Gems and Gemology

WINTER, 1964-65

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Gems & Gemology

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On the Cover

Alois Sturmlechner of Vienna, Austria, received a Diamonds-International Award for this exquisite diamond-and-platinum clip. Two diamond-set platinum branches of different lengths bend forward in a graceful dip. Suspended from the branch tips are graduated round diamonds and synthetic-emerald-coated beryls.

Photo courtesy N. W. Ayer & Son, Inc.
New York City

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Maw-sit-sit

A New Decorative Gemstone From Burma

by

Edward J. Gubelin, Ph.D., C.G.

While visiting the Ruby Valley of Mogok in Upper Burma two years ago, I received a 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. It had been one of my cherished dreams for many years to see the remote sources of the precious material. For centuries, Burma had served the Chinese stone carvers as the one source of this raw material from which they sculptured the magnificent jade figures of highest artistic value. So I profited from the last eight days allowed on my tourist visa, hired a jeep and traveled to Mogaung, where my wife and I were very cordially received by our host and greatly enjoyed his generous hospitality.

The morning after our arrival, while strolling around in Mogaung, watching the jade lapidaries and their curious implements of work, I noticed a few polished slabs and buttons of an unusual, pleasant, bright-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 his exuberance of speech I could grasp that the specimens were either "stones called Maw-sit-sit" or "stones from Maw-sit-sit." When I mentioned this to our host, he confirmed that the material was jade from Maw-sit-sit and that this particular qual-

Figure 1 Stately brick buildings belonging to wealthy jade dealers and miners line the main street of Mogaung, the attractive jade-marketing center. In the shops, beautiful collections of cut and carved jade pieces, representing an amazing variety of colors, are on display.

Figure 2 Jade lapidary, squatting behind a low bench polishes cabochons and buttons on a grooved board covered with Carborundum.

Figure 3 The famous crossing of the Ledo and Stilwell roads, eight miles north of Mogaung.

Figure 4 The wobbling pontoon bridge across the Uru River, at Lonkin.

Figure 5 Small bamboo shrine where jade miners bring offerings and pray to the jade *nats* before they start work at a new jade mine.

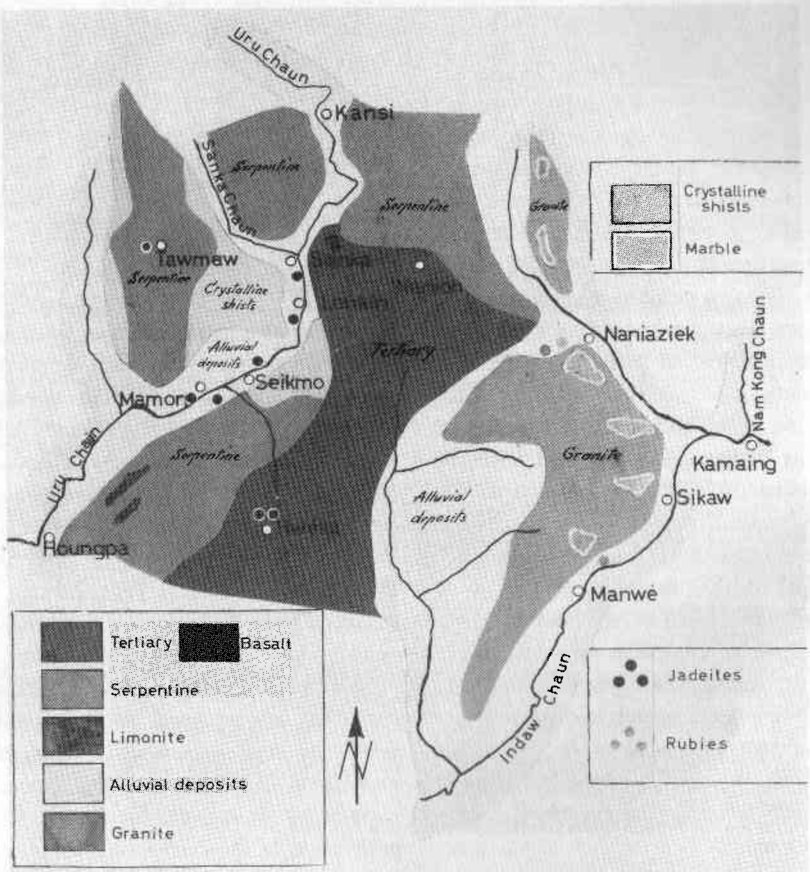
ity usually was referred to by this term.

The following day we left Mogaung at daybreak, in order to pass the gate at Kamaing before 9 AM (because no jeep was allowed to drive the 65 miles on the narrow track up into the jade area after that hour). After passing several picturesque villages of the Kachins, with sparsely-scattered long houses, some of them marked with a white cross by their Christian owners, we reached the famous Uru River. We crossed the Uru on a wobbling pontoon bridge, just as it was being repaired with the assistance of log-carrying elephants. On the other bank we stopped at a tea house in Lonkin to have a modest native meal. Several of the local traders and mine owners approached our host to show him some of the prize pieces they had recently found; among them, there were also a few small, rough boulders of that brilliant-green Maw-sit-sit material that, Mr. Lee explained, had originated in a small place in the neighborhood of Tawmaw.

At Lonkin, the track forked to the right, leading to the region of the primary jadeite deposits surrounding Tawmaw at a distance of 21 miles; to the left, it lead to a higher section of the Uru River, where the alluvial river deposits and the boulder conglomerates are centered around the small mining village of Hpakant. This picturesque village is an important mining center, and workings for jadeite exist in numerous places along the river and in the hills along the south bank. Since Mr. Lee wished to examine some river mines that he was operating, we followed the left track. Thus, I had no further opportunity to investigate the actual source of the mysterious Maw-sit-sit that intrigued me so much. So I decided to return the following year when I would have more time and could visit the outcrop mines in the vicinity of Tawmaw.

After returning to Europe, I was surprised to find that the Maw-sit-sit material had already reached the western gem market and that several lapidaries were 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 it has nothing in common with this mineral, not even its color. This confusion inspired me to convert my decision into action. However, we encountered enormous difficulties, most of which were the expression of a strong dislike for foreigners by Burmese officialdom. One expression of the xenophobic attitude is the curtailment of tourists' visits to 24 hours. However, I was able to revisit the region in March, 1963. This time my eldest daughter traveled with me.

The conditions had changed greatly during the interval of twelve months. The Burmese Government, under General Ne Win, a complete dilettante in state affairs, had issued a new decree to outlaw the Chinese owners of jade mines; many jade traders had left, Mogaung was disturbingly quiet, numerous 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 cooperation from Hong Kong; he let me use his jeep and had his family offer us comfortable accommodations wherever needed. Since we had arranged for a ten-day visit, there was ample time to inspect all the jade-mining sites along the Uru River and around Tawmaw.

At this point, it may be helpful to give a brief account of the geology of the jade-bearing region. The area, so far the only one known in which the mineral jadeite is found in Burma, is situated in the Myitkyina District, around the drainage basin of the Uru River. The course of the Uru is still not exactly mapped, because there are serious difficulties in the way of detailed geographical and geological mapping. 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; also, it is still infested by numerous tigers and

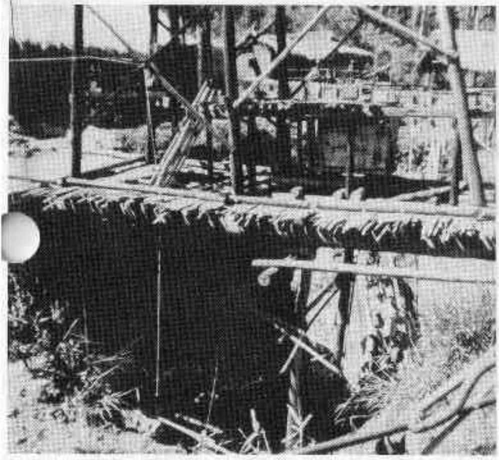


Figure 6 One of the largest and deepest shaft-and-tunnel mines of the Kadon Dwin, near Tawmaw. The vertical shaft is spanned by a wooden bridge, from which a tottering elevator is operated.

