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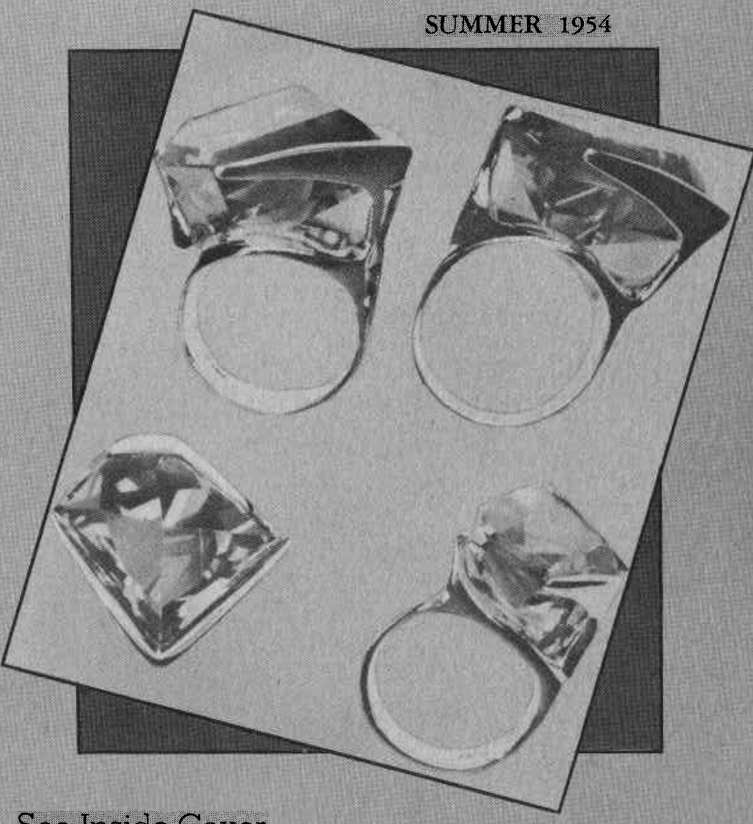

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Discrimination Between Natural Blue Diamonds and Diamonds Coloured Blue Artificially

by

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and

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Nearly all diamonds, as found in nature, are coloured, although generally this colour is weak. A yellowish or light brown colour is quite common, pink and orange diamonds are fairly rare; once in a while a green diamond is found, blue diamonds are sometimes found in special mines, and pure water-white diamonds are highly valuated because they are both rare and optically highly attractive. They show a vivid fire and high light "reflection" in all parts of the visible spectrum, as they absorb very little light. It is, however, not quite correct to call them white or blue white. White is a surface colour which is applied to certain light reflecting surfaces which also are more or less highly diffusing, such as white paper, white paint, white textiles, etc. We do not say that pure water, which also has no absorption in the visible spectrum, is white. It is colourless.

It is well known that pure "white" and blue diamonds are highly priced. Blue diamonds differ from pure "white" diamonds in that they are distinctly blue in colour. They are only found in a few mines, of which the Premier Mine in South Africa is the most important.

One of the items of the research programme of the Diamond Research Laboratory is to try to establish a relation between the minor elements in the diamonds and their colour, for the colour of most diamonds is thought to be due to the presence of some impurity and such elements as iron, silicon, titanium, calcium, etc. often found in diamonds, might be responsible. Another item is the exact specification of diamond colours by means of a system like the I.C.I. chromaticity co-ordinates. It would be very valuable if the colour indication of diamonds could be placed on a sound and objective basis. In this article we shall not go any deeper into this aspect of diamond colour.

We also know that diamonds may be coloured artificially by bombarding them with atomic projectiles — that is, particles which are found in the atom, either in or outside the atomic nucleus, and which have been given high speeds in one way or another. For the production of fast neutrons, a nuclear reactor is generally used. Protons and deuterons may be accelerated to high speeds in a cyclotron or a linear accelerator, whilst fast electrons can be produced in various ways, perhaps the most common being the Van de Graaff generator, which may also be used to accelerate protons and deuterons.

When a diamond is placed in the path of, for example, a beam of fast neutrons, these neutrons penetrate into the crystal, and collide with the atoms of the crystal lattice. Some of these collisions will be sufficiently violent to eject the atom from its lattice site, into some interstitial position. The atom may even be given so much energy by the bombarding fast neutron that it comes to rest only after having knocked several other atoms from their normal positions. This displacement of atoms is known as radiation damage. Associated with this damage in the crystal, is the absorption of light by electronic transitions previously forbidden in the undamaged lattice.

We know that diamonds which are irradiated by fast neutrons in an atomic pile turn green.[1] Other colours have been reported after deuteron bombardment.[2] When a diamond crystal is bombarded by electrons, it will turn blue, under favourable conditions.[3] This artificial blue colouration is nearly indistinguishable by eye from the colour shown by a natural blue diamond, although it is readily detectable when the artificially coloured diamond has the shape of a rectangular block. It will then be seen that the colouration is superficial, as the depth of penetration of the bombarding electrons is only about 0.5 millimetre. However, when the table facets of a brilliant cut diamond have been irradiated and made blue, it is difficult to distinguish such a stone from a genuine blue diamond, as nearly all the incident light, and the light which is reflected from the back facets pass through the table. Discrimination is, however, not very difficult when we do not have to rely upon the eye alone, but examine other non-visible parts of the spectrum as well. Before going into this somewhat more deeply, we will first mention a most remarkable property of all natural blue diamonds, a property which will make it an extremely simple matter to establish whether the colour of a blue diamond is natural or not. It has been found that all natural blue diamonds are electrically conductive, even at fairly low potentials of the order of 100 volts.[4] We have, in the course of the last year, tested about 50 natural blue diamonds, both whole stones and cleavages, varying in weight from 100 carats to 0.1 carat. On the application of 125 volts across these diamonds they all carried an electric current which differed from stone to stone.[5] This current is usually of the order of 0.1 milliamp, but it may be much larger. A diamond of size 3 x 5 x 5 millimetre passed, initially, a current of about 1 milliamp, which increased gradually to about 5 amperes. At this current the diamond becomes red hot; therefore the current should be allowed to flow only for a short time in order not to ruin the diamond.

This conductivity is, in all probability, a structural property of this special type of diamond which has been classified as type IIb.[4] Electrons trapped at crystal imperfections play an important role in this conductivity. When the temperature of the diamond rises gradually, due to the heat developed by the electric current, these electrons will be raised to the conduction band of the diamond, where they can take part in the current which will thus increase.

A very simple method for discriminating between artificially coloured and natural blue diamonds would therefore be to measure their conductivity. This could be done by bringing two metal points into contact with the diamond and by applying about 100 volts across the points. A milli-ammeter will then show a current if the diamond is a natural blue, it will not when the diamond is a normal stone which has been made blue artificially.For with a very few exceptions, all diamonds which are not blue belong to either type I, which is most common, or to the rarer type IIa, both being non-conductors of electricity.

There are two other methods suitable for the discrimination of blue diamonds. One method refers to the absorption by the diamond of ultraviolet light, the other to absorption in the infra red region of the spectrum. It has been found that natural blue diamonds have a low absorption of radiant energy in the ultraviolet. They are transparent down to about 2250A°, also a property of type IIa diamonds. They differ, however, from type IIa diamonds not only in their electrical conductivity, but also in their phosphoresence. We therefore, have classified the natural blue diamonds as a different type; i.e. IIb. The common type I, however, absorbs very strongly at wavelengths shorter than about 3000 Angstrom[6], either before or after having been made blue. It is, therefore, a simple matter to discriminate between a natural blue diamond of type IIb and an artificially coloured type I, by means of a filter which is selectively transparent at about 2700A°.

Type IIa diamonds, we have seen, do not absorb strongly in this part of the spectrum in their natural state, but after having been irradiated with electrons, show a clearly observable absorption which will again assist in distinguishing a natural blue diamond of type IIb from an artificially coloured type IIa.

In both cases, that is type I and type IIa made blue artificially, a photoelectric cell which is sensitive at 2700A° can be used as a detector, or as an alternative, a substance which fluoresces when irradiated by radiant energy of 2700A° wavelength may be applied.

It has also been established that natural blue diamonds show a very strong absorption in the infra red, in the region from 1 to 2 microns, whereas neither type I nor type IIa absorb appreciably in this part of the spectrum, even after irradiation with electrons. Again a filter transparent for radiant energy of about 1 to 2 microns in combination with a suitable infra red sensitive detector can be used for distinguishing between natural and artificial blue diamonds. The detector may be an image-converter tube or a thermopile.

All these devices are still in the laboratory stage. It is, however, felt that a few of these could be simplified to such an extent as to make them a simple tool in the hands of a layman who will thus be in a position to verify simply and rapidly whether the colour of a blue diamond is natural or man-made. It is also felt that the diamond gem trade will benefit in this way as the buyer will want to know the origin of the diamond colour.

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The Nature of Jade

by

DR. RAYMOND J. BARBER

Answers to four questions regarding jade will here be ventured. Why was it so named? What is its elemental makeup? How can it be recognized? Where has it been found?

Jade is an exotic mineral. It invites thoughts of far places, and the vague shadows of antiquity. Tides of human destiny, and struggles for power were swayed by its discovery. To the stone-age man, when survival was ever in doubt, the possession of jade gave peculiar advantages because it could be sharpened to an edge that would not shatter. Later, with more ordered security, the permanence and beauty of jade moved the lapidary artists to dedicate their lives to carving symbols of ancient faiths and customs.

Even the word "jade" is alien, and reflects the supernatural, for these stones were held in awe by primitive folk of both East and West. Marco Polo, returning from Cathay, told about stream pebbles sculptured into wondrous forms so sacred that they were withheld from common view. Cortez found that the Indians of the New World valued certain green stones more highly than gold. He sent back to Spain some that had been cleverly carved as idols or amulets, which were described as *piedras de yjada* or "stones of the groin" because the natives believed them capable of preventing pains in the side. Sir Walter Raleigh, on his voyages to America, found among the Spanish settlers of Guiana curious idols cut from the same kind of green stones which they, too, called *piedras de yjada.* He took some back to England, where they were much admired; but the long Spanish name was difficult for the English tongue, so that soon it was shortened to *ijada* and finally jade.

