 m in 1975/6, principally to the U.S., Japan, Belgium, Hong Kong and Holland. A gem-testing laboratory has been set up in Jaipur (Rajasthan) by the Gem and Jewelry Export Promotion Council, and another will be set up in Delhi. J.R.H.C.

NASSAU (K.). *A new diamond imitation: cubic zirconia.* Gems and Gemology, 1976, XV, 5, 143-144. 2 figs.

Two stones were examined. S.G. determined at 5·7, H. between 8 and 9. R.I. quoted by manufacturer, 2·15. Dispersion 0·060. Cubic zirconium oxide is a high temperature polymorph of zirconia known in nature, so this is a true synthetic. X-ray testing turned it yellow. One stone showed lines of bubble-like flux-filled negative crystal inclusions. Trade name "Djevalite". Another, with 15% yttrium oxide, made in U.S.S.R. by a melt technique called "skull melting", is sold as "Phianite". Commercial viability in competition with YAG and GGG is questioned. R.K.M.

NASSAU (K.). *On the naming of new man-made crystals.* Gems and Gemology, 1976, XV, 6, 168.

Some manufactured gem materials are being made with two or more possible chemical compositions. $Y_3Al_5O_{12}$ and $Y_4Al_2O_9$ are both yttrium aluminate and sold as "YAG", "diamonaire", etc. Strontium titanate ("fabulite") is one form of four possible chemical substances each of which could be called by the same name. Dr Nassau suggests that the chemical formula should be added after the name at all times for these isoidiomorphous substances. Polymorphs (same formula but different crystal system) should have the system appended. R.K.M.

NASSAU (K.). *Synthetic emerald: the confusing history and the current technologies. Part 2—Conclusion.* Lapidary Journal, 1976, 30, 2, 468-492.

Hydrothermal growth of emerald has been confined in recent years to the productions of Lechleitner and the Linde Division of the Union Carbide Corporation. This latter production changed slightly during the period of manufacture (1965-1975). Production as distinct from distribution ceased in 1970. Both Chatham and Gilson processes use acid lithium molybdate as a flux though full details of the processes are not available. M.O'D.

NASSAU (K.), PRESCOTT (B. E.) and WOOD (D. L.). *The deep blue Maxixe-type color center in beryl.* Amer. Min., 1976, 61, 100-107. 8 figs.

A deep blue colour centre is produced in beryl by a variety of penetrating radiations. If the original beryl is yellow or green, the resulting colour can be green or blue-green. This colour centre cannot be produced in just any beryl, and the nature of the required precursor is unknown. Apparently it does not involve transition metals, alkalis, or water. Both light and heat can cause fading of the blue component of the colour, and it can be restored by γ-ray, x-ray, or neutron irradiation in the Maxixe-type material. In the case of the originally blue 1917 Maxixe material, irradiation of bleached material produces a green colour, indicating that the Maxixe colour was not due to irradiation. A.P.

NASSAU (K.). *D'où provient la couleur des gemmes et des mineraux?* (Where does the colour of gems and minerals come from?) Revue de Gemmologie, 1976, 40, 7-10.

French translation of an article first published in *Gems & Gemology*, 1974/5, 14, 12, 354-361; 1975, 15, 1, 2-11; 1975, 15, 2, 34-43. M.O'D.

NEWBURN (J. M.). *The electropolishing of the precious metals and their alloys.* (Part I.) Australian Gemmologist, 1976, 12, 11, 339-346.

This is essentially electro-plating in reverse, the article to be polished being connected to the positive (anode) terminal in what is effectively a plating bath. (In plating it would be on the cathode side). "Asperities" (roughnesses) are removed as the current flows and with care and attention to details of current, electrolite composition, and temperature a very good polish can be obtained in a very short time. The process, properly applied, provides a fine scratch-free finish on good quality single piece items, but tends to accentuate solder lines in joined pieces and porosity or pitting in castings. R.K.M.

O'LEARY (B.) and BALL (R. A.). *Indonesian opal.* Australian Gemmologist, 1976, 12, 11, 327-328. 4 figs.

A report on opal found in a remote but un-named locality in Java. Jelly opal, similar to Mexican opal, some called "tea" opal, or "black tea" opal, and white opal are found. "Crystal opal . . . with intense actinic irisisations" seems a strange misuse of terminology. Opal from this source tends to crack or craze easily, possibly due to unusual micro-structure. R.K.M.

