Gems & Gemology

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The Chemical Compound of Some Liquid Inclusions*

by

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Lucerne, Switzerland

(Continued from Last Issue)

Without difficulty the following limits of pressure and temperature during the gems' genesis may be calculated and read from the corresponding diagram:

Minimum temperature = 30° C.

Minimum pressure = 73 atm.

Since one phase only could originally have formed the inclusions the carbonic acid was enclosed in gaseous state.

Maximum temperature = 370° C.

Maximum pressure = 580 atm.

The fact that gaseous bubbles could only be formed in a liquid phase leads to the conclusion that the maximum temperature was 370° C, which represents the critical temperature of water and that, therefore, water had played an essential part in promoting the formation of such liquid and gaseous inclusions. Water must have been active in the original mother-liquor of those gems.

This speaks for the fact that many liquid enclosures contain two liquid and one gaseous phase, i.e., two non-miscible liquids besides each other and on top of one of them a gas bubble is seen floating. They are most readily distinguished because the two liquids have different refractive qualities. Further investigations, also based on the temperature test and carried out by means of a special electric heating furnace (microscope accessory) proved many of them to be water and liquid carbonic acid. The water generally occupies the parts along the walls and fills the lappets, the carbonic acid is found in the central parts of the cavity. The bubble is then always floating on top of the carbonic acid and is gaseous carbonic acid itself.

The formation of such inclusions containing one or more non-miscible liquids and a gaseous vesicle must be due to special geological conditions and the factors enumerated below may explain it:

1. The older parts (formed right at the beginning of the crystal's growth) of the gem crystallized from a watery solution, which under pressure was saturated with carbonic acid.

2. A tectonic movement or some other mechanical process caused a sudden discharge of pressure succeeded by a boiling of the mother liquor.

3. Rising of bubbles of water vapor and gaseous carbonic acid.

4. Simultaneously the gem crystallized very quickly whereat these

*G.I.A. Research Service.

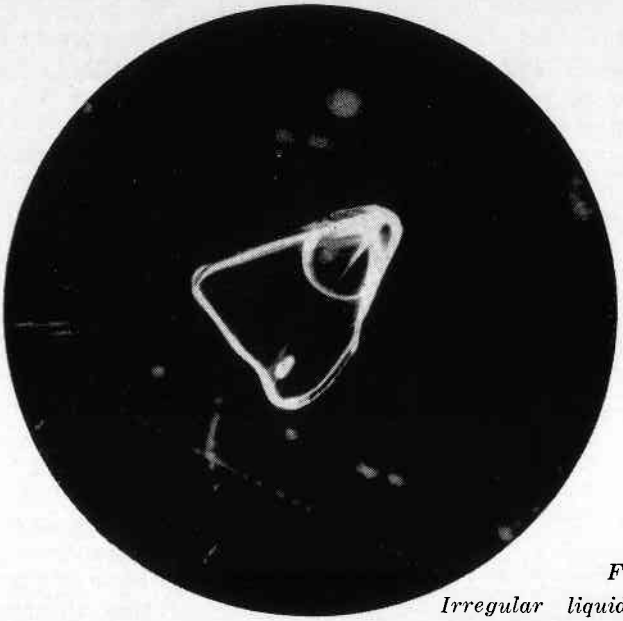

Photo by Dr. Gübelin

Fig. 5
Irregular liquid inclusion in an amethyst at normal room temperature. 300x.

