Gems & Gemology

GEMS & GEMOLOGY is the quarterly official organ of the American Gem Society, and in it appear the Confidential Services of the Gemological Institute of America. In harmony with its position of maintaining an unbiased and uninfluenced position in the jewelry trade, no advertising is accepted. Any opinions expressed in signed articles are understood to be the views of the author and not of the publishers.

VOLUME IV | SUMMER, 1942 | NUMBER 2

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Published by

THE GEMOLOGICAL INSTITUTE OF AMERICA

541 South Alexandria Ave. Los Angeles, California

Genuine Type Inclusions in New European Synthetics*

by
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It is well known that the chemical and physical properties of both the genuine and synthetic corundum are so much the same that practically they cannot be called upon as a means of distinction. Differences between the natural stone and the man-made counterpart, even the luminescence phenomenon, indices of refraction, etc., welcome for distinction, are either too trivial to be of discriminative value or they overlap in both (natural and synthetic jewels) and, therefore, cannot be used as an arbitral basis for identification. However, whether natural or synthetic, both show accidental inclusions discernible under the microscope.

The inclusions of the genuine gem corundum consist of lawfully oriented fine needles and coarser crystals of rutile and variously shaped liquid-filled cavities. Further microscopic characteristics of natural corundum are oriented liquid enclosures, solid inclusions of ilmenite, corundum, pyrite, mica, zircon, spinel, slabs of hematite and growth lines (zonal structure). Twinning, on the other hand, affords no certain means of detection, since in exceptional cases it also occurs in synthetic stones.

On the other hand, the characteristics of synthetic corundum which are sighted through the microscope consist of slightly curved striae and of rounded or ovalized gas bubbles. It must be said, though, that modern methods of manufacture have considerably diminished the size of the gas bubbles. Details concerning inclusions of natural and synthetic corundum are thoroughly described in Prof. D. H. Michel's classical books[1 2] and lately they were illustrated in an article by Dr. E. Wigglesworth, C.G.[3] As is mentioned by the latter, the frequently occurring internal cracks at the junction of the facets rather may be considered as an indication of a suspicious condition than as an actual proof of synthetic origin, as was formerly believed. These cracks are

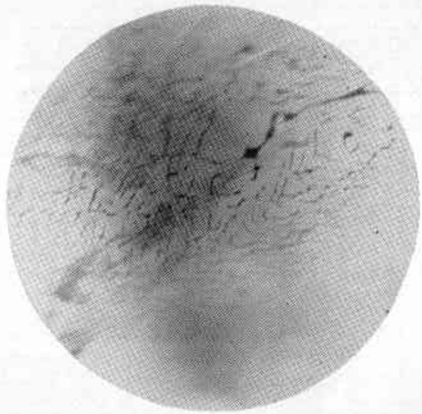

Figure 1
Light blue sapphire from Ceylon. Typical design of included liquids.

* G.I.A. Research Service.

[1] *Die kunstlichen Edelsteine* by Dr. H. Michel, 1926.
[2] *The Pocket-Book for Jewelers* by Dr. H. Michel, 1929.
[3] Detecting Substitute Gems by Dr. E. Wigglesworth, C.G., in the *Jewelers' Circular Keystone* for April, 1941.

caused by internal strain and may be observed in both natural and synthetic gems.

Great was my surprise when a recent microscopic examination revealed to me the astounding fact that the gaseous inclusions in synthetics occasionally appear in bizarre forms very different from the round and oval gas bubbles mentioned above. These peculiar formations of the gaseous inclusions are observed particularly in blue synthetic sapphires. They assume shapes which remind very much of the workworm and hose-shaped liquid inclusions in natural stones.

In Fig. 2 the photomicrograph of such a synthetic sapphire is depicted which, besides some spherical minute gas bubbles, shows a great number of gaseous enclosures of long, hose-like and dendritic formation. The dark and hazy parts are enrichments of the coloring agent which, in this

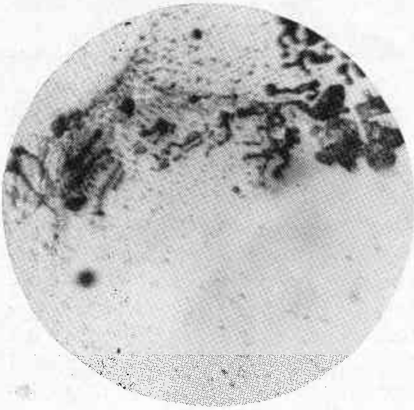

Figure 2

Spherical gas bubbles and irregular gaseous inclusions in synthetic sapphire.

stone, is distributed as stains, whereas normally the blue color of the synthetic sapphire is often concentrated along the skirts of the boule.

