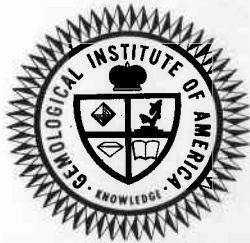


# Gems & G Gemology



SUMMER 1967



RICHARD T. LIDDICOAT, JR.

*Editor*

LAWRENCE L. COPELAND

*Assoc. Editor*

KATHERINE J. MURRAY

*Art Editor*

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GEMS & GEMOLOGY

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# Gems & Gemology

Volume XII

Number 6

Summer 1967

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# Cultured-Pearl Farming and Marketing

by

Richard T. Liddicoat, Jr.

*(Editor's Note: The following is the slightly abridged text of a talk delivered before the annual Conclave of the American Gem Society in Boston, April 3, 1967.)*

The purpose for this paper is two-fold: one is to comment about misinformation that has been widespread since the early days of cultured pearls; the other is to discuss the grading and appraising system that will be part of the new GIA cultured- and natural-pearl course.

Much of the misinformation tends to concern the thickness of nacre on cultured pearls, the length of time in which the nacre is accumulated, and cultured-pearl treatment.

The whole cultured-pearl industry in Japan is based on the mollusc *Pinctada Martensii* (Pink-tahd"-ah Mar-ten"-se-i), a nonedible oyster. It is a mollusc that could be eaten but very seldom is, except for the foot muscle. In contrast to the shell of edible oysters, the interior of the *Pinctada Martensii* shell has a lovely mother-of-pearl iridescence. These molluscs grow to a shell size of

three to four inches in diameter, at an age of about three years, at which time they are fully mature. They stay at about the same size, but good health lasts only about seven years, after which they deteriorate until death at about eight. From the age of three, very little is added to the size of the shell; at this age, they are ready for nucleus insertion. So the free-swimming spat that were gathered at an age of a few weeks and nurtured until they grew to maturity are now ready for pearl culturing. Those that are in good health after three years are prepared for nucleus insertion. Between spat collection and maturity, the molluscs are brought ashore occasionally for shell cleaning, and then finally, at age three, for nucleation.

At this time, they are induced to open the shell enough so that a wedge can be placed to keep the jaws open. An operator then inserts a nucleus or a number of nuclei and an equal number of small pieces of mantle tissue. Mantle tissue comes from next to the shell and secretes the shell-building materials. When placed inside the body of the



Oyster cages being readied to lower to their 2-meter standard depth.  
Ago Bay

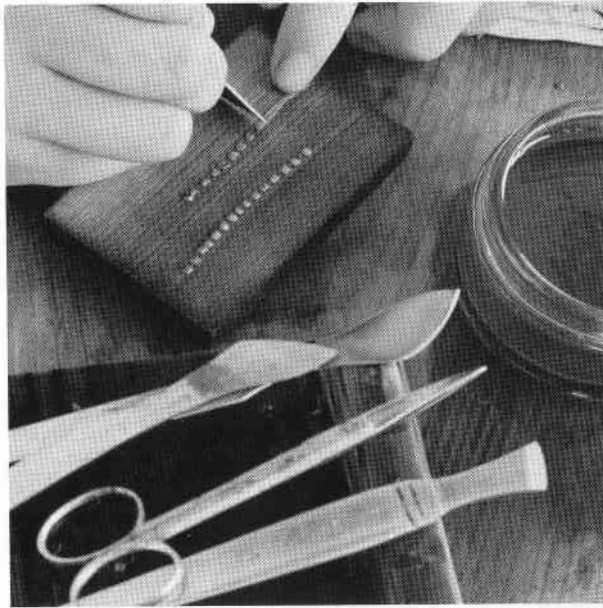


Freeing the shell from encrusting organisms—a 2- or 3-time per year task

mollusc, this tissue causes a pearl sac to form, and the shell-building process starts within that space around the prepared nucleus.

Channels are cut into either the foot

or the body mass of the mollusc, but the key factor is that the position chosen is one that does not interfere with the animal's life process. In practice, it is seldom into the foot muscle, but more

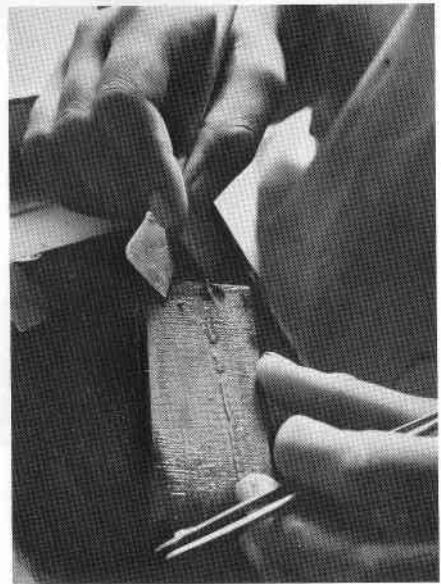


Preparing mantle tissues for the operation

often into or near the gonads. If the nuclei are small, such as two to three millimeters, up to 20 are placed in one mollusc. If the nucleus size is about six millimeters, two usually are inserted; if seven millimeters or over, only one is used.

Recently, a new strain of *Pinctada Martensii* has been developed in the warm waters of Kyushu, the southernmost of the Japanese islands. Some of these shells attain a growth almost double that of the same species used in Ago Bay and, until this development, in Kyushu as well. Shells of the new strain reach a diameter of six or seven inches, instead of the three or four of the Ago Bay mollusc.

In contrast to a ten-millimeter maximum heretofore,  $11\frac{1}{2}$ - or even 12-millimeter cultured pearls have been



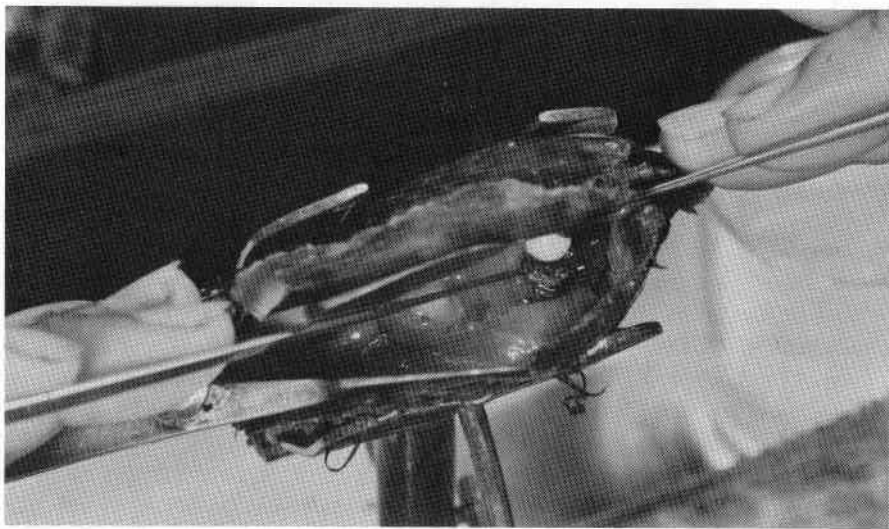
Preparing mantle tissue for the nucleus-insertion operation

produced in this new strain, which is now in production. They are still limited in quantity, but this is a growing segment of the industry. Because the Japanese mollusc produces the most beautiful luster in the world, this will become a very important factor in the industry in the years to come.

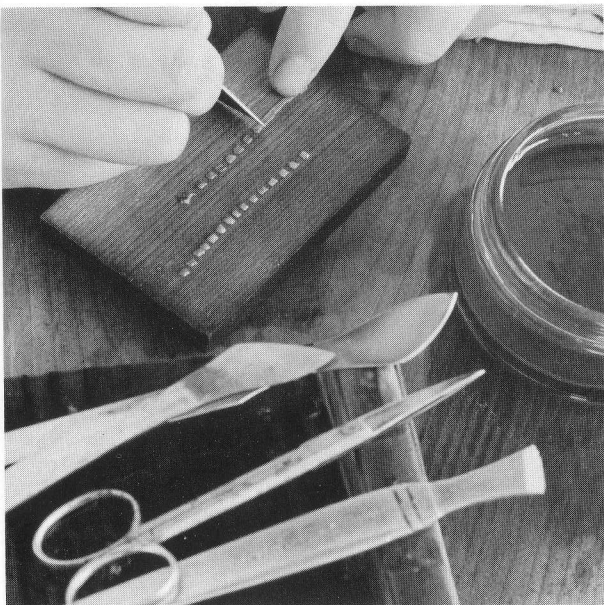
The maximum length of time in which a bead is left in a mollusc is  $3\frac{1}{2}$  years. Smart operators like to permit the mollusc to deposit the thin layers of nacre expected in the winter months, because the colder the temperature within the tolerance range of the mollusc, the finer grained the nacre and the higher the luster. The higher the water temperature, the more rapid the nacre accumulation. However, with rapid high-temperature accumulation, the nacre tends to be coarse. When the temperature falls, the nacre accumulation is reduced, but it is finer grained and more

highly lustrous. Thus, the thin nacre added in late fall and early winter is particularly desirable, if high luster is the aim. So, those that are nucleated in the spring are taken out in late fall three years later, if top quality is the objective.