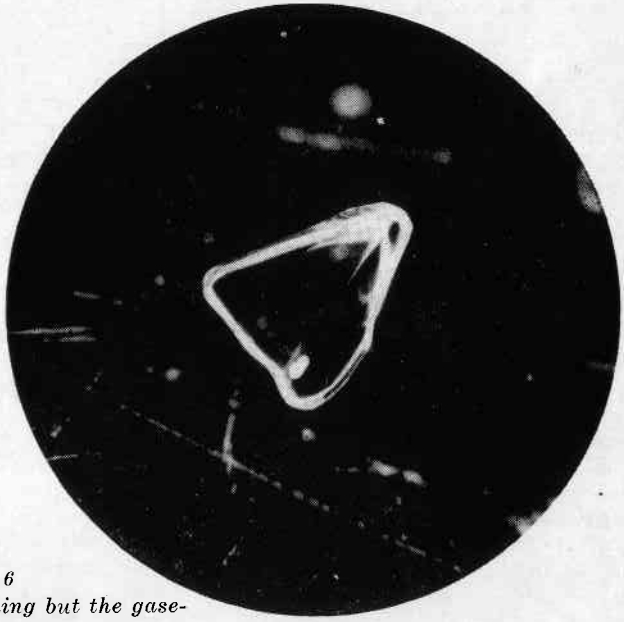

Photo by Dr. Gübelin

Fig. 6
Same cavity containing but the gaseous phase of carbonic acid after the amethyst was heated over 31° C. 300x.

bubbles sticking to the crystal's surfaces got entombed.

5. The larger inclusions form phantoms which counterfeit the exterior habit of a previous stage of the crystal's growth. From this fact it ensues that all inclusions were formed at the same time—another proof of the sudden change of the chemical-physical conditions.

6. The smaller inclusions show distinctly rounded or elongated shape—the shape of bubbles. Since this bubble shape is not true of the larger inclusion enclosures, one may imagine that the growing crystal had it in its crystallization power to force its own habit, against the surface tension of the vesicle, solely upon the inclusions of certain sizes.

The circumstance that the phenomenon described above was observable in gem stones particularly originating from limestone, carbonaceous limestone or dolomite rocks is remarkable and the occurrence of carbonic acid in those gems seems to be quite consequent.

Modern literature dealing with the composition of gaseous and liquid inclusions:

Bach, S. R. Notes on Inclusions in Gem-Stones, *The Gemmologist*, January, 1940, p. 72.

Michel, H. The Pocket-Book for Jewelers, 1929, p. 77.

Cohn, J. Die Einschlüsse der Edelsteine, *Deutsche Goldschmiede Zeitung Nr.* 84, 1924, p. 241.

Conclusion

Institute Establishes Research Membership and Elects First Member

By authority of the Board of Governors the first Research Membership has been awarded. Such Membership is provided in the Constitution and By-Laws of the new Gemological Institute of America, Inc.

Upon Dr. Edward Gübelin, Certified Gemologist of Lucerne, Switzerland, was bestowed the honor of becoming the first Research Member of the Institute. His election to this membership is a timely recognition of the individual research which he has accomplished since he visited the United States in 1939 for the principal purpose of studying the Certified Gemologist courses and taking the examinations.

Readers of GEMS & GEMOLOGY are familiar with Dr. Gübelin's articles in which he has given the results of some of his research. His presentation to the Institute of a series of colored slides illustrating other research work was reported in the last issue.

It is expected that this award will stimulate other Certified Gemologists to pursue a greater amount of individual Gemological research.

The "Moon" Diamond

by

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A diamond weighing 183 carats—possibly the largest ever to have been sold under the hammer—was auctioned at Sotheby's sale rooms, London, on August 20, 1942. The stone was knocked down to a Mr. H. W. Thorne for the surprisingly low figure of £5,200, but subsequently passed into the hands of a Foreign Potentate, whose name cannot be divulged.

One would expect that a diamond of this size would take rank as one of the "famous" diamonds of the world, and at the time of the sale publicity was given to the stone as the "Moon of the Mountains" with an attendant romantic legend which bore considerable likeness to the history usually ascribed to the Orloff diamond.

According to several authorities (among them Schlossmacher and Herbert Smith) the names Great Mogul, Orloff, Derya-i-nur, and Moon of the Mountains all refer to the same jewel—which was taken with other loot from Delhi in 1849 by Nadir Shah, and, after many vicissitudes, was presented by Prince Orloff to Catherine the Great of Russia. Robert Shipley, in his scholarly booklet, "Famous Diamonds of the World," writes:

"The Orloff survives in the Diamond Treasury of the U.S.R.R. in Moscow. The exact weight of the gem is 199.6 carats. It is ⅞ of an inch in height, 1¼ inches wide, and 1⅜ inches long. It is still mounted in the scepter of the Romanoffs" . . . The authority for these statements is the well-known Russian gem expert, Dr. Fersman.