Thus, also, the French *l'ejade* and later "jade", the Italian *giada;* and the modern Spanish "jade". Though they have their separate pronunciations, all came from the same Latin root *ilium,* and the Greek *eilein,* meaning flank or groin. Even the Persian word for jade, *yashm,* seems related to the same tradition.

Among ancient races the protective benefits of jade were thought to be so inclusive as to offer a veritable panacea for any illness. All over Asia it was believed that an amulet of jade would ward off lightning. The South Sea Island tribes thought that if some of the powdered mineral were swallowed just before death it would prevent decomposition of the body. Indeed, the aborigines of many lands believed so fully in its power to protect the spirit during its wanderings toward the Other World, that their jade weapons and fetishes were buried with them in the tombs.

Even as it had such wide repute among primitive tribes for bodily protection, jade was believed by the philosophers of ancient China to have benevolent cultural and spiritual values. To Confucius the clear tinkling of a jade bell was ineffably divine music. The fingering of a smooth, well-rounded object of jade was considered helpful in attaining the perfect calm needed for contemplation. Thus, in that far country, jade became symbolic of the five cardinal virtues: Charity, Modesty, Courage, Justice, and Wisdom. Indeed, revered as embodying infinite goodness, it was too sacred to be worn for decoration, because *"The greatest reverance admits of no ornament,"* certainly not of jade — the very *"Jewel of Heaven."*

Meanwhile, with the awakening of science in Europe and America, archaeologists delving into the remains of ancient peoples were finding Neolithic tools and weapons of jade in France and Switzerland; Egypt and Asia Minor; New Zealand, the Marquesas, and New Caledonia; Middle America, British Columbia, and Alaska. All of these artifacts were much alike in being made of green, hard, and compact rock. Before metals were known, it was the toughness of jade that made it especially valuable;

• The author standing with Mr. Chang Wen Ti behind a 3600 pound boulder of nephrite jade, which was found near Lander, Wyoming, and now is in the front yard of Mr. Chang's home, Los Angeles.

• A close view of the reddish-brown surface of the jade boulder in front of Mr. Chang's home. The picture shows in natural size, the fibrous crystals of nephrite that have been etched in relief by centuries of wind and weather on the open prairie of Central Wyoming.

better than any other stone it was durable under hard use, and retained its edge without fracture. Also, in addition to its lustrous beauty for inspiring admiration, it was this same quality of toughness that permitted the carving of intricate designs without fear of breakage.

Perhaps because of the widespread belief in its benign influence over health and fortune, beliefs that were fostered no doubt by the merchants, it seemed that everyone wanted to own some jade amulet for guarding against evil. Traders, therefore, profiting by the demand, substituted commoner kinds of green stones, until there was some confusion and doubt in separating real jade from among the many imitations. Fortunately there were some who could tell the difference, and they wanted to have a specific name to identify this valuable mineral. It had at times been called "axe-stone" because of that use by the cave-men; but, finally out of regard for its reputed efficacy in curing renal diseases, the name "nephrite", from the Greek *nephros* meaning kidney, was introduced in 1789 by Professor A. G. Werner at Freiberg, Saxony.

It would have been well if the popular term "jade" could have been reserved for none other than the anciently revered nephrite; but History must be served as well as Science. New discoveries cause changes of fashion, and it was even so in the Orient. The native mineral that was called in China *yu*, which had been venerated there for three thousand years, was being superseded by a more brilliant, crystalline stone found in northern Burma. Although the first of this "new" jade probably reached the royal palaces in the T'ang or Sung dynasty, toward the end of the first millenium of the Christian Era, it did not come into known use among the common people of China until about two hundred years ago, in the Ch'ien Lung dynasty (1736-1796 A.D.) Yet because of its ceremonial use indicating sovereign power, and for exhibit at court functions, it had acquired importance equal to that of the more ancient nephrite. The name applied by the Chinese to this newer jade was *yu fei ts'ui,* because the several bright colors in the mineral from Burma reminded them of the plumage of the kingfisher bird — *fei* for the reddish tinge just under the outside rind of the boulders, and *ts'ui* for the bluish-green of the inside core.

When this splendent crystalline jade was mined more freely in Burma, some of it came gradually into the hands of traders, and through them found its way to Europe. Thus, about the middle of the nineteenth century a French mineralogist, Augustine Alexis Damour, saw some of these recent jades from China and India, and noticed that they were different from the more ancient Oriental pieces. Also, many of the prehistoric axes then being found in Europe were unlike the nephrite jade. At about this time, also Damour, remarked a similarity to some Mexican stones that had come to France by way of Spain. Previously he had determined by chemical analysis that nephrite was a lime-magnesia silicate, usually with more or less iron. Now he found that the crystalline jades, though they came from very widely separated sources, and differed slightly from each other, all were essentially silicates of soda and alumina. The established name of "jade" could not be denied to nephrite, which was famed in literature and represented in many of the great museums, where objects of antiquity and beauty were treasured. Yet here was a new mineral, looking much like the other, and already accepted in China, and in Europe, as "jade". To distinguish between the two for the purposes of science another name was needed, and Damour in 1863 proposed *jadeite.*

These two similar but distinct minerals, therefore, nephrite and jadeite, are equally entitled to be called jade. Thus, the first of the questions posed at the start of this paper has been explored. And so, having found the historical sources of the word *jade*, and the precise distinctions, there comes the question: What is it made of, that it should be so remarkable?

Though both of the jade minerals are silicates, as correctly reported by Damour, the basic elements in nephrite are calcium and magnesium, while those essential to jadeite are sodium and aluminum. Jades found in different places, however, and under diverse conditions, vary somewhat in their make-up. Indeed, the physical and chemical influences that must have combined to produce jades are obscure, and explanations of their modes of origin, therefore, are somewhat controversial.

White nephrite, though physically dense, is chemically equivalent to fibrous, asbestiform tremolite. Each fibre of tremolite is a separate crystal, but nephrite is so compact that it seems to lack any crystal form. In the greenish-gray varieties, and through all shades of green to almost black nephrite, more and more of the magnesium has given place to ferrous iron, until by such interchange it becomes like actinolite, at the other end of the amphibole series. Not infrequently, also, it contains more or less adsorbed water. Then, too, if some other metallic elements, such as manganese or chromium, were present at the time of formation, they might take the place of some of the magnesium, with resultant modifications of color. Sometimes an accessory mineral such as graphite, magnetite, or chromite, will cause black spots or gray shades in an otherwise clear green.

Most of the colors of jade are due, probably, to various compounds of iron. When present as finely divided magnetite, iron may cause black and gray tones; as ferric hydroxide it produces yellows and browns; ferrous silicates cause shadings from pale green to almost black; ferric silicates could account for yellows, browns, and even blacks; some silicates of iron might even give rare bluish tints. Since iron may occur in more than one condition in a single specimen, the percentage of total iron shown in a chemical analysis would not suffice to explain the colorings that might characterize its appearance.

The Chinese lapidaries have descriptive names for many nephrite colorings and textures. They distinguish "mutton fat, hog's lard, camphor, or melting snow" for different whites. "Chicken bone" designates the peculiar ivory-like quality that has resulted from chemical action on burial jades. Similarity to different vegetal colorings is recognized as "leaf-, lettuce-, apple-, or spinach-green." "Moss tangled in snow" is vividly descriptive of a feathery green, variegated with surrounding white.

If the original jade rock had been long exposed to groundwater and weather, part or all of the metallic mottlings might have become oxidized to yellows and browns. Even within the same ledge there might have been local changes that resulted in variations of color. Thus, the whitest translucent nephrite may be obtained from a deposit that is mostly grayish or brownish white.

As in nephrite, so also with jadeite, various colors are caused by admixtures of different tinting elements such as iron in various chemical forms, chromium, nickel, or vanadium. Ideally white jadeite is the normal silicate of sodium and aluminum, classified in the pyroxene group of minerals, with percentages of 15.4 soda, 25.2 alumina, and 59.4 silica. Pure jadeite of exactly this composition is possible, but when actual specimens from different places are analyzed they are found to vary appreciably, even in the basic part of their structure. This is especially to be noted in jadeites from Middle America, nearly all of which contain some calcium and magnesium, corresponding to the diopside molecule of the same crystal structure, replacing part of the sodium and aluminum of the ideal formula.

There is one unusual variant of normal jadeite, called *"chloromelanite"* (Greek *chloros,* green, plus *melas,* black) which formerly was deemed to be a third jade mineral. Later studies have shown, however, that it is really jadeite, though containing an unusual admixture of ferrous iron which imparts to it a dark-green, sometimes nearly black, color. Hatchets of this material were found among the remains of the Stone Age men that lived during neolithic time in the pile-dwellings on Lake Neuchatel in Switzerland. Also, a few archaeological pieces of it have been reported from Mexico.

Among the many color variations of jade there are certain ones peculiar to jadeite. Of these the most notable is the translucent "imperial", sometimes called "emerald" green, but described more exactly — by comparison with the Ridgway color standards — as "viridian-green". This, which probably is caused by the presence of chromium and perhaps traces of other metallic oxides, is the *"king chuang-fei ts'ui"* of the Chinese; and the *quetzalitzli* or *esmeralda* jade of the ancient Mexicans. Two other colors not found in nephrite are mauve, a delicate lavender tint thought to be caused by a little manganese or vanadium, and an odd bluish-gray-green perhaps due to a slight admixture of vanadium and beryllium. Finally, there is the bright tomato-red jadeite that sometimes occurs as a thin layer near the outside crust of some boulders found in the river-banks of the Burma jade-field, and caused by oxidation of the iron, perhaps with a little vanadium.