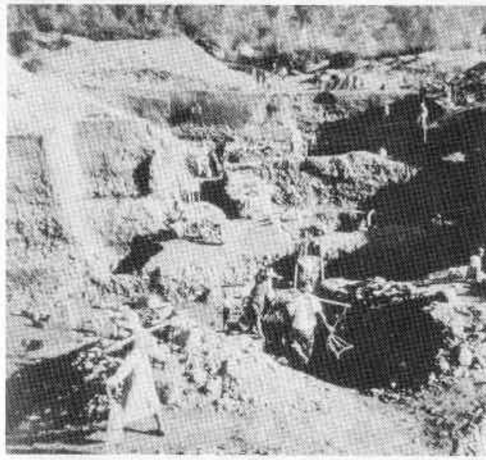


Figure 7 Numerous small workings in the alluvial conglomerates of the Uru Valley, near Lonkin.

hosts of nasty insects. The region is a highly dissected upland, consisting of ranges of hills that 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, lies on a plateau at an altitude of 2755 feet. It is about 165 miles by road (track) from Mogaung. The Uru River is an important degrading stream, and its banks and small feeders are the scene of much jade-mining activity.

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 serpentinized peridotites. The outcrop is elongated northeast to southwest and is roughly oval in shape. This complex is surrounded by crystalline schists, including 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, which are of Pleistocene to subrecent date, occupy a considerable area northeastwards from Tawmaw. It is important on account of its jadeite workings. A brief account of each of the formations follows.

The jadeite-bearing intrusions in the serpentinized peridotites consist of the following three rock types, which grade into one another: jadeite, albitite 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 chromium, apple green to brown by iron, and lavender blue to violet by manganese. Some of the rock is monomineralic; this is the densest type, with a specific gravity of 3.34, and furnishes practically all the precious gem material.

The jadeite-albite rocks are intrusive

into the serpentinized peridotites of the District, either in the form of dikes, or rather in the shape of sills, as is shown by the appearance of the outcrops at Tawmaw. The immediate parent of the jadeite-albite rocks was a soda-granite aplite, produced as a normal product of differentiation from the granite magma, represented by the types mentioned before. The complete assemblage of igneous rocks 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 ($NaA1Si_3O_8$) 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, since the rocks still contain large quantities of albite, with only some jadeite. The latter is sometimes associated closely with albite in albite-jadeite rock; at other times, 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 must 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 mining methods consist of two kinds of ordinary quarry working. Before work is started, however, the jade *nats* (spirits) are propitiated by almost every worker, irrespective of nationality, by placing offerings of fresh flowers, bowls filled with water or rice and occasionally some fruit on a bamboo structure gayly decorated with colored paper banners.

In most of the small number of open pits, the methods usually are very crude. 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 blunt chisels, wedges and hammers. The prevailing mining method in these primary deposits consists of sinking a number of relatively wide vertical shafts about fifty feet down to the jadeite dike, along which inclined tunnels and intermittent stopes are driven, following the inclining course of the dike for several hundred feet. At some of the larger and more enterprising mines, steam hoists and compressed air drills are used. Blasting was forbidden when I visited the mines, for fear of misuse by the insurgents, who haunted the country. In the deepest working chambers, the miners simply work with the above-mentioned hand tools.

Figure 8 Stream-bed workings along the Uru. The majority of the boulders lying about are waste. The chicken ladders to the left carry waste material onto the dam that separates the pit from the river. Jade boulders are stockpiled on the firm ground of the riverbank, in front of the miners' huts. The white wires spanning the pit designate the limits of the individual claims by the suspended and weighted cords that reach the floor of the mine.

Figure 10 One of the very deep quarries in the Uru boulder conglomerates along the hills, south of Hpakant. This pit has reached ground water, which is bailed out by means of a machine pump. The waste materials as well as the jade blocks are carried away in bamboo baskets dangling from shoulder yokes.

The Alluvial Deposits along the Uru River

The plateau gravels of Upper Burma are represented in the north of the Myitkyina District by the Uru boulder

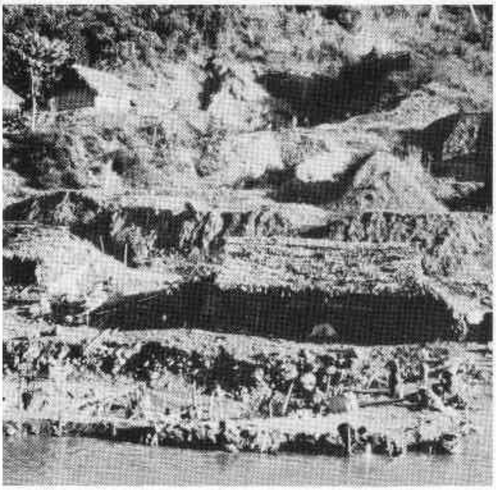


Figure 9 The hillsides opposite Hpakant are worked by innumerable open-cast quarries in the boulder conglomerates that were deposited by the Uru River.

conglomerate, named after the Uru River, 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 subrecent, for it is still more a gravel than a solid conglomerate. The outcrop of the conglomerate extends for a length of several dozens of miles and an average width of two to four miles. The thickness of the formation exceeds a thousand feet in places, as is evident from a traverse along any of the tributaries of the Uru. This thickness is also evident in the hills worked at Hpakant, where the cliffs overlooking the stream are composed entirely of the conglomerate. The deposits along the Uru River can be classified into (a) stream bed workings, where mining is possible throughout the entire year *(Figure 8)*; and (b) hillside workings, where the rock is quarried during the rains, which help in sluicing away the overburden and the alluvial matrix of the conglomerate *(Figures 9 and 10).*

A more detailed report on the geography, geology, mining and cutting methods of the area, 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. It belongs to the so-called Namshamaw dike, which constitutes part of the widespread outcrop mines in the jadeite-albite rocks of the vast jade region of Tawmaw. The small workings at Maw-sit-sit, most of which were deserted when we visited them, are situated about half a mile west-northwest 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 rock and their relationships; the few younger pits were not deep enough to yield full information on the nature and association of the primary rocks. The dike runs northwest to southeast, with a tendency to run west-northwest to east-southeast. Irregular blocks of jadeite, which seem to have traveled 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 dike that either has not yet been exposed or lies a little to the west.

The local miners distinguish two varieties:

(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 favor as a decorative gemstone. Its rare vivid color fascinated me instantly, but judging by its appearance, delicate polish and waxy luster, I was convinced that it was not jade. However, it could be an unusual variety of chloromelanite or the much rarer tawmawite (chrome-epidote). The latter was extremely rare and had only been found in the Mienmaw dike. The important locality of Mienmaw was worked spasmodically by several people. There is a heavy overburden of red earth with abundant iron concretions of 25 to 30 feet in thickness. Nothing of the relationships of the rocks of the dike could be gathered, since the old pits were filled with red earth that had washed down from higher levels. Serpentine and chloritic schists (byindone) could be observed in places. In one, chrome-epidote was seen with albitite (so-called *palun*) ; this is considered a favorable indication of the occurrence of fine green jadeite in the vicinity. Chrome-epidote is formed where chromite is present in serpentine and the associated minerals, albite and jadeite, are colored as a result of absorption of the epidote.

I purchased several samples of the Maw-sit-sit with the intention of investigating it thoroughly at home. Unfavorable circumstances, however, prevented me from carrying out my plan immediately. However, 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

Summarizing the afore-mentioned statements, the rough material may be described as an opaque stone of brilliant-green color of medium tone with a yellowish tinge. The homogenous or sometimes cloudy distribution of the color 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, whereas the surface appears somewhat micacious, 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; therefore, cuttable material of gem quality is extremely rare. The cut stone assumes a smooth polish and displays a delicate waxy luster that betrays a lower order of hardness than jadeite. The hardness is 6, corresponding with feldspar. The refractive indices, measured on the Rayner refractometer, were found to vary from 1.52 to 1.54. The specific gravity obtained from numerous pieces averages at 2.77. These values of R.I. and S.G., gathered by orthodox gemological methods, disclose very clearly that the substance could be neither jadeite nor nephrite, nor chloromelanite or chrome-epidote (tawmawite). Consequently, further research became necessary, the reliable accomplishment of which I am gratefully indebted to Professor Dr. M. Weibel, of the Institute for Crystallography and Petrology of the Swiss Federal High School of Technology in Zurich.