When the nucleus placed in a mollusc is small, often the time in which nacre accumulation is permitted is much shorter than with the larger nuclei. Eight to ten months is common for two- to three-millimeter nuclei. The reason that no nuclei are likely to be left in a mollusc for more than  $3\frac{1}{2}$  years is that in its waning years the tendency is for the nacre to be very poor in quality and unevenly distributed. As a result, a cultured pearl, which at  $3\frac{1}{2}$  years in the mollusc may be beautiful, could become ugly in the next six months to a year. There is a very definite investment factor to be considered, too, since the longer the nucleus is in the mollusc, the



The bead-implacement operation

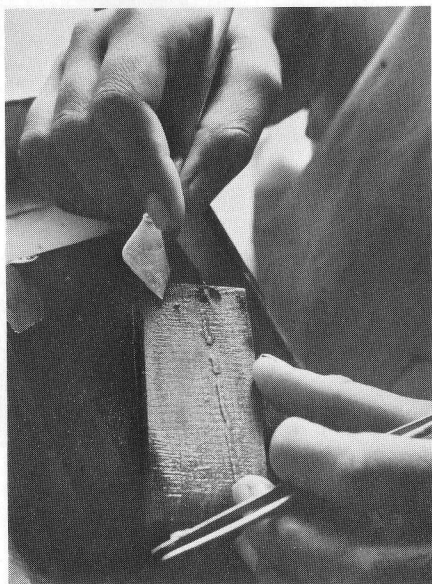


Preparing mantle tissues for the operation

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Preparing mantle tissue for the nucleus-insertion operation

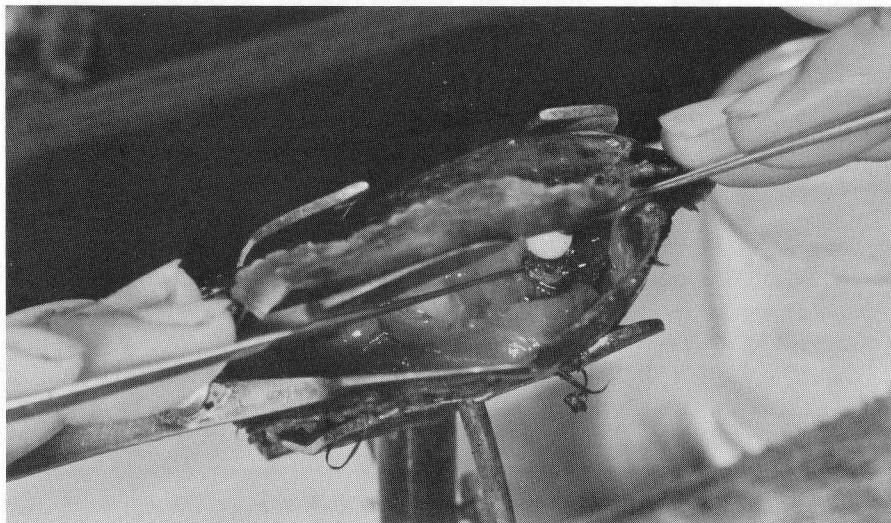


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The bead-implacement operation



Rounding and polishing nuclei

longer the pearl farmer's investment is drawing no return. Therefore, new farmers tend to work with very small nuclei, so that they can get their first crop out in a hurry. It is only the better-financed farmers who can grow the larger cultured pearls.

There are many misconceptions with regard to the rapidity of nacre accumulation. In the chief culturing area, Ago Bay, about .15 mm. of nacre is added annually. This means that the diameter of a bead increases about .30 mm. per year. In a 3½-year period, the maximum accumulation is about .5 mm. in thickness, or 1 mm. in diameter. In the warmer waters of Kyushu, the nacre added is up to two times that of Ago Bay, so an 8-mm. nucleus may yield a 10-mm. cultured pearl after 3½ years.

When the crop is removed from the molluscs, there is a wide variety of colors to be seen. Many browns and

blacks are present, because the conchiolin layer is often quite dark. When the nucleus is inserted, the first layers secreted by the mollusc are rich in this organic material that serves to bind the tiny aragonite crystals in nacre together.

After the product has been cleaned, it is examined with care, to cull out the pearls that will not pass the Cultured-Pearl Inspection Offices in Kobe or Tokyo.

The next step is to examine the product to see how many blemishes are present. If two are very nearly opposite, the pearl will be drilled through these blemishes before bleaching. If there is only one blemish, it will be half drilled. In any event, all pearls to be drilled will be drilled before bleaching, because the bleach will penetrate better after this operation. The drills used are very clever; they are designed to enter from two directions at once, so that a single

drill going all the way through the cultured pearl will not cause the nacre to break out on the opposite side. The design varies. Some are made so that, when a certain point is reached, one drill backs off so that the two drills never touch one another.

Almost all cultured pearls have to be bleached, because so many of them have a brownish or blackish color as

a result of the conchiolin. Even if the color is quite dark, such pearls are not used for black or fancy pearls, because sunlight will bleach them over a period of time, and often in a blotchy manner. Thus, it is practical to bleach them to begin with.

Very few cultured pearls are sufficiently beautiful to be left unbleached. The very finest do not need it, but they



Inserting the nucleus

are not too common. This operation is accomplished by placing the pearls in a weak solution of hydrogen peroxide, which is either slightly elevated in temperature to about 95° to 98° F., or placed under a bright light source. In each case, the purpose is to heighten the action of the bleach. They are left

in the solution for about seven days, and then removed for examination. Those that have attained a satisfactory color are removed at this point, and those remaining are put back for another comparable period, after which they are re-examined and any having attained desired condition are removed.

They are not left in the bleach for more than 30 days, because it will cause the nacre to become brittle.

Most Japanese cultured pearls are slightly greenish, so almost all of them are treated with a light pink water-base protein stain. Thus, perhaps 95% have been subjected to some kind of a treatment. Poor colors are dyed with stronger colors. Unless the dye is so strong as to discolor the ends of the drill holes or stain a string, this is not a matter of too much importance. Natural pearls are also bleached, and some are dyed.

The better cultured-pearl exporters and importers today, as represented by their associations, have a very strong desire to upgrade their product. They are

trying to eliminate thin skins, which do not wear well and which hurt the cultured-pearl image, both in the industry and to the public. Since the Cultured-Pearl Inspection Offices were first instituted several years ago, the minimum passable grade has been raised several times. The last upgrading occurred in October, 1966.

American and European importers met with the Japanese in Tokyo in March, 1967, and urged that the minimum standard be raised to a much higher level and that policing of exports be tightened greatly.

This upgrading means that fewer cultured pearls are available or will be available in the future. At the present time, the industry claims to be *at* or



Shells may be strung on lines and hung beneath the raft without a cage

near the limit of production, since Ago Bay is operating at an absolute maximum, in view of the food supply for the mollusc. They claim to be approaching the same condition in Kyushu. Possibly they will establish pearl-culturing stations elsewhere, but they doubt that conditions will equal those in Japan with respect to quality of product. Another factor is the growing shortage of pigtoe shell used for nuclei. Thus, fine cultured pearls appear destined to go up in price.

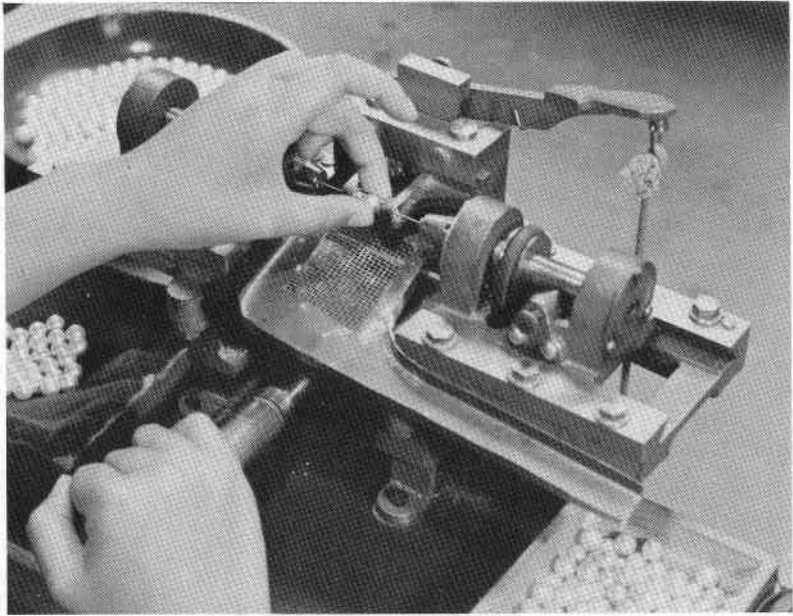
Since 1949, GIA has been testing pearls and cultured pearls by X-ray. During this period more than a million pearls have been tested, and yet, until one starts to observe them and to really examine them, it is very difficult to judge the relative quality between two strands. We have heard many retailers express a feeling of inadequacy when it came to judging the value of cultured pearls. This led GIA to decide that the time had come to develop an appraisal system comparable to that that has proved so popular with diamonds. The obvious place to turn was to the successful cultured-pearl dealers in this country. From the beginning, despite their feeling that this was a very complex subject for which to develop a viable system for evaluation, we have had nothing but cooperation — not only from the Cultured-Pearl Association of America, but from individual dealers. Ernest Reuter and Morton Lippman from New York, plus Hans Bagge and Lee Sparrow from the West Coast, have been especially helpful. The Japanese Cultured-Pearl Exporters' Association has been equally cooperative in assist-

ing us with our efforts to develop a meaningful appraisal system.

