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GEMMOLOGICAL ASSOCIATION OF GREAT BRITAIN
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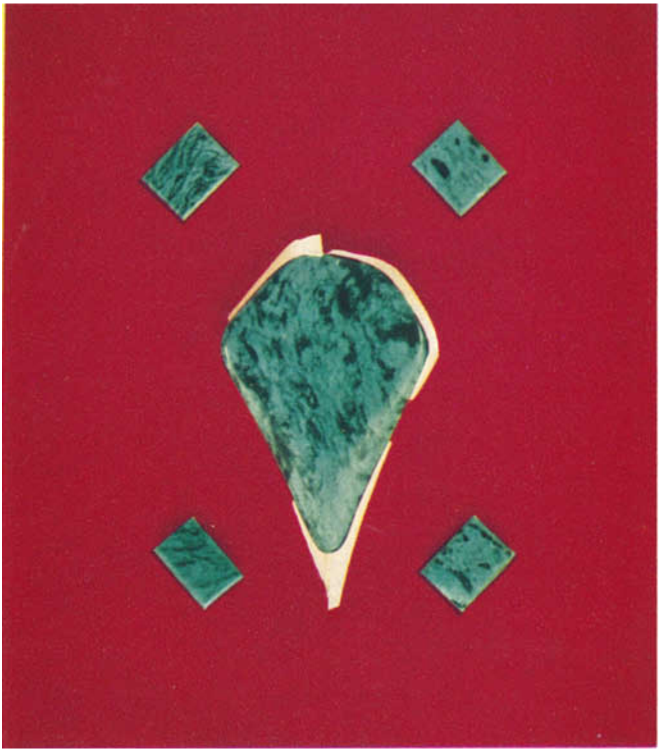

Maw-sit-sit. A decorative gemstone from Burma.

Photo: E. Gübelin

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MAW-SIT-SIT—A NEW DECORATIVE GEM-STONE FROM BURMA

By E. GÜBELIN, Ph.D., C.G., F.G.A.

Maw-sit-sit is an attractive green albite rock, named after the Upper Burmese locality near Namshamaw where it has been found. The following notes describe the author's introduction to this decorative stone.

WHILE visiting the Ruby Valley of Mogok in Upper Burma two years ago I received the welcome invitation from Mr. Lee San Chiek—one of the important jade traders—to undertake an excursion to the jadeite area along the Uru valley in the Myitkyina district of northern Burma. I profited from the last eight days allowed on my tourist visa, hired a jeep and travelled to Mogaung, where my wife and I were very cordially received by our host and greatly enjoyed his hospitality. Next morning, while strolling around in Mogaung, watching the jade lapidaries and their curious implements (Fig. 1), I noticed a few polished slabs and buttons of an unusual, very bright and pleasant green hue, nicely patterned by dark green to black spots and veins, lying on one of the lapping benches. They appeared completely unlike any other green, opaque gemstone that I had seen before and my hunting interest was immediately aroused. The language barrier made it impossible to obtain further information from that lapidary, but from the words "kyauk maw-sit-sit"

FIG. 1. *Jade lapidary squatting behind his low bench is polishing small cabochons and buttons.*

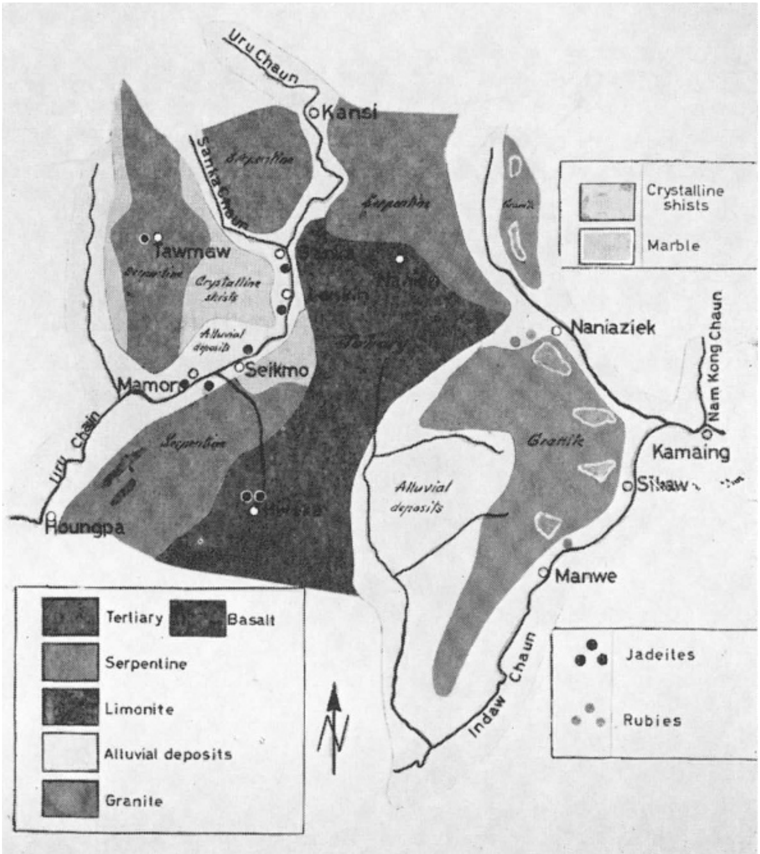
FIG. 2. *Straw thatched "long house" of a Christian Kachin family is marked with a white cross.*

FIG. 3. *A side lane in the picturesque miners' village of Hpakant on the Uru river.*

FIG. 4. *Before a jade mine is opened the jade Nats are propitiated by the miners.*

repeated several times, I could grasp that the specimens were either "stones called Maw-sit-sit" or "stones from Maw-sit-sit". When I mentioned the case to our host, he confirmed that the material was jade from Maw-sit-sit and that this particular jade quality was usually called Maw-sit-sit jade. The following day we left Mogaung early at daybreak in order to pass the gate at Kamaing before 9 a.m. (because no jeep was allowed to drive the 65 miles on the narrow track up into the jade area afterwards) and after passing several picturesque villages of the Kachins, with sparsely scattered long-houses—some of them marked by a white cross by their Christian owners (Fig. 2)—we reached the famous Uru river, which we crossed on a wobbling pontoon bridge, which was being repaired with the assistance of log-carrying elephants. On the other bank we stopped at a tea house in Lonkin. Several of the local traders and mine owners approached our host to show him some of the prize pieces they had recently found, and among them there were also a few small, rough boulders of that brilliant green Maw-sit-sit material which, Mr. Lee explained, originated in a small place in the neighbourhood of Tawmaw. At Lonkin the track forked away to the right, leading to the region of the primary jadeite deposits surrounding Tawmaw at a distance of 21 miles, and to the left to a higher section of the Uru river where the alluvial river deposits and the boulder conglomerates are centred round the small mining village of Hpakant. The picturesque mining village Hpakant is an important mining centre (Fig. 3), and workings for jadeite exist in numerous places along the river and in the hills along the south bank. As Mr. Lee wished to examine some river mines which he was operating we followed the left track. Thus I had no further opportunity of investigating the actual source of the mysterious Maw-sit-sit which intrigued me so much, but decided to return here again next year and spend more time in the region in order to visit the outcrop mines in the vicinity of Tawmaw.

Upon returning to Europe I found that the Maw-sit-sit material had already reached the western gem market and that several lapidaries were already cutting it into all sorts of decorative articles. In the West the stone is being offered under the name of Chloromelanite, which certainly is a misnomer, because the material has nothing in common with Chloromelanite, not even its colour. This confusion inspired me all the more to convert my decision into action and after overcoming enormous difficulties, which were the expression of a strongly xenophobic attitude of the Burmese officialdom, I revisited the distant jade region again in March 1963. This time I was accompanied by my eldest daughter. The conditions had greatly changed during the interval of twelve months. The Burmese government under General Ne Win, a complete dilettante in state affairs, had issued a new decree outlawing the Chinese owners of jade mines and many jade traders had left, Mogaung was disturbingly quiet, numerous jade mines were abandoned and the country was being haunted by dangerous bands of insurgents. Mr. Lee was just as hospitable and helpful as the year before and extended his kindness and co-operation from the distance of Hong Kong, in that he let me use his jeep and had his family offer my daughter and me comfortable accommodation wherever we needed it. As we had prepared to spend ten days in the district we had ample time for visiting all the jade mining sites along the Uru river and around Tawmaw.



Geological map of the area in which Maw-sit-sit is found.

The area so far known at present in which the mineral jadeite is found in Burma is situated in the Myitkyina District around the draining waters of the Uru river. The exact course of the Uru is still not exactly plotted because there are serious difficulties in the way of detailed geographical, let alone geological, mapping as survey work is greatly impeded by the almost impenetrable jungle, which in places is so thick that it is possible to see only a few feet ahead, and it is still inhabited by numerous tigers and infested by nasty insects. The region is a highly dissected upland, consisting of ranges of hills which form the Chindwin-Irrawaddy watershed. It is higher in the north than in the south, and Tawmaw, where the true outcrop jadeite mines are situated, is lying on the plateau at an altitude of 2,755 feet above sea level. It is about 165 miles by road, i.e. track, from Mogaung. The Uru river is an important stream, and its banks and small feeders are the scene of much mining activity for jadeite.