Fig. 3 shows a picture of mostly irregular, hose-shaped gaseous inclusions in a blue synthetic sapphire and which, as a whole, resemble so much a coarsely formed liquid feather in a natural corundum that one has to beware of mistakes. Yet, here as well as in Fig. 2, the minute, round

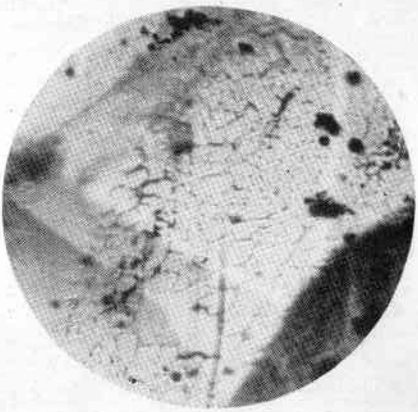

Figure 3

Synthetic sapphire. 0.275 ct. Net- or mesh-like gaseous inclusions as formed in a crack. Magn. 40 x.

gas bubbles betray the synthetic origin of this stone.

Look at the irregular, hieroglyph-like, elongated and worm-shaped gaseous inclusions of a synthetic sapphire shown in Fig. 4. Might they not easily lead to mistakes, were it not for the gaseous nature of the fillings of the cavities and for the sporadic rounded and ovalized gas bubbles?

Those worm-like formations of gas enclosures in synthetic corundums are, however, to be considered rare exceptions for the time being. They are so deceiving because of their likeness to the liquid inclusions in genuine corundums that they are worth being dealt with, and with the permanently improving process of manufacture we may meet them more and more in the future. As said above, these inclusions in synthetic corundums are filled with gas, while the cavities in natural stones contain liquid (gas merely appearing as a bubble, so-called balance-fly, within the liquid). The difference between gas and liquid is easily perceived as the stone is rotated in an immersion cell, since the gaseous inclusions remain always black (opaque), while the liquid inclusions appear transparent when observed through the flat sides.

The synthetic spinel of modern production contains, contrary to the natural gem, a considerable and strongly variable excess of aluminum oxide which causes the physical constants, such as refractive index and specific gravity, to vary. Therefore, tests depending upon these physical properties do not suffice and we must refer to the more reliable methods of examination under the microscope, though the synthetic spinel does not show the typical and well-known curved striae of the synthetic corundum, despite the fact that it is produced in the same manner.

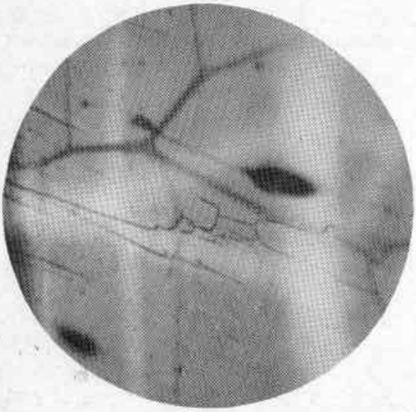

Figure 4

Synthetic sapphire, 0.370 ct. Elongated gaseous inclusion and thread-like gaseous formation, also minute spherical gas bubbles. Curved striae are perceived because iris diaphragm was closed. Magn. 40 x.

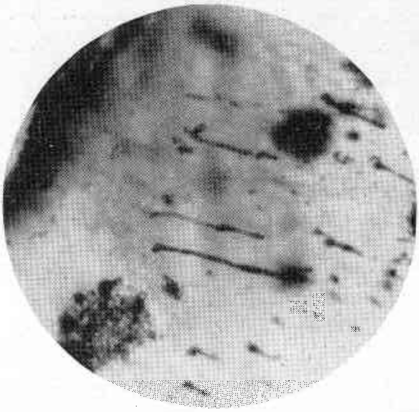

Figure 5

Long hose-like gaseous inclusions and small round gas bubbles as well as large gaseous patches in synthetic sapphire.

The spherical gas bubbles which are seen through the microscope are definite characteristics of the synthetic spinel. Sometimes they differ from the spherical form in that they reveal rather hose-shaped, worm-like, sometimes even oriented forms which, like the gaseous inclusions in synthetic sapphires, readily may be taken for liquid enclosures of natural jewels. Occasionally, larger gas inclusions appear, which amaze because of their elongated and interesting shapes with sharp profiles. Generally gas bubbles of spherical or any other shape occur rather rarely in synthetic spinel of whatever color.