PAVITT (J. A. L.). *Thailand—gem cutting and trading.* Australian Gemmologist, 1976, 12, 10, 307-309, 318-319. 1 map.

Deals mainly with the economics of the Thai gem industry based on available Customs figures. Movement of material across the Cambodian border is not recorded. R.K.M.

PHILLIPS (F. C.). A *letter* referring to paper *Crystallography is fun* (see Abstract in J.Gemm., 1977, XV, 5, 264, s.v. Sutton, J. & P.). Australian Gemmologist, 1976, 12, 11, 329.

Professor Phillips straightens out some misconceptions in the original paper. Erroneous printing of signs, or their complete omission, when dealing with crystallographic angles makes part of this kindly and explicit letter difficult to follow. R.K.M.

PRADESH (S.). *Jade in Salarjung Museum.* Gem World, 1976, 3, 7, 32-35.

The Museum is in Hyderabad and contains such celebrated treasures as Emperor Jehangir's hunting knife, together with other artefacts. M.O'D.

RAAL (F. A.). *The Special Research Project—25 years later.* Diamond Research 1976 (Industr. Diamond Inform. Bur.), 2-3.

Some of the results from co-operation between De Beers and British Universities are reviewed. They include ion implantation, studies of mechanical properties of diamond, surface chemistry, and studies relating to kimberlite and diamond genesis. R.A.H.

Richard (H. M.). *Arizona's rainbow gems.* Lapidary Journal, 1976, 30, 1, 22–48. Illus. in colour.

Minerals able to be fashioned include azurite, turquoise, dioptase, cuprite and wulfenite. Gold is also found and has been used for ornament. Peridot and pyrope garnet are found in Indian reservations in the south-east of the state. M.O'D.

Rodgers (J. R.). *Classic Oregon localities.* Lapidary Journal, 1976, 30, 1, 116–128. Illus. in colour.

Oregon is celebrated for its "thunder eggs" and opalized wood. Transparent sunstones are also found. M.O'D.

Rolff (A.). *A trip to the famous citrine areas of Brazil.* Lapidary Journal, 1976, 30, 8, 1986-95.

Reprint of an article first published in the issue for November 1969. M.O'D.

Rosenthal (J.). *Les perles: pt 1.* (Pearls: pt 1). Revue de Gemmologie, 1976, 48, 11-12.

Outline of the use of pearls in antiquity and of their composition. M.O'D.

Sanders (J. V.). *The structure of star opals.* Acta Cryst., 1976, A32, 334-338. 9 figs.

Optical diffraction patterns have been obtained from a set of unusual gem opals from Idaho, U.S.A. The formation of star patterns in them is described, and the structure producing the stars is deduced from optical diffraction. The arrangement of particles is different from that found previously for Australian opals. (Author's abstract). D.T.

Schmetzer (K.), Bank (H.), Berdesinski (W.) and Kroužek (E.). *Coeruleit—ein neuer Schmuckstein.* (Ceruleite—a new gem). Z.Dt.Gemmol.Ges., 1976, 25, 4, 195-198. 2 illus.

Rough and cut stones were offered on the market which were similar to turquoises, but found to be ceruleite. The colour is sky-blue. The aggregates look homogeneous, but under the Raster electron microscope (10000 × mag) crystals could be seen to have a length of 5 microns and a thickness of 2 microns. Chemical formula: $Cu_2Al_7(OH_{13}(AsO_4)_4 \cdot H_2O$; R.I. 1·60; S.G. 2·70 ±0·02. E.S.

Schowalter (M.). *Slocum stone—a new man-made material.* Lapidary Journal, 1976, 30, 1370-1374. 1 coloured plate.

A brief description is given of imitation opal made by J. L. Slocum of Michigan and guaranteed against crazing, cracking, or colour loss in normal procedures. These stones have H. 5½-6½, sp. gr. 2·41-2·50, *n* 1·49-1·51. R.A.H.

Schwalm (J.). *Von der Heilkraft der Edelsteine.* (On the healing-power of gemstones). Aufschluss, 1975, 26, 355-67.

The medicinal properties of the better-known gemstones are reviewed with references to the literature. M.O'D.

Sheens (K. A.). *Chinaman's hats.* Australian Gemmologist, 1975, 12, 7, 208-209, 5 figs.

