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On the Cover

Diamonds that twist and twine in new formal jewel fashion for fall. Platinum and diamond bracelet, ear clips, and engagement ring.

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The Diamond Syndicates[1] and their Successors

by

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AS EARLY as the first years of De Beers Consolidated (Incorporated March, 1884) a syndicate composed of the Barnato, A. Dunkelsbuhler, and Mosenthal Sons & Company, offered in 1889 to purchase all of the De Beers Company's diamonds. In the following year, a contract was signed with a syndicate composed of ten firms of which the three just mentioned owned 45% and Wernher, Beit and Company, 23% of the shares. This seems to have been the embryo of the famous Diamond Syndicate which became so well known to American jewelers of the early decades of this century as the price fixing and market controlling factor of the diamond industry. In various forms, a diamond syndicate composed of differing persons or firms functioned in this capacity until the crisis of 1929 demanded a marketing organization of more rigid type, and with greater capital.

As early as October, 1894 Cecil Rhodes at De Beers Sixth Annual Meeting had mentioned that when diamond prices were at the peak, America had suddenly collapsed and that a powerful syndicate then came forward that had a very large command of capital and that this syndicate had saved the diamond market. This particular syndicate seems to have been the first one to become generally known as "The Diamond Syndicate," although there may have been no agreement by which the producers and syndicate agreed either upon a percentage quota for each producer or that sales should be made only through the syndicate until a producers' conference in London in 1914. An abortive arrangement was made that year by De Beers, Premier, Jagersfontein, and the German Regie at London. It was never completely consummated because of the outbreak of the first World War, but, as a result of this meeting, the first three producers agreed to sell diamonds through the syndicate "as required." These three producers and the successor to the Regie, the Consolidated Diamond Mines of South-West Africa, were to become known as the "Conference Producers."

Previous to this conference in 1914, De Beers had assisted the Syndicate in controlling the price of outside diamonds by participating with it in purchases from the Diamond Regie, but no syndicate had yet been made the *exclusive* marketing agent for all production. Although the successive syndicates had purchased De Beers diamonds, De Beers Consolidated had maintained a Diamond Committee which arranged sights, fixed prices, and considered offers from various buyers.

However, De Beers did make a long term contract with syndicates. The records of the company show that a five-year contract was made as early as 1901. The Syndicate in terms of this contract purchased the De Beers production at the valuation of the De Beers valuators and this valuation remained unchanged for the full period of the contract. In determining the valuation, negotiations, of course, took place with the Syndicate. Quite naturally the Syndicate

1. This is a portion of a recently rewritten chapter from the textbook *Diamonds.*

would desire to obtain the diamonds as cheaply as possible, but equally so the Company endeavored to obtain the best possible price, with the result that a reasonable compromise was made. Thereafter, the Syndicate reassorted the diamonds and sold them to the market at the best advantage. The Syndicate, of course, had to take the risk of a fall in retail prices and conversely profited through any rise in prices during the period of the contract. These arrangements were to be changed in 1919.

By 1919, the Anglo-American Corporation of South Africa, Ltd. (organized and headed by Sir Ernest Oppenheimer) had acquired control of the former German West African fields and for the first time quotas were shortly set at De Beers 51%, Premier 18%, Jagersfontein 10%, and South-West Africa 21%. **All sales had to be made through the Syndicate** which would bear all losses, although the producers would share in the profits.

In 1925, a syndicate of L. Breitmeyer and friends bid for renewal of a (probably five-year) contract, but instead, a five-year offer was accepted from Sir Ernest Oppenheimer (later to become Chairman of De Beers) and friends. The Oppenheimer Syndicate took over the stock of diamonds, contracts, and liabilities of the Breitmeyer Syndicate. By 1927 this Oppenheimer Syndicate had accumulated an unexpectedly large stock, valued at that time at 8,000,000 pounds, due to purchase of Lichtenburg diamonds necessary to control market prices. It was then to be confronted with the problem of maintaining control of the diamond market when the unprecedented combination of circumstances reached their climax in 1929; i.e., the large production of alluvial diamonds from Lichtenburg (grand total of 4,691,000 carats) and the rich production in Little Namaqualand.

A few years later H. T. Dickinson, former member of the G.I.A. Educational Advisory Board, and former Consulting Engineer and a Director of De Beers wrote:

"The bulk of the claims in Lichtenburg were in the hands of small workers. Independent diamond buyers entered these fields and prices of diamonds fell in 1929 during which year these alluvial deposits were producing more diamonds than all the mines under De Beers' control, as De Beers had restricted production.

"The alluvial diamond production from South Africa has always been bought by independent diamond buyers though the Syndicate also purchased some of the alluvial production principally with the object of maintaining prices. When the Lichtenburg area became such an important producing field, the Syndicate purchased substantial quantities of that production with the object of not only maintaining prices, but of safeguarding the interests of the holders (merchants and private entities of cut diamonds throughout the world).

"Discoveries along the coast line of Little Namaqualand, which is within the Union of South Africa, occurred in 1926. Very rich lands were made on Crown Lands (i.e., land belonging to the government) in the vicinity of Alexander Bay, just south of the Orange River. The original discoverers were granted claims which were subsequently exploited."[2] The remainder of the ground by law reverted to the government and since the private owners' claims were worked out the Union Government has continued to produce diamonds from this area. No private digging is permitted.

"South of the Alexander Bay area further diamond discoveries were made along the Namaqualand coast line, but the bulk of the properties on which diamonds were found were privately owned, and within a comparatively short time such farms were purchased by a concern known as the Cape Coast Exploration, Limited. Production of the Cape Coast Company was all sold to the Diamond Corporation.[3]

Although the Lichtenburg production had

2. Private communication to the G.I.A.
3. Private communication to the G.I.A.

been sharply declining since September, 1927, even before the great depression broke upon the world in 1929, the maintenance of diamond prices by the Syndicate was straining its finances and it became evident that it could not continue to buy from the producers and maintain its huge stock. The Syndicate then proposed to the Conference Producers that they take a 50% interest in its "outside purchases" which included Angola, Congo, Beceka, Koffyfontein, and Namaqualand. The Conference Producers participation: De Beers, 32½%, Jagersfontein, 5%, Consolidated Diamond Mines of South-West Africa, 12½%. Premier did not assist.