Microscopic Investigation

Thin sections, cut across the stone in random directions, yielded the following information:

(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. *(Figures 11a and 11b)*.

(b) An irregularly disseminated pigment appears black under low magnification, whereas innumerable pale-green grains may be recognized through a high-power lens. The diameter of these grains, varying from 0.005 to 0.01 mm., is approximately one-tenth of the size of the albite grains.

(c) Individual crystals surrounding the concentrations of pigment appear to be a little larger than the pigment grains with which they seem to be identical. These larger crystals are equidimensional to elongated, pale-green and transparent. In all instances their size

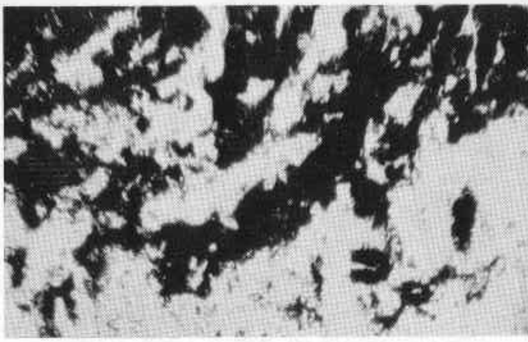


Figure 11a Photomicrographs of Maw-sit-sit. White parts are albite; black patches, pigment. The pigment appears rather evenly distributed. Under low magnification, it is not resolved into individual grains, thus creating the misleading impression of constituting a rather important component. *(25x)*

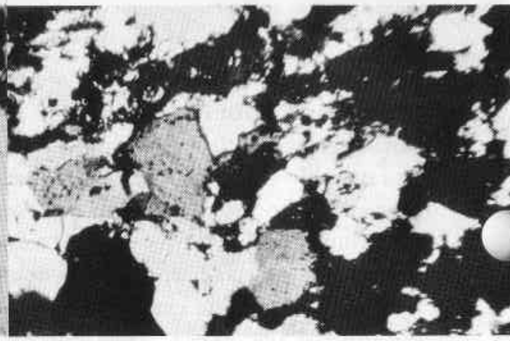


Figure 11b Same as 11a, but taken through crossed Polaroids. The granular texture of the albite mass now becomes very conspicuous. *(25x)*

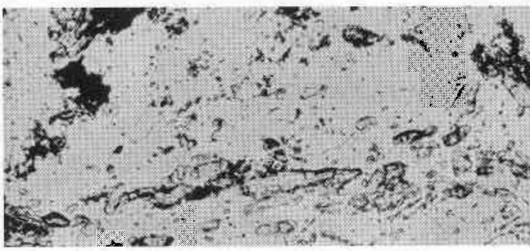


Figure 12a Individual grains are irregularly disseminated through the white mass of albite. They seem to be identical with the minute grains of the dense-pigment patches. *(40x)*

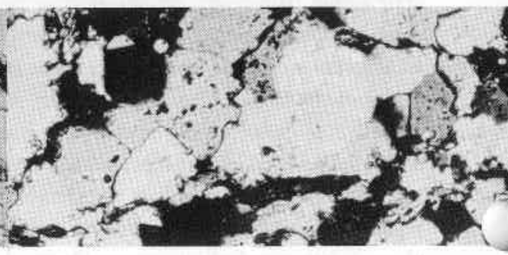


Figure 12b Same picture between crossed Polaroids demonstrates the granular texture of the albite mass. Some of the pigment grains may still be recognized near the left top corner. *(40x)*

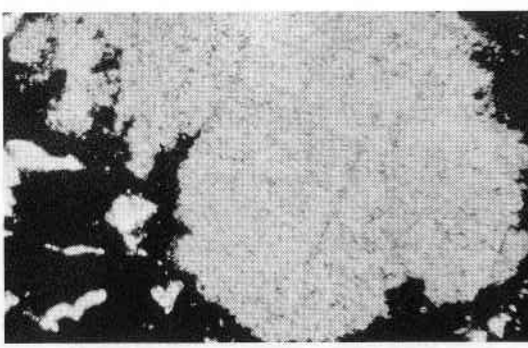


Figure 13a In the black mass of pigment, there is an irregular grayish patch that represents one of those curious brilliant-green areas consisting of an extremely fine-grained aggregate of unknown nature. *(100x)*

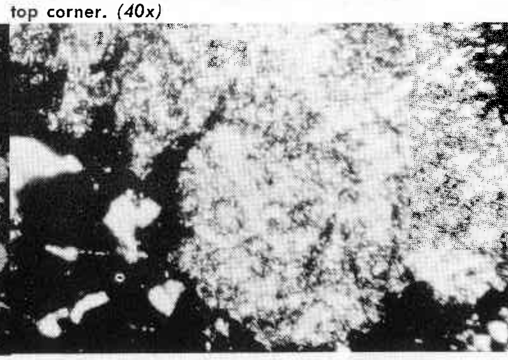


Figure 13b Same picture as 13a, observed between crossed Polaroids. *(100x)*

Photomicrographs by the author; other photos by daughter, Mary Helen Gubelin.

was smaller than the thickness of the thin section *(Figures 12a and 12b)*.

(d) Some colorless, finely granular aggregates of a tabular mineral are embedded singly in the albite mass.

(e) Minute areas of intensive brilliant-green color seem to occur quite sporadically and may constitute an extremely fine mixture of pigment with some other mineral *(Figures 13a and 13b)*.

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 new stone.

Li_2O, K_2O, CaO, MnO and TiO_2 proved to be additional components that were present in small amounts, 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 that contains sodium and silicon in addition to chromium, yet very little or no aluminum. 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. Perhaps the mineral that accounts for the color is a member of the aegirine group, in which the iron is partly substituted for 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 coloring agent in question is a chromium composition. In view of the small proportion of pigment, the chromium content must be relatively high.

	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		

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 color. The chromium minerals that appear to account for the color 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 remembered that albite does not display a uniform X-ray pattern but has slightly varying line positions, depending on the phase condition.

Discussing the Problem of the Pigment

Albite is relatively easily dissolved in hydrofluoric acid. Attempts to selectively dissolve albite and thus concentrate the pigment failed unfortunately, most probably because of the extremely fine distribution of the pigment. The gathered residue, which produced X-ray diagrams differing from those 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 difference of Cr content in basic and acid rocks. Apart from chromite, the element chromium rarely forms minerals in nature. 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 spinters or in the minute dimensions of accessory grains in rocks it appears brown, not green, as observed in the thin sections described above; therefore, chromite cannot be responsible for the green color of the Maw-sit-sit. The highest known content of chromium in a silicate, amounting to 27% Cr_2O_3, is found in the chrome-garnet uvarovite. Chrome-epidote (tawmawite) from Finland contains 6.8% Cr_2O_3. No jadeite hitherto subjected to a detailed chemical analysis has boasted more than 0.01% of Cr_2O_3.

Conclusion

The optical, chemical, spectroanalytical and X-ray investigations lead to the conclusion that the brilliant-green Maw-sit-sit consists essentially of finely granular albite and that its vivid-green color is caused by chromiferous pigment delicately disseminated through it. The nature of the substance accounting for the color could not be determined, but it was found to prevail as minute crystals that are irregularly distributed in the albite mass. Attempts to concentrate the pigment by selective dissolution of the albite failed, because of the ex-

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A 15.4-Pound

Brazilian Aquamarine

by
Francisco Müller Bastos

It is not surprising when an unusual colored stone or a large diamond is discovered in the gem-rich soil of Minas Gerais. Outstanding diamonds found in this State include the 261.88-carat *Star of the South*, the 179.3-carat *Star of Minas*, the 726.6-carat *Presidente Vargas,* the 460-carat *Darcy Vargas,* and the 409-carat *Presidente Dutra.* A more recent discovery was a colorless, flawless 59-carat crystal. It would be necessary to write a lengthy article about all of the famous diamonds that have come from Minas Gerais.