There exists another reliable property which readily betrays the artificial origin of any synthetic spinel and easily distinguishes it from the synthetic corundum, too. While the latter, as a doubly refractive mineral, gives complete extinction in the four positions of greatest darkness as the stage is rotated (except in the direction of the optical axis), the synthetic spinel, which is isotropic (singly refractive), does not give complete extinction, but reveals an irregular pattern due to internal strain. This kind of refraction is called anomalous double refraction by tension, and its presence in a suspected stone would form confirmatory evidence of its synthetic origin.

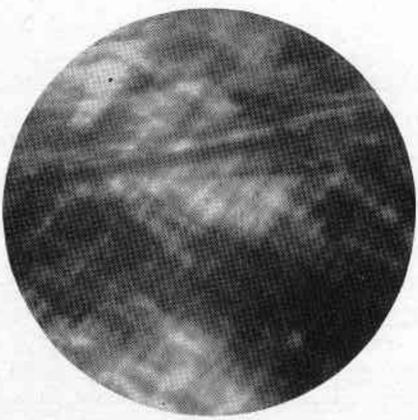

Figure 6

Dark blue synthetic spinel with feathery or "cross-hatched" anomalous double refraction. Under crossed Nicols. 40 x.

This peculiarity of the synthetic spinel is as simple a characteristic as it is reliable and obvious. It appears in many various ways though always recognizable, and among the great number of observed possibilities three typical patterns of extinction are described hereafter.

Synthetic colorless spinel in polarized light whose pattern of anomalous double refraction may be called "cloudy" is common. Irregular, mostly arched, bright and dark patches and more or less broad channels vary alternately. Their mutual borders are hazy. It is interesting to notice that the dark fields emanate from small, hose-like and irregularly formed gaseous inclusions. (In the stone here photographed they were too small to be shown singly.)

The anomalous double refraction due to internal strain may occasionally also occur in the natural spinel, and if so, it shows a "blotted" texture differing greatly from the cloudy and absolutely from the feathery and fibrous pattern of the man-made jewel. It appears most faintly, and the borders between the bright and dark fields or the curved bands are not very distinct. This property, by the way, also discriminates natural spinel from garnet, the anomalous double refraction of which shows a more "chequered" structure. Natural spinels with anomalous double refraction enclose, as is well known, nearly always, solid or liquid inclusions, where the "blotted" anomalous double refraction seems to result from. The latter inclusions, as well as many others, which will be discussed in a later article, may be valued as certain substantiation of the natural genesis of the surrounding gem.

As a conclusion I may state that fibrous, feathery or cloudy patterns of anomalous double refraction are characteristic for synthetic spinel and never occur in the genuine stone.

The Berman Density Balance

by

EDWARD WIGGLESWORTH, Ph.D., C.G.

Director, Eastern Headquarters Gemological Institute of America

In identification work three tests are of utmost importance, first, establishing whether a stone is doubly or singly refractive; second, finding its refractive index, and third, determining the specific gravity. Of these tests the first two are limited to stones possessing a certain degree of transparency, and in the case of the second test we must have a flat, polished surface. The third test may be applied to any stone regardless of transparency, shape or finish. It has also the advantage, in common with the refractive index, of giving a numerical value. This value may vary slightly for gems of the same species, but if they are reasonably free of impurities and inclusions this variation is limited to a narrow range.

There are several means by which specific gravity may be obtained. The method generally employed is to use the diamond scales with a wire to hold the stone when weighing in liquid. This method gives satisfactory results if the scales are of good quality, in proper adjustment, and carefully manipulated, but only in the case of stones weighing two carats and above, and then only when carbon tetrachloride or toluol is used in place of water to overcome the damping effect that water has on the swing of the scales, and to eliminate all chances of air bubbles adhering to the stone. When using tetrachloride the computation is made in exactly the same way as when using water, but the final result must be corrected for the different specific gravity of tetrachloride as compared to that of water. This is done by multiplying the result by 1.59 when using at ordinary room temperatures. When toluol is used the result is similarly multiplied by 0.86. Toluol is perhaps slightly better to use than carbon tetrachloride, but it is not as easily obtained, and, therefore, most gemologists use tetrachloride. One caution must be observed—this liquid evaporates very quickly and, therefore, if left for any length of time on the balance, more must be added occasionally to bring the level of the surface of the liquid to the proper height.