This led to the formation in 1930 of a new company initially financed by De Beers, the Barnato Group, Anglo-American, Dunkelsbuhler and Company, Consolidated West Africa, and Jagersfontein. This was to become the famous Diamond Corporation which was to be heavily capitalized. Sir Ernest Oppenheimer, Chairman, is considered the founder of the Diamond Corporation as finally established, 50% of which was owned by the Oppenheimer Syndicate and 50% by the three Conference Producers in the above mentioned amounts.

The Diamond Corporation was capitalized at 5,000,000 pounds and obtained another 5,000,000 pounds from the sale of debentures due in five annual installments beginning 1935. It was later to make purchasing agreements with the alluvial producers in all of Africa except the unimportant fields of French West Africa. However, later in 1930 the world depression resulted in the practical cessation of mining in South Africa and agreement between the Producers Association and Diamond Corporation to halt diamond purchases by the latter. Angola, Congo, and West Africa had agreed to modifications of their agreements with the Corporation. Soon after this, De Beers was to discontinue all mining until the world diamond demand revived.

The appointment of the Chairman of the Diamond Corporation was vested in De Beers. Sir Ernest Oppenheimer also became Chairman of De Beers in 1930 shortly after De Beers capital was increased from 2,-500,000 pounds which was acquired by sale of debentures. De Beers then (1930-31) proceeded to buy for 2,400,000 pounds the control of other producing companies. From Anglo-American it bought the Consolidated Diamond Mines of South-West Africa and in 1941 Cape Coast Exploration, Ltd. (which had obtained control of privately owned production in Little Namaqualand). From Barnato Bros. it bought control of Jagersfontein (and in 1939 was to arange to lease the whole of that mine). This gave De Beers control of all South African production except that of the Government of the Union of South Africa in Namaqualand, and of other alluvial production in the Union.

Nevertheless, certain problems developed regarding which Mr. H. T. Dickinson wrote:

"The Syndicate for many years was successful in obtaining almost complete cooperation from the government, but the new corporation was compelled to meet a new political situation in the Union of South Africa. Here the government attempted to foster a South African cutting industry, and was disinclined to cooperate with the Syndicate in a rigid control of new prospecting, exporting, etc. In 1932, it was finally deemed necessary for the De Beers Company to close its mines, and the Corporation reduced prices upon its "rough" to the prices of 1912. This price reduction was in keeping with former policies of reductions during depressions and of gradually raising the price of diamonds during normal and better times. With a sharp decline in world prices of major commodities the failure to lower diamond prices would have been the equivalent of a sharp increase in the value of diamonds. This would have been unwarranted and dangerous."

In 1933 an organization called Diamond Producers' Association was formed consisting of the Government of the Union of South Africa; the Administrator of the Mandated Territory of South-West Africa, as the custodian of the diamond interests in that territory; De Beers Consolidated Mines Ltd.; Premier (Transvaal) Diamond Mining Company, Limited; the Koffyfontein Mines, Limited; the New Jagersfontein Mining and Exploration Company, Limited; the Consolidated Diamond Mines of South-West Africa, Limited; Cape Coast Exploration, Limited; and the Diamond Corporation, Limited. The Corporation was also treated as a producer. The Cape Exploration Company was later purchased by De Beers Consolidated Mines and liquidated (1941).

In 1934, this new Producers Association entered into an agreement with the newly formed Diamond Trading Company to purchase and market the diamonds of these producers on a quota basis. This agreement included a quota to the Diamond Corporation for its accumulated stocks. The production of Angola, Gold Coast, Sierra Leone, and more recently Tanganyika — under contracts to the Diamond Corporation — is shipped to it in London and then by it, is sold under the Diamond Corporation's quota to the Diamond Trading Company. Thus, this new Diamond Trading Company took over from the Diamond Corporation that Corporation's former function of selling the diamonds to the trade.

Each member of the Producers Association was to receive a quota of the world's trade of the Diamond Trading Company *after* providing for the purchase by the Diamond Corporation of the output of non-member producers.

An example of the present set-up is the agreement made by the Diamond Corporation in 1948 with Williamson, owner of the immense Tanganyika mine, whereby he confines his sales to the Corporation which in turn agrees to annually purchase from him diamonds in an amount equivalent to 10% of the world's sales. In 1948 he was able to supply less than one third of the share to which he was entitled, and is not permitted to carry forward the shortfall for future delivery.

As we have already seen in our previous study of diamond distribution, the Diamond Corporation has exclusive purchasing contracts from all the other African producers of any consequence who are non-members of the Diamond Producers' Association.

The Diamond Trading Co. was originally capitalized at 1,000,000 pounds, with power to hold a stock up to 2,000,000 pounds, but this capitalization has been increased until in 1949 it was possible for the Diamond Trading Company to have on hand a stock of 6,000,000 pounds thus further strengthening the financial resources available for the control of the diamond market.

In 1938 De Beers purchased the previously mentioned 50% holdings of the Oppenheimer Syndicate. Thus De Beers and affiliated companies now own the Diamond Corporation. A later arrangement divided this ownership 80% to De Beers and 20% to Consolidated Mines of West Africa, which company is controlled by De Beers.

When the agreement was renewed as from the 1st of January, 1946, between the Diamond Producers Association and the Diamond Trading Company, a new world selling agency, Industrial Distributors, Ltd. was decided upon and established early that year. It took over the sale of industrial diamonds leaving the Diamond Trading Company the sale of gem diamonds only. One of the principal reasons for this was "that industrial diamonds, which are a commercial utility commodity, called for an entirely different method of sale from that followed in the case of gems. It is essential that prices of industrial diamonds should not fluctuate with gem prices, but be stable and based on their utility in industry and the prices which industry could economically pay for them."[4]

SUMMARY

The principal organizations which control the diamond market are:

1) *De Beers Consolidated Mines, Ltd.* — owns or controls all of the pipe mines of South Africa including Premier, Jagersfontein, Wesselton, Bultfontein, and Dutoitspan, also the Consolidated Diamond Mines of South-West Africa, Ltd. (87¾%), and the Diamond Corporation, Ltd.

The Diamond Producers Association — the membership of which consists of (1) Union of South Africa, (2) Administrator of the Mandated Territory of South-West Africa, (3) De Beers Consolidated Mines, Ltd., (4) Premier (Transvaal) Mining Company, (5) New Jagersfontein Mining and Exploration Company, (6) Consolidated Diamond Mines South-West Africa, Ltd. and (7) Diamond Corporation. It contracts with the Diamond Trading Company and Industrial Distributors Ltd. to market all the diamonds produced on the properties of all its members. Each of its members receives a quota of the world's *diamond trade after providing for the purchase by the Diamond Corporation of the output of diamond producers which are not members.*

2) *Diamond Corporation Ltd.* — owned 80% by De Beers Consolidated Mines Ltd. and 20% by its subsidiary Consolidated Diamond Mines of South-West Africa, Ltd. It contracts for the diamonds produced by non-members of the just mentioned Diamond Producers Association and as a member of that Producers Association sells them to the Diamond Trading Company and Industrial Distributors, Ltd.