However, with regard to colored stones, only aquamarine, or sometimes tourmaline, is likely to come to the attention of the press. Very seldom do newspapers or magazines print an article describing the discovery of a chrysoberyl, garnet, andalusite or topaz of superior quality. I have had the opportunity to see beautiful and rare specimens of these gem minerals that were never reported publicly. But aquamarines are an exception: e.g., some of the large and beautiful stones from Santa Maria have been given prominence in the news. Also, stones from the Itaguacú Mine, State of Espirito Santo, and from the Pedra Azul (formerly Fortaleza) district of Minas Gerais have received notices in a few newspapers.

The most highly publicized find, however, was a deep-blue aquamarine of about 74.65 pounds that was found in 1954 on a farm near the city of Teófilo Otoni, Minas Gerais. This was the now-famous *Martha Rocha,* which has become a standard for superb color in Brazil. Since then, many other desirable and attractive stones, such as morganite, green and yellow beryl, kunzite, hiddenite and chrysoberyl cat's-eye, also have been discovered.

However, another big "bomba" (the word used in Brazil for sensational news) appeared in Minas Gerais, in 1964, and spread quickly throughout Brazil. An aquamarine equal to, or more beautiful than, *Martha Rocha* had been found. Like its predecessor, this new stone received much publicity, including a feature article in a reliable, respected magazine.

A *garimpeiro* (an unlicensed diamond miner or prospector), Abelo Ferreira, found this magnificent stone while working near the small town of Padre Paraíso (formerly Agua Vermelha), Municipality of Carai, district of Arassuai, Minas Gerais. The date was May 20, 1964, and the site was the Pedroso Mine, in the region of the Marambaia Valley. This is where the largest and most beautiful blue topaz occurs. The Mine is only about eight miles from the new National Highway B.R.-4 (Rio-Bahia), midway between the towns of Padre Paraíso and Três Barras.

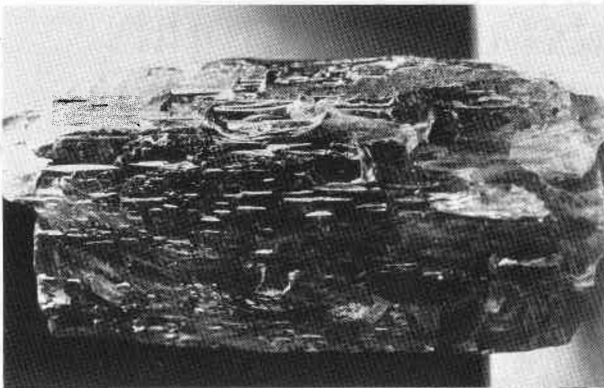
The stone was uncovered at a depth of 21 to 24 feet below the surface. The most common soil in this region is a red clay, called *oca,* in which is embedded quartz and decomposed mica. Some good-quality rock crystal has been mined here. The Pedrosa Mine appears to be located in an altered pegmatite. Prior to the 1964 discovery, only small stones were produced.

The crystal is cylindrical in shape, measures 10.25 by 4.3 inches, and weighs 15.4 pounds. The color varies from deep blue to blue-green, the latter resembling fine tourmaline. It is exceptionally transparent and so nearly flawless that the owner hopes to obtain two and one-half carats or more from each gram of rough.

The best color will be obtained by heat treating some parts of the stone, after which it is hoped that it will compare with, or exceed, the deepest blue color of the *Martha Rocha.*

It did not surprise me that such a rare and lovely stone was discovered in the northwest corner of Minas Gerais, for it is in this State where most of the beryl deposits are located; consequently, the most beautiful aquamarines come from the same region. It was here, in 1919, that the Papa Mel Mine yielded a stone that weighed approximately 244 pounds — the largest ever found. Other producers in this area include the Mueaia and Corsema Mines, seven or eight miles from the famous Pontalete and Martin Luiz Mines; the Pé Sujo ("Dirty Foot") and Felipe Mines, twelve or thirteen miles from the Pedroso, where the aquamarine discussed in this article was found; and the well-known Três Barras Mine, where stones of great value have been brought to light.

A few days after the big aquamarine was found, I had the opportunity to talk with Manoel Bento dos Santos, a former *garimpeiro,* now a gem dealer, who told me how despondent he was feeling. Abele Ferreira, the man who found the stone, worked for Santos for many years; the latter financed the mining, furnishing equipment and provisions. The two men had an agreement, giving Santos 20% of all the profits. However, Santos later decided to break the contract, because he thought that Ferreira was bringing bad luck. In the words of the Brazilian hinterland



Other small stones found in the same area varied in weight from about ten to two hundred grams each.

miner, Santos said that he no longer wished to "jogar" with him (Portuguese, meaning "to gamble," "to stake," "to risk").

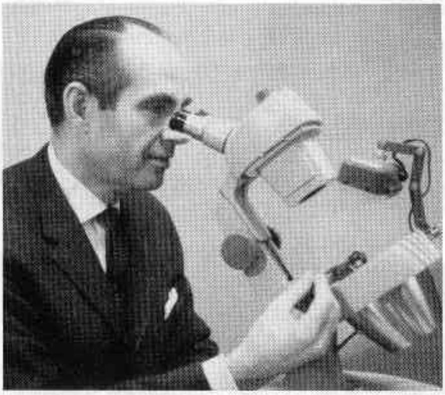
Shortly thereafter, Ferreira was working as usual in the Pedroso Mine, when he felt his pick strike something hard. Mystified, because only stones weighing a few grams each had been recovered previously, he dug with increased expectancy. A half hour later, the fabulous stone was in his hands.

Telling no one of his unexpected good fortune, he continued to work, knowing that other pieces from the same crystal could be found nearby. Indeed, after three days he found three more stones, which varied in weight from approximately four to nine pounds.

Since aquamarines weighing more than ten or eleven pounds are rare, Ferreira resolved to disclose his secret to his fellow miners; as a result, more than five hundred *garimpeiros* hastened to the Pedroso Mine to join the search. But luck was still with him: He found about four additional pounds of small stones, weighing from ten to two hundred grams each. Although now a well-to-do man, Ferreira continues to work, hoping to find more riches.

The stone was bought by H. Stern, the well-known Rio de Janeiro gem dealer, who christened it *IV Centenario* (Fourth Centennial), to commemorate the founding of that great city four hundred years ago. Mr. Stern is very enthusiastic about the cutting possibilities of this magnificent aquamarine.

Developments and Highlights



at the

GEM TRADE LAB

in New York

by

Robert Crowningshield

Rare Synthetic Crystals

We are very much indebted to Dr. Kurt Nassau, of the Bell Telephone Laboratories, Inc., for a selection of synthetic crystals grown by various techniques in the course of investigations for electronics and other applications. Among those were several that showed exceedingly sharp absorption spectra. *Figure 1* is the spectrum of a lavender-colored synthetic scheelite with neodymium as an impurity. Dr. Nassau and his coworkers were the first to produce a continuously-operating crystal laser, using this synthetic mineral doped with the element neodymium (Nd).

Figure 2 illustrates the absorption spectrum of a natural brown scheelite containing various rare-earth impurities. Note that there is a similarity in absorption areas, as one would expect where rare earths are involved in absorption spectra.

Another unusual spectrum, reminiscent of some zircons but unrelated, was that observed in a synthetic yttrium-gallium garnet-structured crystal (YGaG) ; it was pink in color and large enough to cut into an attractive but small stone. The absorption spectrum is shown in *Figure 3*.

Dr. Nassau is the author of a fascinating five-part article entitled *Growing Synthetic Crystals*, which appeared in the Lapidary Journal in 1964.