The dimensions of a cultured pearl's value are quite clear cut. We have to consider certainly the brightness of luster and thickness of nacre. These two factors are closely related. The roundness of the pearl, its freedom from blemishes, its color, the degree of orient, and the matching and blending of a strand are all important. Of course, size is also a key value factor. Without any effort initially to arrange them in order of importance, because they are so closely interrelated, let us discuss thickness of nacre and luster first.

Luster is one of the most important factors affecting value. Thickness of nacre is important both to durability and in its contribution to luster. In order for luster to be as bright as possible, nacre must be quite thick. However, South Seas pearls, grown in waters at temperatures considerably higher than off Japan, tend to have a coarser-grained nacre, which, despite being very thick, does not have quite as high a luster as the Japanese. If those grown in Japanese waters are left in the mollusc into the winter months, a very fine-grained, very thin coating is added, creating a high luster. In grading for luster, it is necessary to judge how high, or bright, is the highlight at the crest of the rounded surface, and also to make sure that there is no mother-of-pearl effect as the pearl is rotated.

In the GIA appraisal system, there are five grades of luster: very bright, bright, medium, slightly dull, and dull. The highest luster is seen in the larger Japanese cultured pearls. South Seas



The drilling operation

cultured pearls of the finest quality do not enter the very bright category, but at best are considered bright, the second of the five grades. As an example of the relative importance of these various grades pricewise, if a strand with a very bright luster is worth \$100, a strand of equal quality otherwise with a bright luster would be worth \$75, one with medium luster \$50, a slightly dull luster perhaps \$35, and a rather dull-lustered pearl would be worth on the order of \$25 to \$27. So the fifth grade is worth approximately a quarter of the value of the top grade. Most of those in the last three grades tend to blink to some extent as the strand is rotated round the string; this is caused by the mother-of-pearl's bright reflections in the nucleus. The bottom grade offered by reputable dealers barely passes the Cul-

tured-Pearl Inspection Office to qualify as exportable.

An important consideration is roundness. The finest grade is perfectly spherical to the eye. The second grade is just very slightly off round — to a degree barely noticeable to the eye. It may be very slightly flat on one side, very slightly elongated, perhaps very slightly oblate or drilled off center. The third grade is off round, far from baroque but clearly not spherical to the unaided eye. This is followed by semibaroque and baroque. The drop in price from a \$100 figure for the perfectly round is to about \$80 for the slightly off round, to \$60 for off round, \$40 for semibaroque, and down to \$20 or \$25 for the baroque.

Another factor is the degree of freedom from blemishes. Obviously, a cultured pearl without blemishes of any

description is the most desirable. Here we recognize four grades on the GIA system: flawless to the unaided eye, slightly spotted, spotted, and heavily spotted. If a flawless strand is of a size that merits a cost of \$100 to the jeweler, a slightly spotted strand would be worth about \$80 to \$85, spotted about \$65,

and heavily spotted about \$40. If an otherwise flawless pearl has one blemish, it will probably be only half drilled and then used for a ring pearl or for earrings. If it has two that are opposite or almost opposite one another, it will undoubtedly be completely drilled and used on a strand. Pearls with more than

Matching and blending to  
make up necklaces

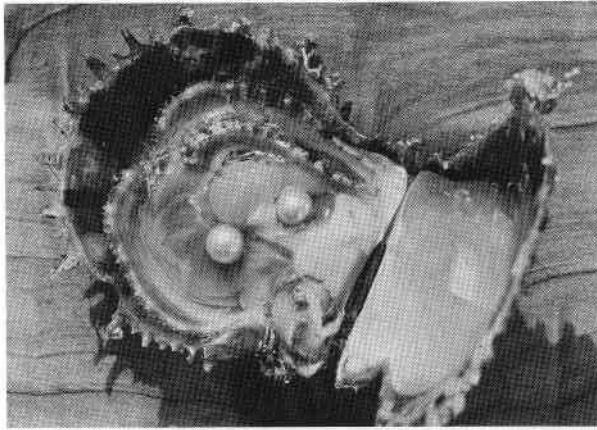


two blemishes are almost sure to be drilled.

Blemishes take many forms, including white spots, dents, welts or bumps, cracks, flats, nacreless areas, gaps, discolored spots, one-sided pearls (that is, ones that are dull on one side and have a normal luster on the other), and hot spots (where the mother-of-pearl or moonstone effect comes through on

a very thin, almost transparent nacre). When a strand is rotated around the string, and most of the pearls show bright mother-of-pearl reflections, a very thinly coated strand is a certainty. This is a definite price-reducing factor.

A major consideration, of course, is color. Since most persons wealthy enough to be in the market for cultured pearls live in the United States, Can-



Two rather large cultured pearls about to be harvested

ada and northern Europe, the greatest demand is for white and near-white body colors. Actually, just slightly creamy pearls with a rosé overtone are becoming to more women than are the very white ones that one sees so frequently. Cream to yellow pearls usually have rather thick coatings, and are very satisfactory for many skin tones; they are very becoming to many women, and they are appreciably less costly. There are also pearls with a very faintly greenish cast — a normal color in Japan, without the rosé stain that most of the pearls are given. These, too, are appreciably less expensive.

One of the factors of importance is orient. This is the combination of diffraction and light interference that gives a pearl an overtone over the body color. This is the iridescence we see. The body color may be white or cream, but often cultured pearls have a rosé cast — a rosy, flesh-colored appearance. This is caused by orient. If the nacre is thick and the pearls have a good orient, sometimes there is a second overtone.

In other words, there is a white body color, plus a rosé overtint, with an overtone of another color, often either bluish or greenish. If blue, the pearl takes on a slightly purplish cast. This overtone is a sign of thick nacre, and is particularly desirable. A strand of dark-cream pearls, otherwise of equal quality to a top-quality white-rosé strand, is likely to be about a third to 40% less in cost.

Let us not forget that paramount factor, size. In a top-quality uniform necklace, a 3mm. 14-inch strand may bring \$45; a 6mm., \$125; an 8mm., \$500 plus; a 9mm., over \$3000; and a 10 plus mm., near \$25,000.

The new GIA course will not just discuss appraising, but will have graded master pearls, and there will be grading and appraising exercises, much like our present Diamond Course. In addition, there will be a good deal of background information and suggestions for merchandising cultured pearls. It will be much shorter than other GIA courses. It should be ready early next year.



# A Prospector's Guide to the Anakie Sapphire Fields

*(The following is a condensation of an article by O. Andersen, Inspector of Mines, Rockhampton, Queensland, Australia. It appeared in a recent issue of the Queensland Government Mining Journal.)*

## General Discussion

The Anakie sapphire fields are situated around a small town of that name on the railway about 28 miles west of Emerald, Queensland. The known mining areas are Sapphire and Rubyvale, six and ten miles, respectively, north of Anakie; Tomahawk Creek, 30 miles northwesterly; and the Willows, 23 miles southwesterly. Emerald, a large country town, is connected by a 181-mile hardtopped road to Rockhampton.

Today, Australian sapphires are in great demand, and production can be increased to meet that demand. New attention is being given to the mining areas by both permanent prospectors and vacationers. A continuous stream of visitors finds its way to the fields to spend an interesting and often rewarding holiday. But they are often handicapped, because they have no knowledge of favorable areas and are unable to distinguish good sapphires from inferior stones.

In this report, mention is made of areas that offer most promise to the

short-term prospectors, who prefer to work at shallow depths, and of areas of deeper deposits that may interest the permanent or more venturesome miners. Reference is made to the occurrence of sapphires, and means are mentioned for distinguishing good stones. Mineralogical descriptions are not given. On a known sapphire field, color alone is usually sufficient for identification. However, stones do vary in grade, and some may have defects that render them uncuttable and therefore valueless. Knowledge of these defects will avert the disappointment that is sometimes experienced when a buyer shakes his head in refusal.

Many colors of sapphires are found in the Anakie fields, including blue (usually dark tones), golden yellow (popular in the Australian market), green (also favored in Australia), particolored stones (not especially favored), alexandrite sapphire (fine stones are rare and in demand), colorless stones and asteriated material (the principal source of black and dark-brown stones).

## Occurrence

Sapphires are contained in layers of ancient gravel called *wash*. The bottom of the wash is often granite and in others, slate; at the Willows field, however, the bottom is usually clay, overly-

ing sandstone. The wash varies in depth from the surface to 60 feet or more, but over large areas it is found from one to three feet; its thickness varies from a few inches to several feet. Gutters (the lowest portion of the wash) in the bedrock seem to influence the deposition of the sapphires: they are not found in the beds of the gutters, unless the beds are very rough; they are found on the banks. Consequently, it is general practice, when working a gutter, to work up towards the higher ground.