Within the area much of the surface is occupied by Tertiary rocks to the west of which lies a great intrusive complex consisting essentially of serpentinised peridotites, the outcrop being elongated north-east to south-west and being roughly oval in shape. This complex is surrounded by crystalline schists which include types derived from both sedimentary and igneous rocks. The sedimentary types appear to represent the country rock into which the plutonic complex was injected. The Uru boulder conglomerates of Pleistocene to sub-recent date occupy a considerable area north eastwards from Tawmaw and it is important on account of its jadeite workings.

The jadeite-bearing intrusions in the serpentinised peridotites consist of the following rock types which grade into one another: jadeite, albite and amphibolite. The jadeite is an exceedingly tough rock, normally white (supplying the mutton-fat jade), but it is irregularly streaked and spotted with emerald-green by chromite, apple-green to brown by iron and lavender-blue to violet by manganese. In some cases the rock is mono-mineralic and this is the densest type, with a specific gravity of 3·34, which furnishes practically all the precious gem material.

The jadeite-albite rocks are intrusive into the serpentinised peridotites of the district, either in the form of dykes or rather in the shape of sills, as is evidenced in the field by the appearance of the outcrops at Tawmaw. The immediate parent of the jadeite-albite rocks of present state was a soda-granite-aplite produced as a normal product of differentiation from the granite magma represented in the district by the types mentioned before. The complete assemblage of igneous rocks in the district comprises various ultrabasic rocks of several types (peridotites, gabbros, amphibolites etc.), and granites of several kinds including pegmatites and aplites, the latter consisting of quartz and albite. The jadeite-albite rocks were derived from the magma represented by these aplites. The aplitic magma, a residuum from the granite magma, on coming into contact with the ultrabasic wall, rock suffered desilication, with the consequent elimination of the quartz and the conversion of much of the potential albite Na Al Si_3O_8 into jadeite. The silica released from the magma was used up in converting the orthosilicates of the peridotites into metasilicates. It is important to note that the desilication is only partial, as the rocks still contain large quantities of albite, with only some jadeite. The latter is sometimes closely associated with albite in albite-jadeite rock; but in other cases it forms lenses of nearly pure or quite pure jadeite-rock, embedded in equally pure albite rock. The amount of jadeite present appears to be directly proportional to the quantity of albite. It has to be understood that these reactions took place under almost unique conditions, presumably involving very high pressure.

The outcrop mines at Tawmaw:

The most prolific outcrop mines of jadeite are situated in the region of Tawmaw. The methods of mining consist of two kinds of ordinary quarry working. Before work is started, the Jade Nats (spirits) are propitiated by almost every worker irrespective of nationality, in that fresh flowers, bowls filled with water or rice and occasionally some fruit, are offered on a bamboo erection gaily decorated with coloured paper banners (Fig. 4). In most of the open pits, which are not numerous, the working methods are usually very crude, as the rock is broken by crowbars or mamooties and the jade veins, which vary from a few millimeters to several centimeters in thickness, are hewn out of the boulders by chisels, wedges and hammers. The prevailing method of extracting jadeite in this region of primary deposits consists of sinking a number of relatively wide vertical shafts about fifty feet down to the jadeite dyke along which inclining tunnels and intermittent stopes are driven, following the inclining course of the dyke for several hundred feet (Fig. 5). At some of the larger and more entreprising mines steam hoists and compressed air drills were being used when I visited the mines. (Blasting was forbidden from fear of misuse by the insurgents, who haunted the country.) In the deepest working chambers the miners simply work with blunt chisels, wedges and hammers.

The alluvial deposits along the Uru river:

The Plateau Gravels of Upper Burma are represented in the north of the Myitkyina district by a boulder conglomerate, named the Uru Boulder Conglomerate after the river Uru which was responsible for its formation. The age of this conglomerate, and hence the formation of these secondary alluvial deposits of jadeite, is probably Pleistocene to Sub-Recent, for the conglomerate has not yet solidified but is still rather loose. The outcrop of the conglomerate attains to a length of several dozens of miles and an average width of two to four miles. The thickness or height of the formation must exceed a thousand feet in places, as is evident from a traverse along any of the tributaries of the Uru and as I noticed by the hills worked at Hpakant, where the cliffs overlooking the stream are entirely composed of the conglomerate. The workings along the Uru river can be classified into (*a*) Stream-bed workings where mining is possible throughout the whole year (Fig. 6 and Fig. 7), (*b*) Hillside workings where the rock is quarried during the rains

FIG. 5. *At Tawmaw wide and deep vertical shafts are sunk down to the jadeite dykes. Here a primitive lift is operated from a simple bridge consisting of jungle wood beams and bamboo rods.*

FIG. 7. *Details of the river mining at Hpakant. Small claim in the foreground. Machine pump hoists ground water through metal hose back into the river.*

FIG. 6. *River mining along the bank of the Uru at Hpakant. The dams enclose different claims.*

FIG. 8. *Small open quarries and a few scattered, primitive miners' huts at Maw-sit-sit.*

which help in sluicing away the overburden and the alluvial matrix of the conglomerate. A more detailed report on the geography and geology of the area, on the mining and the cutting methods, as well as on the trade conditions in Burma and Hong Kong, will be published later in the *Schweizer Goldschmied* as part of an extensive paper about the "Gems from Burma".

The locality with which we are most concerned within the rather limited compass of the present article's subject is the small mining field of Maw-sit-sit (Fig. 8). It belongs to the so-called Namshamaw dyke, which constitutes part of the wide spread outcrop mines in the jadeite-albite rocks of the vast jade region of Tawmaw. The small workings at Maw-sit-sit, of which most were deserted when we visited them, are situated about half a mile west-north-west from the tiny hamlet of Namshamaw in a stream and adjoining it. The oldest mines were swamped with deep water, thus making it impossible to study the outcropping rocks and their relationships, while the few younger pits were not then profound enough to yield full information on the nature and association of the primary rocks. The dyke runs in the direction north-west to south-east with a tendency to run west-north-west to east-south-east. Blocks of jadeite of irregular shape, which seem to have travelled short distances only, occur in red earth formed by the decay of the serpentine. Very likely the jadeite boulders excavated here represent disintegrated portions of a dyke which has either not been exposed yet or lies a little to the west.

The local miners distinguish two varieties, which they call:

(*a*) Maw-sit-sit, the brilliant green hue of medium tone with yellowish tinge,

(*b*) Kyet tayoe, the bright green variety of paler shades.

Of the two varieties, Maw-sit-sit meets with more favour as a decorative gem stone. The rare beauty of the vivid colour fascinated me instantly, but judging by its appearance, delicate polish and waxy lustre I was convinced that it was not jade. However, it could have been an unusual variety of Chloromelanite or the much rarer Tawmawite (chromepidote). Of the latter I knew that it was extremely rare and so far had only been found in the Mienmaw dyke. The important locality of Mienmaw was worked spasmodically by several people. There is a heavy overburden of red earth with abundant iron concretions—25 ft. to 30 ft. in thickness. Nothing of the relationships of the rocks of the dyke could be gathered since the old pits were filled up with red earth washed down from higher levels. Serpentine and chloritic schists (byindone) could be observed in places. In one place chrome-epidote was seen with albite (so-called "palun"), and this is considered as a favourable indication of the occurrence of fine green jadeite in the neighbourhood. Chrome-epidote is formed where chromite is present in serpentine, and the associated minerals—albite and jadeite—are coloured as a result of absorption of the epidote.

I purchased several samples of the Maw-sit-sit with the intention of investigating it more closely at home. Unfavourable circumstances, however, prevented me from carrying out my plan immediately. Now, after subjecting the collected stones to various methods of scientific examination during the last few weeks, I feel satisfied to present some preliminary and surprising results.

Appearance and optical examination:

Summarising the afore-mentioned statements, the rough material may be described as an opaque stone of bright to brilliant green colour of medium tone with a yellowish tinge. The homogeneous or sometimes cloudy distribution of the colour is irregularly traversed by fine veins or spotted by uneven specks and patches of a very dark green to black alien substance, which most likely is caused by a concentration of the pigment. The fracture is granular in concurrence with the stone's texture, while the surface appears somewhat spathose, on account of the sparkling of cleavage planes of individual albite grains. The majority of the material is marred by numerous cracks and fine fissures, which causes cuttable gem-material of good quality to be extremely rare. The cut stone assumes a smooth polish and displays a delicate waxy lustre, which betrays a lower hardness degree than jadeite. Its hardness of 6 corresponds with that of feldspar. The refractive indices, measured on the Rayner refractometer, were found to vary from 1·52 to 1·54.

The specific gravity, obtained from a great number of pieces, averages 2·77. These values of R.I. and density gathered by the orthodox gemmological methods disclose very clearly that the substance could be neither jadeite, nephrite, chloromelanite nor chrome-epidote (tawmawite). Consequently further research became necessary, for the reliable accomplishment of which I am gratefully indebted to Prof. Dr. M. Weibel, of the Institute for

Crystallography and Petrology, at the Swiss Federal High School of Technology in Zurich.

Microscopic investigation:

Thin sections, cut across the stone in random directions, yielded various informative observations which are elucidated hereafter:

(*a*) The main body consists of albite forming in a granoblastic texture. The medium size of the grains measures 0·05 to 0·1 mm (Fig. 9 and Fig. 10).

(*b*) An irregularly disseminated pigment appears black under low magnification, while innumerable pale green grains may be recognized through a high power lens. The diameter of these grains, varying from 0·005–0·01 mm, is approximately ten times smaller than that for the albite grains.