After these observations on the essential compositions of the two separate kinds of jade, first as fundamental silicates and then as modified by tinctures that cause such wide ranges of color, there comes the question, "How can jades be recognized and positively identified?"

Even in China there was not always clear distinction between the two kinds of jade. The lapidaries, as a rule, did not have scientific knowledge of the minerals they were carving. In many cases, therefore, either kind had been called *yu,* together with some other word to indicate the color of the stone or its place of origin. Indeed, although these two minerals are differently constituted, so that chemically they are distinct, they look much alike. Uniformly green pieces, for example, resemble each other very closely in outward appearance, especially when highly polished. Upon careful observation, however, particularly with the aid of a hand lens, the nephrites are seen to be uniformly compact throughout, often with a peculiar oily look, while the jadeites show a distinctly crystalline, or at least a scaly-fibrous texture.

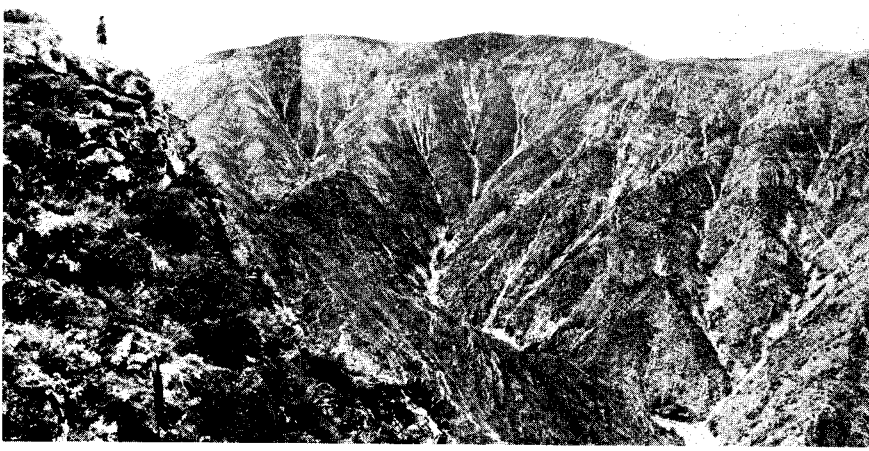
Jade boulders of either kind, when subjected to the constant flowing of sandy water, will show some of their true colors. If they are on land, however, so as to be exposed to continuous weathering, the nephrites usually will have a brownish-red, rather shiny skin, while the jadeites are likely to be more buff-colored and with rather a sandy crust.

A rounded piece of nephrite will be exceedingly hard to break, for although its scratching-hardness is only 5.5 to 6.5 on the Moh Scale (talc being No. 1, and diamond 10) yet, by reason of the interlaced fibers, it is one of the toughest of all minerals. When a freshly broken chip has been obtained, it usually will be seen to have a somewhat dull, flaky appearance, and on thin edges the better grades will be more or less translucent. It will feel colder to the touch than ordinary rocks, and will have a certain resonance when struck sharply. Finally, laboratory tests will be required for positive proof of identity.

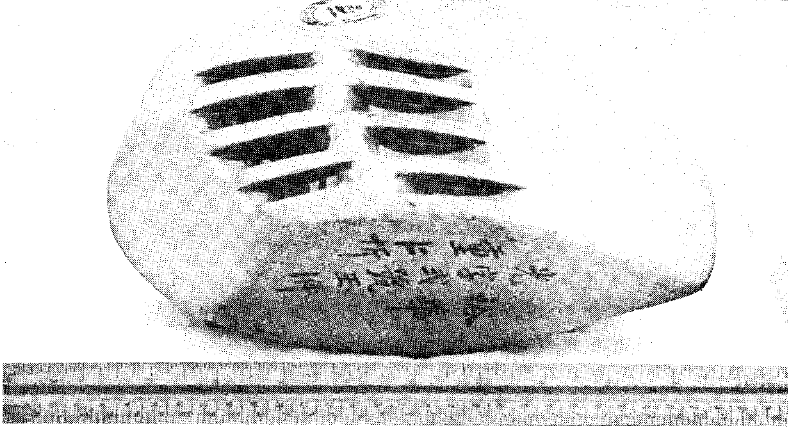
Nephrite is not attacked by acids. A thin splinter, when heated intensely before a blowpipe changes to a cloudy white, and fuses with difficulty to a gray slag. It is somewhat heavier than most non-metallic minerals. Its specific gravity, depending on the amount of iron present, will be within the range from 2.91 to 3.01, though but rarely will any be found as heavy as 3.00. Chemical or spectrographic analysis, supplemented by examination of thin sections under the petrographic microscope, will give the exact identification.

Jadeite is harder than nephrite but is not quite so resistant to fracture. Its range on the hardness scale is from 6.5 to 7.0, so that it will scratch glass but will itself resist attack by a steel file. It feels distinctly cold to the touch, and its heavier density can readily be noticed. The specific gravity varies somewhat because of slight differences in composition, but usually it is 3.33 to 3.50. This is important for distinguishing it from nephrite and other greenish minerals that sometimes have been mistaken for jade.

A very convenient means of measuring specific gravity is by the use of heavy liquids. Almost all nephrites will float on liquid 3.0, whereas most jadeites will sink rapidly in



• **The Barranca de Toliman in the state of Hidalgo, Mexico, from which a discovery of nephrite jade is reported.**



• A jadeite boulder of finest gem quality that was imported by Mr. Chang Wen Ti from Mogaung, Burma. Weighing 15 pounds, it measures 8 x 5½ by 5 inches. The eight "windows" were ground out and polished by the government taxing agent at Mogaung, in order to disclose the intrinsic quality of the stone for appraisal of its value. The circular black-ink mark, at the top, was stamped on the boulder by the assessor at the time of official clearing, as proof that the 33⅓ per cent ad valorem tax had been paid. The Chinese characters on the under side read, "Yu Hwa — Number Kwang Second — One Piece — Weighing twelve catties."

pure methyl iodide — sp. gr. 3.32. Testing with a blow-pipe also will readily distinguish between the two kinds of jade. As stated above, nephrite turns white at first, but does not melt until after long, intense heating. Jadeite, on the other hand, fuses easily to a transparent bubbly globule, and colors the flame a bright sodium yellow.

When thin sections are examined under the microscope, nephrite will be seen to consist of many indefinitely outlined areas which, with higher powers, show wavy and uneven bundles of interwoven fibers, sometimes in clusters or radiating tufts, that merge into one another as the stage is revolved. Though separate crystals can scarcely be discerned, some fibers indicating the cleavage and optical properties of hornblende may sometimes be seen.

On the contrary, when a section of jadeite is examined under such magnification it shows clearly defined, individual crystals interlocking as a mosaic. Usually, also, some crystals exhibiting the features of augite or diopside may be found in some sections. In fact, x-ray diffraction studies have shown that a molecular structure similar to diopside is characteristic of all the monoclinic pyroxenes: jadeite, acmite, and spodumene of the sodium-lithium-aluminum-iron group; as well as clinoenstatite, diopside, hedenburgite, and augite of the calcium-magnesium-aluminum-iron series. Differences in the maximum extinction angles — from about 6° for acmite to nearly 54° for augite — serve to identify the various species. This angle for jadeite is from 30° to 36°, while that of diopside is from 37° to 44°.

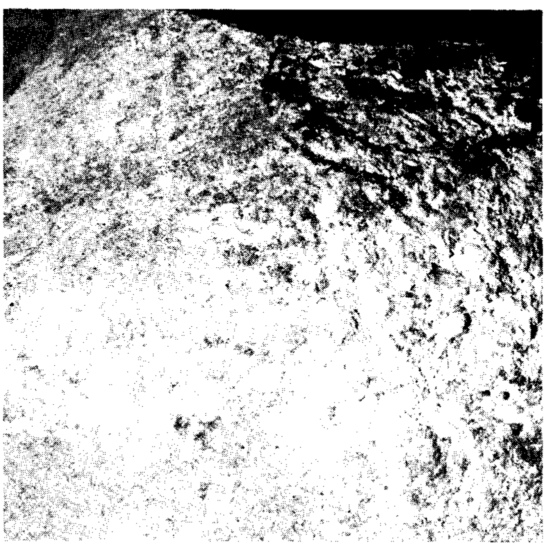
For quick approximation of the essential contents, and of all minor accessory elements in specimens thought to be jade, the spectrograph is very useful. Quantitative chemical analysis will then disclose the exact proportions of all constituent elements.

By such tests it is possible to determine the identity of nephrite or jadeite pieces that may be presented for examination, and even sometimes to discern evidences pointing to the sources whence they came. If, however, a supply of rough stone is wanted, where might it be found?

Since both of these minerals are products of deep-seated disturbance of original rocks, any search for new deposits should be directed toward metamorphic areas. Jade of either kind is scarce. Until recently natural deposits of nephrite were known only in three widely separated regions: Central Asia; New Zealand, and other South Pacific islands; Alaska, and British Columbia. For jadeite there was only one known deposit in all the world — the Kachin Hills in Upper Burma.

Long before the Christian Era, nephrite was obtained by the Chinese from Khotan, an oasis of Eastern Turkestan in the Province of Sinkiang, China. The jade was found first as pebbles and boulders along two rivers: the Kara-Kash, meaning "black jade"; and the Yurung-Kash, or "white jade." These flow out of the K'un-lun mountains and unite just north of the city of Khotan. Much later, not until the 11th. or 12th. century A. D., bed-rock deposits of "mountain jade" were found in the vicinity of Yarkand, some twenty days journey from Khotan, toward the headwaters of the Kara-Kash, high in the K'un-lun mountains. There it occurred as veins and lenses in crystalline hornblendic schist and zeolitic rock containing albite. The middle of the veins was usually of common green jade, while along the sides, and in close contact with the zeolitic country rock, there was grayish to white nephrite. Bright-green jade of a higher translucency occasionally was found in thin veins, seldom more than one or two inches wide; but there were some veins of pale green nephrite as much as ten feet thick, containing numerous inclusions of magnetite. This mountain-jade was quarried for centuries, until the Chinese were driven out of Turkestan by Yakub Beg and his Mahometan followers, who conquered that region in 1865. The mines were then abandoned, and have not been worked since — at least not extensively as before.