Shallow conical opal masses occurring at Lightning Ridge. "Hats" form either apex-up, or -down, usually at end of vertical opal pipe. Some are all potch. Others have "colour" on upper side, regardless of which way up the "hat" has formed. R.K.M.

Shoda (T.). *Basic knowledge on studies of gemstone by the use of polarized light. (Part 1).* Journal of the Gemmological Society of Japan, 1976, 3, 3, 123-131. (In Japanese).

General survey with diagrams. M.O'D.

Speer (J. A.) and Gibbs (G. V.). *The crystal structure of synthetic titanite, $CaTiOSiO_4$, and the domain textures of natural titanites.* Amer. Min., 1976, 61, 3/4, 238-247.

Specimens of synthetic titanite (sphene) proved the space group symmetry to be $P2_1/a$, not $A2/a$ as previously reported for the natural material. Octahedra of TiO_6, corner-sharing and in chains, run parallel to the a-cell edge and are linked by silicate tetrahedra to form a $TiOSiO_4$ framework accommodating Ca in irregular 7-coordination polyhedra. Crystals were manufactured from a mix of composition $CaCO_3.TiO_2.SiO_2$. CO_2 was driven off before melting in a platinum crucible at about 1400°C and 1 atm. Material was homogenized by repeated crushing, remelting and quenching, then crystallized at about 1200°C for several weeks, before cooling. M.O'D.

Sterns (M.). *Gemology—Now you see it, now you don't.* Gems and Gemology, 1976, XV, 6, 169.

Tries to trace the history of the name. "Gemmology" was used as early as 1811. Encyclopedias Americana (1960) and Britannica (1974) ignore it in both its spellings. On evidence provided it seems that the British spelling is etymologically correct and that the American orthography arrived with the G.I.A. R.K.M.

Strunz (H.) and Wilk (H.). *Cuprit von Onganja, SW-Afrika.* (Cuprite from Onganja, S.W. Africa.) Aufschluss, 1975, 1, 1-4.

Cuprite crystallizes in the isometric system and typical crystals are illustrated. Notes on other localities are given. M.O'D.

Sunagawa (I.). *10th General Meeting of the International Mineralogical Association.* Journal of the Gemmological Society of Japan, 1976, 3, 3, 117-122. (In Japanese).

Reviews of some of the papers presented. M.O'D.

Suzuki (S.) and Lang (A. R.). *Occurrence of facetted re-entrants on rounded growth surfaces of natural diamonds.* Journal of Crystal Growth, 1976, 34, 1, 29–37.

Faceted re-entrants are initiated at particular growth horizons at which an episode of strong inhibition of growth on $\{111\}$ commences. It is believed that they occur at dislocation outcrops as preferential locations. M.O'D.

SWINDLE (L.). *Amazonite—a specimen from the Centennial state, Colorado.* Lapidary Journal, 1976, 30, 1, 96–98. Illus. in colour.

The microcline feldspar amazonite was first shown in the U.S.A. about 100 years ago, at the World's Fair of 1876. The material came from the Pike's Peak region. M.O'D.

WILD (H. W.). *Die deutsche Edelsteinstrasse.* (The German Gem-Street). Aufschluss, 1976, 27, 2, 83-86.

The "Deutsche Edelsteinstrasse" is the name given to the villages surrounding the West German town of Idar-Oberstein. A map shows the extent of the area devoted to the trade in and working of gemstones. M.O'D.

WILSON (M. M.). *Montana's treasure. Part 1.* Lapidary Journal, 1976, 30, 1, 100–114.

Some sapphire locations are open for collecting on a fee basis, notably that south of York. Sizes are small. M.O'D.

WILSON (W. E.). *Saint John's Island, Egypt.* Mineralogical Record, 1976, 7. 6, 310-14.

An account, illustrated in colour, of the peridot and associated minerals of the island of St John in the Red Sea. Notes on the history and geology of the island are given together with a table of references. M.O'D.

ZIEGERLI (Karl). Z.Dt.Gemmol.Ges., 1976, 25, 4, 222-225.

The Swiss gemmologist, Mr Karl Ziegerli has prepared an index of host crystals and substances and also of inclusions shown in Dr Gübelin's book "Innenwelt der Edelsteine" ("Internal World of Gemstones"). E.S.