Not all wash is gemiferous, but *billy boulders* (worn and rounded quartzite boulders) are always present where sapphires are found. Decomposed basalt boulders are also found in the wash and are considered a very favorable indication. Sapphires are associated with many other minerals, including nongem corundum and star material, pleonast (black spinel), amethyst, zircon, ilmenite and garnet. These minerals are also a good indication of the presence of gem sapphire.

### Production

Accurate production figures from the Anakie sapphire fields are not known, since, for various reasons, miners do not fully declare their sales and many retain their best specimens. Many large stones remain uncut and are proudly displayed to visitors. When large stones are found, much publicity is created and stones are often assessed at an exaggerated value. Production for the first few years of the 1960's has varied from about 400 to 800 ounces. Two of the most well-known stones are the 322-carat *Golden Willows Sapphire* (later recut to 91.35 carats and renamed the

*Golden Queen*) and the 1165-carat *Black Star of Queensland*, cut to a record 733 carats and presently displayed by the Smithsonian Institution, Washington, D.C.

### Mining

Prospecting for sapphires entails the testing of wash at different locations until gems or favorable indications are found to warrant further work. In deep ground, a number of shafts may have to be sunk before any stones are found. Consequently, visitors to the field prefer to work in shallow ground, to avoid fruitless shaft sinking. Quite large areas abound on the fields where the wash occurs from about six inches to a few feet in depth and these attract the prospectors. In many of the older areas, these shallow deposits have been worked extensively but continue to yield good sapphires. Alert, casual prospectors search for patches of unworked ground left in the midst of old workings, whereas permanent miners devote more attention to areas where the deposit could extend over larger areas.

The tools required for shallow working are merely a pick, shovel and sieve. The wash is dug to bottom and shoveled into a  $\frac{3}{16}$ -inch mesh sieve. For easy manipulation, the screen is suspended from a tripod. The sieve can be square, with its sides about three feet in length, and suspended by each corner. Material is placed in the sieve and shaken from side to side. Large stones are scraped out and all material minus  $\frac{3}{16}$  of an inch will pass through the screen. The material remaining in the sieve is spread out with the fingers and the sapphires are picked out. After

a little experience, the gems are quickly recognized.

When selecting a site to begin mining, the beginner is advised to commence prospecting near an area where gems have been found, since it is easier to find a continuation of a "run" of gems than to find a new run.

Whether he tests near old workings or in a new area, it is necessary to first locate favorable indications; consequently, areas must be selected where billy occurs. Then, by digging down to the bottom of the wash, samples are taken. The  $\frac{3}{16}$ -inch screen is not used when testing for favorable wash or, at least, the screenings are not discarded without prior examination. Examination of all of the wash material increases the chance of finding the associated minerals. Zircons may be present, which would be contained mostly in the screened material. Also, sapphires too small for sale or use may be present to indicate that the wash is gemiferous.

A prospecting pan may be used to wash the screened material. After locating a favorable area, the screen is used to speed examination of the wash; gem particles lost through the sieve are of little value.

An improvement for treating the gravel is the *Willoughby*, in which a sieve is suspended from a pole into a tank of water. The action of this piece of equipment is an up-and-down jiggling movement, concentrating the sapphires in the center of the screen and the surface material being scooped off and more wash material added for further jiggling. This may be repeated several times before the concentrate is

searched for sapphires.

A further improvement utilizes a gasoline motor to drive the crank shaft of an inverted engine block, the connecting rod of which is attached to one end of a pole. The pole is fixed by a hinge at its center and the jig is attached to the end of the pole over the tank. With this equipment, an operator can treat several hundred pounds of wash before hand picking the sapphires.

When the wash is clayey, it is necessary to soak the material in water or use a pug mill to break up the clay. A pug mill, in simple form, consists of a shallow tank containing water into which the wash is fed. A bar revolving above the wash is fitted with prongs extending into the liquid to impart a stirring action. The bar is driven by a gasoline motor.

A more impressive machine is being operated by one miner in the Willows field, consisting firstly of a motor-driven trommel. The sized product from the trommel is fed to a perforated barrel revolving in water to become thoroughly washed. It is then discharged over a flat chute from which the sapphires are hand picked. It is claimed that four tons of gravel per hour can be treated.

### Sources

The area known as Sapphire was one of the first fields to receive attention. It supported a large number of miners and their families over many years. The shallow wash is near the old townsite and varies in depth to about three feet. It has been worked extensively, but short-term prospectors often find good values in virgin patches among the old

workings. The stones occurring include good-quality blues, yellows and greens. Large stones are still being found. Deep ground occurs about one mile west of the old township. The workings are about 20 feet deep, and good stones are being found in the unworked patches.

Tomahawk Creek is an old field and, since it is difficult of access, has received little attention. The road at creek crossings is impassable after heavy rains. During the dry season, when the road is in good repair, the field is accessible by car and many visitors make the trip. The main wash area extends from Tomahawk Creek to Hut Creek, a distance of about two miles, with the best locations occurring at Hut Creek and Costic Creek. Many virgin areas are available for prospecting.

Blue stones in this area are usually poor in quality. The color is often a steely gray-blue, and the better ones often contain enough green for the colors to combine and produce a black appearance when the stone is cut. The greens and yellows are good; yellows are generally good wherever they are found. Inferior stones are more abundant than in the other fields; when they are found, they provide the encouragement necessary to keep a prospector trying. Most short-term prospectors have been well satisfied with their winnings at Tomahawk Creek.

The Willows field is the youngest of the group and, for a time, gained glamour and popularity from the findings of large sapphires. The area enjoyed a period of activity and the shallow ground, up to three feet in depth, was extensively turned over.

Large gems are found infrequently, however, one or more years intervening between finds. Good stones of small size are also rare, and there is an absence of second-grade stones. Stones of lesser grade than good are usually unsaleable rubbish.

The blue stones are too deep in color for the market; the better stones are the yellows and greens. No appreciable quantity of sapphires is being sold to the local buyers. It has been mentioned by residents that large quantities are being sold to tourists, but inquiries do not support this claim. Some of the rubbish has been sold to tourists for two shillings apiece.

No one on the field has been sufficiently successful to earn a living. Practically all have other means of support.

The absence of second-grade stones is the main disadvantage of the Willows field, and the prospector can expect no reward until good gems are found.

It would appear that unless payable runs of sapphires are found in or near the Willows area, the field must close. Areas in which some gemstones have been found, five to 20 miles to the south, should be of interest to prospectors equipped to travel the rough country.

At Rubyvale, the stones found include good blues, greens and yellows. This field has been worked extensively, particularly in the shallow areas, but many fine gems are still being won. The ground is mostly deep and not suitable for casual prospectors. The prospects remain encouraging in the deeper wash for the more venturesome.

Since most of the wash is found at a much greater depth than in any other area, prospecting has depended on the sinking of deep shafts. Sinking such shafts away from known sapphire ground is a costly gamble; consequently, exploration of the sapphire runs in this area is far from complete. Sapphires occur in runs, or patches, and can only be located with extensive prospecting. Past practice has been to sink the shafts as close to known sapphire washes as possible; this accounts for the grouping of old workings.

Cheaper means of exploring the wash in remote areas appeared necessary, so a few years ago one miner submitted a proposal to drill the field and prospect for new areas of wash. This proposal was favored by the Queensland Department of Mines and some assistance was arranged.

An auger drill, capable of boring nine-inch-diameter holes, was made available to the miner and his partner. Fitted to a tractor and driven from the power takeoff, the drill became a readily portable unit. It was intended that virgin areas be tested, the drillers having the right to sink shafts and further explore any favorable wash encountered. Aerial photographs were supplied to assist in selecting areas and fixing the location of holes.

Difficulties were met in the early stages of the program, but they were overcome as experience in the local drilling conditions was gained. Heavier tungsten-carbide teeth proved necessary, and it was found that when the teeth were given sharp cutting edges, they tended to chip. But this was over-

come when, in sharpening, the edges were left slightly rounded. The presence of billy boulders gave difficulty, and it was found that, rather than persevere under adverse conditions, it was preferable to abandon the hole and drill nearby. The smaller boulders gave no trouble.

### Assessing Drilling Results

In assessing drilling results, consideration was given to all indications encountered. The nature of the wash, the presence of associated minerals (including iron sands), the presence of billy, the results of later exploration by shafts, and the personal views of the driller who had examined the wash samples were taken into account.

The drilling provided very useful information, indicating that follow-up shaft sinking is warranted in the areas tested. However, it was haphazard and without coordination and a number of holes lost their effectiveness, since they were drilled to explore known wash runs. It is not intended to disparage the efforts of the drillers, who did good work under the conditions. The reward for their work was to come from their right to explore promising discoveries; a sequence of unproductive work would drain the men's resources, forcing them to return to known areas of sapphire-bearing wash.