3) *The Diamond Trading Company* was formed by the Diamond Corporation.

4. Communication to the G.I.A. from De Beers.

Headquarters of the Diamond Corporation, Ltd., Kimberley

It purchases and markets to the diamond trade the *gem diamonds* produced by the members of the above mentioned Diamond Producers Association and of non-member producers whose output is under contract to the Diamond Corporation.

4) *Industrial Distributors, Ltd.* purchases and markets to the diamond trade the *industrial* diamonds produced by the Diamond Producers Association and of the non-member producers whose output is under contract to the Diamond Corporation.

With the exception of (1) the somewhat important Brazilian production of gem diamonds and of industrial diamonds in the form of carbonado, and (2) the unimportant diamond production of French West Africa, all diamonds are sold through the Diamond Trading Company and Industrial Distributors, Ltd.

THE GOVERNMENT ASSISTS AS MINE OWNER AND PROFIT SHARER

At least as early as 1914, the Government of the Union of South Africa showed an interest in the control of the diamond market when it called the first producers' conference which we have previously mentioned. This conference included the Premier Mine in which the government had 60% interest. Again, in 1920, after the Consolidated Diamond Mines of South-West Africa took over the production in that former German colony, the Minister of Mines called a conference between representatives of that new company, De Beers, Jagersfontein, and the Premier Mine. It was this conference which decided to sell all diamonds through the Syndicate on a quota basis.

The Illicit Diamond Buying Law and the registration of both buyers and diggers had always afforded some control of production.

In 1926, the Union Government was already benefiting by export and income taxes from De Beers, Premier, and Jagersfontein and its 60% interest in Premier profits, a total of 1,600,000 pounds ($4,-480,000).

In 1925 the Union Government had established a Diamond Control Act. This, however, did not adequately provide for the control of alluvial fields. Beginning 1926, the unprecedented production of the Lichtenburg fields revealed the inadequacy of the Diamond Control Act and in November, 1927, the Precious Stones Bill brought alluvial production under the provisions of the 1925 Act. By its powers to limit prospecting, the uneconomical operations of alluvial fields were checked as was over-production, with its resulting disturbance of market prices. Alluvial ground, which previously could be allocated only to individual diggers, could now be leased or else *worked by the government itself*. Also, new discoveries which had been proclaimed (as open to diggers within three months) could be deproclaimed at will.

During the ensuing years, the Union Government became more and more of a diamond producer in its own right, especially in Little Namaqualand (which is a part of the Cape of Good Hope, a province of the Union) where it operated much of the rich "oyster line." Hence, it became increasingly interested in the maintenance of the market.

The control of alluvial production through the power of the government to withhold the proclamation of newly discovered alluvial areas was further strengthened in 1934 by the establishment of the policy of consulting The Diamond Producers Association concerning the proclamation of such new areas. In the same year, the Union Government discontinued its selling agency and agreed to market through the Diamond Corporation and Diamond Trading Company.

The Precious Stones Act of 1927 requires the licensing of prospectors and notice to the government by such prospectors of discoveries even though it be on the prospectors' own land. The government may then approve or withhold license to mine, although a discoverer of an alluvial diamond area is entitled (1) to receive on unaliented government land 20 (31x31 ft.) claims, (2) on alienated government land 30 claims, and (3) on private land 60 claims in the Transvaal and 200 claims in either Natal or the Cape of Good Hope Provinces.

After a discovery, the government may at its pleasure proclaim the area for the issuance of diggers' licenses. On privately owned lands, (or government land alienated with a reservation of precious stone rights), the government then shares in 50% of the profits from operation from the mines on this land. On unalienated government land, the government receives 70% of the profits of a discoverer-operator. The Act provides for adequate auditing and inspection by the government.

In addition to all this control if the government so elects it may, after the discoverer has selected the claims to which he is entitled, declare any *proclaimable* or *proclaimed* land to be a state mine or alluvial diggings, subject to the rights of discoverer and owner, or the government may declare any or all alluvial diggings to be "restricted alluvial diggings" upon which the government may restrict the number of persons who can work on each claim (and never more than 20 per claim).

If the owner, surface owner or discoverer, at any time fails to finance, or work the mine to the satisfaction of the government, or produce stones to its satisfaction, the government, upon three months' notice, may require that the mine be tendered for sale, or the government may deproclaim (halt mining operations). if it decides that the production is not in payable quantities. (Subject to the rights of existing claim holders — that is the right to work out their claims — the government has the power at any time to deproclaim any mining area.)

Indeed, the government's control is so complete that no one at any time may live or work in any capacity in an alluvial digging without a Certificate of Character from the government.

It seems that the operations of this Act make it possible to regulate the alluvial output of South Africa to the benefit of the government which profits from the maintenance of diamond prices because of:

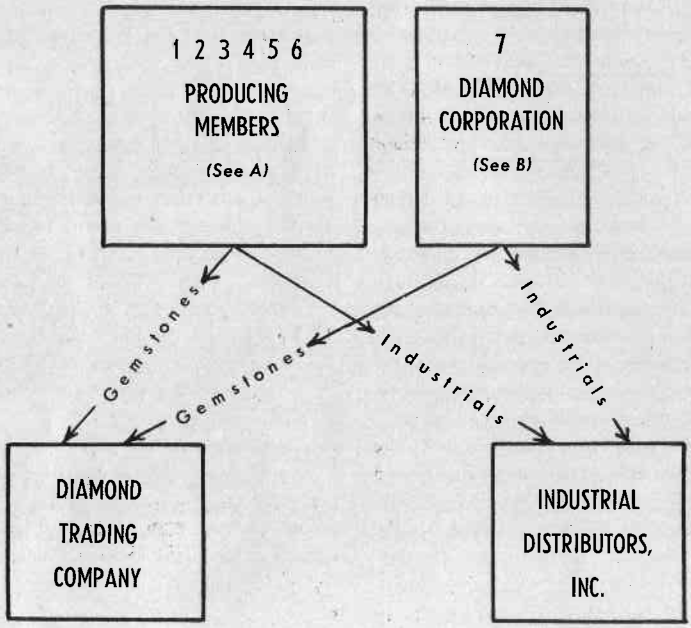
1) The effect upon prices it obtains for diamonds from its own mines.
2) The share of the profits in all alluvial mines operating profitably in the Union, profits which would be greatly reduced by reduction of diamond prices.
3) Export and income taxes from all diamond mining operations which would be greatly decreased by reduction of diamond prices.