There are legends of jade stones having been found in Shensi Province of China proper, in very ancient times, but these tradi-



• Close-up view of the buff-colored surface, or "rind," of the boulder of Burmese jade seen on the opposite page. The outside diameter of the black tax-mark is 1 3/8 inches, by which the size of the crystals of jadeite can be judged.

tions have not been authenticated.

The only other known source of nephrite in Central Asia is near the western end of Lake Baikal in Siberia. During the early nineteenth century boulders of jade were reported by travellers in that region; and in 1850 the stone was found in place along the Onot River, in the Botogol Mountains of Irkutsk, by a French engineer named J. P. Alibert. Also, he discovered nearby a large deposit of graphite, which later was worked by Faber, the Bavarian pencil manufacturer. Indeed, some of the green nephrite from that region is speckled with black inclusions — which were thought to be graphite but more probably are magnetite — causing a characteristic appearance called by the Chinese "spinach jade".

These sources of nephrite would have continued to be all important for supplying the lapidary trade of Canton, Shanghai, and Peking, except for the increasing popularity of the Burmese jadeite. The Chinese always have venerated the whitest white nephrite, which came mostly from Khotan in Eastern Turkestan; but for the other colors they preferred the more brilliant jadeite. Ever since it came into general notice in China, this *new* jade from Upper Burma had been gaining in popularity. So, for more than a hundred years, the Kachin and Shan miners would dive for loose jade stones in the Uru River, or pick and wash the rough rocks from the conglomerate beds along its banks, apparently content with their river diggings, and making no effective search for the source of these erratic boulders.

It was not until about 1881 that any bedrock deposit of this mineral was found, and then it was quite by accident. A Kachin hunter, following an elephant that he had wounded, was led five or six miles into the hills northwest of the main Uru River, where eventually the beast fell. Then, it is said that before undertaking the labor of removing the tusks for their ivory, the man gathered together a few stones on which he built a fire to cook some rice. But, while he was eating his meal, one of the larger stones split open from the heat, and there, inside the whitish rind, appeared the crystal green of fine jadeite. So he started digging in the red earth, where, at less than four feet deep, he struck bedrock. And when he cleaned off the loose dirt, there was the jadeite vein, where the famous Tawmaw mines were soon to be exploited.

Naturally, when news of this great discovery got about, there was a rush of miners to the new field; and it was not long before this outcrop was being worked to its full extent — about 300 yards long and 200 wide. Then, when this ground had been all taken up, the later prospectors spread north and south of Tawmaw, and, by digging deeper, uncovered three other deposits of jadeite. All four of these have been called dykes, but they are more like sills since they dip at such low angles — only 20° to 30° from the horizontal. Although many exploratory pits were dug all over the region, there are only about twelve productive mines on the four jadeite sills, all within an area roughly eleven miles long by two miles wide. In some of these mines there is a very thick mantle of red earth, underlain by as much as twelve feet of serpentine, before the valuable mineral is reached; but then, in some parts, the jade vein is as much as ten feet thick. The deepest shaft among the outcrop mines is fifty feet to the jadeite.

Except for the Chinese merchants who go to the region in order to buy directly from the miners, there are few outside visitors to this inhospitable jungle. However, in 1892, F. Noetling made a geological reconnaissance of the jade fields. His observations were reported in the 1892 issue and those of A. W. G. Bleek in the 1907 Records of the Geological Survey of India. Then came the thorough researches in the field by H. L. Chhibber from 1928 to 1931, published in his *Mineral Resources of Burma.* The complex rock formations in that remote region, therefore, have become known.

(to be continued)

The Gem and Ornamental Stone Market of Hong Kong Today

by

COMMANDER JOHN SINKANKAS, U.S.N.

The British Crown Colony of Hong Kong comprises several islands and a section of the mainland near the southeastern extremity of the China coast. Two major cities, Victoria and Kowloon, face each other across a busy harbor through which much trade is carried on. Hong Kong has no import or export duties and therefore acts as a *free port* and being centrally located in the Far East, is possibly the major trade port in the whole area. Inevitably as a result of Communist domination of the mainland, much wealth in the form of easily portable valuables has found its way there including gemstones, jewelry, and more particularly objects of art of all kinds. In the central district of Victoria and also in Kowloon, a surprisingly large number of shops deal in these objects and display huge quantities of classical Chinese art works as well as the far less tasteful modern productions.

Gemstones as a whole are scarce and limited both in variety and quality. Ceylon gems are fairly common but scarcely important while a considerable number of diamonds can be had as well as jade of gem quality. Several English firms offer diamonds with the usual guarantees of quality, color, etc. and they are recommended to anyone who cares to purchase one in this port. A considerable number of poor to indifferent star stones may be had but none can be said to be good buys. Gem quality jade is quite common and seems to be offered everywhere in any size and in any of the subtle degrees of quality accorded this stone by the Chinese. Along Queen's Road is an area of native jewelry shops which all follow the same layout and sell almost precisely the same goods. Each store is open at the front and is lined on each side with glass table-top cases illuminated by blazing lights. On one side are sold gold rings and gold pendants which seem to be popular with the poorer classes as a portable nest-egg, while on the other are sold jade jewelry of all types plus some tourmaline pendants and synthetic rings. Outside the stores are individual guards equipped with shotguns, mute testimony to past unpleasantries. Finer quality jewelry is available from several large and long-established firms of European origin.

Fine quality gem jade is difficult to get in the raw form due to the unsettled conditions surrounding the jade producing areas of Upper Burma. Three or four auctions a year are held at Rangoon where buyers from Hong Kong send representatives to bring back the alluvial boulders for processing either in Victoria or at other points on the mainland. Top notch quality is, as always, rare and expensive but lesser quality grades are abundant and a very brisk trade is carried on in mounted jade jewelry. Because of the policy of the United States toward trade with Communist China, gem jade is acceptable if brought in mounted in jewelry — loose pieces are NOT acceptable at customs. In order to fill the urgent demands for jade jewelry, local jewelers in Hong Kong not only have started up cutting establishments but have also created overnight a large and thriving precious metal manufacture for making the mounts. There is little experience in these hastily contrived shops however, and the general quality of mountings in gold and platinum show altogether too plainly the lack of skill and the almost frantic haste with which the various metal-working operations were completed. There are many hollow back rings in thin rolled sheet simulating cast forms, rather poorly soldered throughout. The art of casting is not too well known and most pieces are *built-up* from simple sheet and wires. The finishing and buffing also leaves much to be desired.

In regard to stone carvings two distinct classes of work are to be noted at even the first glance — the old traditional work of painstaking care and design, and the newer work which displays a slick finish and an almost universal artistic ineptitude. None of these carvings may be admitted in the United States at the present time and every shopkeeper is not loath to bemoan this fact since it leaves him with a splendid but static stock because the best customers are barred from buying. This ruling by the Federal Government is not quite fair since most of the pre-war work had no active connection with Communist industry while the new work is definitely made in Communist China. Perhaps those who imposed this rule recognized the futility of trying to distinguish between the two since this can be done ordinarily only by someone well-acquainted with the differences in style, finish, and raw materials employed, and presumably the ordinary tourist could be sold a new piece as old without being aware of the difference until the denouement came at customs. Shopkeepers were reluctant to discuss the origin of the new pieces but some were honest enough to admit that they were done on the mainland. A few claimed they were executed in Macao, the Portuguese colony only a few miles distant from Hong Kong but this is probably not the case at all. The sheer volume of new work would indicate a large and well-organized industry and not some impromptu gathering of refugee lapidaries.

Recent works employ a great deal of the so-called "Soochow Jade," a fine quality translucent serpentine which is easily worked and capable of taking a high polish. A considerable amount of Brazilian gem material is also in evidence particularly the characteristic rose quartz, smoky quartz, and citrine. Much of the rock crystal undoubtedly comes from that country also. Brazilian chalcedony is also heavily employed as well as carnelian and agate. Some shopkeepers admitted purchasing supplies of rough from abroad and sending these stocks over to the mainland to be carved to their order. They all appear to be anxious to get more rough but never having been faced before with this particular aspect of the business, they frankly do not know where to turn to establish business connections.

Old works of classical design are very common and stocks are substantial, only a fraction of the total stock ever appearing upon the shelves. There is little question that Hong Kong represents the largest gathering of classic Chinese art works in all media today whether it be refugee wealth or delivered there in behalf of hidden Communist sellers. Pieces range from the small impedimenta of the Chinese costume such as pocket pieces, buckles, pendants, etc. to museum specimens of enormous size. All gradations of quality and artistic execution are available and one needs only to look around to see every period of Chinese jade carving represented. There is a brisk local trade among the natives for small pieces of jade which no Chinese in his right mind would be without. Even poverty-stricken coolies and sampan dwellers sported jade bracelets or small pendants while several others whom I questioned in higher positions of society were only too willing to show the piece they had either in their pocket or suspended by a thong from the trousers belt. Larger and important pieces moved slowly but steadily into the hands of local merchants whose coffers are filled by the increasingly brisk trade which characterizes Hong Kong today, but this is only a small dribble of business at best and the important market of the United States still remains closed for the present.

Because the first thing a person recognizes about a carving is the identity of that mineral, I will discuss those commonly noted in Hong Kong and the use to which they were put. This will, I believe, serve best in familiarization.