Granted that this method gives sufficiently accurate results for stones of two carats or more, it does take a considerable length of time, although the time of making the computation may be materially reduced by the use of a slide rule, and facility coming with practice makes the actual weighing process a matter of only a few minutes. In order to save time, a series of heavy liquids of various densities may be employed. By dropping the stone into these, one can quickly tell whether the stone is heavier or lighter than the liquid (whose density is, of course, known) by whether it sinks or floats. If it sinks, it is taken out, wiped, and dropped into a heavier liquid. Usually it is found that it will sink in one liquid and float in another liquid. This means that the specific gravity of the stone is somewhere between the density of the liquid in the first tube and that of the liquid in the second tube. In a few cases it will remain suspended in the liquid without sinking or floating and then, of course, the density of the stone is the same as that of the liquid.

The use of liquids has several disadvantages. They tend to vary in their specific gravity when composed of mixtures of two liquids, as one liquid will evaporate faster than the other. Some of them are highly poisonous and will burn the skin of the hands. Some are difficult to obtain or make and are very expensive. They are fairly rapid for quick, rough determinations, especially when one has a number of similar stones and wants to be sure they are all the same. In such a case the whole batch of stones can be dropped into the liquid known to have the same density as the stones, and if any show a strong tendency to float or sink they can immediately be assumed to be a different species. The use of liquids is equally efficient for large and small stones, and in the case of the latter is more satisfactory than the diamond scales.

The Pycnometer or Specific Gravity Flask is an accurate means, especially for small stones, but it is slow, as the flask must first be weighed empty; second, full of distilled water; third, containing the stone; fourth, containing the stone and distilled water. The Jolly Balance is used in mineralogical laboratories, but it is not very accurate and is useful only with the largest cut stones.

At the eastern laboratory of the Gemological Institute we have been using an instrument known as the Berman Density Balance for all specific gravity determinations of stones under two carats. This balance was shown at the conclaves in 1940 and has been in constant use ever since. It has the advantages of being extremely accurate and much more rapid than other weighing methods. It consists of a standard Roller-Smith Precision Balance, Model "C," specially adapted for specific gravity measurements. It is a delicate torsion spring balance with a scale reading up to 100 milligrams (one-half of a carat). By means of two small counterweights this capacity can be increased to 400 milligrams or two carats. This scale is not the standard one ordinarily supplied with these balances which read only to 25 milligrams. At each end of the balance beam is a small hook, on one of these is suspended a fine platinum wire with two pans, one above for weighing the stone in air, and one below for weighing in liquid. On the other end of the beam the counterweights of 100 and 200 mg. may be hung. Both ends of the beam are protected from drafts of air by glass-sided cases that swing out for access. At the right-hand side under the pans is a device to hold a small beaker or glass to contain the liquid which may be raised or lowered to adjust the level of the surface of the liquid.

The stone to be weighed is placed in the upper pan, having first locked the beam by a lever at the left and having the lower pan immersed in the liquid. The beam is then released and brought into balance by rotating the arm in front of the scale until the beam pointer at the right of the dial indicates zero. A reading, giving the weight in air, is then made directly on the scale. The beam is then locked again and the stone taken from the top pan and placed in the lower pan in the liquid and again weighed. By means of a vernier on the scale, readings can be made to 0.01mg. This gives extremely accurate results. The whole weighing and calculation can easily be made in less than five minutes.

Our balance was presented to the laboratory by the Boston Guild. For those who wish a complete gem-testing laboratory this is one of the most valuable instruments both from the points of accuracy and rapidity. It is made by the Roller-Smith Co. at Bethlehem, Penn., and is sold by the Baird Associates, 20 Palmer St., Cambridge, Mass.

Cecil A. Allen, Certified Gemologist

The American Gem Society is grieved by the loss of Cecil Albro Allen, C.G., Cranbury, New Jersey, who died May 22nd in Boston.

Allen, one of the early members of the Society, was respected and liked by all those who knew him. He was one of the most constructive members of the A.G.S., having served capably, over a period of several years, as chairman of the Graduates' Committee.

After entering the precious gem business in 1932, Allen soon became the largest importer of zircons in North America, with cutting works in Bangkok. (The ever-increasing popularity of zircon is probably in a large measure due to the early efforts of Mr. Allen.) His numerous gifts of zircons and other gems to the Gemological Institute, both for its collections of practice identification stones and for research work is still deeply appreciated by the Institute and its students.

Cecil Allen was born in Union City, Pennsylvania, September 11, 1890. After preliminary schooling in Union City, he attended Wesleyan University in Middletown, Connecticut. He received his B.S. degree in 1917, a short time before entering the American Volunteer Service in France. From 1917 to 1918 he was financial secretary of the Y.M.C.A. In 1919 he was on the International Committee of the Y.M.C.A., and continued in that capacity until he became secretary of the Y.M.C.A. in 1921. From 1922 to 1931 he was treasurer of a Siam Mission. After returning from Siam he became an importer of precious stones. Allen became a Certified Gemologist in 1938.