The example of the manner in which the Union of South Africa has benefited financially from the maintenance of diamond prices has not gone unheeded by the Colonial Office of the British Empire. Hence, the provisions of the Precious Stones Act of 1927 are influencing the regulations of diamond mining in the diamond producing colonies of the British Empire. In the world today only Brazil and Venezuela remain important producers that are not in the voluntary price fixing structure. Here, diamonds are found in widely distributed and isolated areas that are impractical to supervise and the nature of those countries does not lend itself to the establishment of any well-organized buying agencies.

It will be seen from this preceding discussion of marketing that the "rough" diamond trade has been closely controlled for many years. The comparative stability of prices which has resulted has been an excellent thing for all merchants engaged in the trade and for the possessors of cut diamonds.

DISTRIBUTION OF DIAMOND PRODUCTION

DIAMOND PRODUCERS ASSOCIATION



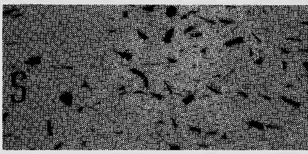
A. Members of the Diamond Producers Association are:

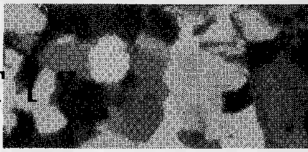
1) De Beers Consolidated Mines, Ltd.
2) Consolidated Mines of South-West Africa
3) Union of South Africa
4) Administrator of the Mandated Territory of South-West Africa
5) Premier Mining Company
6) New Jagersfontein Mining and Exploration Company
7) Diamond Corporation

Each receives a quota of the world's sales of the Diamond Trading Company and of Industrial Distributors, Inc., after providing for the purchase by the Diamond Corporation of the output of as many non-member producers as can be placed under exclusive buying contracts by that corporation.

B. The Diamond Corporation contracts with almost all important producers which are not members of the Diamond Producers Association to buy from each of them a certain percentage of the world's sales of the Diamond Trading Company, usually based upon their production capacity. The production of Brazil, Venezuela, and French West Africa is the only gem important output of diamonds which is not marketed in the manner described. The Diamond Trading Company, in turn, purchases these diamonds from the Diamond Corporation, allotting to the remaining members quotas based on the remaining percentage of the world's sales.

AVENTURINE: Glass Feldspar Quartz





by

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Gemmological Laboratories

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THE MISCONCEPTION shown by various authors as to the mode of formation of the so-called *goldstone* or 'aventurine glass' has prompted the writer to present this article. As consideration of the subject developed it became obvious that mention must also be made of those varieties of feldspar and quartz, which show in reflected light a metallic spangled effect known as *aventurescence,* and to which the name *aventurine* has been applied. Indeed, the term was first used for the glass and only at a later date applied to natural minerals which showed a vivid spangled effect reminiscent of 'goldstone.'

Aventurine, or the German form *avanturine,* is so named because the effect was first noticed in a glass produced at Murano, near Venice in Italy, which, so the story goes, was due to a quantity of copper filings falling by accident (*par aventure*) into a pot of molten glass. This legend, so often repeated by writers of gemstone literature, is, according to Bauer[1], highly improbable and most likely a fable invented in order to preserve the true secret of its manufacture. What then is this secret manufacture and is it still a secret?

Examination of aventurine glass by a lens or microscope shows the structure to consist of myriads of octahedra of a copper color, and they are in fact copper crystals in a glassy matrix. This regularity of form would surely not be attained were the metallic pieces copper filings which would have irregular shapes. It is by reflection of light from the triangular (sometimes hexagonal) faces of these copper crystals that the aventurescence is produced and filings would scarcely have the brilliant reflecting surfaces displayed by these small crystals.

The method of the manufacture of this glass was said to have been discovered by chance in the 13th Century by Briani of Venice, and was largely used for the preparation of ornaments and especially for the Venetian mosaic work. The process was

(1) Bauer (Max) trans. Spencer (L. J.) *Precious Stones.* Chas. Griffin & Co. London. 1904. p. 503.

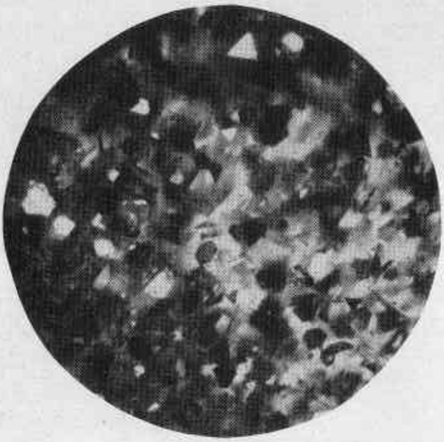

Figure 1. **Aventurine Glass *(Goldstone).* Copper crystals in the glass matrix. Combined transmitted and reflected light. 25X.**

kept secret and only carried out by a few of the highest Venetian families, and at last the art became lost, and a forgotten thing. Its rediscovery in the 19th Century has been variously ascribed to the glassmaker Bibaglia in 1827, and to Pettenkofer 20 years later, who, while investigating the preparation of the antique *Haematine,* an opaque red glass, obtained by accident aventurine glass.

Roscoe and Schorlemmer[2] state that the glass is a soda-lime glass containing an excess of alkali, is colored red by cuprous oxide and contains an enormous number of minute spangles of metallic copper, probably produced by the partial decomposition of cuprous silicate. According to Hautefeuille a green cupric glass is first prepared; to this iron filings are gradually added until it becomes red and opaque; haematine glass is thus formed, which is then well covered with ashes and allowed gradually to cool, when the artificial aventurine is formed. The main difficulty in the preparation of this glass, which contains about two per cent of copper, is to prevent the copper separating into clusters of crystals and to obtain the crystals distributed regularly throughout the whole mass. Evidence of the lack of complete regular distribution is often seen in the poorer samples which are found to show concentration in swirls.