Thus, though there is still a mystery concerning the origin of the 183-carat stone sold at Sotheby's, it can be definitely stated that it was *not* the Orloff.

The "Moon" was actually the name attached to the Sotheby stone, and of this there appears to be no previous record.

According to an eye witness, the stone was a well-cut brilliant, almost circular, rather on the thick side, but showing good fire in any light. It had a faint tinge of yellow and was almost certainly not an Indian stone—more probably a South African specimen, which would account for its lack of history.

The stone reached London from Paris, where it had been in the hands of the (anonymous) owner for some twenty-five years. It was reputed to have been formerly among the Russian Crown Jewels, but this cannot be substantiated.

A scale drawing of the "Moon" diamond appeared in "The Gemmologist" for September, 1942, shortly after its sale at Sotheby's. The drawing depicts a stone of diameter about 1¼ inches, with the bezel facets divided into two facets each, making forty-one facets in all for the front part of the stone.

It is quite possible that though the "Moon" diamond has at present no history, it will earn one for itself in the future. Its acquisition by a "Foreign Potentate" has the correct romantic flavour.

Honorary Members of Institute Elected

By authority of the Board of Governors the contributions to Gemology of three well-known men have recently been recognized by their election as the first Honorary Members of G.I.A., Inc. They are Dr. Sydney H. Ball, Mr. H. T. Dickinson, and Dr. Edward Henry Kraus. Drs. Ball and Kraus had previously been elected Honorary Members by the Board of the Institute before its acquirement by the North American jewelry industry. Their contributions to Gemology are well known to all members of the Gemological profession on this continent and in Europe.

Dr. Kraus is Dean of the College of Literature, Science, and the Arts, and Professor of Crystallography and Mineralogy, at the University of Michigan. He is the author of numerous books and scientific reports, including "Gems and Gem Materials" in collaboration with Dr. Chester B. Slawson of that University.

Dr. Ball is recognized internationally as perhaps the world's outstanding mining geologist. His best-known contributions to Gemological literature are the Gem-Stone Chapter of the "Minerals Yearbook" published annually by the U. S. Department of the Interior, Bureau of Mines, and the "Annual Reports on the Diamond Industry."

Both of these men have rendered constructive assistance in the development of the Gemological Institute over a period of more than ten years. They have criticized and suggested additions to the Institute's courses and have contributed valuable articles to GEMS & GEMOLOGY.

Mr. Dickinson's contribution to Gemology is also of great importance. He holds the degree of E.M. from Columbia University, and is a Director of De Beers and Affiliated Mines, Ltd. He has served upon the Advisory Board of the Institute for ten years. He has criticized and made valuable additions to all portions of the Institute's courses which refer to the geology, mining, distribution and quality of diamonds. His other contributions to the development of Gemological education in general and to the development of the Gemological Institute in particular have been numerous.

Notes on Identification of Synthetic Spinel*

by

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Synthetic spinel is often difficult to identify. The better stones often lack the definite characteristics listed in the textbooks. We are taught to look for bubbles and curved striae as proofs of the synthetic origin of both corundum and spinel. However, bubbles in synthetic spinel are usually very small and scarce, never occurring in groups as in synthetic corundum. In some stones it is difficult to find a single bubble and when they are found they appear as bright pin points rather than the spherical forms seen in synthetic corundum and glass. Curved striae, I feel certain, never occur in synthetic spinel, in spite of many printed statements to the contrary. I had almost arrived at this conclusion at the time B. W. Anderson's "Gem Testing for Jewellers" was published last year. I was much interested to note that he states they are not present.

Another thing that is troublesome is the presence of an occasional small inclusion that is obviously not a bubble. Anderson describes these as having the appearance of bread crumbs. They are probably bits of unfused material. The fact that they are angular is often misleading to anyone not having had experience with these stones.

As a result of the absence (or near absence) of bubbles, the lack of curved striae, and the presence of solid inclusions, we must look for other evidence to make our identification between natural and synthetic spinel.

First is the color. Most synthetic spinels are in light tones, and usually not the colors found in natural spinel.