(*c*) Individual crystals surrounding the concentrations of pigment appear to be a little larger than the pigment grains, with which

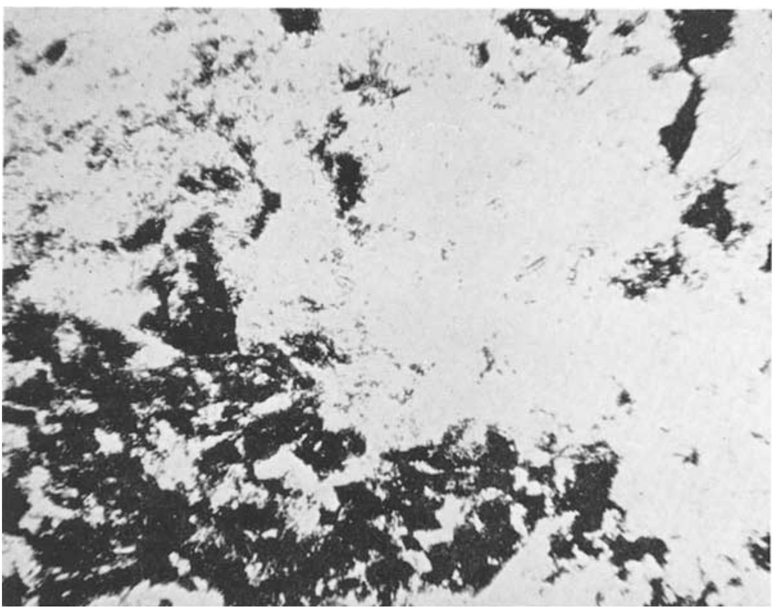


FIG. 9. *Photomicrographs of Maw-sit-sit. White parts = albite; black patches = pigment. The pigment appears rather homogeneously extended and on account of the low magnification it is not dissolved into individual grains, thus creating the misleading impression of constituting a rather important component.* (25 ×)

they seem to be identical. These larger crystals are isometric to elongated, pale green and transparent. In all cases their size was smaller than the thickness of the thin section (Fig. 11 and Fig. 12).
(*d*) Some colourless, finely granular aggregates of a tabular mineral are embedded singly in the albite mass.
(*e*) Minute areas of intensive emerald green colour seem to occur quite sporadically and may constitute an extremely fine mixture of the pigment with some other mineral (Fig. 13 and Fig. 14).

Chemical analysis:

The following table, in which for the sake of comparison the chemical compositions of pure albite and jadeite are also presented, renders evidence of the result of the chemical and spectroanalytical investigation and manifests the quantitative composition of the stone.

	Maw-sit-sit	*Pure Albite* $NaAlSi_3O_8$	*Pure Jadeite* $NaAl(SiO_3)_2$
SiO_2	66·0	68·7	59·5
Al_2O_3	16·5	19·4	25·2
Na_2O	11·1	11·8	15·3
Cr_2O_3	2·6		varying amount
Fe_2O_3	·8		varying amount
MgO	2·2		
H_2O	·6		
	99·8		

Li_2O, K_2O, CaO, MnO and TiO_2 proved to be further components which were present in small amount varying between 0·01 and 0·1%.

The analysis of the Maw-sit-sit allows certain conjectures with regard to the pigment. It is most likely to be a composition which contains sodium and silicon besides chromium, yet very little or no aluminium. The ratio Na:Al:Si of the total analysis revealed more Na and Si to be present than is necessary for the formation of albite. Maybe the mineral which accounts for the colour is a member of the aegirine group, in which iron is partly substituted by chromium. One might suspect the occurrence of a new mineral, not described heretofore. However, this is mere speculation and so far with regard to the pigment the total analysis of the Maw-sit-sit only permits the conclusion, that the colouring

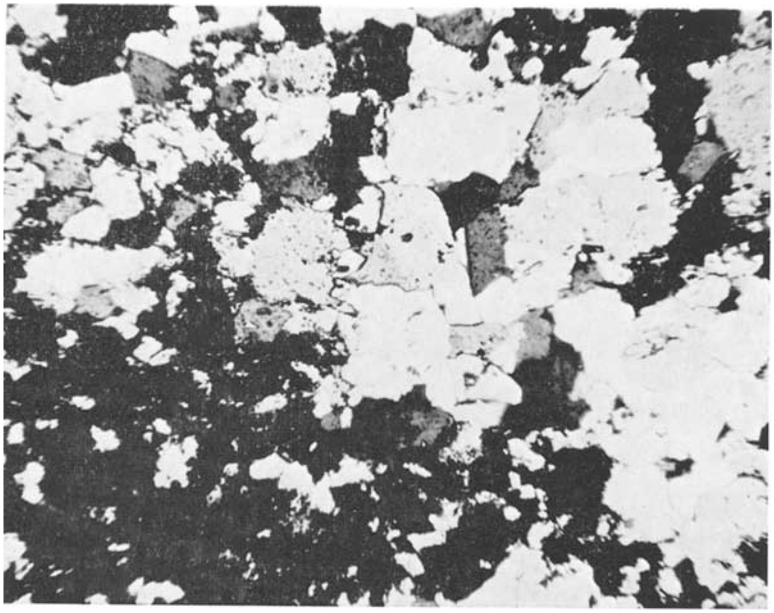


FIG. 10. *Same as 9 but through crossed polaroids. Now the granular texture of the albite mass becomes very conspicuous.* (25 ×)

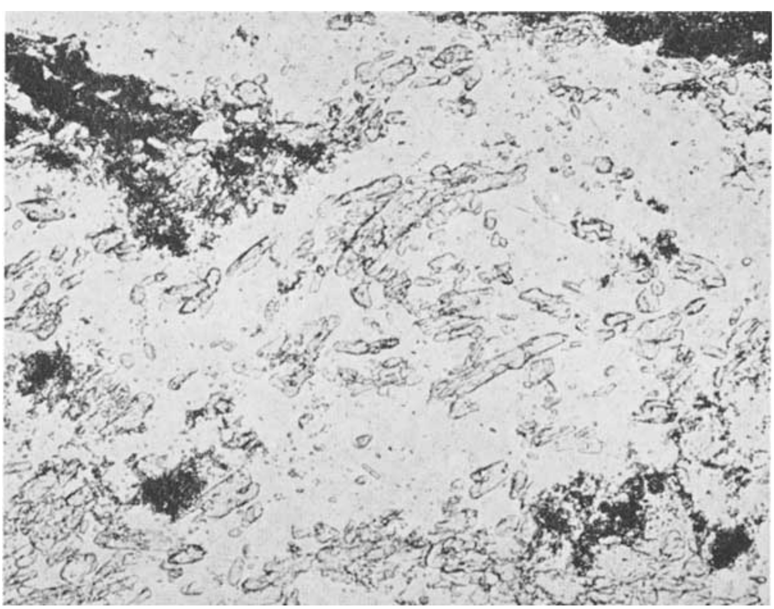


FIG. 11. *Individual grains are irregularly disseminated through the white mass of albite. They seem to be identical with the minute grains of the dense pigment patches.* (40 ×)

FIG. 12. *Same picture between crossed polaroids manifests the granular texture of the albite mass. Some of the pigment grains may still be recognized near the left top corner.* (40 ×)

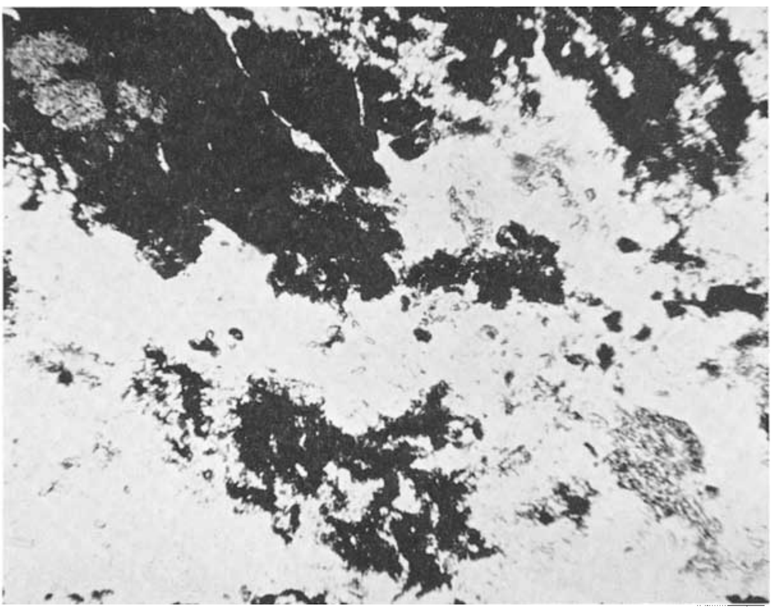


FIG. 13. *In the black mass of pigment there is an irregular greyish patch which represents one of those curious emerald-green areas consisting of an aggregate of extremely fine grains of unknown nature.* (100 ×)

agent in question is a chromium composition, whose chromium content in view of the small proportion of pigment must be relatively high.

X-ray examination:

The powder diagram of Maw-sit-sit depicts practical concurrence with albite. A very small number of three or four additional lines, which were certainly produced by the pigment or other accessory minerals, was not sufficient to identify the accessory components responsible for the green colour. The chromium minerals which appear to account for the colour of the Maw-sit-sit, seem to be chromiferous varieties whose x-ray diagrams have not yet been established. On the other hand, it must be considered that also albite does not display a uniform x-ray diagram but slightly varying line positions depending upon the phase condition.