Short Gemmological Notes. Z.Dt.Gemmol.Ges., 1976, 25, 3, 156-160.

H. Bank publishes a short note on the R.I. of vivianite from Cameroun and also discusses the high R.I. of colourless topaz from Pakistan. H. Dern has patented a new cut suitable for diamonds based on a triangle and also publishes a short note on synthetic amethyst crystals. E.S.

Short Gemmological Notes. Z.Dt.Gemmol.Ges., 1976, 25, 4, 214-221.

H. Bank describes cuttable green diopside from Minas Gerais in Brazil, especially pointing out differences between enstatite, which crystallizes in the orthorhombic system, and diopside, which is monoclinic. H. Bank also describes some transparent, cuttable, pale brown pollucite, which originally was found on the island of Elba together with petalite (formerly known as "Castor" to the "Pollux" of pollucite as both were found together in lithium-rich pegmatites). Pollucite yields caesium, but cuttable qualities are only found in Maine, U.S.A. H. Bank also reports on a transparent chambersite, a manganese borate, which is orthorhombic and has a hardness of 7; it is doubly refractive, colourless to dark red, and is called after Chambers County in Texas, U.S.A. H. Dern reports on a method introduced by the firm Ernst Winter & Sohn in Hamburg, in which transparent (natural or synthetic) gemstones are covered with a thin layer of synthetic diamond, in order to improve optical properties and durability. E.S.

BOOK REVIEWS

ANDERSON (B. W.). Trans. BOSCH FIGUEROA (J. M.). *Gemas—Descripcion Identificacion.* Entasa (Publicaciones Tecnicas), Madrid, 1976. pp. 471. Illustrated in black-and-white, with 1 coloured plate. Price on application.
A straight translation of the 8th edition of "Gem Testing".

BOSCH FIGUEROA (J. M.). See ANDERSON (B. W.) above.

FRANK (Joan). *All gemstones are precious.* Argus Books, King's Langley, 1976. pp. 48. Illus. in colour. £1·95.

A simple guide presumably intended to introduce gemstones to the general public. To this end it contains notes on birthstones and the legendary powers possessed by gems, together with some coloured illustrations rather awkwardly captioned. Some attractive models display the latest designs in jewellery. M.O'D.

O'DONOGHUE (M.). *Synthetic Gem Materials.* Worshipful Company of Goldsmiths, London, 1976. pp. 215. £12.

This book is a review of the literature of man-made gemstones, mainly consisting of annotated references to the growth of gem materials, including the important properties of the various stones. There are roughly 2,000 entries, for example nearly 100 on ruby, referring to syntheses of historic interest as well as those relating to gemstones which might now appear over the jewellery counter. The introductory section lists trade names of well-known synthetics and the main journals and books which might contain articles or sections pertaining to the growth of synthetic gemstones. There are a few notable omissions from the list of monographs, such as J. C. Brice's "The Growth of Crystals from Liquids" (North Holland, 1973).

The title of the book might be slightly misleading since the compilation includes references to imitations, including doublets using only natural gemstones, rather than referring only to materials which have been synthesized. The author's rather derogatory use of the term "synthetic" is, of course, not uncommon in gemmology, but "man-made" would be more accurate.

It is interesting to note that no example of synthetic corundum or spinel can be attributed to Djevahirdjian, who are the largest manufacturers of such materials in Europe and possibly in the world.

There are a few inconsistencies, such as entries under "beryllia" and "bromellite" for the same material, BeO, and the use of "yttrium aluminium garnet" and "yttrium aluminate" to refer to the material of formula $Y_3Al_5O_{12}$. Some materials, such as the metals cadmium and copper and the water-soluble salts like aluminium ammonium sulphate, would perhaps have been best omitted, since they are not normally considered gem materials.

In general, however, any quibbles are minor and the main impression left by the book is one of admiration for the author's diligence and patience in compiling so extensive a reference work. There is no doubt that "Synthetic Gem Materials" will be greatly welcomed by anyone interested in gem synthesis and identification, and Mr O'Donoghue has performed an invaluable task in bringing together in one volume such a vast compilation of literature on known types of man-made gemstones. The book will be continuously up-dated by means of entries which will appear in the *Journal of Gemmology**, so that it will constitute the first part of an on-going and unique service. D.E.