Further, sapphires occur in runs, or patches, and it is possible for a drill hole to encounter sapphire wash only a few feet from a proved "dud" hole. This, then, led to haphazard drilling and the close grouping of holes. Drilling on a grid pattern in new areas would

have enabled wash areas to be mapped, but it would have been possible to miss runs of sapphires. Such a scheme would have been beyond the resources of these drillers.

The drill was also used to assist in shaft sinking. Four holes were drilled to bottom and the shaft followed them down.

### Advice to Prospectors

The holiday prospector will usually find the old hand on the field most obliging with advice, but the visitor can be given some tips that will help him preserve this happy relationship.

Many newcomers do not realize that it is unlawful to poach on a claim held by another person, and they openly scratch through heaps of wash on a registered claim and feel aggrieved when they are ordered off.

When a prospector displays a tray of cut gems, it will be noticed that he keeps a firm grip on the tray. He does not doubt your honesty; he is only protecting the gems from spilling on the floor. Most newcomers have an irresistible urge to twist and tip the tray in order to catch different angles of light on the stones, and when the angle is too steep, they slide out.

Most areas are well supplied with water, but it is advisable, particularly in the dry months, to take drinking water onto the field. When leaving, do not empty the surplus water out on the ground; it may be appreciated by the other prospectors.

### Compliance with Mining Acts

Any person prospecting or mining for sapphires must hold a Miner's Right. This costs five shillings (50

cents) a year and can be obtained from, and renewed at, the office of the Assistant Mining Registrar, Police Station, Anakie; from the Mining Warden, Court House, Clermont; from any other mining warden in the state; or from the Department of Mines, Mineral House, 2 Edward St., Brisbane.

The provisions of the Mining Act and Regulations must be complied with. Information may be obtained at any of the above offices.

If a Miner's Right has been accidentally lost or stolen before expiration of the time for which it was issued, a duplicate may be obtained for the remainder of the term, at a fee of one shilling, when the applicant gives satisfactory evidence to the warden of its loss.

### Future Prospects

The prospects for the various fields can be summarized as follows. Tomahawk Creek appears to offer by far the best opportunities; very few leave the field disappointed.

Sapphire town, although well exploited in the past, still offers opportunities when the prospectors know where to dig.

Rubyvale has continued to keep more men employed during recent years than any other field, but results have been variable. Most of the payable wash is much deeper, and few short-term prospectors can afford the time for tedious shaft sinking.

The history and production figures of the Willows is not impressive.

To the more venturesome prospector, it may be of interest to know that sap-  
*(continued on page 192)*

# Developments and Highlights at the

## Gem Trade Lab in New York

by

Robert Crowningshield

### Psilomelane

Not mentioned in many gemstone textbooks and frequently described only as an ore of manganese is psilomelane. We have encountered it as a black banding in chalcedony, but lately we have seen this massive oxide of manganese as a hematite substitute, if one can think of a natural material as a substitute. We have found the material to be quite hard — approaching 7 on Mohs' scale — and very lustrous with a slightly silvery look compared with hematite. The streak is brownish black. A drop of concentrated hydrochloric acid placed on the stone will dissolve the area and release chlorine, which can be smelled. Specimens we have checked for specific gravity averaged 4.35; Dana gives a wide range: 3.3 to 4.7. We are indebted to both Dr. A. E. Alexander and graduate Howard Rubin for specimens for

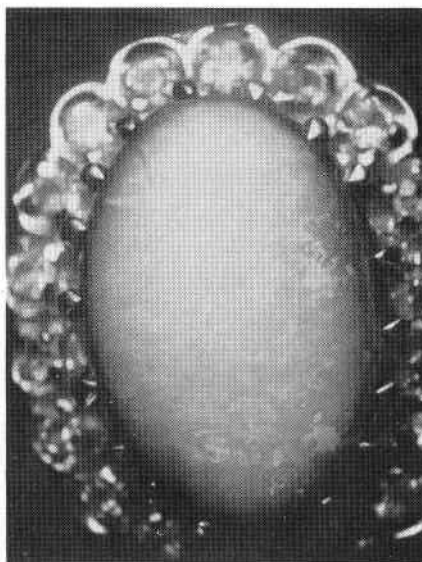


Figure 1

our collection.

### Loss of Color in Opal

A remarkable opal in a lady's cluster ring was submitted with the complaint

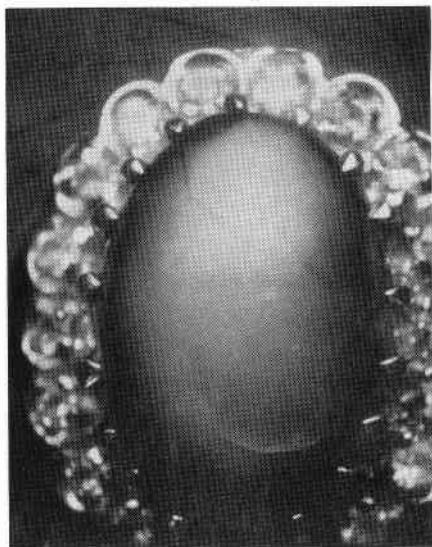


Figure 2

that the customer had noticed a color change and had returned the stone. The store had the stone repolished but it continues to change color. *Figure 1* illustrates the opal and several of the attractive patches of color. When it was first taken from the registered parcel and before reading the accompanying letter, the writer had an uncontrollable urge to put his tongue on the stone. Immediately it lost all play of color, several prominent fractures appeared, and the whole stone became dull with brown edges (*Figure 2*). It clung to the tongue with such force the whole ring could be lifted. In a matter of minutes the stone returned to its former appearance. As it dried, the fractures disappeared, the brown color vanished, and the patches of color appeared again. As an experiment, Bert Krashes of the New York Staff wrote "GIA" with water, using a cotton swab. Immediately the areas touched became brown

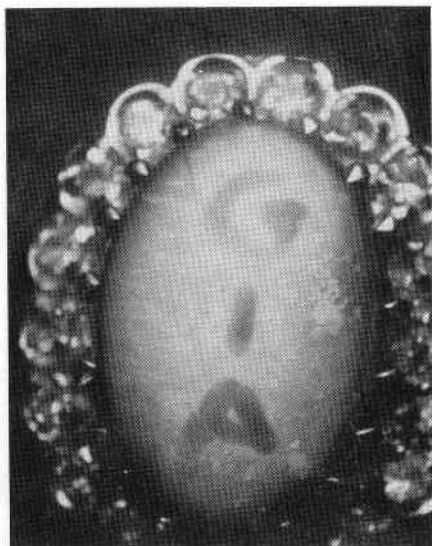


Figure 3

and the letters became clearly legible (*Figure 3*). It was our suggestion that the stone was simply highly porous but not so porous as to be earthy. We do not know of any "variety" name for such a stone.

#### Sintered Synthetic Corundum

*Figure 4* is the absorption spectrum of an oval double cabochon of a translucent pink material we identified as sintered synthetic corundum. Although the pink color was unlike any known gem material, resembling a piece of hard candy, we did expect to see chromium in the absorption spectrum. Heretofore, we have seen sintered corundum in nearly opaque white and translucent orange-pink, resembling coral.

#### Dyed Lapis-Lazuli

We have frequently mentioned that although we encounter lapis-lazuli in which selected areas of fissures contain dye (which we detect using a swab moistened with fingernail-polish re-



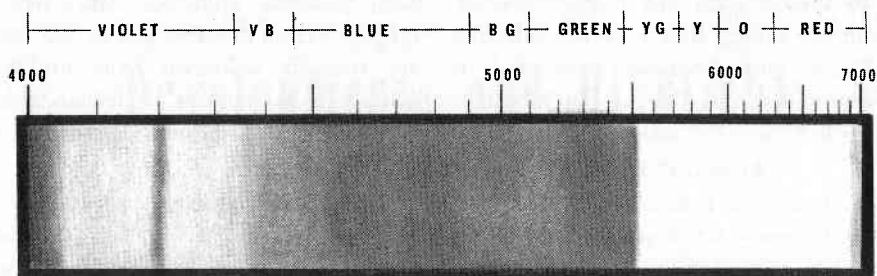


Figure 4

mover), we have never seen lapis owing most of its color to dye. Therefore, we were shocked recently when we received for testing several oval flat tablets, one of which had split lengthwise along the thin direction parallel with the girdle. Along the broken surface of both sides was a rim of darker color that immediately stained the swab moistened with polish remover. However, no dye was detected on the polished surface or on the partly polished flat back. Using a little diluted HCl on the smaller of the broken pieces shown in *Figure 5*, we were able to remove most of the dye. It is our feeling that a great deal of lapis is subjected to dye

that is taken up only in porous or fractured zones. This particular stone absorbed the dye only in the fracture, which subsequently caused the splitting. In none of the other stones from the same lot submitted were we able to detect dye, but they were unusually attractive and homogeneous in character.