The problem of the pigment:

Albite is relatively easily dissolved in hydrofluoric acid.

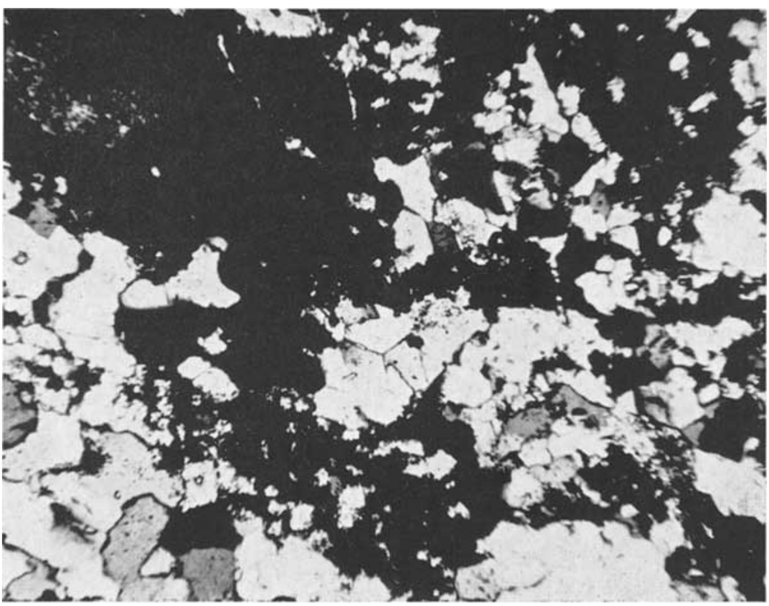


FIG. 14. *Same picture as 14a, observed between crossed polaroids.* (100 ×)

Attempts selectively to dissolve albite and thus concentrate the pigment unfortunately failed—most probably because of the extremely fine distribution of the pigment. The residue, which produced X-ray diagrams differing from that of the Maw-sit-sit, consisted of conversion products of the albite and contained even less chromium than the original Maw-sit-sit.

Some consideration concerning the occurrence of chromium in other minerals may be interesting at this point. Trivalent Cr (ion radius 0·63) usually replaces trivalent Fe (ion radius 0·64) and Al (ion radius 0·51). The average content of chromium in the crust of the earth has been estimated to amount to 0·01%, this value however, is uncertain, because of the great differences of Cr contents in basic and acid rocks. Apart from chromite the element chromium relatively rarely forms minerals in nature—referring to their geographic distribution as well as to the number of their species. Consequently the chromium varieties of other minerals are very little known. Chromite, the most important chromium mineral, may contain more than 50% of Cr_2O_3. In the shape of thin splinters or in the minute dimensions of accessory grains in rocks it appears brown, and not green as observed in the thin sections described above. Therefore, the identity of chromite with the pigment seems to be excluded and chromite cannot be responsible for the green colour of the Maw-sit-sit. The highest content of chromium in silicates, amounting to 27% Cr_2O_3, has so far been found in the chrome-garnet Uvarovite. Chrome-epidote (Tawmawite) from Finland contains 6·8% of Cr_2O_3. No jadeite that has hitherto been subjected to a detailed chemical analysis has boasted a greater amount than 0·01% of Cr_2O_3.

Conclusion:

The optical, chemical, spectroanalytical and röntgenographical investigations lead to the conclusion that the intensively green Maw-sit-sit essentially consists of finely granular albite, which owes its vivid green colour to a chromiferous pigment that is delicately disseminated through the stone's body. The nature of the substance accounting for the colour could not be determined, but it was found to prevail as minute crystals which are irregularly distributed in the albite mass. Attempts to enrich the pigment by selective dissolution of the albite failed on account of the extreme smallness of the grains. At least one or two further green (chromium-bearing) minerals seem to occur as subordinate components, whose nature also could not be identified because of their very small sizes. Contrary to the impression the relatively homogenous coloration might imply, chromium is not directly incorporated in the albite, but it is rather present in high concentration in a mineral of unknown nature which acts as a pigment. Up to date, chrome-albite has not yet been mentioned, and it is rather doubtful that chromium could be integrally built into the albite structure. It is difficult to corroborate this assertion, but the microscopic observation has established the clear evidence that in Maw-sit-sit a green mineral is present besides the albite. From the results discussed above, the following knowledge can be inferred: Maw-sit-sit is not a mono-mineral but a mixture of minerals, that is, a rock. The body-substance consists of albite, which is irregularly interspersed with an alien chromiferous mineral inducing the vivid green colour. With a rock, chemical formulae can only be established for the individual components. In Maw-sit-sit albite forms the principal component, whose formula is $Na\ Al\ Si_3O_8$; on the other hand the chemical formula of the pigment is not yet known. Only a method which enables operation with extremely minute quantities of material may provide a solution to the problems of the Maw-sit-sit, and it is therefore intended to carry out further investigations by means of a latest model of an A.R.L. electron microscope. In view of the fact that Maw-sit-sit consists mainly of albite, it seems appropriate to give this new decorative gemstone a name which carries the name "albite" as principal word, yet as long as the pigment is not determined, the native name of Maw-sit-sit may just as well serve as a distinctive designation.

Pictures by Mary Helen Gübelin. Photomicrographs by the author.

IF THERE'S A DOUBT HAVE IT TESTED

By A. E. FARN, F.G.A.

THIS advertising phrase is apt and very rewarding. In the world of gem testing there were some stones which hardly needed testing, since they were impossible to copy or imitate successfully. Emeralds used to be easy—if red under a filter, it was an emerald. Black opals were once a certainty, but nowadays there are treated or carbonized opals of a very attractive appearance but which are not exactly as one would expect when a stone is termed "black opal".

Possibly one of the least tested stones is the diamond. By diamond I mean transparent white diamond, not any fancy colour or hue, since the detection of possible treatment is a separate and very technical problem on its own.

Diamond is the hardest known gemstone and in what one terms "the good old days" an anvil was said to be shattered quite readily when a diamond was tested upon it by striking! Apart from being the hardest known gemstone it also has a now well-recognized weakness, i.e. cleavage. We all know what would happen if we placed a diamond on an anvil and struck it a heavy blow.

A gem-testing laboratory sees more unusual stones from hopeful jewellers than most people in this trade. Some people specialize in certain stones such as star-stones and cat's-eyes, emeralds and opals, or rubies and sapphires. Diamond-dealers proper seldom mix with the coloured stone trade. It is interesting, sometimes, to see an obvious large synthetic ruby brought in by a dealer who usually specializes in diamonds only.

Whilst there are coloured-stone dealers, and diamond dealers, there are dealers who dabble in many gems including corals, pearls, ivories, etc. and seldom do these people manage to specialize in any particular one.

How much more difficult then is it for the retail jeweller who has to consider all these, together with watches, clocks, gold, silver, plated wares and repairs and estimates.

Small wonder then that the jeweller who is suddenly confronted with a "pearl" necklace, a chrysoberyl cat's-eye ring or a fine pink sapphire in a cluster surround sometimes feels himself at a loss to identify such gems.

"Are they diamonds" or "is it a diamond" is the kind of question which brings quick reaction. But, and it is a very big but, once doubt is sown in the mind then fermentation takes place and the slogan "If there's a doubt have it tested" pays its dividends.

In the laboratory quite recently we had an old-cut long cushion-shape thick diamond of good quality brought in by a slightly irate though somewhat apologetic diamond dealer. I thought he wanted it weighed to settle a point one way or the other. He said "I want it tested". To me, it was so obviously a diamond. I could not help pointing this out as diplomatically as possible (after all he was a diamond dealer). To my relief he immediately agreed, "Yes, indeed I know it is a diamond but someone has doubted it because it is an old stone". Thus we had the crux of the matter—a doubt. This particular case, one of a few I can recall, was outstanding in its sharpness of doubt and certainty. Others, of course, are a good deal more nebulous.

Some while ago a dealer asked me if I was interested in a parcel of rose-cut diamonds and on being shown them I suggested he had them tested. He protested that they were all old Indian stones but to me they looked like zircon—and a check by spectroscope confirmed the diagnosis.

Another dealer had a diamond and onyx eternity ring, which had been fished up from the sewers by a sewerman, and the diamonds were very rubbed indeed—no one could have said what the stones were by just looking.

It is my experience that pawnbrokers above all seem to be considered fair game to the unscrupulous. Most pawnbrokers are open not only to lend money on valuables but are very often more liable to buy jewellery from the public than many retail jewellers. Therefore more people "try it on" with pawnbrokers than otherwise. I am, perhaps, specifying the pawnbroker at the moment because the average retail jeweller buys from regular suppliers mostly new goods. These in turn are obtained from manufacturers who are buying their diamonds direct from well known sources of supply. It is not these kinds of goods I have in mind.

Quite frequently a very pleasing ring (with, say, a circular amethyst or golden quartz) is mounted in a cast setting with a cluster surround of synthetic white spinels. Very clean and newly polished it looks very pleasant because the cast is from a very good pattern and perhaps the finish of the ring by the polisher has been well done. This kind of ring after being worn a little (with a little dust, or powder or soap accumulation behind it) if offered over the counter under artificial light at a reasonable asking price, can cause an error. When goods are offered too cheaply suspicion is aroused. If offered at a reasonable price—then commerce overcomes gemmology (if there is any gemmology).