PECH (Heinrich). *Smaragde-Gauner und Phantasten.* (Emerald, rogue and visionary). Pinguin Verlag, Innsbruck, 1976. pp. 124. Illus. in colour. DM 28·50.

A description of the emerald locality of the Habachtal, Austria, with notes on other occurrences of emerald, this is a lightly-written book with attractive photographs, largely anectdoal in tone. M.O'D.

SCHUMANN (W.). *Edelsteine und Schmucksteine.* (Precious and ornamental stones). BLV Verlagsgesellschaft, Munich, 1976, pp. 255. Illus. in colour. DM 28.

A beautifully-produced guide to the wider range of gem materials, this pocket-sized book contains brief descriptions facing whole-page colour illustrations of high quality. Identification tables are also provided and there are production statistics for diamond. Photographs are by the firm of Hartmann and some of them have covered some mileage, notably that of rutilated quartz on page 47: but, in fairness, the previous appearances have been in larger books designed for a less discriminating market. A first-class guide and worth a translation into English. M.O'D.

TRÖGER (W. E.). *Optische Bestimmung der gesteinsbildenden Minerale. Teil 1, Bestimmungs tabellen.* (Optical properties of rock-forming minerals: Part 1, Tables of Properties). 4th edn, revised by H. U. Bambauer and others. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, 1971. pp. 188. Price on application.

This first volume of a complete work in two parts contains diagrams of the crystals of rock-forming minerals with illustrations of their optic properties. Tables are arranged in order of optical properties, crystal systems and chemical groups; diagrams on pages following the relevant parts of the tables. Pleochroic colours are included with the crystal diagrams and there is a table of interference colours at the end of the text. A table lists the minerals under their strongest x-ray interference lines and references to the literature are given with this table; other tables include birefringence and specific gravity. The whole book is extremely well printed. M.O'D.

VOLLSTADT (H.). *Einheimische Minerale.* (Native minerals). 4th revised edn. Steinkopff, Dresden, 1976. pp. xii, 399. Illus. in black-and-white and in colour. M 26·00.

A general introduction to the commoner minerals precedes accounts of East German localities which are in some cases illustrated by sketch-maps. M.O'D.

ZIMMER (S. H.) and METZ (W.). *Mineralfundorte in Frankreich.* (Mineral locations in France). Werner Noltemeyer Verlag, Dossenheim/Heidelberg, 1976. pp. xviii, 228, 37.

A pocket-sized guide arranged alphabetically by location, this handy book should lead the mineral collector fairly close at least to the sites where specimens can be found. In an appendix are sites listed under Departments and notes on the crystal systems with illustrations. Further guides to other European countries are promised. M.O'D.

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*In "Gemmological Abstracts".—Ed.

International Mineralogical Association. *Papers and proceedings of the ninth general meeting, Berlin (West)—Regensburg, September 12-18, 1974.* Special issue to vol. 52 of Fortschritte der Mineralogie, 1975. pp. xxxiv, 629. Price on application.

Includes: Gübelin (E. J.), *Where gemstone research stands today:* Sunagawa (I.), *Surface microtopography as a tool of distinguishing natural and synthetic emeralds:* Monés Roberdeau (L.) et al., *Quantitative study of fluorescence of brilliant-cut diamonds:* Arbuniés-Andreu (M.) et al., *Physical and optical properties of garnets of gem quality.*

M.O'D.

Mineralienfreund. Zeitschrift der Urner Mineralienfreunde. Published bi-monthly by UMF at Herrengasse 2,6460 Altdorf, Uri, Switzerland. Annual subscription Sw.fr. 23.

The issue examined (14, 3) contained articles on bazzite from the Alps (bazzite is the scandium analogue of beryl) and on the phosphate minerals from the pegmatite at Hagendorf in the Oberpfalz. There are illustrations in colour and the text is authoritative. M.O'D.

ASSOCIATION NOTICES

PRESENTATION OF AWARDS

The annual Reunion and Presentation of Awards was held at the Goldsmiths' Hall on 15th November, 1976, when the Chairman, Mr Norman Harper, remarked that the number of entries for the examinations had, at 1,201, once again exceeded all previous records. He said the Tully Memorial medallist came from America, the Raynor Prize-winner from Finland, and specially commended for her papers was a candidate from Paris: others in the gathering came from France, Germany, Holland and Spain. During the past year their Secretary, Mr Harry Wheeler, had visited Japan and Hong Kong to meet gemmologists, many of whom had taken the Association's examinations.