Black-Treated Opals

Figure 4 illustrates a peculiar iridescent patchiness that we have noted on

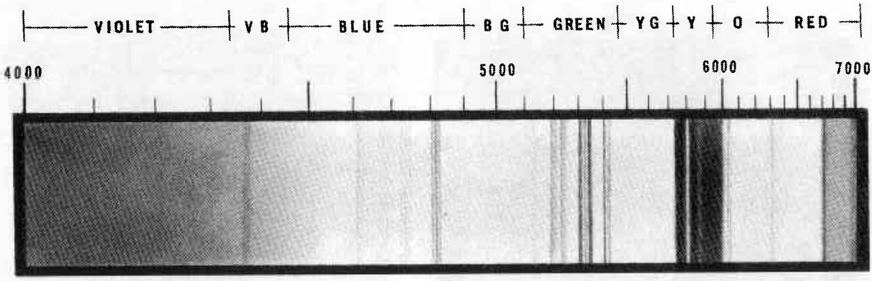


Figure 1

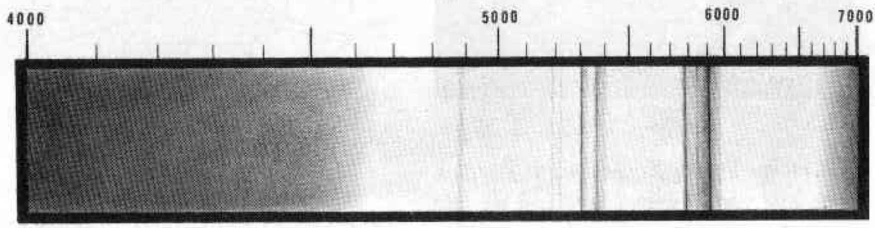


Figure 2

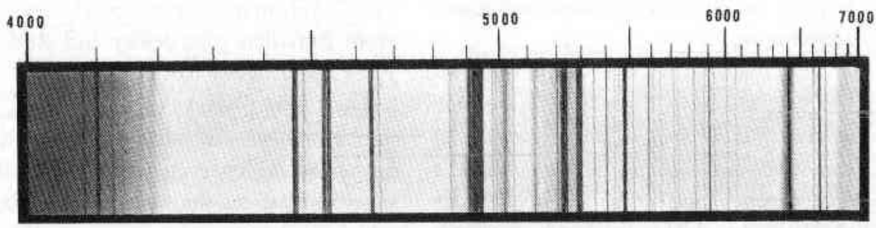


Figure 3

about one in five black-treated opals. In some, the patches are fairly numerous and fairly easy to detect; in others, only one or two small and easily-missed patches may be present.

Pressed Amber

We were happy to be able to purchase two strands of pressed amber, which were the only ones available at

Figure 4

Figure 5

the recent Polish Trade Fair at Poznan. The material is very scarce and we had been unable to obtain any for years. The best description we have been able to find is in Bauer's monumental *Edelsteinkunde.*

This material differs from block amber by remaining light in all positions in the polariscope. In this instrument, too, one can see patches of different transparency and color caused by the mixture of different amber pieces pressed together during manufacture. Specific gravity, hardness, refractive index and fluorescence are similar. We noted a slight softening with sulphuric ether that is not characteristic of block amber. We were surprised that one clue for the identification of the pressed material – elongated gas bubbles – was missing from all the beads in these two strands. The irritating odor of block amber when burned was noted with the pressed amber. *Figure 5* illustrates the relative clarity with some patchiness of one of the end beads.

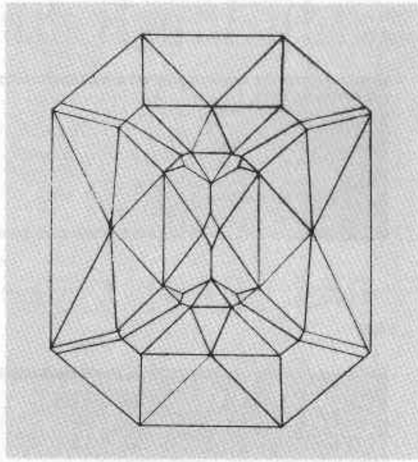


Figure 6

Unusual Chromeless Emerald

Some time ago we received a gift of small yellowish-green beryl crystals from Brazilian gem dealer and student Jules Sauer. They had a high refractive index (1.59-1.599), were inert under the color filter and ultraviolet, and did not show evidence of chromium in the spectroscope. At the time, we were not asked to classify them.

Recently, jewelry with cut stones from this Brazilian source has come to our attention and, in spite of the lack of chromium, which is considered a criterion for emerald by many authorities, we felt compelled to call the stones natural emerald. Our reasoning was that they were more emeraldlike in depth of color and beauty than the pale stones one encounters and that, if chromium is used as a criterion, we would call emerald. The source of the green color has not, to our knowledge, been determined.

Nassak Diamond

We were very happy to have the opportunity to examine the world-famous **Nassak Diamond,** which weighs 43.38 carats, is a modified emerald cut, and was last sold in 1944. We found the stone to be flawless and of the highest color grade. The crown is cut in the normal three-step emerald-cut fashion but the pavilion is a most unusual and complicated pattern *(Figure 6).*

New Opal Source

We are indebted to Mr. Eric Engel, dealer in Brazilian gems and minerals, for several interesting specimens of aventurine quartz, chrysocolla quartz and sapphire. In addition, he loaned for lecture purposes a quantity of Brazilian opal, which is just now coming into the market. We hope to have more information about this new source for the Spring, 1965, issue.

Odontolite

We were happy to receive as a gift from New York precious-stone dealer, Ralph Esmerian, our first specimen of odontolite. One test needed to confirm the identity of the lovely turquois-blue stone was X-ray diffraction, which established an apatite structure.

Carved Psilomelane

Some attractive black hematite-appearing carved stones were tentatively identified as psilomelane, on the basis of the specific gravity of 4.2, streak, and reaction to hydrochloric acid, with the release of chlorine fumes. With a hardness of 6 and the compact nature of this mineral, the stones should wear as well as hematite, although one wonders about the economics of using it for jewelry.

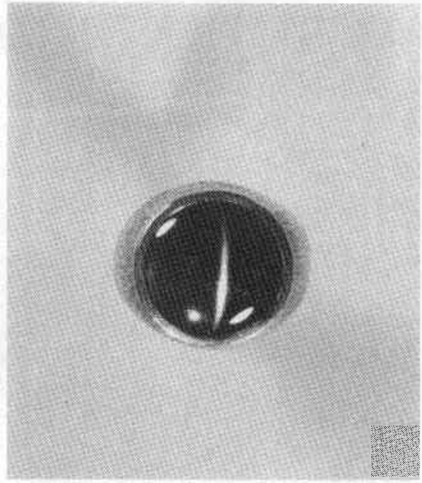


Figure 7

Seldom-Seen Diopside Cat's-Eye

Although importers have submitted chrome-diopside cat's-eye and four-rayed star diopside before, we have only recently encountered both stones mounted in rings. *Figure 7* illustrates a particularly striking chrome-diopside cat's-eye in a man's ring.

Acknowledgements

We acknowledge with thanks the following gifts: From student **Mrs. Charles Schiller,** Mexico City, a specimen of chrysocolla-malachite from Mexico.

From student **Mrs. Baunislawa Salette** numerous glass- and amber-imitation beads.

From precious-stone dealer **Walter Arnstein,** New York City, a necklace

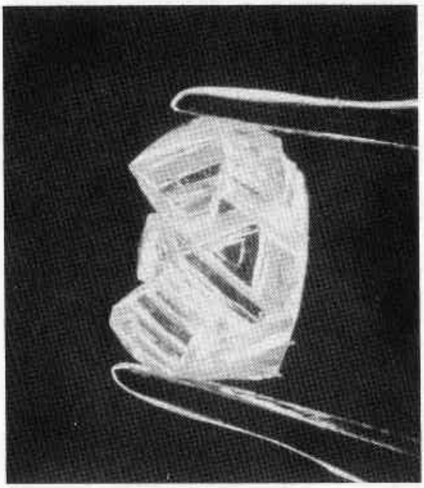


Figure 8

of red quench-crackled quartz beads, which are often miscalled "Chinese rubies."

From **Lazare Kaplan & Sons,** New York City, a most unusual twinned diamond crystal *(Figure 8).*

From student **Italo De Vivo,** of Colombia, several specimens of uncut *trapiche* emerald crystals (see *Fall, 1964, Gems & Gemology)* and a handsome 1.08-carat round stone cut from such a crystal growth.

From **James H. Guernsey,** Landen-True Co., Inc., Springfield, Mass., an unusual "imitation doublet," which is a term used for two-toned glass imitations.

From graduate **Sam Koulish,** Meyer-Koulish Co., New York City, chrome-pyrope garnets from Arizona.

From graduate **Melvin Strump,** Superior Gem Co., New York City, a very useful lot of small golden beryls, peridots and other stones.