QUARTZES AND ALLIED MATERIALS

Rock crystal is very common both in antique pieces and in newer pieces. Older works do not possess quite the hard glassy polish of the more recent productions and of course show entirely different styles and subjects. Seated gods are a favorite subject for newer pieces as well as small squat vases and urns, and willowy Kuan Yins or goddesses of mercy. Details of work are strained and inclined to be angular but surface finishes are superb. Older works show far more grace in the employment of curves but the polish seems more velvety in texture. Favorite antique subjects are urns and vases of all kinds, some in the typical formal style but others in double and single bud vases representing the trunk of a pine tree covered with sprays of needles and branches of the sacred fungus. Adequate supplies of excellent rock crystal were hard to come by in the old days and most of the older pieces show veils of inclusions or other flaws. In contrast to this the newer pieces are virtually flawless pointing strongly to the likelihood that Brazilian material is used. The largest piece made from rock crystal was a magnificent capped vase standing almost 24″ high and about 6″ in its largest diameter. The cover and upper part were highly ornamented and bore loose rings suspended from the jaws of beasts while the body of the vase was carved in rounded geometric patterns in shallow relief. This was truly a specimen worthy of addition to any collection, private or public.

A considerable number of pieces made from fairly milky material were also noted including a rather unique snuff bottle which had been prepared from a crystalline aggregate. This tiny work of art showed the hexagonal intergrowth of rock crystals near their bases and by transmitted light displayed a reticulated pattern similar to a honeycomb. A few carvings of tourmalinated and rutilated quartz were also seen but all were of very poor quality except several snuff bottles in which the dispersion of the needles gave a very pleasing effect. Sometimes snuff bottles of rock crystal would be cut cameo fashion to take advantage of a layer of chlorite inclusions but this technique was most often used with agates and some jades.

Citrine was noted only in a few instances and all of these were patently modern work although done well artistically and of course superbly finished. It was assumed that the raw material came from Brazil since citrine in large sizes has never been common from Chinese sources.

Smoky quartz appeared rather frequently in modern pieces and the same remarks made for citrine apply here. Older smoky quartz pieces were made from much flawed material of a dingy and inky color which appears dull and lifeless alongside the Brazilian. It is believed that the old supplies of smoky quartz came from Japan.

Rose quartz has always been a favorite material with the Chinese carvers and numerous specimens of both old and new work may be seen. The recent carvings are made from the superb Brazilian material sometimes remarkably free of imperfections and always of a fairly intense color. Older specimens using material from unknown sources is paler and the hue seems to tend toward the yellow side. Favorite subjects for older works are extremely massive rectangular vases and short squat urns with a minimum of thin appendages, their relative simplicity is no doubt due to the cracked nature of much rose quartz which prevents too much delicate work. Modern pieces from the Brazilian rough are somewhat more elaborate and also include many animal subjects as well as vases and urns. Much of the raw material is superb but is wasted effort in view of the lack of artistic merit.

Aventurine quartz from India was seen in only two instances and both were rather poor specimens. One shopkeeper who had some carving work done on the side showed me a piece of "jade" which had been sent to him by a dealer in the United States and which turned out to be aventurine of poor quality. He stated that his cutters had much difficulty in polishing the material, the surface always remaining pitted. I pointed out the fuchsite inclusions to him and explained that it was not really jade that he had but a type of quartz with specks of mica and the undercutting of these specks were the cause of the trouble. He was not convinced that it was quartz until I demonstrated a hardness test on a piece of white nephrite. His experience may be the main reason why aventurine has never been popular with the Chinese even though it is known that the source of this material has been open to them for many years.

Amethystine quartz was relatively rare and always commanded a high price. In appearance the material is basically rock crystal with patches and areas of true amethyst which may or may not be carved so as to take advantage of the contrast afforded. None of the carvings noted were good. Quite a few sets of beads in amethyst are offered for sale and each bead shows very strong and patchy lines of coloration quite unlike modern Brazilian material, from this it may be safely assumed that Brazilian material is not used at all for today's work.

Chalcedony in grayish or bluish-gray tones of extreme uniformity is very common in carvings especially for egg-shell-thin bowls and dishes. A favorite technique seems to be to supply the surfaces of these objects with a delicate fluting convex on the outside and concave inside, reduced to almost playing card thickness. None of these were large, seldom exceeding 4 inches in a major dimension. Fine blue chalcedony was occasionally noted but the rare color demanded a different treatment and accordingly this material was carved in massive bowls with pierced sprays of flowers and branches on the outside. Once in a while the gray chalcedony is crossed by a strongly contrasting band of white agate and in such cases the band was placed to coincide with the girth. Agate as such is seldom encountered except in snuff bottles where cameo-type carving can be used to great advantage, some are extremely clever and deserve a place in any collection.

The well-known Indian moss agate is surprisingly rare but several snuff bottles were noted of this material as well as a rather fine screen carved in relief about 6 inches by 4 inches but suffering from too much stiffness of design. Moss agates of other types were common in bottles particularly a type in which sard was intergrown with dark green moss. No moss agate was noted in any large piece. The type of agate called "tube agate" was seen in several examples of snuff bottles. One splendid bottle noted in a well-known store had a beautiful black dendritic growth in a matrix of warm light brown sard, the carver had carefully cut away the intervening material in such a fashion that the layer containing the growth was of uniform depth and color intensity.

Carnelian in extremely bright orange and orangy-red colors is quite common especially in modern work. Typical objects are bowls heavily ornamented with detached branches and sprays of carnelian surrounding the matrix part which is generally the unaltered grayish chalcedony. In a number of cases a large number of cracks were noted which may indicate that such pieces obtain their bright hues from heat treatment. While on the subject of artificial colors in agate, it may be interesting to remark that no dyed chalcedony or agate of any kind was seen.

AMBER

In the past, Burma has provided many large pieces of almost flawless red amber and these can be seen today in fair number in completed pieces. Urns and animal carvings are favorite subjects while many extremely dark-appearing amber pieces of more recent vintage turn out to be pressed amber made by the Germans for the Chinese trade. These specimens are also red but so dark that they must be held close to a strong light to see any color at all. The swirling and patchiness is easily visible and is proof of origin. The extremely dark color is interesting for this pressed amber since it indicates the addition of some artificial coloring agent. Bright yellow and golden amber is far more rare than the red and seems inordinately prized by the merchants but for what reason I could not find out, — no doubt there is something special about it since the Chinese seldom do anything without good reason, although it be based on an entirely superstitious property of the material. One carving of animals grouped into a compact assemblage is worthy of mention, — it was roughly 6 inches in length and about 4 inches tall. The surface was unusually free from the crazing which commonly befalls older pieces of amber but some discoloration was noted on thin edges.

TURQUOISE

Turquoise of good blue is very common in all kinds of jewelry and carvings. The latter sometimes reach amazingly large proportions as for example one ornate carving seen of a group of figurines with approximate dimensions of 10 inches by 8 inches. This type of turquoise is said to come from the mainland and is nodular in form with dark matrix. The large carvings seem to be prepared from gatherings of these nodules into compact lumps but smaller carvings of several inches in height come from relatively pure material. The carvings are generally of rather poor workmanship and are finished to no more than a gloss while beads, cabochons, and carved sets are often highly polished. Baroque beads are popular either as polished angular fragments or as spiderweb nuggets. They are extremely attractive but their lustre and feel indicates the use of an impregnating wax to heighten the gloss and enrich the color. Some older carvings show considerable loss of color which often fades into a peculiar pale purple, although this may be some sort of chemical alteration. One such specimen when examined closely displayed the unmistakable cross-hatching of ivory and indicated a unique use for that versatile material. The deep blue Persian turquoise was not noted at all and neither was any American material.

SERPENTINE

Every curio store in Hong Kong carries a wide assortment of "Soochow Jade," a variety of serpentine remarkable for providing highly translucent, fine-grained material in large flawless blocks. The clearest kind is a very pale green reminiscent of jadeite, while others are a dark oily green only somewhat translucent, a brilliant yellow with a greenish tinge, and a host of intermediate colors. Sometimes a piece is seen of a number of different colors including red in which case it is carved to imitate a jadeite piece with the artisan placing the red in much the same manner as he would if he had the finer material to work with. It is understood that much of the carving in this material is done in Canton while hard stones are still produced only at Peking.

This highly translucent serpentine is customarily carved into long and slim goddesses, cranes, animals, and other figurines. The lapidary techniques are excellent but the final product is usuallv offensive artistically. Dark green serpentine is made up also to imitate dark green spinach jade but again the lack of excellent artistry soon betrays the inferior material employed. Much of this material is made up into cheap flat trays patterned after a lotus leaf with up-curled rims. Bright yellow rough is prepared into baroque cabochons and strung up on beads, they are quite attractive.

In spite of the inferior material used, serpentine carvings are far from cheap, very often a similar genuine jade piece can be purchased for nearly the equivalent amount. The reason given for this high cost is that modern workers demand wages by the day and as a result, the work costs have risen greatly. There is no doubt that a market exists for these carvings but it is too bad that most tourists who buy go away with the conviction that they have a jade piece, the shopkeepers always using this term to identify "Soochow Jade" and only furnishing more details when pressed. In size, carvings may reach as tall as 18 inches and as much as 8 inches across, generally being quite flawless.

FLUORITE

Not one shopkeeper in a dozen admits that the green fluorite which is for sale everywhere is not "Green Quartz," — the name first supplied upon inquiry. This cheap material also occurs in large blocks but is seldom clear except in the smallest objects. Its price is also out of proportion to its intrinsic value in spite of most of the carvings being in atrocious taste and flawed to disfigurement. Somehow both fluorite and serpentine have been sold in enough quantity to raise the price to unreasonable levels in contrast to comparable pieces carved from the much harder nephrite and other stones. Both fluorite and serpentine are fragile and easily susceptible to damage yet it must be supposed that a clever sales campaign convinces unwary and uninformed buyers that they are getting something good at a cheap price.

Subjects in fluorite may be almost anything but are generally massive and blocky in recognition of the difficulty of working this mineral. The effort expended is crude in quality and surface finishes are quite poor, the impression received is one of sheer mass and little else. In color most pieces are a rather fine green but sometimes purple is noted in small areas. Cracks are often iron-stained and highly disfiguring in such cases.

BERYL

Very little beryl of any kind was noted, sometimes some pale aquamarine and golden beryl could be seen as baroque cabochons, beads, or in snuff bottle stoppers. Excellent quality material was totally absent.