Experiment has shown that the density of this material lies between 2.50 and 2.80, which, considering the copper inclusions, is remarkably low. The refractive index has been found to be about 1.53 and the hard-

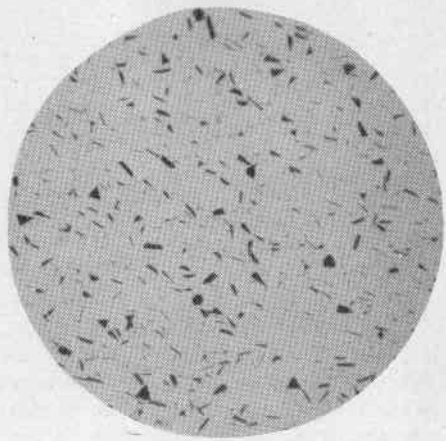

Figure 2. **Aventurine Glass *(Goldstone).* Copper crystals in glass matrix. Transmitted light through thin section. 17X.**

ness four and three-fourths, for apatite just marks the glass and fluorspar slides easily over the surface. It is, however, by microscopic examination that the material is best identified—should identification be at all needed—for the beautiful copper octahedra suspended in a transparent sea of glass, provides at once a joy to look at and an identification of the substance.

The aventurine which resembles most closely the glass imitation is the red or

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(2) Roscoe (H. E.); Schorlemmer (C.) *A Treatise of Chemistry.* McMillan & Co. London. 1907. Vol. II. p. 583.

brown variety of quartz showing aventurescence.' This material, the best of which is found at Cap de Gata in the province of Andalusia, Southern Spain; in the Altai Mountains, Siberia; and in India, owes its spangled appearance to flakes of haematite or mica[3] or to minute fissures causing a play of light[4]. Examination of the polished surfaces and the internal structure of a number of these quartz aventurines shows that the degree of aventurescence can vary widely; from a near appearance to 'goldstone' to where there is barely any spangled effect. Such is the case, in the writer's opinion, with the huge vase of aventurine quartz which graces the Main Hall in the Museum of the Geological Survey of Great Britain at South Kensington. This vase of Siberian aventurine quartz stands on a pedestal of gray porphoritic granite, both materials having come from the same locality, the Korgon Mountains in Tomsk Province, U.S.S.R., and was, in 1843, presented to the then Director of the Survey, Sir Roderick I. Murchison, Bart., by Emperor Nicolas I of Russia in recognition of his work on Russian Geology.

The vivid spangled appearance of aventurine quartz is caused by reflections from the surfaces of flakes of the included minerals, and may not only show bright flashes of white light but also to some extent a play of iridescent colors; this being particularly so in the reddish brown types and in the dark grey variety from Chili. The green aventurine quartz, miscalled "Indian Jade," owes both its color and aventurescence to included flakes of *fuchsite,* a chrome-rich muscovite mica, and to the gemologist is probably the best known type of aventurine quartz.

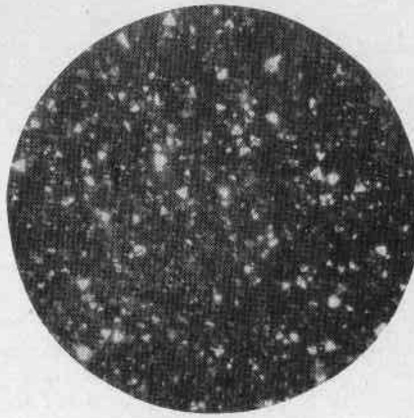

***Figure 3.* Aventurine Glass *(Goldstone).* Copper crystals in glass matrix. Reflected light from surface. 17X.**

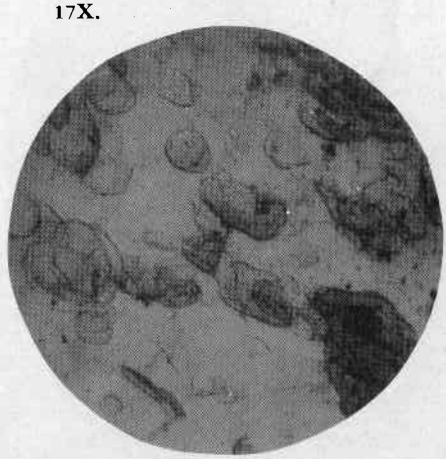

***Figure 4.* Green Aventurine Quartz. Flakes of chrome mica in quartzite matrix (thin section). Ordinary light. 25X.**

From much of the literature one is led to infer that the flaky inclusions are in a matrix of single crystals of quartz, as, for example, rutile needles in rock crystal producing *Venus hair stone.* This is not correct, for examination of thin sections by the

(3) Dake (H. C.); Fleener (F. L.); Wilson (B. H.) *Quartz Family Minerals.* McGraw Hill Book Co. N. Y. 1938. p. 100.

(4) Bauerman (H.) *Text Book of Descriptive Mineralogy.* Longmans Green. London. 1884. p. 136.

polarizing microscope clearly proves the matrix to consist of an aggregate of quartz grains, hence, could more correctly be termed *quartzite.* When it is possible to obtain a refractometer reading the values obtained are found to be consistent for those of crystal quartz, and in some cases the two shadow-edges of the birefringent rays are able to be measured (1.544 - 1.553). The hardness is also similar, 7 on Mohs's scale, and the material, owing to its granular nature, shows an uneven or hackly fracture and not the typical conchoidal fracture associated with quartz crystals. The density of a number of different varieties of these quartz aventurines was

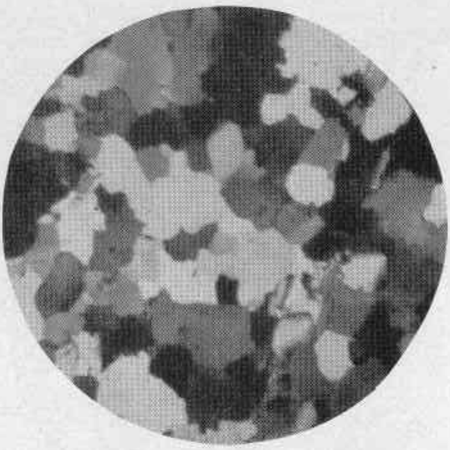

***Figure* 5. Green Aventurine Quartz. Granular structure of the quartzite shown by polarized light. 25X.**

determined and in no case were they found to be outside the range 2.64 to 2.66, which, taking into consideration the slight impurities due to the inclusions, accords well for the value of 2.651 for pure rock crystal.