From **Mort Lippman,** Felco, New York City, a selection of cultured pearls, illustrating before-and-after preparation for market.

From student **Aldo del Noce,** New York City, a very welcome selection of numerous natural, synthetic and imitation stones.

From precious-stone dealer **Leo Boyajian,** New York City and Miami, a similar very useful selection of stones.

From **Harry Bookstone,** New York stone dealer, a specimen of hematite that is a handsome addition to our mineral cabinet.

From student **Rex B. Hamaker,** who paid us a visit from his home in Eugene, Oregon, a much appreciated large cabochon of dyed-green jadeite.

From **L. Vayna,** of Adris Oriental Gem and Art Corporation, for a very nice selection of chrome-diopside cat's-eyes, moonstones of many colors, and some black four-rayed star stones that were forwarded to the Los Angeles Laboratory of GIA and found to be diopside.

From **John Krzton,** of Chicago, we are indebted for our first specimen of mohawkite (copper arsenide) in calcite, a large dyed jadeite, and opal in matrix, and recently-mined lapis from Afghanistan.

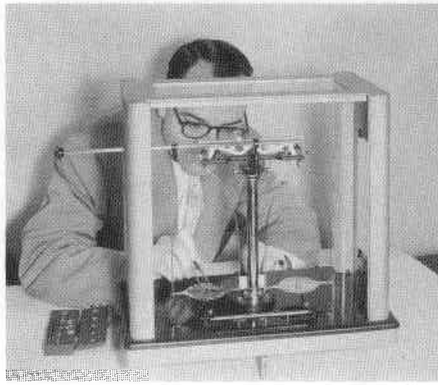
From **Wm. V. Schmidt Co.** and **Allan Caplan** for specimens of the peculiar *trapiche* emerald crystals.

Developments and Highlights

at the

GEM TRADE LAB

in Los Angeles



by
Richard T. Liddicoat, Jr.

One Pink Pearl — Two Earrings

We received a pair of drop-shaped pink pearls with flat backs that gave the impression of being *mabes*. *Figure 1* shows the two, one of which has the flat side up. In the photograph, the slightly raised center portion of the flat side is quite obvious. The jeweler who brought them to the Laboratory said his source claimed that a single pearl from Baja, California, had been sawed in half and the raised portion on the flat side was only a protective coating. After examining them under magnification, Glenn Nord, of the GIA Staff, thought this might be true; an X-radiograph bore out his belief. The photo of the tip of one of the half pearls shows clearly the difference in nature between the top and back *(Figure 2)*. It is hard to believe that anyone would cut a pearl in half to make a pair, but this evidently had been done in several cases, because the jeweler told us that more of the same kind were brought to him a few days later.

Unusual Cutting Discrepancy

A pear-shaped diamond was photographed to show a rather unusual cutting discrepancy: The shorter pavilion mains had not been brought to the culet but only as far as the lower-girdle facets; i.e., they stopped considerably above the culet on the two short directions *(Figures 3 and 3a)*.

Goldstone-Appearing Aventurine

We received, for identification, a stone that was indistinguishable to the

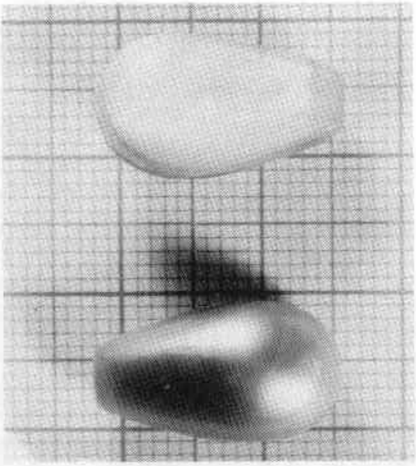


Figure 1

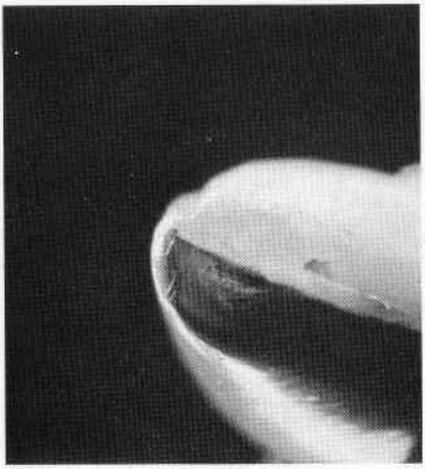


Figure 2

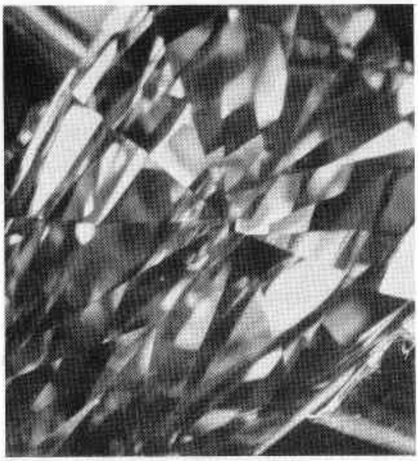


Figure 3

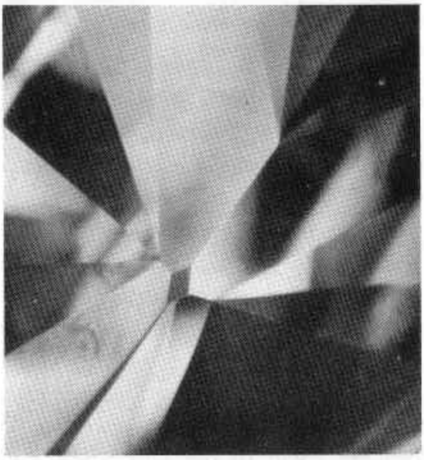


Figure 3a

eye from goldstone. Testing proved that it had all the properties of aventurine quartz. One had to view it under magnification to be sure of its true nature. The appearance of the spangles under magnification is shown in *Figure 4*. Goldstone, lighted by an overhead lamp, is pictured in *Figure 5*.

Large Knots in Diamonds

In the past month, we have encountered several diamonds with very large knots; one of the largest of which is shown in *Figure 6*. A similar knot is shown on the pavilion facets of another diamond in *Figure 7*. Such a stone is particularly likely to show strong evi-

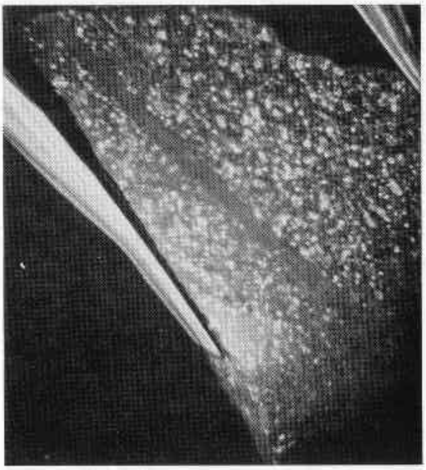


Figure 4

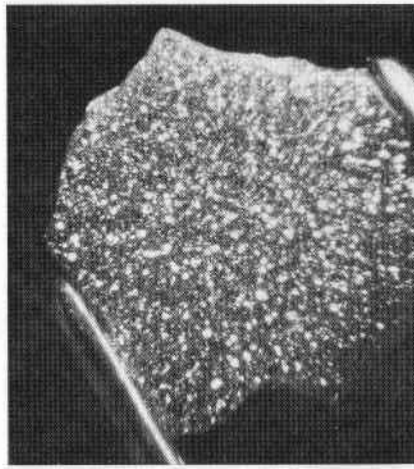


Figure 5

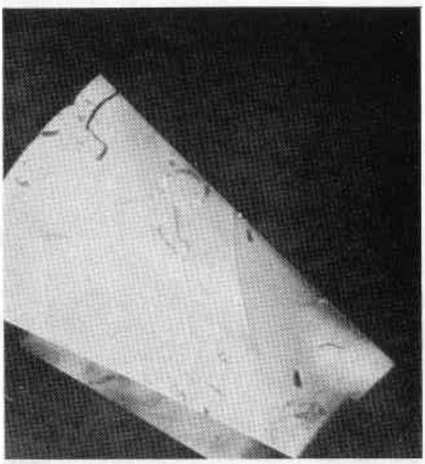


Figure 6

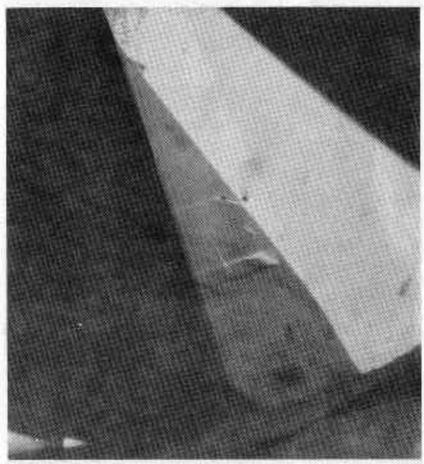


Figure 7

dence of strain and to be somewhat more subject to damage during wear than are most.