#### Trapiche Emeralds

Since last issue, we have identified numerous Trapiche emeralds, some of which have been as large as 8 carats in weight. One gentleman showed us a single crystal weighing more than 80 carats. He stated that this "Christmas candy," or gear-shape-type beryl, is not really new, but in early days, because of

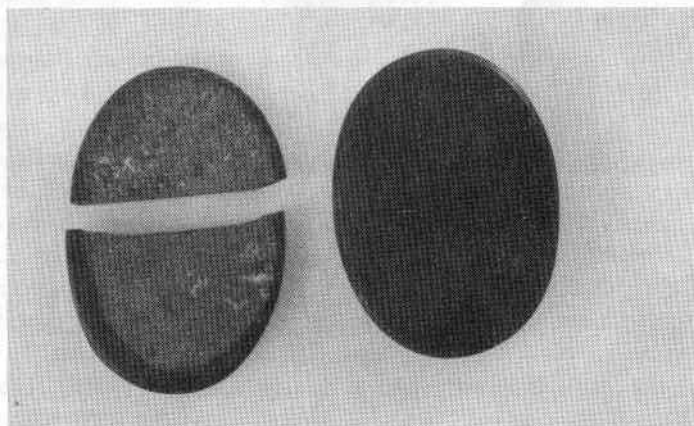


Figure 5

the smaller sizes and milky texture of the cut stones, they were not saleable. Today, with emeralds scarce and in strong demand, there is an incentive to offer them for sale.

#### "Emerald" Doublet

An unusual assembled stone encountered recently was a quite good emerald imitation, consisting of a green-glass back and a colorless (and flawed) beryl top.

#### Another Jade Substitute

With the continuing dearth of jadeite on the market we see new substitutes with regularity. The latest is a dyed quartzite, which more closely resembles fine jadeite than dyed chalcedony ("green onyx"). One stone left in the sun for 30 days showed no fading. Stones examined to date have a strong absorption band centered at approximately 6800 Å, compared with 6500 Å for dyed jadeite and serpentine. However, unlike dyed jadeite and serpentine, the stone showed no red color under a color filter.

#### Odd Fluorescence in Cultured Pearl

A twin-pearl ring examined recently contained one large white cultured pearl and one even larger dark gray-blue cultured pearl. The latter showed a reddish-brown fluorescence under long ultraviolet — a reaction heretofore observed by us only in natural-color natural pearls. The size of the pearls suggested a South Sea's source; in fact, the owner had been told that the black pearl was a "natural South Sea's pearl." Since it had been purchased in Japan, it is quite apparent that the term "South Sea's pearl" in that country, as well as in our own, is frequently used by the

trade to mean "cultured." Since natural pearls from that area and in that size are virtually unknown from present fishing, it is perhaps understandable why the proper terminology is often disregarded.

#### Acknowledgements

We are indebted to **Mr. Eddie Wong** of Chinese Jade Corp., New York City, for a pair of slightly mottled, dark-green, flat cabochons that we have tentatively identified as massive diopside. The refractive-index readings are not too clear but appear to be 1.67-1.69, and the specific gravity is almost precisely that of methylene iodide — 3.33. The absorption spectrum is not dramatic, showing only a weak jadeite-like chromium absorption in the red. X-ray diffraction tests may reveal the true nature of these unusual stones.

We are happy to acknowledge receipt of a fine Tanzania spessartite of the type mentioned in the last column from former GIA instructor, **Bill Collison**, now a stone dealer in Philadelphia.

We are indebted to GIA Graduate **Louis Kuhn** for a selection of Mexican opals and two fine faceted cherry opals. **Mr. Bill Lott** of Englehard Industries very kindly gave us a number of both synthetic-corundum boules and synthetic-spinel boules. We are indebted to **Dr. Frederick H. Pough** for two Pakistani emerald crystals. From student **Bob Baron**, Honora Watch Co., we received a very welcome selection of small natural sapphires and rubies. From student **Joachim Gross** we received various useful colored stones for class and correspondence use.

# Developments and Highlights at the

## Gem Trade Lab in Los Angeles

by

Richard T. Liddicoat, Jr.

### More "Sugar-Cube" Inclusions

Unusual circumstances always seem to happen in groups, as both Lab columns have mentioned on several occasions. A further example of "sugar-cube" inclusions in diamond, which we showed in the last two issues of *Gems & Gemology*, has been sent to us since publication of the Spring number. It was in the center of a small single cut donated by Joe Bernie of Paul Johnson Jewelers, Tempe, Arizona.

### Needlelike Diamond Inclusions

Not long ago, while examining a large group of diamond melee, we encountered one stone with a distinct needlelike inclusion (*Figure 1*), which is a rare occurrence in diamond. Another one, which appeared in a .60-carat stone, is pictured in *Figure 2* (it resembles a scratch near the culet). It extends all the way to the surface, as we did that in the stone in *Figure 1*.

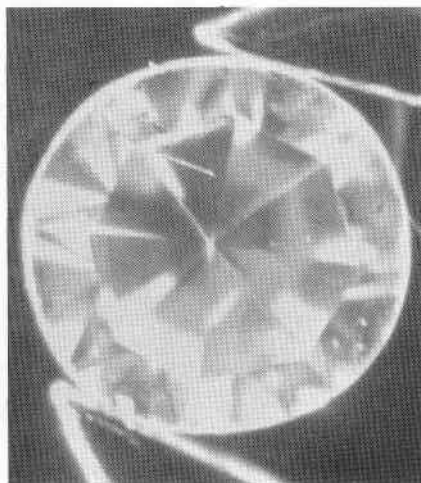


Figure 1

### Unusual Facet Arrangements

On fancy-cut diamonds, the cutting patterns are not as rigid as on the brilliant, so occasionally rather unusual facet arrangements are seen. We are inclined to feel that pairs of facets op-



Figure 2

posite one another, which are not merely placed to remove naturals but rather to give a more pleasing appearance to the stone, are acceptable on fancy-cut stones, unless they distort the symmetry. In *Figure 3*, for example, can be seen a pair of facets on opposite sides of the pavilion side of the point. In this case, they did not detract in any way from the appearance of the stone.

synthetic was 1.771-1.779, and the dichroism was rather weak for the deep color of the stone. We were unable to account for this odd occurrence.

#### Ghanian Diamond Crystals

We had the opportunity to examine

Another unusual pattern is seen in *Figure 4*, which shows a marquise with a facet in the normal position on the keel line running down from the point. This pavilion-main facet is tiny and does not extend all the way to the cutlet, but ends at the junction of the last pair of lower-girdle facets.

#### Unexplainable Straie

Recently, while examining a dark-red synthetic ruby, we encountered a very unusual undulation in the strai (*Figure 5*). The R.I. of this garnet-colored

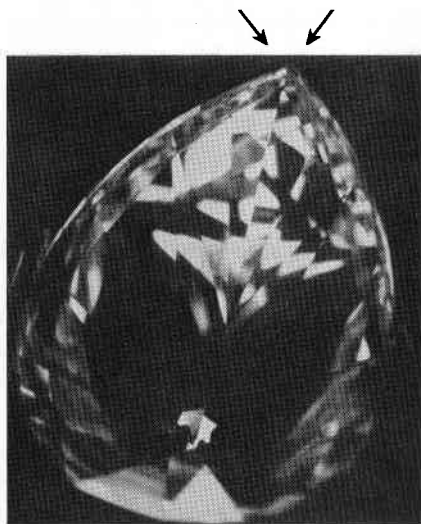


Figure 3

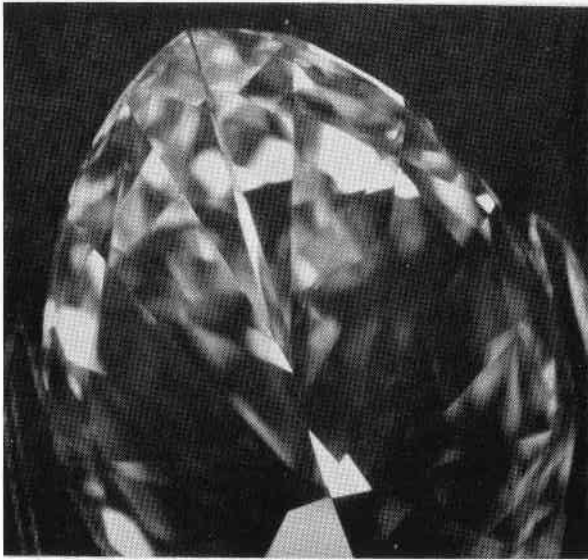


Figure 4

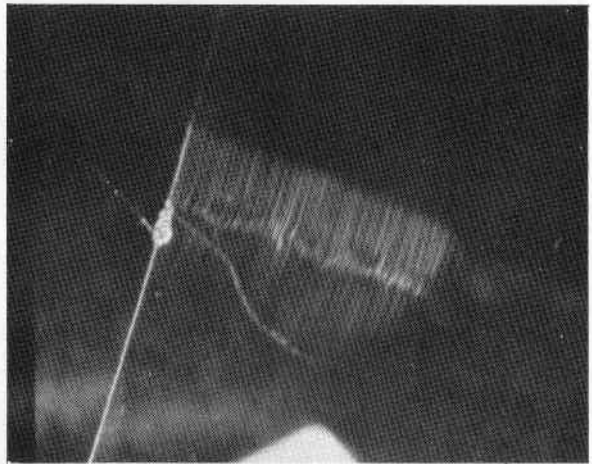


Figure 5

several hundred carats of small Ghanaian rough diamonds. The wide variety of crystal shapes is apparent in *Figures 6 through 8*.