Sometimes it happens a diamond is cut with too much spread to make it look more for the money and the stone looks a little "laxey", a term somewhat similar to "lasque", which is used to describe a very thin flat style of cutting from India. When a diamond is cut in a manner which is not familiar to the jeweller then he is troubled. A very tricky point arises sometimes when a stone is a baguette-shape and used as a shoulder stone to a ring, and is set flush with the metal. This allows very little chance of inspection, due to the mount immediately obtruding when by turning the ring the stone is examined.

Artificial lighting can mislead when quickly looking at a cluster-set ring, especially if one has approached the problem by examining the centre stone and assuming a diamond cluster surround. Lack of "fire" can thus be put down to general dirtiness at the back and a mental note that it will improve if the ring is cleaned. It is usually the next day, with daylight to help and a clean-up of the accumulated debris from behind the stones, that the truth becomes apparent.

By these observations it is not intended or suggested that jewellers and pawnbrokers are constantly being taken in by unscrupulous methods, because the majority make their living adequately enough to disprove any such opinion.

With the advent of strontium titanate, however, I think it to be a little dangerous to assume too readily that diamonds never need testing. One afternoon, about 2 years ago, I had a strontium titanate single stone ring in to test from a West End jeweller. Immediately following we had a cluster ring from the National Association of Goldsmiths to test for one of their members. The centre stone was a strontium titanate with a cluster surround of reasonably good quality diamonds. The whole effect was good and if a little dirtier could have passed quickly as a very fine all-diamond cluster. Two rings in immediate succession one afternoon having strontium titanates in them was remarkable.

"Diamonds are forever", as a title, indicates the inherent hardness and durability of diamonds. This hardness of diamond is its important factor—it is related to the quality of polish the stone can take, and upon the finish of the facet edges. In fact, a hard look and finish. Because of its simple chemical and molecular structure diamond has a single refraction and a characteristic optical clarity. Such is this impressive quality that when viewed through the table facet with a lens the culet seems to be very close to the table.

The stones which are most commonly used in jewellery in place of diamonds or as diamond simulants are: (1) Synthetic Spinel, (2) Synthetic sapphire and natural colourless sapphire, (3) Zircon, (4) Synthetic Rutile, (5) Strontium Titanate, (6) Paste, with high refractive index. There may be others—one can cite almost any colourless stone, but I think the stones listed are the most commonly used and reasonable to expect.

Jewellery which is "diamond"-set, if suspect, should be cleaned in order that information can be obtained by visual methods. A clean stone or stones in settings are much more easy to test if light can readily be transmitted.

In a cluster setting synthetic spinels are very quickly identified by immersing in methylene iodide because their refractive indices very nearly match at 1·728 and 1·74 respectively. The effect can be quite startling, the stones tend to disappear from their settings and an empty mount is left.

Since natural spinels do not exist as colourless stones (they always draw a little colour in comparison to a parcel of diamonds or synthetic spinels), it is safe to assume the synthesis of the spinels. Synthetic sapphires, as opposed to diamond, are doubly refracting (as shown by a doubling of the back facets or the effect seen when a piece of jewellery is revolved between fixed crossed polaroids). Although it is safe to assume that all spinels which are colourless in a setting are likely to be synthetic it is not the same case with colourless sapphires.

Usually, of course, one is not trying especially to identify the suspect colourless stone—only to avoid buying it as a diamond. Natural colourless sapphires are very bright stones and it is not unusual to find them in cluster settings surrounding a genuine blue sapphire in jewellery emanating, say, from Ceylon. Examination by microscope will sometimes reveal crystalline inclusions, feathers, silk, etc. in even very small stones.

Synthetic colourless sapphires will very often show included gas bubbles much more readily than synthetic spinels. A thorough cleaning of the backs of small cluster-set jewellery is really important when examination has to be made by microscope. Being a cheap product synthetics are very seldom well cut or polished and reveal this by certain small useful factors such as fire or chatter marks on the new face. These marks are caused by heating due to pressures in polishing and are seen as slight surface cracks in a slightly zig-zag manner. They are more frequently seen on synthetic stones than on genuine ones.

Colourless zircons, because of their superior "fire", are a very good imitation of diamonds. With zircons, providing one is a reasonably well-versed jeweller, gemmologist or probationer, it is a fairly easy matter to see quite distinct double refraction evidenced by the doubling of back facets. I have quoted jeweller, gemmologist or probationer because one presumes that readers of the JOURNAL OF GEMMOLOGY are just that. Colourless zircons are brittle and soft and usually reveal this by the very frequent chipping and worn appearance of the facet edges. Zircons have a muzzy look when viewed through the table facet with a lens. This "out-of-focus" appearance is due to the marked double refraction.

Should very small rose-cut or brilliant-cut colourless zircons be used in a cluster setting the stones may be slightly rubbed or no double refraction easily recognizable, and then the spectroscope comes into its own. The well-known absorption band seen in the red end of the spectrum at 6535Å is completely diagnostic for zircon—very easy to find and practically infallible in showing (besides other lines) in zircon. The spectroscope knows no barriers of size, cut, polish, rough, or water-worn.

Synthetic rutile with its play of colour should never cause any hesitation even to a non-gemmologist jeweller. Its large double refraction is so startling as to make the doubling of back facets look like separate distinct facet edges. Synthetic rutile is the extrovert among stones. Rutile does not exist in nature as cuttable rough material and certainly no rough or natural rutile ever looked like a poor relation to the poorest quality in diamond used in jewellery. Synthetic rutile in any case cannot get that white or colourless aspect of diamond. It always looks a little yellow or off-white.

Strontium titanate is the most dangerous to the jeweller. Although it has too much fire in its pristine state it can be dangerous when a little rubbed or dirty. Strontium titanate is very soft and has a slightly moulded look if observed carefully at the facet edges with a lens. Apart from an old-fashioned (but very practical in this case) hardness test, there is little one can do to identify a strontium titanate except by examining certain abrasive marks seen under laboratory conditions. For an artificial stone it is quite expensive—the smaller sizes are more expensive per carat than the larger sizes. Its brilliance and fire cause it to stand out as superior to diamond but its soft look and rounded facet edges betray it. Strontium titanate is much heavier than diamond and if a stone is loose this factor can be used against it. Quite recently a friend of mine ordered a Strontium titanate with a 1-carat diamond spread. In actual fact it weighed 1·61 cts. So that comparison of a stone by gauge to actual scale weight can be very informative.

High refractive index pastes are sometimes deceiving. One always thinks immediately of swirl striae and bubbles, but they are not always seen. In an antique ring of backed table-cut stones it is not always wise to attempt a hardness test. If a spinel refractometer is available a refractive index reading is often possible and here information is quickly gained if the resultant reading seen on the scale of the spinel refractometer has a colour fringe. These colour fringe readings indicate paste as opposed to glass. Because of the high dispersion of most pastes a coloured fringe or edge is seen as the reading on the refractometer scale. Pastes from 1·61 upwards especially towards 1·65, 1·66, 1·67, etc. show this effect clearly. Similarly if a paste-set article cannot be checked on a refractometer for various reasons often it will yield information if immersed in monobromonaphthalene. Monobromonaphthalene has a refractive index of 1·66 and pastes around this reading will tend to disappear or the facet edges fade when a stone or jewellery is immersed. In contrast, diamond will stand out clearly. Certainly it is helpful also to find swirls or bubbles, but immersion will readily distinguish paste from diamond, and it is the elimination of suspects from diamond we aim at in this article, not necessarily complete identification of the simulant.

We have dealt with the stones most likely to be met with as "diamonds" and discussed their characteristics. What if the stones are diamonds? Nowadays with the decline in horse drawn traffic anvils are not so common, so the gemmologist usually equips himself with a large cheap synthetic ruby or sapphire with a large table to it. Diamond will scratch synthetic ruby or sapphire. Brute strength is not required. Diamonds have a clarity and brilliance unapproached by any other stone. Very often the girdle of a diamond has a small "natural" unpolished face left on it, either by design or fortuitously, and this is very helpful. Although this is not a laboratory test, I have frequently noticed how even a light touch of the finger on the table facet of a diamond leaves an imprint of grease from the skin (or fingerprint) very sharply defined indeed bearing ample witness to the well known affinity diamond has for grease. Diamonds will stand out sharply in methylene iodide. Diamond facet-edges have a quality of finish and a degree of hardness not seen in any other stone. Simple tests to prove diamond are the hardness test against synthetic corundum and high relief in methylene iodide. Laboratory refinements, of course, are infinite, and include fluorescence, under X-ray excitation or long and short wave lamps. Electro-conductivity tests also play their part, but by and large it is: Look first, lens second, opinion third and then proof by whatever method seems obvious, expedient and positive. The X-ray excitation or short-wave lamps, etc. are refinements but all add to and play very useful parts in this identification of diamond, this common stone that seldom needs testing—or does it?

A reiteration of factors in the foregoing to eliminate diamond simulants from diamond may be helpful here. Synthetic spinels are singly refracting, disappear in methylene iodide, and are scratched by sapphire and diamond. Synthetic sapphires are doubly refractive, often have bubbles and chatter marks, and are scratched by diamond. Zircons are soft, brittle, strongly doubly refracting, have a 6535Å line and are heavy stones. Synthetic rutile has tremendous double refraction, strong play of colour, and is markedly off-white. Strontium titanate—tremendous fire, singly refracting, soft facet edges and girdle, "centipede" outline scratch marks. High R.I. pastes—sometimes bubble and swirl marks, are very soft, and disappear in monobromonaphthalene; heavy, colour fringe on spinel refractometer; single refraction.