LAPIS LAZULI

Ordinary Afghanistan lapis is fairly common in jewelry and in carvings but top grade intense blue is not. One or two carvings were seen in which patches of fine blue afforded a pleasing and striking contrast to the white speckled matrix but lower grades suffered from the common fault of being entirely too dark. In size, carvings ranged from speckled pieces around 12 inches across to one superior specimen of excellent color which was about 5 inches in maximum dimension. The latter was very carefully carved with good crisp detail and bore an unusually high polish for lapis. Its price compared with that of an outstanding jade carving of about the same size. No Chilean material was seen but some pieces may have been Lake Baikal rough.

TOURMALINE

Pink to deep pink material is seen everywhere mounted in jewelry but never in a size large enough to afford even a modest carving. As a jewelry stone it must be much admired by the Chinese who use it extensively for pendants and beads. Very often a set of beads of another material will be terminated by a carved and highly polished pendant of deep rich hue while paler pieces are used for beads, baroque cabochons and for snuff bottle caps where it seems extremely popular. The color, structure and size of the tourmaline objects leads one to believe that here is some of the old stock produced at the turn of the century from the famous gem mines of San Diego County, California, and still available after all these years since about 1912 when major production ceased.

Multi-colored tourmalines were seen in only a few instances and none of the material bore any resemblance to Brazilian rough regardless of color. The common green types for example, were not seen at all.

MALACHITE

Two distinct types of malachite were noted — a finely patterned dark-toned material with many small pockets at the intersections of the botryoidal growths and a lighter colored material of large bold pattern which was obviously new and easily identifiable as African stock of recent years. Both kinds were very expensive, even the modern carvings costing far more than one would expect from their size. None of the pieces were large incidentally, the largest seen being a natural bowl-shaped vessel created by slight modification from a thin spherical growth of malachite which was smoothed here and there and then polished after a fashion. In dimensions this specimen was about 10 inches in diameter. Older pieces display a gloss finish while new specimens show a higher luster. Outside of the few "in-the-round" pieces, some malachite was noted in beads and in cabochons.

CORUNDUM

A very dark red, finely fractured corundum was seen in a few instances as baroque cabochons in either pendants or bracelets. In color it was very similar to brownish-red almandine garnet. Other than these, no corundums were noted except star sapphires and rubies.

ODDS AND ENDS

Almandine garnet was noted in round beads; a statuette of massive realgar was seen in one shop — it was very unusual but almost completely defaced by the ravages of time and exposure to light. The shopkeeper was aware of its poisonous qualities curiously enough.

JADES

Both nephrite and jadeite are extremely common in jewelry and in carvings. Every imaginable implement, ornament, object of art, etc. can be had in varying qualities and in many but not all colors. Prices are very consistent for similar pieces from shop to shop, indicating the complete familiarity of merchants with the selling prices of their competitors. Good to excellent pieces are widespread and each shop regardless of where it is in relation to the better class shopping districts, usually has a few pieces to show. Old established shops naturally have specimens to suit anyone's purse up to and including very wealthy connoisseurs.

In age, jades range from Ming upwards for the most part while earlier pieces are far more rare. Only one store had in stock archaic jades dating back to the Hsia — Shang — Chou dynasties and these were only smallish pieces or fragments. Recent carvings are sometimes good but like those executed in other hard stones are apt to be highly polished but devoid of imagination. Massive carvings are available as well as delicate and small pieces. The very dark green black-spotted nephrite yields large blocks and many bigger pieces are cut from this material. One magnificent vase comes to mind in particular, — it was a rather simple basic form but was completely covered with shallow relief decoration, restrained and tasteful.

In size this vase measured approximately 22 inches tall, 9 inches in diameter, with walls of about ¼ inch thickness.

(to be continued)

A Tribute To Arthur Tremayne

by

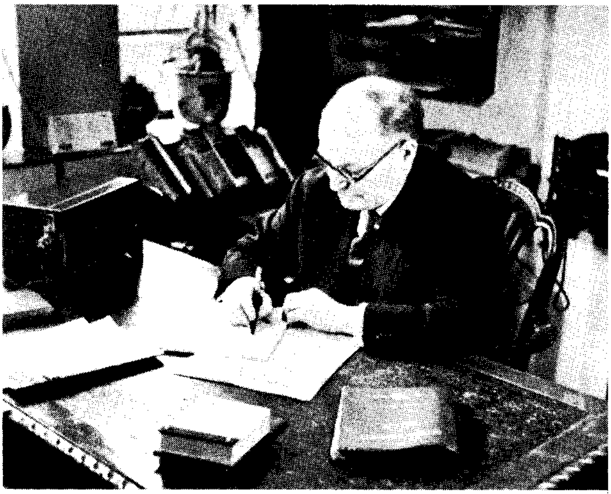
ROBERT WEBSTER, F.G.A.

The news that Arthur Tremayne passed away suddenly on Saturday the 20th of March came as small surprise to the writer, for when he last saw A. T. as he was affectionately called by all who knew him well, it could be seen that Tremayne was a very sick man.

Arthur Tremayne is best known to gemologists through THE GEMMOLOGIST. This journal was one of the first publications ever to be devoted entirely to gemology. THE GEMMOLOGIST was a product of the versatile brain of Arthur Tremayne and its present world-wide circulation will ever be a monument to his name. The writer personally owes a debt of gratitude to those first issues in 1931; for it was through those early pages that acquaintance was made with the Chelsea Polytechnic gem classes and a career in the science of gemology started.

The initial publication of THE GEMMOLOGIST was not A.T.'s first essay into gemology. About 1909 he had commenced a general correspondence course for jewellers which included a study of gemstones. In 1911 this was voluntarily discontinued to allow a fresh course prepared by I. G. Jardine for the recently formed Educational Committee of the National Association of Goldsmiths to go ahead. Later Tremayne became a member of this committee, now renamed the Gemmological Committee. In May, 1931, Arthur Tremayne made the proposal that resulted in this committee becoming a branch of the National Association of Goldsmiths to be known as the Gemmological Association. A. T. became its first Honorable Secretary.

The writer first met the dynamic personality of Arthur Tremayne at his Old Street premises during 1935 — the beginning of a happy association which lasted for nearly twenty years. A. T. was educated at the Coopers Company School and began his working life in a pawnbrokers shop — as did the writer. Never completely satisfied unless he could be active in other fields of endeavor; A. T. undertook the study of watchmaking in his limited spare time. In later years this study stood him in good stead



• Arthur Tremayne at his desk in Latymer Court.

when his publishing house produced periodicals and books on horology.

Tremayne first started publishing during the first World War; at the same time working in a draftsman's office on war production. He was medically unfit for service in the Armed Forces.

Advertising and publicity, for which he had such a flair, was always his first interest. After a few years with Pollards, the London Storefitters, he again returned to the world of publicity. He was for a short time Honorable Treasurer of the Incorporated Society of Advertising Consultants, and later their Vice-President.

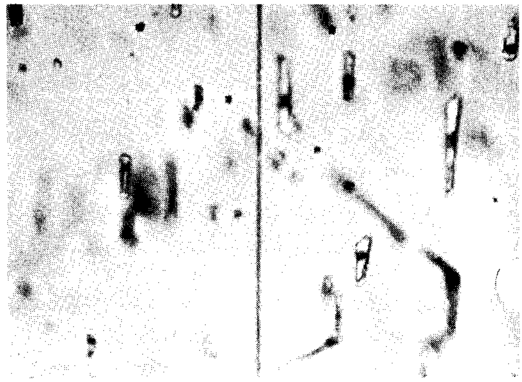
In 1925, Tremayne formed N.A.G. Press, Ltd., to publish the GOLDSMITHS JOURNAL, and in August, 1931, he started THE GEMMOLOGIST. Two months after World War II started Tremayne brought out THE INDUSTRIAL DIAMOND REVIEW. This was with the assistance of Paul Grodzinski, and again was the first in the field in a new and increasingly important subject. A year later Tremayne's premises at Old Street was razed to the ground by the fury of the enemy bombers and everything on the premises was consumed in the flames. Unlike many another man, A. T. was undaunted and next day opened in temporary offices loaned by Ingersolls. Subsequently he moved to the premises at Latymer Court at Hammersmith which has since been the post-war home of N.A.G. Press, Ltd.

Stubborn in character; impetuous in action, Arthur Tremayne was a staunch friend but could be a bitter enemy to those whom he felt had crossed his path. His direct speaking often antagonized those who did not see eye to eye with him, but even they could not dispute his sincerity of purpose and the foresightedness of his policies. There are few who can replace his wide knowledge of all things in the jewellry and watchmaking industries and the trade is the poorer for it.

Arthur Tremayne was 74; leaving a widow but no heirs. N. A. G. Press, Ltd., will carry on with Eric M. Bruton, F.G.A., as the Editor.

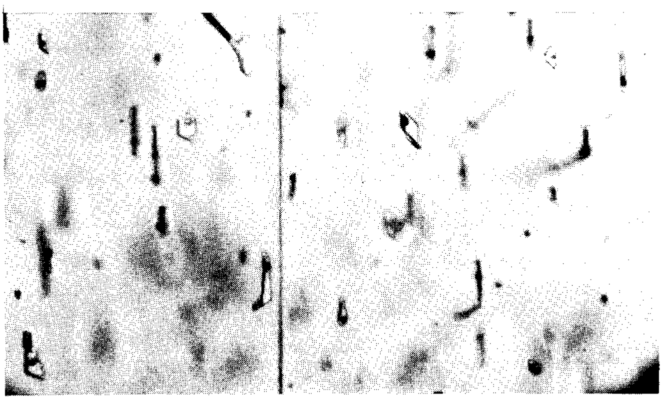
Letter to the Editor

A letter was recently received from Albert J. Breebaart, Nijmegen, Holland, in which he reports on an interesting yellow-green synthetic spinel as follows:



"While controlling a sending of cut synthetics from Germany, my eye fell upon one stone in particular, a yellow-green synthetic spinel round 10mm. This stone looked rather dull, compared with others of the same kind; examination with a 8x loupe gave as result that the stone contained a great many tiny inclusions. I decided to see about it under the microscope and who describes my astonishment when I found that the stone contained, besides elongated gaseous inclusions, many inclusions with a distinct two-phase like appearance! Having not heard about such inclusions in synthetics, I contacted the Gemmological Association of Great Britain and sent them some photo-micrographs, which I'd taken of the inclusions in the meantime. They were greatly interested and the stone was sent to England for further examination. The result was that there really appeared to be two-phase inclusions, besides the elongated gas bubbles, more common in synthetics. Holding the stone in a pair of tweezers and using dark-field illumination, the inclusions showed to be laying in a curved zone, when looking perpendicular to the direction of the light rays. This curvature is probably to be explained by the fact that the inclusions are orientated parallel to the domed top surface of the original boule.