Unusual Needlelike Inclusions in Quartz

Figure 8 shows a smoky quartz in which numerous needlelike inclusions were arranged in fan-shaped bundles that met at one end and spread at the other. Lawrence McKague, of the GIA Staff, was able to scrape enough powder from the point where one of the bundles reached the surface to take an

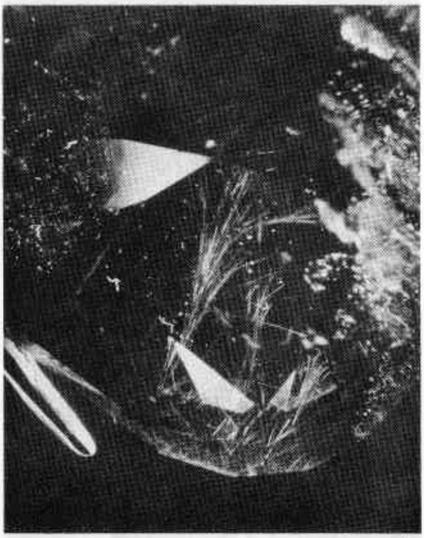


Figure 8

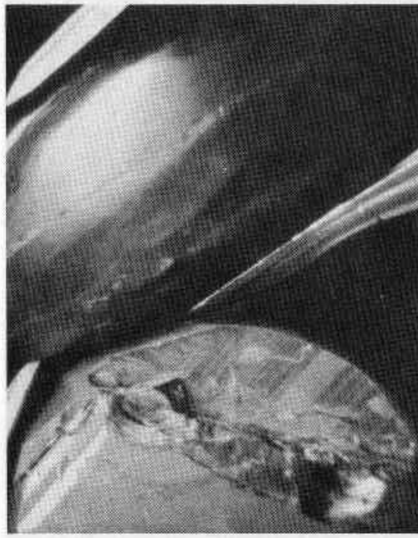


Figure 9

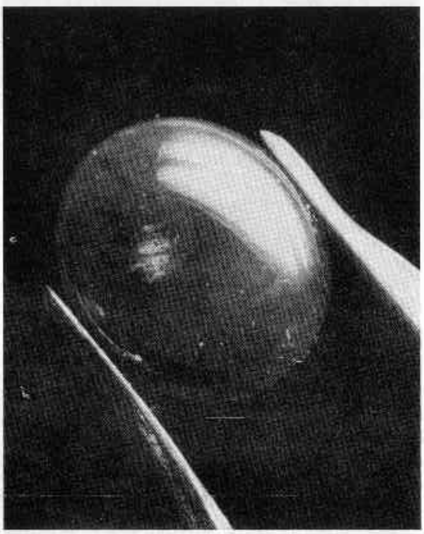


Figure 10a

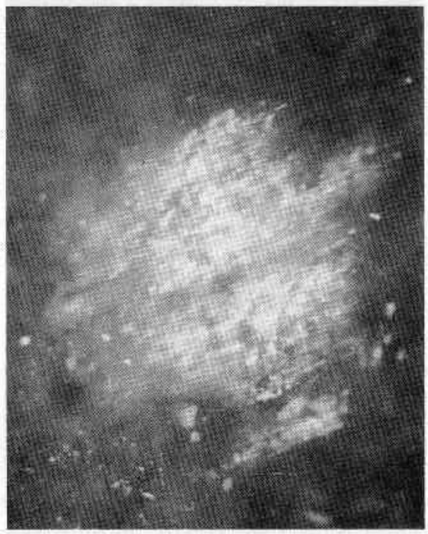


Figure 10b

X-ray powder pattern. He identified the crystals as tourmaline.

Parting in Black Star Sapphires

We were sent a number of black star sapphires, because a jeweler thought they might be doublets. All showed a very strong basal parting, and several parting cracks gave the im-

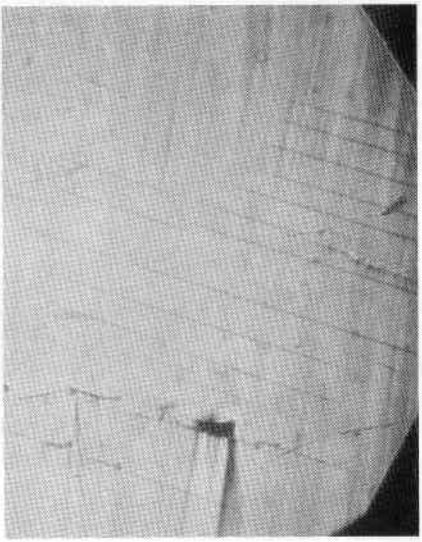


Figure 11

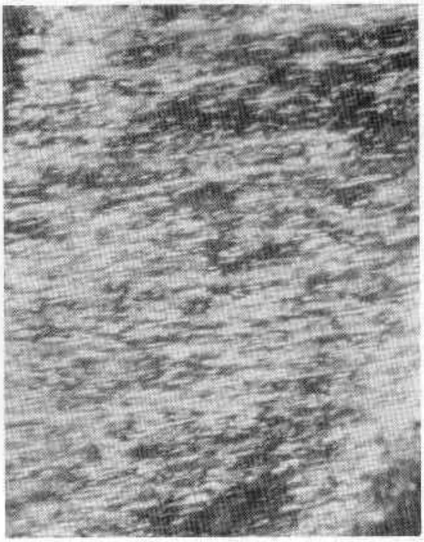


Figure 12

pression that the stones were assembled. *Figure 9* is a photograph of two of the stones, one of which was taken from the girdle direction and the other from the back. The lower stone shows the smooth parting surface where a piece was broken away; the upper one shows the kind of parting crack that lead to the jeweler's suspicion.

"Pigeon's-Eye" Nephrite

Hugo Elsenhans, a jeweler-student from Las Vegas, gave the Institute a piece of Wyoming nephrite jade *(Figure 10a)* in which there was a small area of chatoyancy. This stone is referred to locally as "pigeon's-eye." *Figure 10b* is an enlargement of the chatoyant area, showing the needlelike inclusions arranged in parallel groups. It is possible that the chatoyant area is predominantly tremolite.

Parting in Synthetic Ruby

A synthetic ruby, submitted for identification, showed strong evidence of parting at the surface of the table. The cracks were almost at right angles to the polishing directions, as is evident in *Figure 11,* in which the polishing lines are approximately vertical and the parting lines more or less horizontal.