Diamond is singly refracting and has an affinity for grease. It will easily scratch all other gemstones including sapphire and ruby (both natural and synthetic). Sharp relief is shown in methylene iodide. It has optical clarity, extreme hardness and polish, and sharp facet edges. Diamond fluoresces milky-blue when excited by X-rays. It has characteristic carbon inclusions and may show naturals on the girdle.

RADIO-ACTIVE DIAMONDS

By R. WEBSTER, F.G.A.

The first of these stones was a round brilliant-cut diamond of dark "tourmaline-green" colour weighing over six carats, which was found to be one of the strongest radio-active diamonds seen. When placed on a Levy-West screen (activated zinc sulphide) the scintillations observed were strikingly beautiful, and even when the lens used to view these flashes of light was removed, a halo of light could be seen surrounding the diamond. When the stone was placed one inch (2.5 cms) away from the edge of the screen the radiations were found to just reach it, causing scintillations at its edge. A Geiger counter test, by courtesy of the Officers of the Overseas Geological Surveys, showed the diamond to have radio-activity as great as, or greater than, a radium watch dial. The illustration (Fig. 1) shows the auto-radiograph produced by this diamond when left on an Ilford double-coated x-ray film for about 60 hours. The photo also shows signs of directional intensity of the radio-activity.

The second example consisted of a two-stone diamond ring, one stone being green in colour and the other white, both being about three carats in weight. A preliminary test on a Levy-West screen showed the green stone to be radio-active, which indicated that the colour was undoubtedly due to radium treatment. When an autoradiograph was taken for confirmation, most surprisingly the white diamond also gave a self-picture (Fig. 2). The cause of this makes an intriguing problem. Had the radium-treated green diamond induced radio-activity in the white diamond, or was it some reflective effect of the alpha particles by the white diamond?

FIG. 1

FIG. 2

As the stones could not be unmounted a subsidiary test on each stone singly, which might have proved either of these hypotheses, was not able to be carried out. This is the first time such an effect has been noticed although other jewels containing radium-treated green diamonds mounted with white diamonds have been so tested on previous occasions.

R.W.

Gemmological Notes

A FEW GEM ODDITIES

The textbooks are not always correct. How many collectors, on being unable to find their rare gemstone in the reference books, have taken it for granted that "something was wrong somewhere", and have even attached a new label to their gem just to conform with well-known books?

Many reasons exist for this state of affairs. Gemstones come and go. Also, there is a limit to any one person's knowledge. Most collectors are limited financially and consequently never get offered many of the rarer and costly varieties. Few of us can expect to develop a collection containing top-grade specimens of all varieties. We have to be content with what we can afford. Thus the tendency to say, "Such stones just don't exist", has to be restrained. They may quite well exist.

The following are a few items which the author has come across in recent months.

Apatite, of a deep hue, is rarely met with, yet Brazil supplied a sapphire-blue apatite full of unusual inclusions. The stone weighed 1·12 carats.

Aragonite is not usually encountered among faceted stones. Crystals from Horschenz, near Bilin in Bohemia, afford quite large stones with a pearly finish.

Barite is also rarely met with in collections mainly because it is so difficult to handle. Blue barite from Sterling, Colorado, affords stones which look somewhat like aquamarine.

Diaspore is one of the hydrous oxides. The manganiferous variety from South Africa provides small stones of a rose to dark red hue.

Dickinsonite—a hydrous phosphate—is one of the minerals usually ignored by gem textbooks. Yet crystals have enabled one or two small stones of olive-green hue to be cut.

Natrolite is usually presented in textbooks as being available in fibrous form or in needle-like crystals. Thus faceted stones are usually very fragile. However, a granular vein of natrolite encases the benitoite in San Benito County, California, and this locality provides material good enough for the cutting of stones of two carats or more.

Phosgenite, a chlorocarbonate of lead, is sometimes found in fine crystals large enough to cut stones of over 30 carats. This mineral is usually not mentioned in textbooks on gems. Oddly enough, phosgenite is also found at Laurium, Greece, as a result of the action of seawater on ancient lead-slag dumps. So in this locality, man and nature have combined their efforts to produce a natural gemstone.

Prehnite is quite well-known, but the clear faceted variety is rare. One source is Argyll, Scotland, and stones of several carats have been cut.

Pyroxmangite yields small but beautiful stones of an attractive red hue. One current source is Honshu, Japan. One wonders what a gem trade laboratory would do if faced with such an unusual stone. No doubt the equipment of the mineralogist would be necessary in this case. In this case, the mineral textbooks, too, do not provide much information as to sources or the possibility of obtaining faceted red stones from the crystals.

Smithsonite is well-known in cabochon stones of beautiful pastel hues, and crystals from Tsumeb provide faceted stones.

Sphene is familiar gem, but a faceted stone of 27·25 carats must be considered something of a rarity even though it is not flawless.

Tourmaline of the colourless variety has long been known to be rare. The Himalaya Mine of Mesa Grande, California, is one source.

G.V.A.

A DUBIOUS ROSE

A rose-cut diamond of about 4ct. spread mounted as a single stone ring with closed-in setting was examined recently.

The under-side of the ring was rounded and a double rose-cut diamond set in gold was indicated. Examination gave an appearance of doubling or a doublet. The top "half" certainly was diamond. Wisely the stone was unset and found to be a straightforward flat-backed rose-diamond slightly off-white, weighing 2 cts.

The hollow rounded cradle of the ring was seen to be not only foiled but the foiling was faceted! This was the reason for the appearance of depth in the stone. Needless to say it was an expensive overseas purchase.

A.F.

PROBLEMS IN BURMA

One way of obtaining a valuation of gems is reported in the February 1965 *Lapidary Journal.* An extract says:—

"Recently the present Burmese government, which is completely Communistic in its national policies, held a purported 'auction sale of seized gems' in Rangoon from 1st December to 12th December. Supposedly the ordinary passport and visa regulations were relaxed for this purpose in order to attract foreign gem experts. The sale, it was said, was meant only for gem dealers and stone sellers.

"Reliable persons who were inveigled to attend from outside Burma have now returned disappointed and report that the whole thing was a fake. The government only wanted to get a free appraisal of the gems from gem experts and dealers through written bids on each item of gemstones. This seems to be the only purpose for such a fake sale. Persons who made offers in writing were answered by slips under their hotel room doors stating that the gems they bid on were not for sale. Many persons complained about losing their valuable time and their own transportation money in this deal.

"It is widely known that the gem mines of Burma have been 'nationalized', that is, seized by the Communistic dominated government authorities and that all former owners have been dispossessed, particularly and especially the Chinese who owned the principal gem mines in the ruby district of Mogok and in the jadeite regions of upper Burma".

Gemmological Abstracts

HARRISON (E. R.) and TOLANSKY (S.). *Growth history of a natural octahedral diamond.* 1964, 279, pp. 490-496.

The growth history of the diamond was studied by examining eleven successively polished cubic sections of the complex structure of an octahedral diamond.

S.P.

POLUTOFF (N.). *Die Sibirischen Diamantlagerstätten.* The Siberian diamond finds. Zeitschrift f. Erzbergbau und Metallhuttenwesen, 1964, 17, 8 pp. 440-443 and 9, pp. 500-503.

Small finds of diamonds in Siberia, between the rivers Lena and Jenissei, were reported in 1898 and again in 1937. Soviet scientists then started prospecting for diamonds, assuming that most finds were situated in the world's older plateaux. Diamonds were found in 1949 and the first primary occurrences in 1954/55. The first kimberlite pipe was found in 1954 by the young female mineralogist, L. Popugaewa. She at first assumed the presence of diamonds because she found pyropes very similar to those found in South African kimberlite. The prospecting was very difficult owing to the climatic conditions and working in virgin land (Taiga). Aircraft were a great help in this respect.

The diamond finds are limited to the eastern half of the middle Siberian plateau, to the north of which is the tundra. There is not much snow during the winter, which lasts about 6-7 months with temperatures usually under -40°C, sometimes even -60°C. The air is dry. Rivers are the only ways of transport, apart from reindeer and aircraft. The article gives details of the geological character of the region and of the prevailant magnetism. A detailed map of the area is also published, together with sketches of the actual pipe. The Siberian diamonds have been classified into 10 morphological types, which make up about 75–90% of all crystals. There are only 3 or 4 crystal habits. Isometric diamond crystals are rare, most common being octahedra and rhombic dodecahedra and habits between the two. There are few cubes but quite a number of twins. Most of the Siberian diamonds are colourless, which vary from each other mainly by their degree of transparency. There are very few coloured crystals, the few there are being mostly green-yellow. There are very few pigmentation spots, but occasionally there are grass-green spots to be observed. Inclusions are not numerous, those present are mostly graphite, olivine and sometimes pyrope. Inclusions of diamond in diamond are very rare.

The first big stone was found in 1956 and weighed 32·5 cts. In 1957 a stone weighing 37·35 cts. was found and in 1962 the stone "Mirnyj" was found weighing 56·2 cts.

The Soviet production, including industrial diamonds, was in 1958, 650,000 cts.; 1959, 800,000 cts.; 1960, 950,000 cts.; 1961, 1,000,000 cts.; 1963, 2,750,000 cts.