"Meanwhile I was lucky to find another stone from the same parcel, certainly cut from the same boule, showing two-phase inclusions as well if not more distinct than in the first stone. The first stone thereupon was exchanged with the Gemmological Association for an andalusite, still lacking in my collection.



"The stone now in my possession shows the two-phase inclusions very clearly and they even show distinct crystal forms, which could be considered negative crystals. One question remains to be answered: how is the formation of such inclusions in synthetics to be explained? From Dr. Gubelin's book INCLUSIONS AS A MEANS OF GEMSTONE IDENTIFICATION I'd learned

LETTER TO EDITOR—Continued.

that synthetic spinel sometimes imposes crystal faces to its included bubbles and so these negative crystals may be formed. However where could the liquid in the cavities come from? The Gemmological Association gave me as theoretical answer, that under certain ideal circumstances, it might occur that the hydrogen and oxygen of the blowpipe fused at a ratio of 2 to 1, thus forming water. Due to the terrific heat in the furnace, however, this water would be evaporated immediately and perhaps it was included as vapor during the growth of the boule, and on cooling partly condensed into water again and thus filled the cavities, previously formed by the vapor."

Book Reviews

INDUSTRIAL DIAMOND TRADE NAMES INDEX

Fifth edition, 1954. Compiled jointly by Industrial Diamond Information Bureau and Industrial Diamond Review, 124 pp, N.A.G. Press, Ltd., 226 Latymer Court, London, W6. Price 3s.6d.

This Trade Names Index first published in 1954 has been thoroughly revised and now contains about 2,500 trade names. A data sheet supplement gives information on a number of subjects to users and producers of diamond tools and the physical and chemical properties of diamond, the crystallography of diamond and the care of diamond truing tools, shaped diamond tools, glaziers diamonds, are covered. Further a list of diamond tool standards as established in England and other countries is given as well as a comparison of fine sieve sizes. The Trade Names Index does not only contain registered trade names but also generally used abbreviations and names of firms which have a special standing in the trade. A classified index covering over 20 individual groups is added so that trade names which are used in any particular branch of the industries using and working hard materials, can easily be found.

Book Reviews

A HISTORY OF JEWELLERY 1100-1870 by Dr. Joan Evans. 10 color plates; 176 glossy halftones; 48 line drawings; 240 pages; published by Pitman Publishing Company, New York, Toronto, London; $17.50.

During the long and important period covered by this book, the jewelry industry underwent great evolutionary changes. The art of faceting gems was perfected and metallic alloys were developed. The art of metal working reached a high level of quality, enamels and enamelling techniques were perfected and new minerals were discovered and utilized as gems.

These facts, the new and improved materials with which to work plus the development of highly trained craftsmen and craft techniques resulted in new design and fashion trends.

Dr. Evans has expertly described these developments and illustrated her book so that the reader is able to understand and to see portrayed the jewelry extant at given periods.

The preparation involved in this book and the assimilation of the material required a keen insight and appreciation of jewelry on the part of the author as well as a great deal of effort and research. The finished product is worthy of Dr. Evans' ability and effort. Her book is a refreshing and welcome addition to gemological literature and will be welcomed by libraries, students, designers, jewelers and connoisseurs of jewelry.

Gemological Digests

NEW HOME FOR LONDON LAB

By Robert Webster, F.G.A.

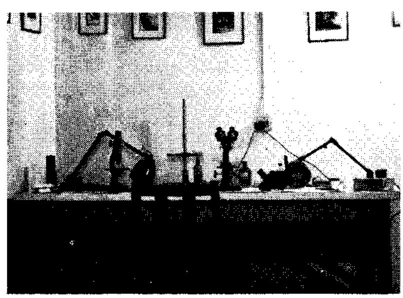
The laboratory of the Diamond, Pearl & Precious Stone Trade Section of the London Chamber of Commerce recently moved to new premises at 15, Hatton Garden. Although only some two blocks south of the old premises, Number 15 is more in the heart of the stone trade and is more conveniently situated to the transport services.

The laboratory had been located at Number 55, Hatton Garden since July, 1929, and it was with sensible nostalgia that the staff departed from the old premises. Expiration of lease was the main reason for the change, but the prospect of a better situation helped to influence the move. Number 55 suffered badly from enemy action during the war, both from the bombing by enemy aircraft and from the V2 rocket which fell with such terrible results on nearby Smithfield market. A number of the rooms of the laboratory premises were in very bad condition in 1946 with a number of windows still boarded up as a result of the bomb damage repair. All through the war years the Director, Mr. B. W. Anderson, had been practically single-handed, and with part-time service in the Auxiliary Fire Service, could do little to clean up the successive devastations. Since 1946 much has been done to straighten up the rooms, but 55 Hatton Garden never returned completely to its original pristine condition.

The new premises consist of six rooms of various dimensions which are ideal for the laboratory functions. The front room with two large windows looking out to the front has been allocated to the administration and affords facilities for the reporting and clerical duties. Besides containing the safe, the trade balance and the aperiodic balance, a working bench for the microscopic and refractometric testing of gemstones is provided. The extensive library and reference specimens are mainly housed in this room.

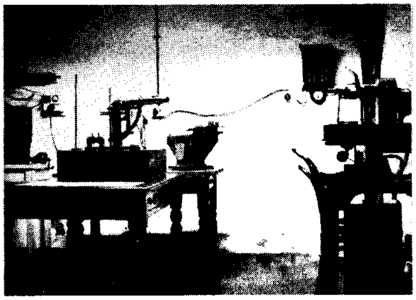
• General view of the administration room.

Behind this main room is a long narrow room which has been divided into two, a smaller section forming the waiting lobby and the larger part for reception. This latter room contains the main telephone and a fully equipped bench for stone testing.



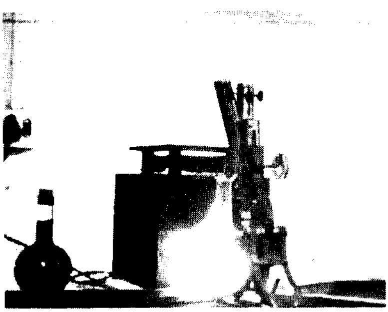
• Instrument bench in front room showing Beck microscopes and the refractometer with diamond prism.

At the rear of the reception room are the two main instrument rooms, lit by fluorescent tube lighting. The adjacent and smaller of these rooms contains the two main endoscopes for testing drilled pearls; a baise-lined table for cutting the pearls from their



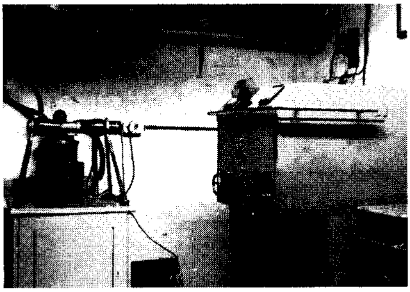
• The spectrograph and spectrometer table, Mr. Webster's Endoscope and wall points and controls for the arc.

strings and for counting them, a binocular microscope that is handy for any special examinations. In one corner of the room is set up the equipment for absorption spectroscopy — a 500 watt projection lamp, microscope, with spectroscopes of all types in a handy drawer. A flask of water to condense the light and to act as a heat filter and similar flasks containing copper sulphate solutions for use in conjunction with spectrum filters for "crossed filter" experiments are also provided. The opposite corner holds the table supplied with gas points for bunsen and meker burners for any chemical experiments requiring heat.



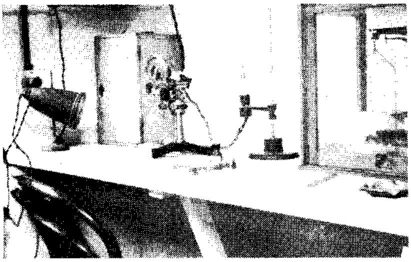
• The set-up for absorption spectroscopy and crossed filter observations.

In the furthest rear room, nearly as large as the front room, the back wall is the bastians of the Roman Catholic Church of St. Ethreldreda's in Ely Place, whose foundations are said to be Roman in origin. In this room are housed the X-ray and electrical equipment. These consist of the main X-ray set (described in GEMS & GEMOLOGY, Spring, 1950), and the small Philips "Metalix" portable set, which was in reserve and rarely used in the old laboratory. This is now set up permanently and is available for immediate operation.



• The two X-ray machines.

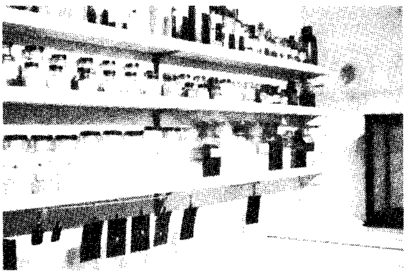
The Abbe-Pulfrich refractometer with sodium discharge lamp are housed in a



• The Abbe-Pulfrich refractometer and sodium lamp.

suitable recess in this room, as are the long and short wave ultraviolet light sources. Arranged down the middle of the room at

Gemological Digests



• Chemical reagents in dark room.

one end are tables accommodating the quartz spectrograph, which can be changed for the spectrometer if required, and the necessary arcs supplied by metered direct or alternating current from convenient plug points. The Fulmen electric muffle furnace is also situated in this room.