The Chairman continued that whereas when he took the examination in 1934 all his class of 21 had passed and in 1949 with 104 sitting 81 passed, 21 with distinction, the percentage rate of successes had been falling. This year 413 sat for the diploma but only 116 passed.

The Chairman extended a warm welcome to Professor Dr Hermann Bank, F.G.A., President of the German Gemmological Association (Deutsche Gemmologische Gesellschaft) and a member of the Board of the Diamond and Gemstone Exchange in Idar-Oberstein (Diamant-und Edelsteinbörse), who then presented the prizes, diplomas and certificates won in the gemmological and gem diamond examinations and delivered an address, which is recorded in full below.

Mr Douglas King, the Vice-Chairman, in thanking Dr Bank, congratulated him on two counts, not only on mkaing such an excellent speech following a difficult flight to this country—his plane had been diverted to Bournemouth because of fog and a dash by train had brought him to the ceremony with little time to spare—but also on being accompanied by his charming wife, a veritable gem from Brazil, of which she was a native. Mr King added that he hoped the newly qualified members would draw together to strengthen the Association and to benefit themselves.

PROFESSOR DR HERMANN BANK'S ADDRESS

Ihre Einladung ist für mich eine grosse Ehre und ich möchte mich sehr herzlich dafür bedanken. However, I think that you prefer that I speak in your language and beg you to excuse my poor English.

I feel it a great honour to have been invited to present the awards of the Gemmological Association of Great Britain to the successful examination candidates this year, and I should like to thank you very much for this invitation. I have been asked to address you after having fulfilled my first obligation, and I should like especially to speak to the candidates.

As many other parts of our daily life have undergone an enormous revolution and unforeseen developments in the last few years, our special field of gemmology has also experienced many changes. On the one hand new minerals have been discovered; on the other, old minerals have been found in better quality—and therefore worth cutting. Likewise we have invented new synthetic and artificial products as well as new colour manipulations which are not easy to diagnose.

For many years gemmology has been regarded as an appendix to mineralogy—more technical and commercial than scientific. However the discovery of new mineral species in cut stones (taaffeite and sinhalite) and the adoption of scientific methods by gemmologists have caused people to regard it as a new and special science. Every day mineralogists and gemmologists all over the world are trying to discover new gem minerals—their properties, genesis and special distinguishing characteristics. Comprehensive information is nowadays increasingly important in all fields; thus the customers of jewellers expect more information and this places additional demands upon the jeweller. The Gemmological Association of Great Britain recognized this demand at an early stage and started the gemmological courses many years ago which have become an example for many Gemmological Associations in other countries and the title "F.G.A." is highly esteemed throughout the world—hence the enormous number of students taking part in the courses and in the examinations.

The Gemmological Association tries to give the students a general idea of mineralogical science in the preliminary course and special theoretical and practical knowledge in gemmology in the diploma course. However it can only give instruction until the date of the examination. So, if a student—as I was nearly 25 years ago—should remain on the level of knowledge of that day, he would be lost among the present synthetics as well as the new methods of treating gemstones and the new methods of examining them. Therefore it is necessary not only to have good fundamental education but also to keep up-to-date by continuous study. Goethe says: "What is written in black and white you can confidently bring home". But I hope that most of you have not been interested only in obtaining a diploma but that you really have been interested in educating yourselves—so that you will have the knowledge and information to pass on, and learning to examine and determine a given stone as real, synthetic or imitation.

You have been successful—and perhaps ingenious—in convincing your examiners that you have collected enough practical and theoretical knowledge to pass successfully the examinations of the Gemmological Association of Great Britain. But this is only the beginning of your career—now daily examinations will follow in your gemmological life and you must prove that you can use what you have learned. And—most important—you should be aware that you should never mention the result of a test if you are not sure—if you have even the slightest suspicion of the result. Ask somebody who knows it better than you do, who has more practice and more experience in gemmology. You should never be too proud to ask since you can easily lose your good name as a gemmologist if you are careless. The great philosopher Immanuel Kant said: "Act always in such a manner that the principle of your acting can at any time be used as a general law".