#### **Arizona Andradite**

The andradite garnet from Stanley Buttes, Arizona, is a rather unattractive yellowish-green color, but it is sometimes used for gem purposes. It has a

unique mosaic pattern in reflected light (*Figure 9*). The relatively flat base of a cabochon-cut stone was photographed to show the odd pattern, which identifies the natural material.

#### **Cylindrical Diamond Crystal**

George Kaplan, of Lazare Kaplan & Sons, New York City, sent us a very odd industrial diamond measuring 5.7

mm. x 1.5 mm. The cylindrical crystal, unique in our experience with diamonds, is pictured in *Figure 10*. The crystal has been elongated greatly in an octahedral direction. In other words, a preferred growth has taken place with accumulation parallel to one pair of the four pairs of octahedral faces. This is

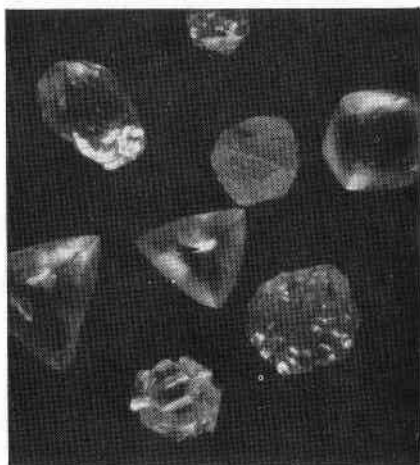
shown clearly both by the pattern on the elongated side, as in *Figure 10*, but also by *Figure 11*, which shows one end of the crystal depicting the trigons that identify octahedral faces clearly.

#### **An Odd Canary Diamond**

We had occasion to examine a canary diamond recently to determine whether



*Figure 6*



*Figure 7*



*Figure 8*

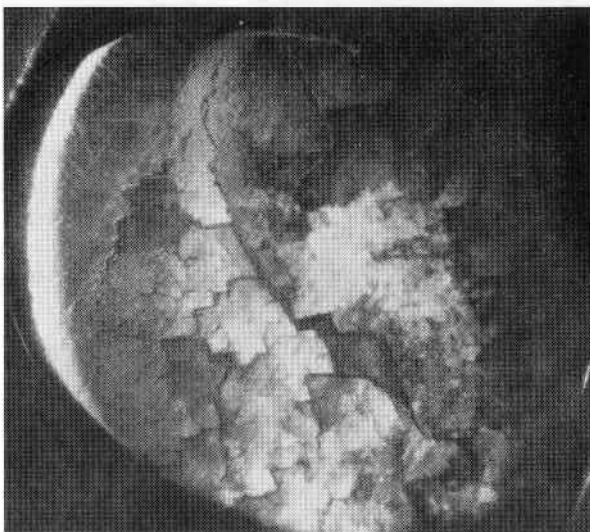


Figure 9

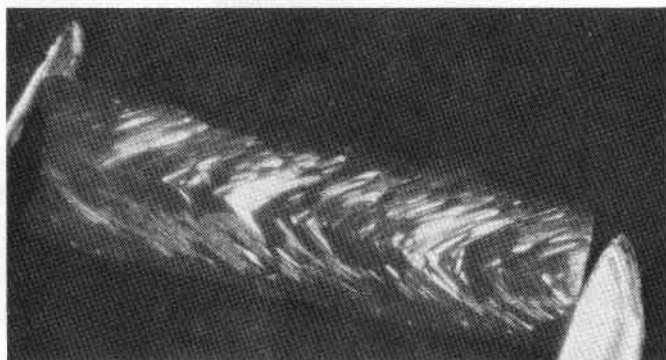


Figure 10

the color was natural or the result of irradiation plus heat treatment. During the course of the examination, we were startled at the reaction of the stone in light that had passed through a copper-sulphate solution. The stone turned to a rather bright red. We can never recall having seen such a reaction in the past.

#### Scapolite Cat's-Eye

There is nothing unusual about scapolite cat's-eye, but the one we examined recently was exceptional in that it had an eye comparable to that of a fine

chrysoberyl cat's-eye. It was slightly bluish gray in color and fluoresced a pale-peach to pale-apricot color under long-wave ultraviolet radiation.

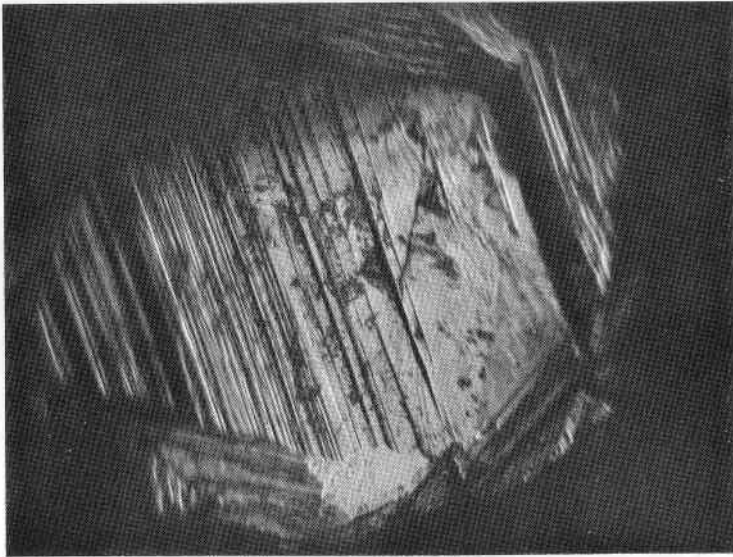
#### White Serpentine

We received an unusual snuff bottle in the form of a Foo dog. It was unusual in that it had been fashioned to lie on its side, instead of upright. It was a white material that, upon testing by X-ray diffraction, proved to be white serpentine, a color seldom encountered in this mineral.

### Flux-Fusion Rubies

We received four faceted stones for identification that were all fairly dark but intense red. They were mounted with diamonds in white-gold rings, and were said to have been sold to the firm that had mounted them by a professor in Texas. *Figure 12* shows a typical series of veillike inclusions that characterize flux-fusion, or flux-melt, syn-

thesis. *Figure 13* shows the same kind of inclusion under slightly higher magnification, and *Figure 14* illustrates inclusions that, had they been encountered without other inclusions, would have been difficult to classify. It was possible to test the stones in the mountings for ultraviolet transparency: they were characterized by a high degree of transparency to short-wave ultraviolet.



*Figure 11*

### Badly Worn Pearls

We recently tested a pair of natural-pearl earrings that were rather worn at the top. It was obvious from the edges just above the prongs that quite a number of layers of nacre had been worn away. The remaining nacre was so transparent that it was possible to see through to the upper end of the drill hole that had pierced no more than one-half of the diameter of the original sphere (*Figure 15*).

### Chrome-Rich Chalcedony

A richly colored semitransparent green cabochon was sent in for identification. Our first impression was of a slightly roiled interior and a rather greasy appearance, so we would not have been surprised to find the properties of dyed serpentine. Turning first to the spectroscope, we found not the dye-induced broad absorption in the red, but that seen in *Figure 16* — clearly a chromium spectrum. The refractive-in-



Figure 12

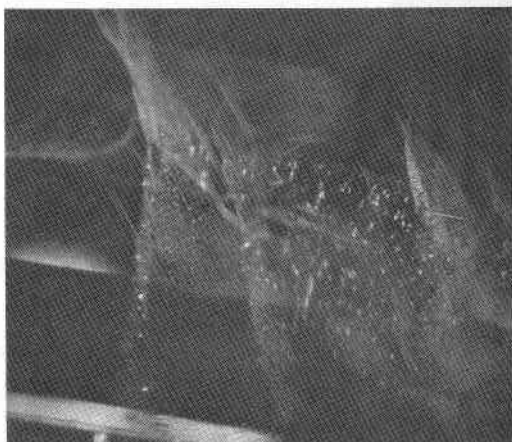
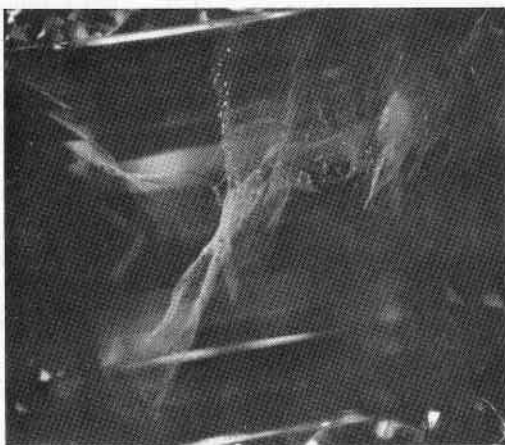


Figure 13

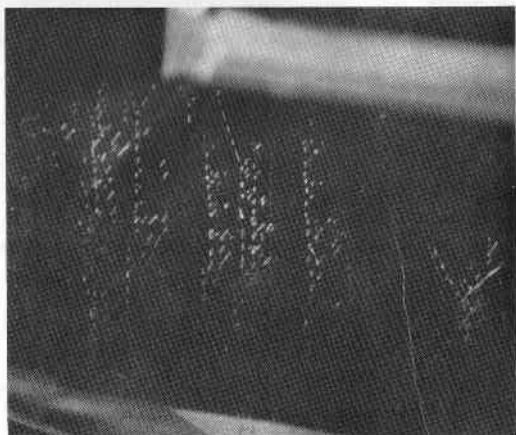


Figure 14



Figure 15

dex reading was just slightly below 1.54 and the stone barely floated in 2.57 liquid. Since the spectrum was unique for chalcedony, we scraped the girdle for a few grains of powder to use X-ray diffraction, confirming the chalcedony identification. We concluded that this must be from the new find in Rhodesia. The chrome imparts such a rich coloration that the material resembles exceedingly expensive jadeite.