Sheen Obsidian

A Tiki god showed the sheen sometimes seen in a variety of obsidian. The cause is apparently a flow structure, with a resulting parallel orientation of inclusions. These are shown under high magnification in *Figure 12.*

Polishing Lines Clue

In *Figure 13,* a peridot that had a very serious cleavage was sent in to determine its nature and, if possible, the cause. Since it was shown clearly

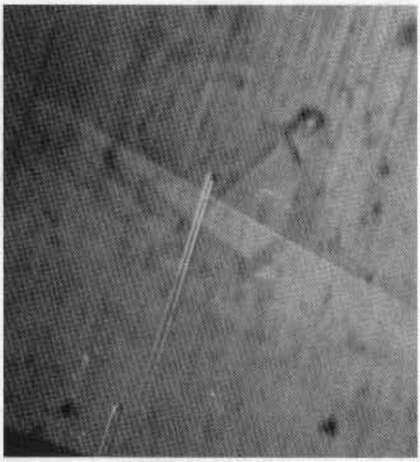


Figure 13

Figure 14

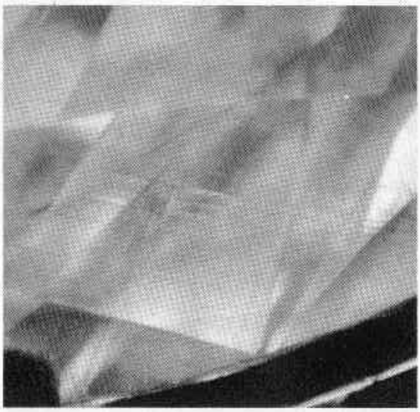


Figure 15

by the cleavage and polishing marks that the damage had occurred after the stone was cut, we photographed it for the column. The polishing marks run from approximately 1 o'clock to 7 o'clock and the drag lines (heavier parallel lines) extend from center to 7 o'clock; the cleavage crosses them almost at right angles. It can be seen that all of the obvious polishing marks and drag lines cross the break without interruption, proving that they were there when the break occurred.

Blemishes

When the American Gem Society expanded its definition of *flawless* by specifying the meaning given to the term *blemish,* reference was made to *crystal-growth lines* and *twin lines.* The former were considered acceptable, if there were no surface manifestations visible and no color zoning along them.

Crystal-growth lines usually are very difficult to photograph, but twin lines are usually more obvious.

In *Figure 14,* pairs of twin lines are obvious at the surface. They appear curved, because in each case we are viewing through the crown their trace across pavilion facets.

In *Figure 15,* Crystal-growth lines extend more or less from 3 o'clock to

9 o'clock. They do not cause ridges on the surface. These, however, are very readily visible under magnification — an unusual condition. When it is this obvious, color zoning is likely to be present, which, by AGS standards, would rule out flawless.

We Appreciate

The gift from **Dave Widess,** Los Angeles gem dealer, of a Gilson-treated faceted emerald of 3.67 carats and an 18.12-carat flat specimen of the same material.

We are grateful to **Bertold Nathaa,** New England Diamond Corporation, New York City, for the black star sapphire, diopside cat's-eyes and Rhodesian ruby.

We are indebted to **Harold Tivol,** Kansas City jeweler, for the broken diamonds that will be used to good advantage in our practice sets.

We appreciate the gift of numerous pearls, garnets, quartz, chalcedony, zircon and turquois from **Burton Joseph,** jeweler of Des Moines, Iowa.

From **Alden Aldrich,** Cranston, R.I., we received several colorless synthetic sapphires that will be used to good advantage in our Gem-Identification Course.

From **P. W. Kriegler,** Hopewell, Va., we received a miscellaneous assortment of gemstones that will be used to advantage in our practice sets.

Our thanks to student, **Yochanan Dreifuss,** Jerusalem, for the translucent pink grossularite garnet cabochon. More information will be forthcoming on this unusual material in a later issue of *Gems & Gemology.*

We appreciate the faceted labradorite received from student **Leon M. Agee,** Rogers, Nebraska.

Book Reviews

THE BOOK OF OPALS, by Wilfred Charles Eyles. Published by Charles E. Tuttle Company, Rutland, Vermont and Tokyo, Japan. 224 pages. Numerous black-and-white illustrations and line drawings and 20 color plates. Price $7.50.

A love of opal is manifested in the author's comprehensive book on this subject. Since he is a professional mineralogist, an accomplished lapidary and an opal dealer, he has approached the subject material from the standpoint of one well versed in all aspects pertaining to the gemstone.

Starting with the nature of opal as a mineral and a gemstone and explanations of geological origins, Eyles continues with definitions of types and a brief history of the world's outstanding sources. He explains mining methods and dealers' methods for buying and selling. He gives a history of opal as a gemstone with exposés of superstitions attached to it. As an experienced lapidary and dealer, his how-to-do-it hints for amateur lapidaries on purchasing, cutting, polishing, mounting, etc., are knowing. The author's account of opal deposits describes those in the

United States and Mexico, as well as in Australia.

The book closes with the first-published account of *Wollaston's Journey for Opal,* a vivid, real-life diary of rugged early-day mining in Australia.

The Book of Opals will be an invaluable source of information for collectors, jewelers, lapidaries and connoisseurs of fine gems on one of the most mysterious, colorful and enchanting gemstones.

THE ROCK-HUNTER'S RANGE GUIDE, How and Where to Find Minerals and Gem Stones In the United States, by Jay Ellis Ransom. Published by Harper & Row, New York. 213 pages. Price $4.95.

This book approaches mineralogy from a slightly different direction than the preceeding one. In the first part, one finds such topics as preparation of samples, necessary tools, field-trip equipment and labeling procedures. The fourth chapter on the geologic time table and the sixth chapter on the use of geologic maps add to the value of the book.

Collecting localities and the more common minerals are described in chapters seven and eight. Collecting localities in 47 states (missing are Alaska, Delaware and Hawaii) are listed; this provides a starting point for neophyte mineral collectors in all parts of the country. The listing of mineral museums by state should be useful for amateur mineralogists who want to see additional specimens and compare their collections with those of museum quality.

THE ROCK HUNTER'S FIELD MANUAL, A Guide to Identification of Rocks and Minerals, by D. K. Fritzen. Published by Harper & Row, New York. 207 pages. Price $3.50.

In the first part of this new book, an elementary introduction to the fundamentals of amateur mineralogy is followed by a brief discussion of igneous, metamorphic and sedimentary rocks. Descriptions of the more common rock types within each class are given.

A short description of the physical properties that can be used for field identification leads off the second part. A color classification is used as the first step in mineral identification. The various minerals covered are listed and described under one or more of the ten colors considered.

In the sixth section, the use, crystal form and occurrence of the minerals are given. Chemical compositions of the minerals are considered in the final section.

GEMMOLOGIA, PIETRE PREZIOSE E PERLE, by Madame Speranza Cavenago-Bignami. Published by Ulrico Hoepli, Milan, Italy (2nd. edition). 1300 pages, numerous color plates and black-and-white illustrations. Price: approximately $45.

The second edition of Madame Speranza Cavenago-Bignami's encyclopedic textbook is now off the press. If the first edition was huge, this one is positively monolithic. It still features the loveliest and most numerous color plates to be found in any text in this field. The beauty of the book makes it desirable in any gemological library — whether the reader is able to read Italian or not.

The present book has been increased from about 1100 to over 1300 pages. The printing run for the original work was very large for a $30 textbook in a very limited field, but it sold out in only three years. The current edition will sell in the United States for between $45 and $50.

Madame Cavenago-Bignami, a charming and delightful person, heads the State Gemmological Laboratories at the jewelry-manufacturing center of Valenza, as well as that at nearby Milan. She also teaches gemology at the jewelry school in Valenza. Thus, she has experience in both laboratory and classroom problems.

The second edition of *Gemmologia* is a beautiful book that will grace any gemologist's library.

Continued from page 238

tremely small grain size. At least one or two other green (chromium-bearing) minerals seem to occur as subordinate components. Their nature also could not be identified because of their very small sizes. Even though the color is relatively homogenous, chromium is not directly incorporated in the albite, but is present in high concentration in tiny grains of a mineral of unknown nature that acts as a pigment. Chrome-albite has never been reported 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, it can be inferred that Maw-sit-sit is not a monomineral but a mixture of minerals; i.e., a rock. The body substance consists of albite that is irregularly interspersed with an alien, chromiferous mineral that induces the brilliant-green color. With a rock, chemical formulas can only be established for the individual components. Albite forms the principle component, whose formula is $Na\ Al\ Si_3O_8$, although the chemical formula of the pigment is yet unknown. Only a method that enables operation with extremely minute quantities of material may yet solve the still-open problems of Maw-sit-sit. Therefore, investigations by means of a late model of an A.R. L. electron microprobe will be undertaken.

In view of the fact that Maw-sit-sit consists mainly of albite, it seems appropriate to give this new decorative gemstone a name incorporating the term "albite." However, as long as the pigment is not determined, the native name, Maw-sit-sit, serves as a distinctive designation.

(See enclosed color plate of Maw-sit-sit.)