E.S.

TSUJII (T.). *The Change of Pearl Colours by the Irradiation with γ-ray or Neutron ray.* Journ. Rad. Rea., 1962, 4, 2-3-4, pp. 120-125.

Pearls produced either in pearl oyster or in fresh-water mussel change their colours into black by the irradiation with either γ-rays or neutron rays. In this coloration, blackish pigments are found chiefly in the inserted nuclei of the pearls produced in marine molluscs and also in the nacreous layer of pearls produced in fresh-water mussels, but seldom in Japanese pearl oysters. The insertion nucleus is made of the nacreous layer from the shell of fresh-water clams.

The nacreous layer either in the shell or in the pearl or fresh-water clams easily changes colour from the original to black by the irradiation. In order to clarify the mechanism of the coloration, the coloured pearls were observed, using chemical and physical methods.

In physical observations, in the coloured pearls examined submicroscopically, using electron microscope and x-ray diffractometer and heat-effects, no physical differences were found before and after the irradiation.

In chemical observation, the shell of fresh-water clams contains comparatively larger amounts of Mu than marine molluscs.

T.T.

LEIPER (H.). *Occurrences of gem topaz in north America.* Lapidary Journ., 1964, 18, 8, p. 956.

S.P.

FERNANDES (L. L.). *The gold and diamond deposits of British Guiana.* Proc. 5th Inter-Guiana Geol. Conf., Georgetown, 1959 (Publ. 1961), pp. 273-283.

Alluvial diamonds are found in the Pakaraima Mountains escarpments in a 15 mile wide belt. Since 1887, 2,700,000 carats of diamonds have been produced.

R.A.H.

TOLANSKY (S.). *Synthetic diamonds: growth and etch phenomena.* Proc. Roy. Soc. London, series A, 1962, 270, pp. 443-451.

Microscope studies of de Beers synthetic diamonds showed growth spirals on cube faces.

R.A.H.

EVANS (T.) and PHAAL (C.). *Imperfections in type I and type II diamonds.* Proc. Roy. Soc. London, series A, 1962, 270, pp. 538-552.

Electron microscopy revealed impurity platelets, probably of nitrogen, on (100) planes in type I natural diamonds but not in type II. Dislocations are common to both types.

R.A.H.

THEISEN (V.). *Es sieht aus wie Türkis.* It looks like turquoise. Deutsche Goldschmiedezeitung, 1964, 12, 62, pp. 1144-1147.

This article is the continuation of one published in the same journal, no. 11, pp. 1033-1036. This part of the article deals with various imitations, mostly with so-called "Wiener Türkis" (Vienna turquoise), "New" turquoise and the use of howlite. The first type is produced from malachite, aluminium hydroxide, phosphoric acid, which are heated to 100°C under strong pressure; the second type has a very similar composition, while howlite is found in North America, together with gypsum and anhydrite, and is dyed to simulate turquoise. At the end of the article there is a table, which is very useful. The materials tabulated are turquoise, dyed turquoise, turquoise with impregnated surface, dyed and hardened turquoise, reconstructed turquoise (natural material bonded together with blue resin), odontolite, amatrix (which is utalite and wardite), kallainite (a clay phosphate), lazulite, dyed chalcedony, glass or china imitations, elatite (a mixture of copper carbonate and blue azurite), chrysocolla, "Vienna turquoise", "new" turquoise and dyed howlite. In each case special characteristics are given together with hints on how to recognise them. Apart from these, the following details are enumerated: chemical composition, appearance, RI, spec. gravity, hardness, absorption spectrum, luminescence in UV light.

E.S.

. . . *Die synthetischen Smaragde.* The synthetic emeralds. Deutsche Goldschmiedezeitung, 1964, 12, 62, p. 1148.

Short notice referring to "Diebeners Goldschmiedejahrbuch" (Goldsmith's Almanac) for the year 1965. In this Dr. W. F. Eppler published an article on emerald synthesis, dealing with productions by Chatham, Lechleitner, Zerfass and Gilson. It is mentioned that the latest synthesis by Lechleitner is a complete synthesis, as the emerald is built up in layers. The colour is very good and the layers can only be observed when the stone is viewed from the side in a liquid having similar refractive index.

E.S.

. . . *Mikro-boy, ein Mikromessgerät für Brillianten.* Micro-boy, a micrometer for brilliants. Deutsche Goldschmiedezeitung, 1964, 12, 62, p. 1162.

A new instrument made by the firm "Micro-boy" in Zürich, which should prove useful for anyone concerned with the measurement of stones. It is as large as a pocket watch, very light, easily adjusted and its scale is graduated to 1/100 mm.

E.S.

LIDDICOAT (R. T.). *The G.I.A. photoscope.* Gems & Gemology, 1964, 7, IX, pp. 195-199.

Reports an ingenious adaptation of the Polaroid Land automatic 100 camera so that it may be used for photomicrography. This camera has a shutter which opens manually but closes electronically when sufficient light to expose the film is recorded by a photo cell. The adaptation lies in the use of an armoured flexible fibre optical light wire connecting the photo cell to the second ocular of the binocular microscope.

10 illus. R.W.

BOOK REVIEWS

FISHER (P. J.). *Jewels*. B. T. Batsford Ltd., London, 1965. 112pp., 4 colour plates, 49 photographs and 32 drawings. 35s.

Jewels is essentially a brief and well-illustrated introduction to Gemmology, aimed especially at "young people and others who would welcome a book written in simple terms". There is room for such a book, and Mr. Fisher has on the whole succeeded very well in his purpose. There are more than 80 illustrations, derived mostly from excellent black-and-white photographs, in addition to 4 plates in colour. Of these, three were specially taken for this volume and reproduce fairly faithfully the appearance of most of the gems described in the text: the fourth, which is also reproduced on the cover, is a superb plate of diamond crystals of varying colour and habit, provided by De Beers. A sister plate to this has already graced the jacket of Webster's *Compendium*.

After a first chapter on "Gems through History", which includes notes on the making of modern jewellery, there follows one on "The Nature of Gems" into which are crowded basic facts of the chemistry, crystal form, etc., of gem minerals, the nature of light, and its reaction upon cut gems. This chapter is rather too "instructional" in tone, and in places seems to assume that the reader is not only young but dim-witted: for instance, "Everybody today has heard of that most terrible weapon known as the atom bomb. Do not imagine that our beautiful gemstones have anything to do with that fearsome thing, but they do have in common the fact that they are composed of atoms, as indeed are all things in our world". There are a number of ways in which this chapter could be improved: as it stands it may quench the ardour of a beginner before he breaks through to the easier reading of the chapters beyond.

The stones selected for treatment in the descriptive sections are sensibly limited to the 20 or so species utilized in commercial jewellery, together with the organic gems amber, coral and pearl. The only stone outside this canon which is allowed to intrude is sphene—the name of which has acquired a certain mystique amongst dealers, even if they have never seen a specimen in their lives.

The chapter on diamond is good, though scant treatment is afforded to important fields outside South Africa. Since such things are interesting to the general public, rather more might have been given of stories of diamond discoveries, together with production figures for gem and industrial diamonds. For the other gems the descriptions are fairly adequate, if rather on the dry side. The explanation given of "High" and "Low" zircon is not really accurate, and one or two paragraphs could do with rewriting here.

Jade is so important a material in human history, pre-history, and culture that the author might have spared more space in which to bring it to life for the layman. In the mere 300 words or so actually given to the jade minerals there are several inaccurate statements. For instance, nephrite was *not* worn by the ancient Greeks as a protection against kidney troubles; it is probable that neither the Greeks nor the Romans knew anything about the jade implements which were later found in their countries. Nor has jadeite been valued by the Chinese "since the dawn of history", but only from the eighteenth century onwards when the lovely material from Upper Burma first became available to the Chinese craftsmen. Mr. Fisher should also have included the important North American deposits of nephrite jade in his list of sources.

The chapter on pearl is very well written and illustrated, but pink (conch) pearl should have been mentioned as it has some commercial significance, and its distinction from coral needs to be indicated.

The seventh and last chapter in the book, on "Testing Gems", is excellently done, and cleverly compresses the essentials of the subject into a dozen or so pages. Extended captions under the photographs of instruments make for clarity and save the author from having to give this information elsewhere in the text. In dealing with the spectroscope, Mr. Fisher makes the statement that "various metals often cause the dark lines which appear in definite positions in the absorption spectra of minerals, and in this way it is even possible to discover the composition of the stars in the universe. . . ." This shows a confusion between the narrow, fixed lines appearing in the emission or absorption spectra of the vapour of an element with the absorption bands in the solid state. The latter of course vary in position according to the host mineral—hence their usefulness in identification.

The book concluded with "Gem Tables" and a short combined index to both text and illustrations. The "Tables" consist in fact of one useful comprehensive table, giving the composition, hardness, density, refractive index and occurrence of the main species. For some reason, sphene, spodumene, fluorspar and lapis-lazuli, which are described in the text, are missing from this table..

Mr. Fisher suggests only two books for further reading: *Gem Testing*, and Robert Webster's comprehensive *Gems*. Perhaps a word as to the scope of these might have been added to save the innocent reader from plunging into waters deeper than he intended. Herbert Smith's *Gemstones* as revised by F. Coles Phillips might also have been recommended, as it still provides the best one-volume coverage of the whole subject.

B.W.A.