Second, it has been my experience that strong anomalous double refraction is practically always present. This is indicated by the wavy type of extinction. Instead of the stone extinguishing all at once as in true double refraction, there is a dark band that passes over the stone as it is revolved in the Shipley polariscope. A further test has been described by Robert Shipley, Jr. The stone in the polariscope is turned to a point where the greatest amount of light comes through it. The top polarizing disk is then revolved away from the "crossed" position. If the light coming through the stone increases, it is proof of anomalous double refraction.

Third, the refractive index is, in most cases, around 1.73, as compared with 1.72 for the natural material.

Fourth, the specific gravity is usually slightly higher than that of the natural material, running about 3.63, as compared with 3.60. This is contrary to what we learned in the elementary gemology, that a synthetic must have the same optical and physical characteristics as the genuine. The explanation is that spinel is a mixture of magnesium oxide and aluminum oxide and in the man-made spinel a higher percentage of the heavier magnesium oxide is used than in nature.

* A.G.S. Research Service.

GIFTS TO THE INSTITUTE

From **James G. Donavan, Jr., Registered Jeweler, A.G.S.**, an important group of synthetic emeralds manufactured in the United States and purchased by the donor especially for the Institute's collection. The group consists of: One emerald-cut stone of .66 carats; three emerald-cut stones, total weight .76 carats; and three uncut crystals totaling 5.73 carats in weight. A long-desired addition to the Institute's gem collection, these stones are of great value for research purposes and as additions to those divisions of the Institute's examinations in which candidates for titles are required to identify unknown stones.

From **Virginia V. Hinton, Certified Gemologist, A.G.S.**, a collection of nineteen beautifully cut stones from various carefully identified localities in the state of Texas. These were collected by the donor as the nucleus of what she hopes will become a separate gem display representing each state of the United States, in the Institute's museum collection. Her gift collection includes jasper, topaz, turquoise, hornstone, agates, opalized and petrified woods.

CLIFFORD F. LAMONT

Clifford F. Lamont, head of the firm of John Lamont and Son, precious stone importers, a former president of the Jewelers' 24-Karat Club, and for ten years a member of the Examinations Standards Board of the Gemological Institute of America, died on August 8 in his sixty-third year.

Appointed to the Institute's Examinations Standards Board ten years ago as the representative of the Gem and Pearl Dealers Association on that Board, he assisted in the establishment of the standards and questions of those parts of the Certified Gemologist examination which related to colored stones.

During the ensuing years he contributed practical and valuable suggestions at the annual meetings of the Institute's educational boards. He was a man of outstanding uprightness and integrity. His influence and advice will be greatly missed by the entire Gemological profession.

DIAMOND GLOSSARY

(Continued from last issue)

Intergrowth. A small completed diamond crystal partially inclosed by a larger crystal.

Internal Fracture. Breakage or separation within a diamond or other mineral, in any direction other than a cleavage direction, is known as internal fracture. In the diamond the most common form of internal fractures are known in the jewelry trade as feathers.

Internal Strain. When an inclusion, particularly a solid inclusion, is caught up by a diamond crystal during its formation, the atoms on all sides of the inclusion attempt to assume the same positions with respect to one another which they would if the inclusion were not present. This force of attraction between the atoms is offset by the inclusion and a state of strain results.

International Carat. See Carat.

Interpenetrating Tetrahedron. A term used to describe a twinned crystal form, which probably consists of distorted octahedrons penetrating one another, as diamond is not tetrahedral. See Distorted Crystals.

Interpenetration Twins. Two or more crystals in twinned positions which penetrate each other.

Intrusion. In geology a mass of igneous rock which while molten was forced into or between other rocks.

Ion. An atom with its associated electrical charge, i.e., its electron.

Iris Diamond. A European term for a diamond chemically treated so as to appear to possess increased fire or dispersion.

"Irish Diamond". Rock crystal.

Irregular Crystal. A crystal which has not had room in which to grow freely in all directions, assuming a shape conforming to its environment. See Tabular Crystals; Negative Crystals; "Hopper" or Skeleton Crystals.

Irruptive Rock. An igneous rock which was forced into or invaded other rocks as molten magma.

"Isle of Wight Diamond." Rock crystal.