He is survived by his widow, a son, Richard, and three daughters, Beatrice, Virginia and Charlotte.

The Classification and Sales Possibilities of Genuine Pearls

by
PAUL C. RIETZ

(Continued from last issue)

A matter of major importance in assembling a pearl necklace is luster, and the even blending of color. One often hears the expression matched pearls. Pearls are not really matched, but are blended. There is variance in color in a lot of pearls of the same general color, consequently pearls are blended so as to produce a fine color to give the effect of matched pearls in the necklace. They will appear to be matched when casually observed, but careful examination will usually show there is a variation in color between the center and the end pearls. When necklaces are not skillfully blended it is immediately noticeable, consequently high luster and even blending of color and density are of far more importance in the construction of a pearl necklace than other qualities affecting the value of pearls, such as small surface blemishes or slightly off shape pearls. The most important factor in the making of a good, saleable necklace is creating beauty and eye appeal. It is not advisable to put too much stress on absolute perfection, which jewelers are inclined to do to top quality, flawless diamonds, for it must be remembered that pearls are a product of nature. They are not fashioned by man as diamonds are. First of all the production is relatively small.

Production and Cost of Necklace

Now let us see how the things we have discussed apply to an actual necklace. Suppose we take a necklace of one hundred and nineteen pearls that has a total weight of 113.04 grains, the center pearl of which weighs 6.92 grains graduating down in size to about one-half grain pearls on the ends. The necklace at $1.00 base figures to cost $215.65.

The center pearl is one of fine quality and costs $8.00 base, the six, eight or ten supporting pearls on either side $6.50 base graduating down to about $2.50 base for the end pearls. We computed the cost of the various pearls in the necklace and they totaled to $1240.00 for the entire necklace. The one times or the dollar base cost of the necklace is $215.65 which divided into the total cost of the pearl, namely $1240.00, gives you an average base cost for the necklace of about $5.75.

Computing the Dollar Base

In a single pearl the dollar is the square of the weight multiplied by one or $1.00. In a number of pearls it is the average weight of the pearls comprising the unit, times the total weight, times one or $1.00.

Let us determine the value of a necklace as an example: To accurately figure the one times of a number of pearls, you must first divide them into units, the pearls of each unit must be approximately the same size, in fact, the variation in weight of the pearls in a unit should not be more than about five per cent.

For instance, you cannot take the

total weight of a complete, graduated pearl necklace, divide it by the number of pearls and obtain the so-called average weight and use this figure to be multiplied by the total weight and expect or hope to come anywhere near the correct answer. For example, let us take the necklace which we just figured having one hundred and nineteen pearls with a total weight of 113.04 grains, which actually has a one times or a cost at $1.00 base of $215.65.

If we divided the total weight 113.04 grains by one hundred and nineteen, which is the number of pearls in the necklace, your answer for the supposed average weight would be .95 grains; hence, if we multiplied 113.04 by .95, we would have $107.39 as being the $1.00 base cost of the necklace, while the correct dollar base price is $215.65. So you see it makes a vast difference and demonstrates the importance of figuring the pearls making up the necklace in units of actual average size.

I believe I can truthfully say to you that the pearl business done in this country to date has merely scratched the surface of the possible pearl business there is available to the jewelers.

Almost every woman has the desire to own and wear pearls, but they have received little or no encouragement from jewelers.

Jewelers are always looking for something new. As a result, they have spread their activities to include many items not sold in early jewelry stores.

Many jewelers have gone along the lines of least resistance since the early thirties to maintain a volume of business and directed their efforts into less and still less expensive articles on which they could put a much higher percentage of profit and forgetting that their finer articles of jewelry, which carry a smaller percentage of profit, have a much larger dollar profit and require far less number or unit sales to produce the same answer in total dollars.

Proceeding along these lines many jewelers neglected and lost sales possibilities for gems and completely passed up one of the cleanest, most satisfactory, profitable business opportunities by not awakening the latent desire of women to own and wear pearls.

I will agree that it takes time, a great deal of concentration, and hard work to build up a genuine pearl business. If you, as jewelers, do not have the knowledge and the

No.	Weight	Average	At $1.00 Base	X Base Price	Cost
1	6.92	6.92	$47.89	8.00	$383.09
2	9.44	4.72	44.56	6.50	289.62
4	13.68	3.42	46.79	6.50	313.13
4	9.12	2.28	20.79	4.50	93.55
2	3.48	1.72	6.06	4.50	27.27
8	9.16	1.145	10.49	3.00	56.43
10	9.12	.91	8.32		
88	52.12	.59	30.75	2.50	76.87
119	113.04		$215.65		$1239.94

confidence in yourself to do the job and you are not willing to give it the time and effort, just forget all about it, for this business will not walk into your store.