### Cuprite Spectrum

Figure 17 is the rather undramatic absorption spectrum for transparent dark-red cuprite, a copper ore very rarely seen in transparent form or as a cut gem material. It can be seen that the complete absorption extends from about 6400 Å through the lower end of the visible spectrum.

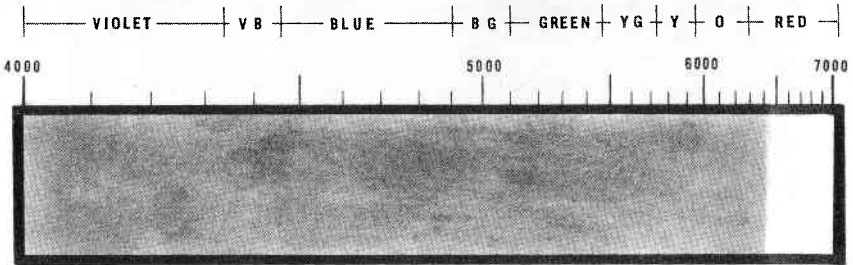


Figure 16

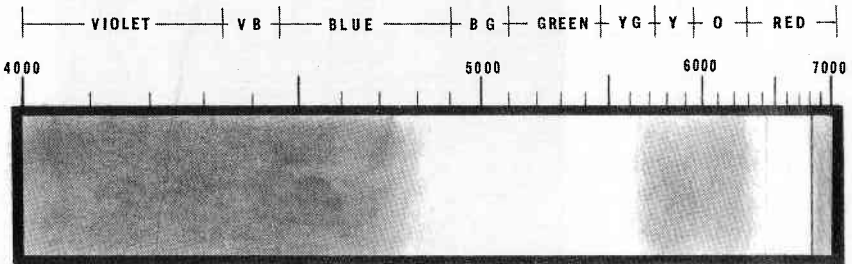


Figure 17

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# Book Reviews

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*COLLECTING GEMS & ORNAMENTAL STONES*, by Kenneth Blakemore and Gordon Andrews. Published by W. & G. Foyle, Ltd., London, England, 1966. 80 pages. Hardbound. Illustrated with black-and-white photographs. Price: \$1.

This little book is an abbreviated, nontechnical introduction to collecting gems and ornamental minerals, with emphasis on British occurrences.

The first chapter discusses the fascinating hobby of collecting, gives tips on where to find gem materials, explains the terms "precious" and "semiprecious," and discusses synthetics and imitations. The second chapter is devoted to the quartz-family gemstones and the third, to the "big four" — diamond, emerald, ruby and sapphire. Following this are chapters on the organic gems (pearls, coral, amber and jet) and some of the other well-known gems, concluding with an elementary discussion of the effects of light on gemstones and brief references to the major steps in cutting and polishing.

*Collecting Gems & Ornamental Stones* is one in a series of popular *Foyles Handbooks*, printed in England, which deal with a wide variety of nonrelated subjects, from boat building to orchid growing. It should serve the purpose for which it was intended nicely.

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*A BOOK OF JEWELS*, By J. & A. Bauer. (Translated by Alzbeta Novakova.) Published by Artia, Prague, Czechoslovakia, 1966. 142 pages. Clothbound. Illustrated in color and black-and-white line drawings. Price: not given.

*A Book of Jewels* is essentially and most importantly a collection of color photographs of jewels and fashioned and uncut gems,

ranging in quality from fair to magnificent. In general, the color fidelity is excellent; unfortunately, however, a few of the pictures are out of focus.

The accompanying text describes briefly in clear, nontechnical language the major gemstones, recounts stories of some of the more famous diamonds of history, and includes interesting bits of legend, lore and superstition associated with gems. Before discussing the individual stones, preliminary information is given under such chapter headings as *Man's First Encounter With Precious Stones*, *The Properties of Natural Gemstones*, *Working Gemstones Past & Present*, *Gemstones & Their Influence on Human Fate*, *Gemstones & Fashion Trends*, and *Not All That Glitters is a Gemstone*. The book closes with brief discussions of synthetic rutile (synthetic corundum and emerald are dealt with under the natural gems), natural glass, ornamental limestone, pearl, coral and amber.

This book would make an ideal "conversation piece" to be kept on one's coffee table.

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*KLOCKMANN'S LEHRBUCH DER MINERALOGIE*, by Professor Emeritus Dr. Paul Ramdohr & Professor Dr. Hugo Strunz (15th edition). Published by Ferdinand Enke Verlag, Stuttgart, Germany, 1967. 820 pages. Clothbound. Illustrated with numerous black-and-white photographs and line drawings. Price: \$42.

This exceptional mineralogy text appeared for the first time in 1891. Professor Klockmann, of the University of Aachen, the original author, was one of the world's famous mineralogists. By 1936, this German equivalent of Dana's *Textbook of Mineralogy* was in the 10th edition. Professor Dr. Ramdohr,

of the University of Heidelberg, was in charge of the 11th to 14th editions. The present edition was prepared by Professor Dr. Strunz, of the University of Berlin.

It is a monumental effort — probably the most impressive mineralogy text extant. For example, the section on crystallography and crystal physics has been expanded from 230 to 320 pages. The description of minerals has also grown by the same extent. The layout and arrangement of the book are reminiscent of Dana's *Textbook*, but the last revision of that fine book was many years ago. Klockmann's has the advantage of timeliness; this is the 15th edition in the three-fourths of a century since the book was first published.

The sections on crystal morphology, crystal chemistry and crystal physics (including optics) are large, beautifully illustrated and exceptionally clearly written. Excellent tables break down symmetry classes in the different crystal systems and the 230 space groups effectively.

The nature of a good mineralogy text is such that much of the book is of real value to a gemologist or mineralogist, even though he does not read German. *Lehrbuch der Mineralogie* is an outstanding book.

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*THE SCIENCE OF GEMS*, by P. J. Fisher, FGA, FRSA. Published by Charles Scribner's Sons, New York City, 1966. 189 pages. Clothbound. Illustrated with black-and-white and color photographs and line drawings. Price: \$7.95.

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(continued from page 178)

phires have been found on most properties around Anakie. Little attempt has been made to locate the wash runs, and it is likely that some good deposits remain undiscovered.

Mining in the past was performed by small operators, yet the field lends itself to large-scale operations. Bulldozers can be used to uncover and extract the wash, and recovery of sapphires can be

As the author points out in his preface, *The Science of Gems* is meant to serve as an introduction to the subject of gemology. Although the book accomplishes this objective generally quite well, it should not be considered a comprehensive textbook. For example, the section on the descriptions of colored stones is much too sketchy to be of value to the practicing gemologist; only 21 species are covered.

Mr. Fisher writes clearly and accurately but briefly on the usual subjects to be found in a book of this nature and scope. Starting with interesting historical background on gems and jewelry making, he progresses to chapters entitled *The Nature of Gems*, *Diamonds*, *Other Important Gemstones*, *Organic Gems*, *The Diamond Cutters*, and *Testing Gems*. For some unexplainable reason, the chapter on diamond cutting is entirely divorced from that on mining, industrial applications and famous stones and has been relegated to a position toward the end of the book in a disjointed chapter.

Appendices include an abbreviated gem table, including name and chemical composition, varieties and color, hardness, specific gravity, refractive index, birefringence and sources. This is followed by a short glossary, a bibliography and an index. The four color plates are pleasing and the stones are fairly well reproduced.

*The Science of Gems* is an attractive and well-made book and should serve its intended purpose fairly well: it is unfortunate that the author has had a minimum of experience in the field.

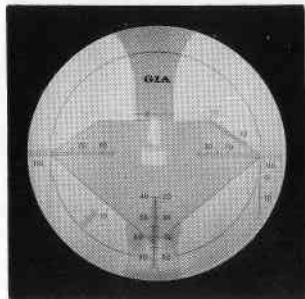
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speeded up with powered grading and washing plants.

The past uncertainty of the market for sapphires has been a deterrent to investors. But the present world-wide demand, firm indications of stability in price, and the fact that sapphires are in greater demand than synthetic stones should alter investors' line of thought.

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