Isometric. Equal in measurement, as minerals in the isometric (cubic) system, in which the three crystallographic axes are of equal length. See Isometric System, Cubic System.

Isometric System. Another and more preferable name for the cubic system of crystallography. The most symmetrical of the crystal systems.

Isomorphous. Exhibiting isomorphism.

Isotropic. Singly refractive, affecting light similarly in all directions as it passes through the mineral. Having the same properties in all directions. The diamond, and other

gem-minerals of the isometric system, glass and other amorphous substances are isotropic.

Itacolumite. A hydrated mica schist containing much quartz. The itacolumite of Brazil has been advanced by several authorities as a possible original matrix of diamond.

Jaca (Brazilian). Spots in diamonds.

Jager. A term originally applied to a diamond of especially fine color found in the Jagersfontein Mine. Later, by general practice in the trade, Jager has become a term used to describe diamonds with a slightly bluish body color (as distinguished from colorless diamonds) regardless of the locality in which such diamonds may have been found. The Jagersfontein Mine also produces many stones of inferior color.

Jagersfontein Diamond. A large diamond found in 1881 at the Jagersfontein Mine. It weighed in the rough, 215 ct.

Jagersfontein Mine. First pipe mine in South Africa, discovered in 1870 in the Orange River Colony. Many writers make the mistake of calling Dutoitspan the first pipe mine discovered. The diamonds were discovered among the boulders in the stream bed, and the difficulty of mining contributed to the late development of Jagersfontein in comparison with other pipes. The Excelsior, the Jubilee and other large but unnamed stones have been found in this pipe. Though the production of this mine has been below average, the quality has been very high. See also De Beers Consolidated Mines, Limited.

Jagersfontein Mines. In addition to the Jagersfontein Mine four other important mines were discovered in or near Jagersfontein: Buffelhoutfontein, eleven miles south; Koppiesfontein, 250 yards from Buffelhoutfontein; Vogelsfontein, three miles northwest, and Kalkfontein in the town itself. Two less important pipes were also discovered in this area.

Jamb-peg. An upright at the edge of a lap which contains holes or carries a modern mechanical device for controlling the angle of the dop in which the diamond is held during grinding or polishing.

Jargon. A term once used for an inferior diamond having a yellowish color. Jargon or jargoon is the correct name for a yellowish zircon.

Jewel Box. A popular name given to a section of Kimberlite in the Roberts Victor Mine which was unusually rich in diamonds.

Jig. Sieve shaken vertically in water to separate gem gravel from worthless material. Also, a pulsator.

Jigger. A workman who sorts or cleans ore by the process of jigging. Also a machine for dressing small ore in which a sieve is dipped or moved about under water. See jig.

Jonker Diamond. A diamond, weighing 726 carats in the rough, which was found by Jacobus Jonker in January, 1934, in alluvial deposits on his own farm known as Elandsfontein, near Pretoria, South Africa. The Jonker diamond was of unusually fine color and purity. It was purchased for the Diamond Producers Association for $315,000 and later sold to Harry Winston,

a New York dealer. The diamond was entrusted to Lazare Kaplan, a cutter, who produced from it twelve fashioned gems. The largest stone, also called the Jonker, weighed 142.9 carats, but was later recut to secure further brilliancy and fire and to remove a slight imperfection near its edge. Recutting reduced its weight to 129 carats.

"Jourado Diamond". An incorrect term for an imitation colorless stone.

Jubilee Cut. A special type of brilliant with 88 facets in which the table and culet were each replaced by eight facets meeting at a point and other facets were added or modified on both crown and pavilion. In England the name "Jubilee" was given to this cutting in honor of Queen Victoria's Jubilee (60th year of her reign) but in the United States it was known as one style of the 20th Century Cut. See Twentieth Century Cut.

Jubilee Diamond. Found in the Jagersfontein Mine, Orange Free State, South Africa, in 1895. In the rough, it was a flattened octahedron weighing 650.8 m.c. It was flawless and perfect in color, transparency and brilliancy. When the stone was found, it was named the "Reitz Diamond" in honor of F. W. Reitz, then Orange Free State President. In 1897, the year of the Diamond Jubilee of Queen Victoria, the great diamond was cut. It was renamed the "Jubilee" and weighed 245.35 metric carats. In 1930 the Jubilee was in the possession of the London firm Wernher, Beit and Company. In 1939 it was reported sold to an unnamed East Indian prince.