Remember that it takes a lot of cultured pearl and costume jewelry sales to equal even a small genuine pearl necklace sale or the addition to a necklace. Also remember that when you sell cultured pearl necklaces, etc., the sale is completely finished, but when you sell a genuine pearl necklace, particularly smaller necklaces, you are really only starting. The possibilities to the jeweler, if they will go after this added business, will result in many more sales for additions.

All or many of you no doubt realize what has happened to the jewelry business in the past ten or twelve years. Many jewelers have slipped away from the real meat of the jewelry business which is the sale of diamonds, colored stones and pearls, etc., many jewelers have extended too much of their time and energies along other lines. Today, they find that their competitor is not the other jeweler or the other jewelers in their city, but the department stores and dress shops. Even the dollar chain stores are now more active competitors than fellow jewelers.

I can tell you that these new competitors are using their original, inexpensive lines as stepping stones for the sale of better jewelry, they work into gold jewelry and watches and then into the sale of gems. They are extending their efforts to get up into the better end of the jewelry business while many jewelers are going the other way.

To demonstrate this more clearly, I can tell you that within the past two weeks we have received an inquiry from a very exclusive dress shop whose principal business is ladies' fine clothes and accessories. I understand they originally planned a department for unusual costume jewelry as a sideline to their dress business. They moved up into the sale of gold jewelry, and in looking into the matter further, I found out that they developed prospects and occasionally sold unusual articles of effective real jewelry.

Now they write to us and say, "We believe that we can sell genuine pearls and pearls for additions." They further stated that they were not interested in the small end of the add-a-pearl business, as they catered to women and not to children.

There, gentlemen, is the seed for the development of a pearl business. These people are more awake to the possibilities at the top of the jewelry business than many jewelers are.

You gentlemen are or intend to be specialists in your business and I believe it would be greatly to your advantage to give the matter I just mentioned a little thought, for if this shop is successful in its endeavors to sell genuine pearls you can be sure that others will follow. This business really belongs to the jewelers, for a jeweler has the background and the real opportunity to develop and hold the business for pearls and precious stones of all descriptions.

Naturally, my first reaction on reading this letter was one of elation, but that evening after thinking it over, I really felt deflated. Here we spend years of untold effort to promote and assist in the sale of pearls to the jewelers around the country, and, frankly, I cannot ever recall our having received such an inquiry from a jeweler. Out of a clear sky we receive a letter from an exclusive dress shop we knew little or nothing about, never thought to solicit for business, saying that they believed they could sell real pearls.

To further enlighten you to the interest concerns other than jewelers have in gems and pearls, I can tell you that one of our largest add-a-pearl accounts is a department store and that another department store in another larger city does not sell or carry diamonds, but they do successfully sell genuine pearls, precious colored stone rings and jewelry in which colored stones predominate; furthermore, this particular institution in 1941 sold in number more small, complete pearl necklaces than all the jewelers we solicit in the country combined, also the number of genuine sapphires, rubies, emeralds, aquamarines, citrines, pearl rings, pearl earrings, etc., which they sold last year was astonishing, particularly as they have only been extending their activities in this direction for a little over a year.

Frankly, it is terribly disappointing and distressing to me to see business that belongs to the jewelers getting away from them and I feel that you gentlemen should know these facts and that you should plan your future activities as jewelers accordingly, that you should take advantage of the added knowledge you have acquired in the study of the course and apply this in your business activities, and right now is the time for you to extend your activities in the promotion and sale of colored stones and pearls, in addition to your regular diamond business, as restrictions enforced by our entry into the war has already almost depleted the market and manufacture of fine costume jewelry, cultured pearls, articles made of gold-filled and ten-karat gold, and it is questionable just how much longer we will still have fourteen-karat gold.

Let me again stress the fact that genuine pearls are the product of nature, we must accept them as they are produced by nature; consequently, you cannot expect the absolute perfection as one can in diamonds or other gem stones which are fashioned by man to produce the correct shape and proportions to produce utmost brilliancy.

The real importance in pearls is beauty and the factors producing beauty in pearls are iridescence, luster and eveness of color.

DIAMOND GLOSSARY

(Continued from last issue)

Cleavage. (1) The process of splitting a mineral in a definite direction or directions to produce smooth planes. (2) Diamond crystals which require cleavage, also pieces cleaved; large fragments, and applied also to diamonds whose faces are formed by cleavage surfaces.

Cleavage cracks. See Cracks.