The aventurine feldspar, perhaps better known as *sunstone*, is a variety of oligoclase, an intermediate member of the series known as the *plagioclases,* the end members of which are *albite* ($NaAlSi_3O_8$) and *anorthite* ($CaAl_2Si_3O_8$). The aventurescent effect being due, as in the case of the quartz aventurines, to included flakes of an iron mineral, possibly haematite or goethite[5] (goethite is a hydrous iron oxide and is so named after the German poet-philosopher — Goethe), the blood-red flakes of these minerals causing the striking iridescent aventurescence which gives to the colorless oligoclase matrix a rich golden, or reddish brown color. The spangled effect differs somewhat from the quartz type; it is livelier, the platelets are larger and are often in parallel arrangement so that the reflections tend to show as pronounced bright areas at certain angles of reflection.

The hardness of oligoclase approximates to 6 on Mohs's scale and any fracture is completely overshadowed by the two directions of easy cleavage — a dangerous weakness in fashioned material. In hand specimens of rough material the cleavages are very evident, the more perfect direction, the basal (001), also showing the fine striations due to the polysynthetic twinning so common in the feldspars. The prismatic cleavage (010) is somewhat less perfect, the cleavage angle between the two directions being 86° 32′.

Unlike the quartz aventurine, thin sections of sunstone show between crossed nicols no sign of granular structure, but extinguish fairly regularly at 90°. The density, determined by the writer on a number of specimens, has been found to be 2.64, with a possible variation of $\pm .01$; and the refractive indices to be about 1.535 — 1.544. These values accord to a molecular ratio of approximately seventy-five per cent albite and twenty-five per cent anorthite. The source of the best sunstone is at Tvedestrand and Hitero on the south coast of Norway where the mineral occurs as irregular masses in veins of white quartz traversing gneiss. Another locality is at

(5) Smith (G. F. H.) *Gemstones.* Menthuen. London. 1949. p. 359.

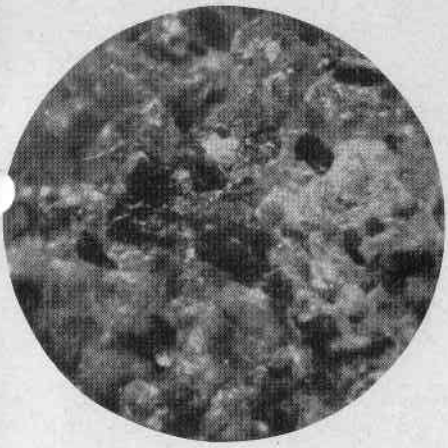

Figure 6. Red Aventurine Quartz. Siberia. Surface Structure. 25X.

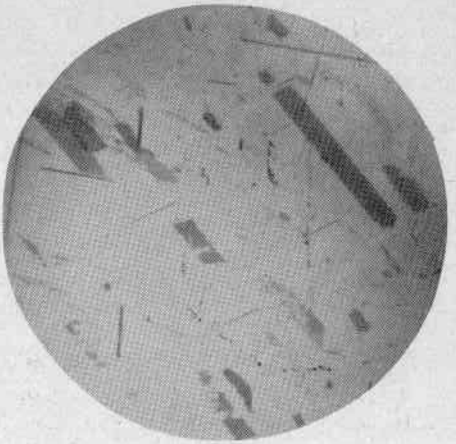

Figure 8. Aventurine Feldspar *(Sunstone).* Platy crystals as seen in a thin section. Norway. 25X.

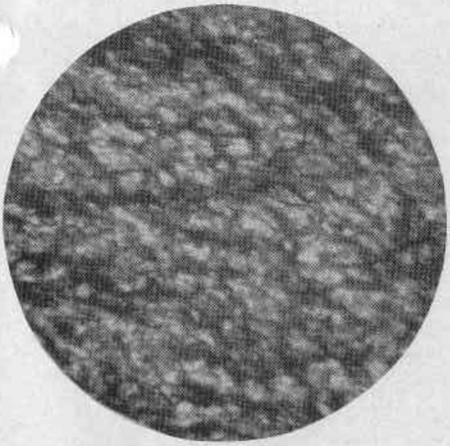

Figure 7. Red Aventurine Quartz. Surface structure of a type showing little aventurescence. The granular matrix appears to be filled with cracks. In some directions the material shows a fine-grained or pinpoint aventurescence. 17X.

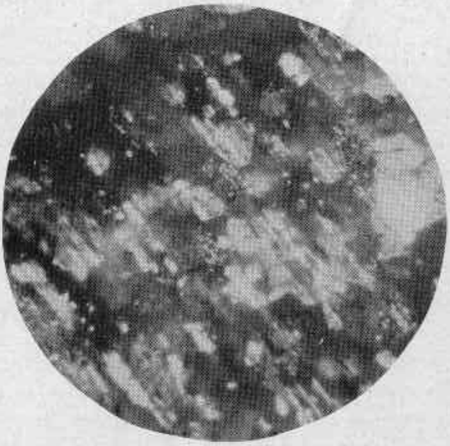

Figure 9. Aventurine Feldspar *(Sunstone).* Structure as seen in microscopical examination of the surface, polished surface. *(Monochrome fails to express the beautiful iridescent colors exhibited by the platy crystals.)* Norway. 25X.

Continued to Page 222

The Precise Determination of the Colors of Gems

by

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Gem Research Laboratory, Idar-Oberstein
Translated by Edward H. Kraus, Ph.D.