As a practical matter you are fortunate to have available the facilities of the London laboratory and you should make use of it. The field in which you and we labour is so elegant, so aesthetic, that it is a great pleasure to work with gemstones in which, according to the great roman writer Pliny, "the whole majesty of nature is encompassed in minute space and a single one suffices to demonstrate the excellence of creation".

You have to test carefully, you have to use several methods as you have learnt during your studies and you have the obligation to keep your knowledge up-to-date. Doctors can bury their mistakes: your mistakes can bury you. Everyone makes mistakes: try to keep them small. You need not say with Socrates "Scio, nescio, I know that I do not know anything", and you also need not say with a kind of conceited scientist "I know that I know much, but I should like to know everything". It is not necessary that you know everything, but it is important that you have the right brain-wave in the right moment, and I wish that you and we all will always have the right idea at the right moment.

You must also not become too great experts, because, as you probably have heard, the definition of an expert is that he knows more and more about less and less, until he knows everything about nearly nothing. I think it quite adequate that you become gemmologists who do their investigations carefully and who know their limits. Perhaps one or more of you will also become outstanding scientists or practicians, who will help to develop gemmology and make it an ever more widely recognized distinct science in itself as well as a means to assist the gem trade.

A Chinese poet once said:

I lay in the garden and dreamed that life would be joy;
I awoke and saw life is duty;
I began to work and recognized duty is joy.

Successful candidates, I congratulate you on your diplomas, I welcome you among the gemmologists and I wish you much success in your gemmological future. Perhaps you will find a new gemstone, perhaps not, but I hope that after a while you will find out that this is not the most important thing in the world but that doing your duty is most enjoyable. You may perhaps have heard the story of an old lady who approached a professor after his lecture and said: "Oh, Professor, before your lecture I was so confused, and now I am even more confused, but on a much higher level". I wish that you may never get confused—even on a higher level—when you are testing gemstones and their substitutes. I wish you, as the miners say, good luck on your way!

ANNUAL GENERAL MEETING

The Association's Annual General Meeting will be held at Saint Dunstan's House, Carey Lane, London E.C.2 on Monday, 23rd May, 1977, at 6.00 p.m.

MEMBERS' MEETINGS

London

On the 9th February, 1977, at Goldsmiths' Hall, London, Mr A. E. Farn, F.G.A., Manager of the London Gem Testing Laboratory, gave a talk entitled "Gemprint—identification method for diamonds".

Midlands Branch

A talk was given on the 17th February, 1977, at the Royal Institution of Chartered Surveyors, Birmingham, by Mr P. Cook, of the Diamond Trading Company, London. Mr Cook spoke on the "Automation of Cutting in Diamond Rough".

North-West Branch

A buffet dance was held on the 22nd January, 1977, at the Shaftesbury Hotel, Liverpool.

On the 10th February, 1977, at the Royal Institution, Liverpool, Mr M. J. O'Donoghue, M.A., F.G.S., F.G.A., gave a talk on the subject "Some Recent Developments in Synthetic Crystals".

South Yorkshire and District Branch

The inaugural meeting of the Branch was held at the Sheffield Polytechnic, Sheffield, on the 17th January, 1977. Dr M. W. Eldridge, F.G.A. and Mr D. M. Larcher, F.G.A., were elected Chairman and Secretary respectively.

ACTIVITIES BY FELLOWS

Mr Norman Harper, F.G.A., Chairman of the Council of the Association, conducted two N.A.G. seminars in the theory and practice of appraisals at Goldsmiths' Hall, London, on 14th and 15th March, 1977.

In January, February and March, 1977, at the Geological Museum, London, Mr E. A. Jobbins, B.Sc., F.G.A., gave ten out of a series of twelve evening lectures on "The Geology of Gemstones", arranged jointly by the Institute of Geological Sciences and the University of London Department of Extra-Mural Studies.

GIFTS TO THE ASSOCIATION

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

Mr David Callaghan, F.G.A., London, and Mr Peter Truman, F.G.A., London, for two garnet-topped doublets having a good resemblance to demantoid garnet.

Mr Alan Hodgkinson, F.G.A., Glasgow, for Microscope Demonstration–Viewing Attachment which allows two persons to view at the same time.

Mr E. A. Thomson, London, for a fine faceted specimen of oval tektite, weighing 4·90 ct.