Cleavage (Diamond). Perfect cleavage occurs in four directions, each parallel to a pair of opposite faces of the octahedron. The cleavage planes are known in the trade as the grain of the diamond. Sutton and others state there is also a much less perfect cleavage in six directions parallel to the faces of the dodecahedron.

Cleavage, False. See Parting.

Cleavage, Octahedral. This cleavage is in but four directions, each of which is parallel to a pair of octahedral faces.

Cleavage planes. The planes along which cleavage occurs.

Cleavages. Misshapen stones, particularly flat, rather elongated crystals. Called cleavages by cutters whether or not their forms result from cleavages

Cleaver. (1) An experienced workman who cleaves diamonds; (2) also the tool with which he cleaves them.

Clerici's solution. A liquid mixture of thallium carbonate and malonic acid, that has a very high specific gravity. The specific gravity is controlled by the amount of water added. Used for specific gravity determination.

Close Goods. Diamond crystal requiring no preparation for cutting. Diamond Syndicate classification for diamonds which contained few imperfections.

Closed season. When placers cannot be worked during seasons of drought.

Clouds. Flat, semitransparent patches, usually brownish or blackish, along the cleavage planes (grains); often finely powdered with "carbon."

Cloudy Texture. This refers to "milky" appearance of some diamonds which may result from infinitesimal inclusions, groups of tiny internal fractures, or possibly from lamination due to repeated twinning.

Clusters. Groups of small diamonds (melee) set closely together and to give the effect of a single (round) brilliant-cut diamond.

"Coal-oil blue." Phenomenal diamonds having an oily body appearance. See Phenomenal Diamonds.

Coated. Diamonds are sometimes given a coating of bluish dye to improve color, or often a dye is applied around the girdle of mounted stones. This improves color, but of course is a deceptive practice.

"Coffees" (fancy brown diamonds). See Brown, Fancy.

Cognate Inclusions. Inclusions derived from the same source as the kimberlite.

Cohesion. All substances are considered to be made up of small particles or atoms. These minute particles are held together by force of attraction called cohesion, which tends to resist any separation between the atoms.

Collet. Same as culet. Also the metal portion of a finger ring in which a stone is set.

Collection Color. (1) Term used in color classification of diamonds at the sources by Diamond Trading Co. for the finest color grade of diamond, equivalent to River. Classification of retail jeweler. (2) Also, sometimes used by jewelers for colorless diamonds and occasionally for those more or less tinged with yellow.

Collection Blue. A term sometimes improperly used in the trade to refer to colorless diamonds and occasionally to those showing more or less yellow.

Collection Gem Blue. Same as collection blue.

Color, Desirable. Absence of color or slight tinge of blue preferable in diamonds. Slight yellow and brown tints are common and values decrease as amounts of these colors increase.

Color Grades. (1) Fashioned diamonds which are colorless or which possess but slight tinges of yellow or brown were graded for many years by many experts as follows. Rivers: Top Wesseltons; Wesseltons; Top Crystals; Crystals; Very Light Browns, Top (or Silver) Capes; Capes: Yellows. See under name of grade for definition. Color Grades (2) Condensed system of nomenclature used by some dealers. Blue-White; White; Capes; Slightly Yellow; Slightly Brown. In this system Blue-White and White probably include all grades above and including Crystal. See under name of grade for definition.

Colorimeter. Instrument for color matching. A colorimeter was especially developed for diamond grading by the G.I.A. and in 1941 made available to A.G.S.

Color, Loss of. Becoming lighter or darker in tone when blue becomes darker when observed under artificial light (either change in tone results in lowered intensity of a hue, hence the "loss").

Color, Play of. In diamond, play of color refers to colors produced by dispersion.

Columns. Inclusions in kimberlite. Huge rounded boulders of foreign rock embedded in a matrix of blue ground.

Combustible. Capable of undergoing combustion; inflammable. The diamond is combustible.

Combustion. In science, rapid oxidation caused by the continuous combination of a substance with oxygen.

Combustion point. Temperature at which a substance starts to burn.

"Commercial White" or "Commercially White." Term formerly used by many dealers to mean "not White." Term prohibited by American Gem Society and Federal Trade Commission.

Commercially perfect. Usually misleading term for diamond showing small imperfections. Prohibited by American Gem Society and Federal Trade Commission.

Common Bort. See Bort.

Common Goods. Poor quality diamonds—used mostly for industrial purposes—rejection chips, rubbish and bort. Dr. Sutton's classification as used at Big Five mines of Kimberley. See Rejection Chips, Rubbish, Bort.

Compact. Closely or firmly united or packed; solid; dense; as a compact texture in rocks.