• Mr. Webster in dark room.

At the rear of the X-ray machines is a commodious dark room which is equipped with a convenient bench, a washing sink with water supply, and a Kodak dark room lamp with interchangeable filters. The dark room also houses the cupboard for chemical glassware, a table and wall shelves for the bottles of chemical reagents.

The staff are finding the new premises, with its more compact arrangement, much more convenient to work in and are looking forward to many happy years of routine and research.

INCLUSIONS IN A MADAGASCAN YELLOW BERYL

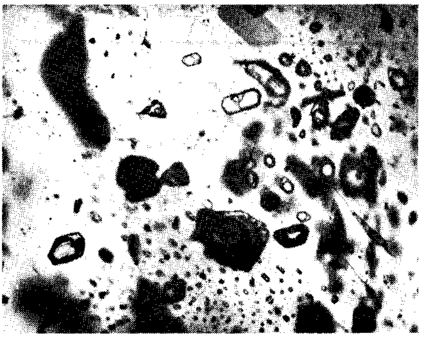
By Robert Webster, F.G.A.,

Recently it has been the writer's privilege to examine a yellow beryl from Madagascar which showed inclusions which do not appear to be common to other beryls.

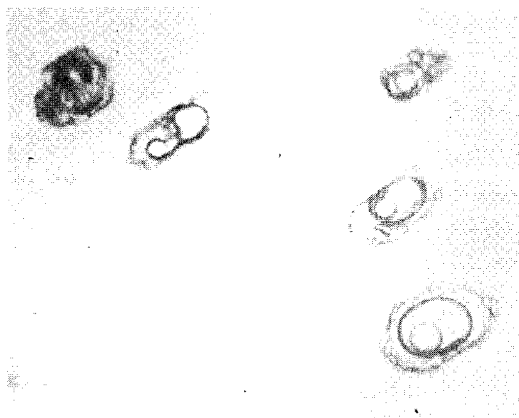
The specimen examined was not a faceted stone but a section of a prismatic crystal cut and polished so as to show two pairs of parallel faces. One pair being at right angles to the vertical crystal axis — that is parallel to the basal pinacoid, and the other pair at right angles to these and thus parallel to the vertical axis. The ends of the block were formed by the natural prism faces of the original crystal; thus producing a trapezoidal outline.

Probably due to the inclusions, the reflections from the polished surfaces showed a golden metallic lustre not unlike the golden flashes seen in some labradorites.

Microscopic examination of the internal structure revealed a veritable "jardin" of inclusions of various types. There were seen

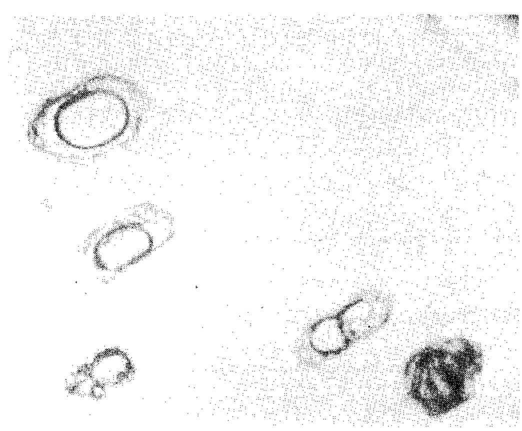


• General picture of the inclusions seen in the yellow beryl. (Owing to time taken to set up camera, the inner libella had disappeared due to heat from the microscope lamp.)



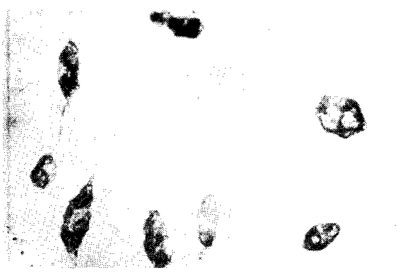
• Cavities in the beryl showing the inner bubble, and eroded effect of cavity surfaces.

to be many small cavities which appeared to be simple 2-phase inclusions; but the larger cavities, of which there were a great number, revealed that the contents were more complex. These cavities, sometimes straight-sided negative crystals, often with the cavity edges roughened either by erosion of the faces or by crystalline deposition on their inner edges, were found to contain the usual bubble. However, in many of these bubbles there was a smaller bubble inside them, and this inner bubble tended to disappear after being warmed by the heat of the microscope lamp, returning again when the stone cooled. This is the effect so elegantly described by Sir David Brewster in his letter to Sir Walter Scott[1]. The inner libella shows quite a good relief and gradually decreased in size



• Cavities in the beryl after the heat from the microscope lamp had caused the inner bubble to disappear.

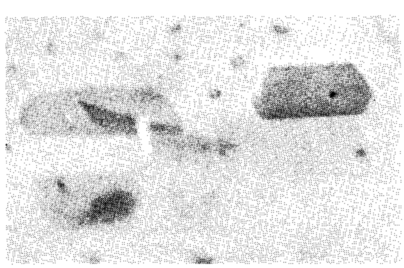
as the stone warmed up till it finally disappeared. Some of the larger cavities appear to be filled with solid material, as though



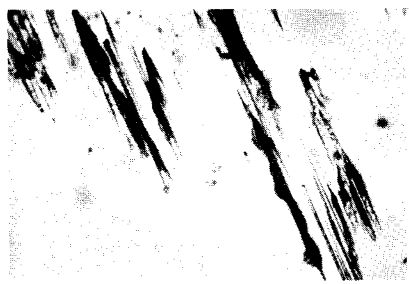
• Filled cavities with "tails" looking like mice.

the liquid had crystallized out, and some showed "tails" like the "mice" picture included in the illustrations.

Other inclusions were six-sided platelets of bright or dull green colour. In some cases these platelets were covered in patches with a red or orange coating. Unlike the other inclusions which showed slight preferential orientation to the host crystal, these platelets were completely disoriented. When viewed through the polished planes which were parallel to the vertical crystal axis the stone was seen to contain a number of tube-like cavities, some with "tails" streaming from them at an angle of about 17 degrees.



• Six-sided platelets seen in the Madagascan yellow beryl.



• Tubes seen in the beryl. These are parallel to the verticle crystal axis.

The specimen, which weighed 4.215 carats, was found to have a density of 2.71, and to have refractive indices of ω - 1.581; ε - 1.575; ω-ε 0.006. The dichroism was seen to be distinct; for the ordinary ray the colour was a light pinkish brown, and that for the extraordinary ray a yellow colour. The absorption spectrum showed two rather vague bands in the blue at about 4500A and 4200A; a spectrum not unlike that for the yellow orthoclase which also emanates from the island of Madagascar. As would be expected, with a stone whose colouration is probably due to iron, no fluorescence could be observed by irradiation with long-wave (3650A), or short-wave (2537A) ultraviolet light, or by x-rays. In view of the reported radioactivity of the yellow beryl called Heliodor from Southwest Africa, a test for this effect was made by seeing if the stone would affect a photographic film. The plate was unaffected.

Acknowledgment is made to W. F. Eppler of Bavaria who donated the specimen which these notes discuss.

[1]Journ. of Gemmology. Vol. IV. No. 2. pp. 56-63. April, 1953.

Here is printed the letter sent to Sir Walter Scott by Sir David Brewster in 1835.

Contributors in this Issue

COMMANDER JOHN SINKANKAS, U. S. Navy, Executive Officer of the aircraft carrier USS SAIPAN CVL-48 is currently based in the Far East. He joined the Navy as an Aviation Cadet in 1936 following his graduation from the Paterson, New Jersey State Teacher's College. In 1937 he received his Naval Aviator's wings at Pensacola, Florida.

As he explained, "Due to my entry in the Navy, I realized the impracticality of lugging around a mineral collection. As I had always been interested in the science of gemology, I undertook the study of gems and then studied lapidary work in 1947. I specialize in the cutting and polishing of extremely soft, brittle or other 'difficult' gemstones such as apatite, kyanite, cerussite, etc." Commander Sinkankas received his Gemologist diploma in March, 1951.

A number of cut specimens of Commander Sinkankas' work are presently in the collection of the United States National Museum including a 578 carat oval brilliant aquamarine and a 50 carat step cut rock crystal. The rock crystal is unique in that it is cut from synthetic quartz, perhaps the first of such size ever to be cut.

He is the dicoverer of the third known source of rhodolite garnet which is located in a fjord known as the Sondrestromfjord, just above the Arctic Circle in the West Coast of Greenland. This discovery was made in the summer of 1942. The garnet was subsequently submitted to the late Mr. John N. Trainer, distinguished mineral collector who specialized in garnets and who verified the identification.

In addition to maintaining and adding to his fairly extensive collection of rare and unique gemstones, Commander Sinkankas has found time to write numerous articles for ROCKS AND MINERALS magazine and conducts the Amateur Lapidary column in that publication. He is also the author of ANYONE CAN CUT GEMS which is scheduled for publication by D. Van Nostrand Company in the early part of 1955.

His article, THE GEM AND ORNAMENTAL STONE MARKET IN HONG KONG TODAY appears in this issue on page 47.

DR. RAYMOND JENNESS BARBER, Curator of Mineralogy and Petrology at the Los Angeles County Museum, after thirty years of mining engineering and fifteen of university teaching, now devotes most of his time to mineral science. Graduated from Massachusetts Institute of Technology in 1906, he has traveled to many different countries in his mining practice and geological explorations. He was a special lecturer at Stanford University; Dean of the School of Mines at the University of Alaska; and lately on the staff of the school of Engineering at the University of Southern California. During various sojourns to Old Mexico, he became interested in the "jade question."

In 1951 and 1952 – spending most of his time in Oaxaca – he investigated this question for the Los Angeles County Museum. His article JADE IN MEXICO concerning his trip appeared in the Spring, 1952 issue of GEMS & GEMOLOGY. His discussion of the NATURE OF JADE appears in this issue on page 38.