EYLES (W. C.). *The book of opals.* C. E. Tuttle Co., U.S.A. and Japan, 1964. 224 pp., 13 colour plates, 28 photographs and 8 drawings. 60s.

A useful contribution to the literature on opal. In discussing geological explanations of opal origins no conclusion is reached about the cause of colour. The book is entertaining in the parts dealing with mining methods and the history of opal as a gem. The major opal producing areas are described in detail and this section of the book benefits from the author's visits to several of them and his own mining experiences. Reference is made to some of the outstanding opals that have been found, though the list is incomplete. The index is irritatingly inaccurate.

S.P.

ASSOCIATION NOTICES

JOURNAL OF GEMMOLOGY

Secondhand copies of back numbers of the *Journal of Gemmology* urgently required. Vol. IX No. 1, and Vol. IX No. 3 1963, are particularly needed. Will members having copies for disposal please communicate with the Secretary.

TALKS BY MEMBERS

BENSON-COOPER, P., "Gemstones", Ash Vale Women's Liberal Club, 30th January, 1965.

BLYTHE, G. A. "Gemstones", St. Saviour's Women's Fellowship, Westcliff, 3rd November, 1964; Women's Branch British Legion, Southend, 4th February, 1965; Institute of Petroleum, Shell Haven, 24th February, 1965.

KENNEDY, N. W., "Women and gemstones", Poulton and district Ratepayers' Association, Bebington, 9th February, 1965.

LANGTON, E. G., "Pearls", Soroptomists' Club, Hornsey, London, N.8, 27th January, 1965.

ANNUAL MEETING

The 35th annual meeting of the Association will be held at Saint Dunstan's House, Carey Lane, London, E.C.2. on Wednesday, 5th May, 1965, at 6.30 p.m. to transact business usual to an annual general meeting.

Officers:

The Council has made the following nominations:—

President: Sir Lawrence Bragg, F.R.S.
Chairman: Mr. Norman Harper
Treasurer: Mr. F. E. Lawson Clarke
Vice-Chairman: Mr. P. W. T. Riley

The following members of the Council retire in accordance with the Articles of Association and, being eligible, offer themselves for re-election: Messrs. D. J. Ewing, W. Stern and R. Webster.

Messrs. Watson Collin & Co., Chartered Accountants, have signified their willingness to continue as auditors.

MEMBERS' MEETING

A meeting of members was held at the Films and Art Theatre, London, W.1. on Thursday, 28th January, 1965, when the following films were shown: "Diamonds in the West", "The Cleaver" and "Diamonds in the stone industry".

LETTER TO THE EDITOR

DEAR SIR,

Pleochroism through the Microscope

I read with great interest the article "Dichroism through the Microscope" by R. S. Miles, F.G.A. and J. T. Herring, F.G.A. (Journ. Gemm., 1965, IX, 9). Possessing a very simple microscope, without compensating eyepiece, rotating stage, polarizing equipment and spares, I approached the problem in a different way:

A piece of polaroid film was cut in two and the pieces were placed at right angles to each other on a $\frac{3}{8}''$ washer, which has an outer diameter of 21 mm.

The polaroids were stuck down with transparent adhesive tape dividing the aperture field into four quarters.

After trimming the surplus tape the washer is placed on the field aperture which is found between the collecting lens and the ocular lens of the $\times 5$ Huygens ocular. On rotating the ocular, four colours are seen in pleochroic gemstones, such as andalusite, iolite, etc.

If the washer is placed the wrong way on the field aperture, the polaroids are out of the picture plane and there appears dichroism only.

Yours truly,

Ludenscheid, RUDOLF THURM.
W. Germany.

MIDLANDS BRANCH

Mr. R. A. Jones, an Executive of De Beers Corporation of West Africa, spoke about "Diamonds in the West" at a Midlands Branch meeting held in Birmingham on 22nd January, 1965. Dimonds were first discovered in Sierra Leone in 1919, in the Berry River, but it was not until 1924 that extensive mining began. Many diamonds were smuggled into Liberia at first. A state buying operation, financed by De Beers, is now in force and much of the buying is organized by the Sierra Leonians. After the showing of the film "Diamonds in the west" Mr. Jones answered questions. Mr. A. E. Shipton proposed a vote of thanks.

OBITUARY

David Keefe Lynch, 21st February, 1965, after a long illness. Mr. Lynch gained his diploma in 1951.

Raimo A.U. Marno, Helsinki, 27th October 1964

MEMBERSHIP

The following were elected on 1st February, 1965:—

FELLOWSHIP

Davis, Margaret (Mrs.), Wembley, Middx. (D.1964)

ORDINARY MEMBERSHIP

Cameron, Donald A., Ottawa, Ont., Canada
Chang, Sin Kong, Hong Kong
Duyk, Francois, Brussels, Belgium
Gibson, Henry G. W., London, N.W.2.
Gunaratne, Somasema, Via Kahawatta, Ceylon
Hanebach, Stanley, Scarborough, Ont., Canada
Ison, John P., Farnborough, Hants.
Lucas, Richard G. H., Sittingbourne, Kent
Mansoor, Ahamed Y. M., Puttalam, Ceylon
O'Donnell, Arthur L., London, S.E.3.
O'Grady, Royston J., London, N.19.
Ono, Tsutomu, Hyogo Pref, Japan
Pearson, Malcolm D., London, E.3.
Subhan, Mohd., London, E.C.1.
Gibson, Craigie A., Causeway, Rhodesia

PROBATIONARY MEMBERSHIP

Boruszak, John K., Blackpool, Lancs.
Taylor, Andrew W., Newton Abbot, Devon.

COUNCIL MEETING

At a meeting of the Council held on 1st February, 1965, Mr. Norman Harper, Vice-Chairman, presided.

The following elections took place:—

ELECTED TO FELLOWSHIP

Bagi, Julius, Toronto, Canada
Baguley, Kenneth, Liverpool, 10, Lancs
Barrett, Robert C., Ansty, Sussex
Beckwith, John M. E., Middlesbrough, Yorkshire
Burslem, William A., Liverpool, 14, Lancs.
Calmus, Michael, Nottingham, Notts.
Chambers, Edwin J., Dagenham, Essex
Cornish, S., Birmingham, 22A, Warwicks.
Grey Harris, Stephen J., Bristol, 7
Hartley, Mary L. (Miss), Liverpool 8, Lancs.
Johnson, Donald H., Kitwe, Zambia
Major, Keith R., East Grinstead, Sussex
Mooney, Eugene, Edinburgh, 10, Scotland
Nilsson, Carl A. G., Boliden, Sweden
Pierce, William M., Athens, Ohio, U.S.A.
Richardson, Kenneth, Birmingham 9, Warwicks.
Rowley, Robert E., Tadworth, Surrey
Schriber, Urs, Lucerne, Switzerland
Wain, Edward H., Ipswich, Suffolk
Walters, George C., Leicester, Leics.
Barrett, Henry M. S., Lewes, Sussex

ELECTED TO ORDINARY MEMBERSHIP

Austin, Virginia S. (Mrs.), Phoenix, Arizona, U.S.A.
Downes, Bryan, Silkstone, Yorks.
Earthy, Peter B., Newbury, Berkshire
Ek, Stig Yngve, Vallingby, Sweden

Franke, Lois E., Hollywood, California, U.S.A.
Holdroyd, David M., Hong Kong
Huish, Diana (Mrs.), London, N.2
Inkersole, Denis, London, E.9
Johnson, Douglas A., Nuneaton, Warwickshire
Kerez, Christoph J., Baden, Switzerland
McLean, Eldred M., Orkney, Transvaal, S. Africa
O'Shea, John P., Orpington, Kent
Ponahlo, Johannes (Dr. Ing.), Wien 22, Austria
Salt, Ilse (Mrs.), Vancouver 8, B.C. Canada
Salt, Thomas E., Vancouver 8, B.C. Canada
Sarkodie-Mensah, James, London, N.W.6
Sweet, Ronald D., Sidcup, Kent
Wardulenski, Witold, Montreal 26, Quebec, Canada
Ozolins, Nikolajs, Willowdale, Ontario, Canada

Elected to Probationary Membership

Bartolotti, Anna (Miss), Lucerne, Switzerland
Bullock, Gabrielle J. D. (Miss), Worcester, Worcs.
Burgerhout, Saskia, The Hague, Holland
Gauntlett, Gillian (Miss), Haslemere, Surrey
Lewis, Leslie J., London, E.5
O'Donohoe, John P., Dublin, 2, Eire
Popper, Madeleine C. (Miss), London, N.W.3
Simmonds, Stephen J. M., London, S.W.1
Stadler, Othmar, Lucerne, Switzerland

The Council decided to form a separate company to handle the sales of gem-testing instruments. Directors of the Company would be appointed by the Council.

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The ballast choke, starter and switch are housed in a metal casing measuring $6\frac{3}{4} \times 3\frac{1}{2} \times 3\frac{3}{4}$ inches, and the lamp hood enclosing the lamp measures $2\frac{1}{2} \times 1$ inch diameter. The lamp hood has two apertures measuring $1 \times \frac{3}{16}$ inch. Once switched on, the lamp strikes immediately and after a few minutes the lamp gives an almost pure sodium emission.

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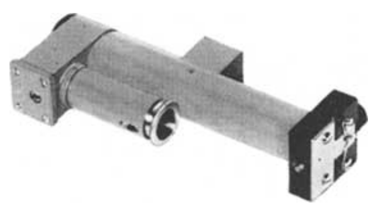

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