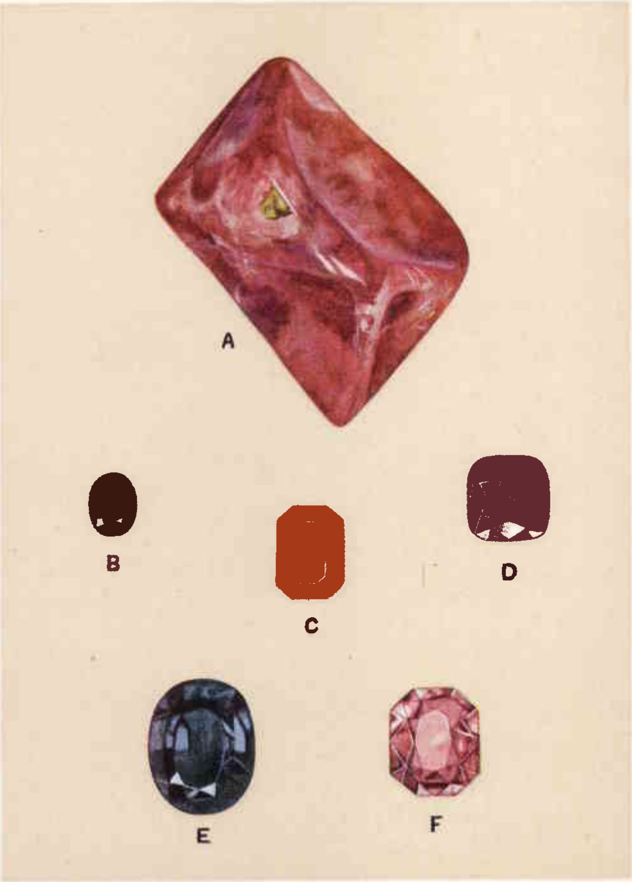
SPECIFIC GRAVITY and index of refraction are the two physical constants commonly considered of greatest value in modern gemology. This is due to the fact that gemology has been primarily concerned with investigating and testing gemstones. In most cases it is sufficient to know these two constants in order to identify the gemstone, although at times it may be necessary to determine the hardness and also to subject the stone to study under the microscope. However, color, which is the most important property of a gemstone, has not up to the present been sufficiently used. The recognition of the various tints of color, which the layman can usually make with the naked eye, is indeed fundamental in the study of gems but it has not at yet been placed on a scientific basis.

Since analysis of crystal structures by means of X-ray has been introduced in modern gemtesting, one might conclude that the precise determination of color is unnecessary. But the accurate determination of the genuineness of a gem is not the only task of gemology. One of the most important of these tasks is the accurate recognition of the color of the gem.

The theory of the colors of gems is not only theoretically and scientifically important, but also from a practical standpoint. It is highly important that the dealer in uncut gem material should be able to determine accurately the color possibilities of his material before proceeding with the cutting and polishing of it. Then too, the jeweler is frequently required to estimate the value of a stone because of its striking shade of color. A prospective purchaser will more readily become interested in an expensive gem if he can be assured that its color is of a superior quality and even quite unusual.

That there is a great need in the gem trade for a more precise determination of color is shown by the efforts which have been made by the American Gem Society and the Gemological Institute of America with respect to the color grading of diamonds. The accurate determination of the color of diamonds is now possible by means of the colorimeter, which serves as the standard instrument at the Gemological Institute of America in the same way as the iridium standard meter in Paris does for linear measuring instruments. The diamondlite is a simpler instrument for the determination of color. The colorimeter and diamondlite both depend upon the comparison of colors and not on the measuring of color. Even though much progress of practical importance has been made, there has been no advance in the precise measurement of this important physical property.

The object of this scientific research is the measurement of color in terms of numerical values, which had not as yet been accomplished. Theoretically, the problem



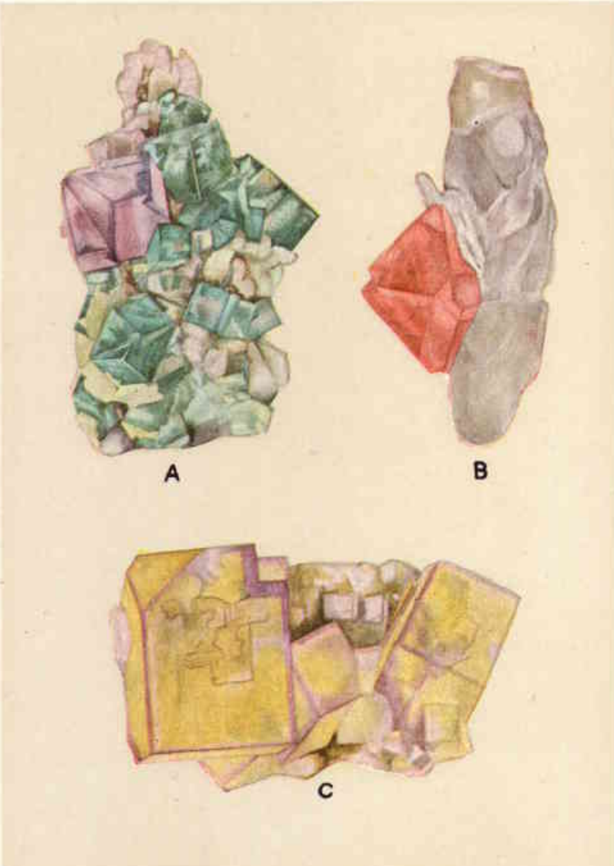
SPINEL

The large slightly distorted octahedral crystal (A) clearly shows spinel as a member of the cubic system. This is a Burma stone. The fashioned stones (B) to (F), all from Ceylon, illustrate a few of the more common colors that have confused spinel with other species. (B) ruby colored spinel; (C) rubicelle; (D) almandine spinel; (E) blue spinel; (F) pink spinel (often incorrectly sold as "balas ruby"). Specimens from the collection of British Museum (Natural History), London.

Genuine Spinel is sufficiently rare to be seldom seen in jewelry, although synthetic spinel is widely used under other names.

PLATE XXII

Printed in England.



FLUORITE

The crystals pictured here show both a wide range of colors and perfection of form characteristic of fluorite. The cubes and octahedra easily distinguish it as a member of the cubic system. The green and pale purple crystals at (A) are from Durham, England, while (B) shows a rose colored octahedron found in Haute Savoie. The parti-colored cubic crystals (C) are from the Weardale, Durham deposits. Specimens from the collection of British Museum (Natural History), London.

PLATE XXIII

Printed in England.

appears to be very simple, but from the practical standpoint there are many difficulties. The color of a substance is due to the absorption of light as it passes through the substance. Light, for example daylight or lamplight, consists of light of all colors. This mixture is called white light. If a ray of white light is passed through a polished section of a gemstone, the component colors undergo differential absorption, that is, some pass through unchanged, while others may be only slightly or even entirely absorbed. Therefore the light which emerges is colored. If all colors were absorbed to the same extent, the emergent light would appear as white light and the polished section as being colorless.

The absorption of the component colors of light depends upon two factors, (1) the thickness of the plate and (2) the properties of the substance. Moreover, the absorption varies with thickness. Thus, if the intensity of light of a given color in passing through a section of a gemstone 1 mm. thick is reduced one half, the emergent light would be further reduced one half if allowed to pass through a second section of the same thickness. That is, after passing through the two plates the intensity of the color of the emergent ray would be reduced to one fourth of that of the original intensity. It is self-evident that the same result can be achieved by passing the ray through a polished section 2 mm. thick. The fundamental law for the color of minerals is Lambert's law of absorption.