Mr Chr. Zachariades, Cyprus, for four pieces of analcite. Thanks are also due to Mr R. Holt, of Hatton Garden, London, who has kindly arranged for two of the pieces to be cut and polished *en cabochon.*

"OPAL THE RAINBOW GEM"

There is to be a joint exhibition, devised by the artist Laurence Hope in collaboration with the Geological Museum and the Institute of Contemporary Arts, opening on 12th May, 1977.

Opals and colour photographs of highly magnified opal surfaces will be on display at the Geological Museum, South Kensington, London SW7, with paintings and photographs on view at the Institute, N.A.S.H. House, The Mall, London SW1.

EXAMINATIONS 1977

The Gemmological Examinations will be held as follows:

Preliminary (Theory) —Tuesday, 28th June
Diploma (Theory) —Wednesday, 29th June
Diploma (Practical) —Thursday, 30th June, or Friday, 1st July, or as notified for local centres.
Gem Diamond Examination: Theory—Monday afternoon, 13th June
Practical—Morning monday, 13th June or
Tuesday morning, 14th June.

GEM TESTING LABORATORY FOR HONG KONG

Hong Kong has recently opened its own gemmological laboratory for the testing of precious stones and metals. The new laboratory has been set up by the Hong Kong Standards and Testing Centre, a branch of the Federation of Hong Kong Industries. The gemmological laboratory will work closely with the chemical laboratory of the Centre. It will provide a wide range of testing services, which include assaying precious metals used in the jewellery trade as well as testing stones for authenticity.

INDEX—"INTERNAL WORLD OF GEMSTONES"

Mr D. N. Frampton, F.G.A., has compiled an Index of the photo-micrographs in Dr Gübelin's book *Internal World of Gemstones*. A copy of the printed index can be obtained from the Gemmological Association.

Price is as follows: 1 copy—17p including postage in U.K.
1 copy—30p including airmail postage overseas.

Please send payment with order.

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Easibinders which will take one volume (8 issues) of the *Journal of Gemmology* are now available. Colour of binding—grey, gold blocked on spine with title.

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LETTER TO THE EDITOR

From Dr E. Gübelin, C.G., F.G.A., and Mr M. J. O'Donoghue, M.A., F.G.S., F.G.A.

Dear Sir,

The undersigned wish to congratulate Drs M. S. Joshi and B. K. Paul for their excellent "Studies of Nucleation and Propagation of Cracks in Natural Quartz", which was published in the July 1976 issue of the Journal*. In our opinion this paper represents the first absolutely clear and profound explanation of the mechanisms involved in the formation of cracks in a natural mineral.

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* *J. Gemm.* 1976, XV, 3, 129-135.—Ed.

Yet we rather feel that the term "nucleation" was wrongly chosen in connexion with the cause of releasing a crack. According to Van Nostrand's Scientific Dictionary nucleation is (1) "the formation of condensation nuclei which are the first structurally stable particles of a new phase in a phase transformation" and (2) "a process of phase transformation from a less to a more condensed state when initiated by particles of the condensed state". In simpler words, nucleation is the process by which a nucleus, a seed, is formed which is a minute particle of solid matter. In all these definitions the formation of a particle or particles is of paramount importance. Contrary to this the initiation of a crack does not create particles but rather a void. Consequently it would perhaps be more appropriate to substitute either "initiation", "formation" or "development" for the term "nucleation". Of course, the formation (=nucleation) of an alien particle (for instance by exsolution) or its extension (for instance by thermal expansion) inside a crystal could also be the cause of a crack but this case was not considered in the above mentioned paper.

Although a linguistic authority once warned his audience that "Language criticism is a ticklish affair and the person following it gets under fire in the twinkling of an eye", the undersigned felt that in the interest of pure scientific expression the above remarks should be made. In times like ours, when traditional values are dethroned and the etymological significance of words dialectically misused, it is imperative to watch our words and preclude them from impure elements—especially so the language of science.

E. GÜBELIN
25th November, 1976. M. J. O'DONOGHUE

CORRIGENDA

On p. 260 *ante*—

(1) in the 21st line from bottom of page, for "R.I. 1·81" read "R.I.> 1·81":

(2) in the 16th line from bottom of page, for "10·15 mm" read "10-15 mm":

(3) in the 12th line from bottom of page, for "YA 10_3" read "Y Al O_3" and for "garnet (YAG)" read "oxide":

(4) in the 7th line from bottom of page, for "Ditcburn" read "Ditchburn".

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