Julius Pam Diamond. A large diamond found in the Jagersfontein Mine in 1889, which weighed 248 ct. in the rough and 123 ct. when cut.

K. Abbreviation for karat.

Kaalfontein Mine. A small diamond mine in The Transvaal, Union of South Africa.

Kalette. German equivalent for the word culet.

Kalkfontein Mine. See Jagersfontein Mines.

Kamfersdam Mine. See Kimberley Mines.

Karat. Originally a unit of weight, now replaced by carat. Karat now refers to the proportion of pure gold in an alloy. Pure gold is 24 Karats; 10-Karat gold is 10/24 or 41 2/3% pure gold, etc. To distinguish these two different meanings (except in England) the word is spelled "karat" when applied to alloys of metals, and "carat" when referring to weight. See also Carat.

Kathode. See Cathode.

Kettle Hole. A steep-sided hollow, without surface drainage, especially in a deposit of glacial drift. See Pothole.

Kettled. In geology, hollowed out like a kettle, as surface bowls by action of a glacier.

Key Diamonds. Diamonds of known color grade used as master stones in comparing the color of other diamonds.

Keystone. A style of cutting of diamonds and other gem-stones, the outline of which is the shape of the conventional keystone.

"Killiecrankie Diamond." Colorless topaz from Tasmania.

Kimberley Mine. July, 1871, is the usually accepted date for discovery of diamonds at Colesburg Kopje upon the farm Vooruitzigt. This first discovery was originally known as the De Beers New Rush, later shortened to New Rush and finally named Kimberley in honor of the then British Secretary for the Colonies. See De Beers Mines.

Kimberley Mines. A term used to designate a group of diamond mines in and around Kimberley, Union of South Africa. These mines include: Bultfontein, De Beers Dutoitspan, Kimberley, Wesselton (all within five miles of the city hall), Belgravia, Kamfersdam, Otto's Kopje, Taylor's Kopje, St. Augustine, and Spytfontein. Only the first five, sometimes known as The Big Five, or the De Beers Mines, proved to be important producers. Seven other mines were discovered in this area. To the northwest of the Kimberley Group of Mines, proper, is a group usually distinguished from the Kimberley Group by the name of the Barkly West Group, which includes fourteen diamond mines, the Frank Smith being the most important gemologically. See also Klip-drift.

Kimberlite. A brecciated biotite-peridotite, occurring in the diamond pipes of South Africa. Also known as blue ground, yellow ground, and hardebank.

Kimberlite, Inclusions in. Accidental or foreign inclusions in kimberlite are frequently called reef. When they consist of small fragments they cannot be distinguished from the original or cognate inclusions of kimberlite.

Kistna Group (India). The group of mines to the south and east of Golconda. See Golconda.

Kite. A style of cutting of gems, the outline of which is kite shaped.

Kite Facets. A rarely used term for the bezel facets. The outlines of these facets resemble a kite.

Klip-Drift (Barkly West). A kopje, or mound, near the Vaal River in the Orange Free State, South Africa. Here the early diamond prospectors found the first diamonds. In this area fourteen diamond mines were discovered in ensuing years. This group, about twenty to forty miles northwest of Kimberley, were known as the Barkly West group.

Knife-Edged. Term used to describe a sharp narrow girdle edge when the diamond is so fashioned. Desirable for beauty and superior brilliance but somewhat more easily chipped than a wider girdle.

Knots. A term used by cutters to describe an irregularity in internal structure of a diamond which makes sawing more difficult, frequently resulting in incorrect statements that such diamonds are harder than others. Such irregularities are usually inclusions of other transparent diamonds. Sometimes such knots protrude from the surface of a fashioned stone in the form of rounded knobs.

Knot Lines. A term used by some cutters for the grain lines or cleavage lines seen within a stone. They are apparently tiny separations between cleavage planes caused by the presence of an included crystal of other diamond.

(To Be Continued)