Comparator. A device for examining variations of color under artificial light.

Compound. Inclosures at the South African diamond mines in which the natives are held under contract while they work.

Compressed. Pressed together; reduced in volume by pressure. Diamond is the least compressible of minerals. This quality is probably the result of the closeness with which the carbon atoms are packed together.

Concentrates. The more valuable material that remains after the first separation of the sought-after mineral from the poor rock of an ore. In diamond mining, the residue of heavier minerals and smaller crystals which remains after crushing and breaking up the "blue ground" and floating off the lighter material.

Conde Diamond (Le Grand Conde). See Rose and Pink diamonds.

Conoscope. An instrument making use of convergent polarized light for gem examination—to produce interference figures.

Consolidated Diamond Mines of South West Africa, Limited. German South West Africa was taken by Union of South African forces and subsequently by the territory was mandated to the Union government. After the declaration of peace a new concern was formed known as the Consolidated Diamond Mines of South West Africa, Limited, which by purchase amalgamated practically all the producing companies formerly operating in the territory. See also Diamond Corporation.

Contact goniometer. A projector of metal or cardboard used for measurement of crystal angles.

Contact Twin. Twins united in a common plane. See also Twin Crystals.

"Cornish Diamond." Rock crystal.

Cracks. Cleavage planes which are separations "along the grain," i.e., between atomic planes in gems, which show smooth reflective surfaces.

Cradle. A trough in which placer miners wash or "rock" gem gravels. See Baby.

Crater. The basin-like or funnel-shaped opening which marks the vent of a volcano.

Critical angle. The least angle of incidence at which total reflection takes place within a material.

Cross-grained stones. Diamond crystals intergrown and irregular in form.

Crystal. A regular polyhedral form, bounded by planes, which is assumed by a chemical element or compound, under the action of its intermolecular forces, when passing, under suitable conditions, from the state of a liquid or gas to that of a solid. A crystal is characterized, first, by its definite internal molecular structure, and second, by its external form. (Dana).

Crystal. A trade term for diamonds with a tinge of yellow; below Wesselton and above Cape in the standard color classification.

Crystal forms. Various crystal shapes occurring in a crystal system.

Crystal indices. See Miller Indices.

Crystal system. All crystals fall into 6 groups on a basis of the crystallographic axial relations. Each group is called a crystal system.

Crystallographic axis. Certain imaginary lines passing through the center of ideal crystals are taken as a basis to describe the crystal. They are called crystallographic axes.

Crystallographic direction, or crystallographic orientation. Refers to directions in the various crystal systems which correspond with the growth of the mineral and often with the direction of one of the faces of the original crystal itself.

Crystallographic orientation. See Crystallographic direction.

Crystallographic system. See Crystal system.

Cube or hexahedron. An ideal crystal form of the diamond with six square faces of equal size.

Cubic. Having the form of a cube, as a cubic crystal; or referring to directions parallel to the faces of a cube, as cubic cleavage.

Cubic system. A crystallographic system, the crystals which may be described by reference to three axes of equal length, each situated perpendicular to the plane of the other two.

Culasse. The pavilion.

Culet. Small flat facet placed upon the bottom of the stone for safety, since if a sharp point were left here it could easily be splintered owing to the perfect cleavage of the diamond.

Culette. The culet.

Cullinan. Largest gem diamond ever found. From Premier Mine, South Africa, 1905. Named for Thomas Cullinan, promoter of mine. Weighed 3106 carats. The stone was presented to Edward VII. It was cut into nine large stones and nearly 100 smaller brilliants. The largest cut diamond in the world was cut from the Cullinan. It is the "Star of Africa," 530.2 carats.

Curvette. See Chevée.

Cushion Cut. The older form of the brilliant cut, which has a girdle outline approaching a square with rounded corners. Often applied, probably incorrectly to the step or trap cut. See Step cut.

Cut-corner-triangle cut. A modern diamond cut. The stone, from which two of the corners have been cut, is triangular in shape.

Cutting. Strictly speaking, that operation in the fashioning of a diamond commonly called "rounding up," also "rounding," "bruting," "grinding" or "roughing." Applied rather generally in the jewelry trade to the entire process of fashioning diamonds and other gems. See Fashioning

Cutting centers. Early cutting centers were Bruges and Paris. Prior to the World War II, Antwerp and Amsterdam in the low countries, and Idar Oberstein in Germany were very important cutting centers. Paris and New York were less important. Since the fall of France, Belgium and Holland in 1941, the cutting centers have moved to London, South Africa and especially the Western Hemisphere. New York City is the most important center in this hemisphere.

(To be continued)