The factor for the decrease or reduction in intensity in the case just cited is one half per 1 mm. of thickness and is termed the constant of absorption. It is also known as the index, coefficient, modulus, and so forth, of absorption. But the basic value is always the factor of decreased intensity, and is designated as the transmissibility. This value can be measured directly by suitable instruments.

An extension of Lambert's is Beer's law, which substitutes the degree of concentration of the pigmenting substances in place of the thickness of the specimen. This law can be applied to solutions as well as to solid substances. Beer's law is easily understood. For example, a very dilute solution of copper sulphate has a pale blue color, which is very similar to the color of a very thin section of a crystal of copper sulphate. If the concentration of the solution is increased a correspondingly thicker section of a copper sulphate crystal is required to obtain the same color as possessed by the solution. It is therefore possible to consider the thickness of the specimen and the concentration of the solution as interchangeable, and the formulas which are derived from Lambert's law can be applied to the concentration of the pigmenting substance. This is very important in gemology for in most substances the color is not an inherent property, that is, it is not idiochromatic but rather it is dependent upon the presence of pigmenting agents, hence allochromatic.

Based upon these theoretical considerations the following simple method for the measurement of the absorption of light can be used: A highly polished plane parallel section of the substance to be investigated must be available. A ray of light of known intensity is directed perpendicularly upon the section and the intensity of the emergent light measured. The loss of intensity due to reflection is determined and taken into account. Measurements of this type should be made for all colors, that is, for various wave lengths. From these measurements a series of transmission values or factors is obtained, from which transmission graphs are readily constructed. With liquids, plane parallel glass containers or boats must be used. Obviously, the method depends upon the comparison of two intensities of light.

Up until two decades ago only the optical methods of photometry were available. These methods are based upon the comparison of the intensity of the incident and emergent rays of two specimens placed in juxtaposition. The comparison is made by the naked eye, but it is extremely difficult to estimate numerically the intensity of brightness of two sections of the same color. The following procedure was therefore used, that is, the intensity of the incident ray was reduced by means of a smoky colored glass wedge, which was introduced into the path of the ray until both sections had the same intensity as observed by the eye. The percentage of decrease in intensity can be read on the graduated scale of the wedge. This method was made more sensitive by applying refinements which are based upon the use of some of the principles of crystal optics. The best instrument of this type is the microphotometer which was developed at the University of Koenigsberg. However, all of these optical methods have serious drawbacks and consequently photometry has not been applied to any considerable extent in crystallographic research demanding a high degree of precision. This is also the reason why the theory of the color of minerals has made little progress.

The inapplicability of optical methods is due to the lack of sensitivity of the eye to light, for it is unable to observe slight differences in intensity in the red, blue, and violet portions of the spectrum. Moreover, it is impossible to develop simple and portable apparatus to investigate small specimens as is often required.

To obtain reliable absorption curves highly monochromatic light must be used. In photometric methods such light is obtained by using a monochromator by which incident white light is dispersed into a rather broad spectrum. By means of a very narrow slit an extremely small portion of the spectrum can be singled out. Obviously, the narrower the slit the more monochromatic the emergent light will be. Although this procedure permits more accurate absorption curves to be constructed, the intensity of the light is greatly reduced. Furthermore, on account of the unreliability of the eye there are many limitations to the use of monochromatic investigations. Consequently, optical photometry has contributed but little to the advancement of our knowledge of the color of minerals.

The development of the photoelectric cell during the past two decades has made it possible to compare and measure the intensities of light by electrical methods. In these methods the eye observes only the deflections of the needle on an electric meter, and the eye can be depended upon to make accurate readings. After many years of research a photoelectric cell which would meet the specific requirements was developed. At first gas filled alkali cells were tried, and subsequently some which were evacuated, but without success. Sperr's photoelectric cell also did not meet the necessary requirements. However, the microselenium photoelectric cell proved to be usable in limited areas which could be measured accurately.

The apparatus which now can be used for the precise measurement of the intensity of light consists of (1) a strong and constant source of light, (2) a monochromator, (3) a crystal holder, and (4) a photoelectric cell connected with a galvanometer. The monochromator must be of a type that will permit extremely pure monochromatic light to be obtained. The crystal holder consists of a round metal disc with a hole 1 mm. in size. A second disc with a somewhat larger hole is placed in front of the first one. The crystal holder is fastened to the second disc. Thus, by moving the second disc in and out of the beam of light the intensity of the ray can be measured with or without the crystal in its path. The selenium photoelectric cell is placed directly back of the crystal holder and is connected to an extremely sensitive galvanometer. The deflections on the galvanometer must not exceed 30 cm. If stronger photoelectric currents are produced the area in which proportionality prevails will be exceeded. An accuracy of 0.5% for the intensity of the transmitted light can be obtained.

By this method very accurate absorption curves can be constructed and very slight variations in tints distinguished. By using the observed values and applying Lambert's law the transmission factors for sections 1 mm. thick can be calculated and compared. The validity of Lambert's and Beer's laws was verified by applying the method to liquids and solids. The effect of two pigmenting substances upon one another was also investigated. The way in which the maxima and minima of absorption are displaced according to concentration causing new tints and colors to result can be observed.

The precise measurement of the absorption of light is of great importance in the study of gems. With this new method the colors of gemstones can be accurately determined by means of numerical tables and graphs. If the method were applied to the diamond it would mark another important advance in color determination. In fact many controversies which have arisen in the gem trade could be readily and accurately settled; for example, the precise differentiation between the emerald and green beryl. Unfortunately, however, the method and the necessary apparatus are not well adapted for use by gem dealers, for the apparatus is very expensive and the method demands a specialized scientific background and much technical skill. Nevertheless, it is highly desirable that every gem research and testing laboratory should acquire the necessary instruments and make use of the described method.

Twenty-three Receive Gemologist Diplomas; One Becomes Graduate

Glynn W. Cremer of La Crosse, Wisconsin, has completed studies and examinations of the Gemological Institute of America that earned for him both diplomas and entitles him to use the term of Graduate Gemologist.

GRADUATE GEMOLOGIST
- Glynn W. Cremer

GEMOLOGISTS
- Gertrude A. Walcher
- William A. Bolender
- John M. Friedlander
- Hersh Druxman
- Jon Gard
- John B. Hughes
- Henry Mnich
- James K. Smith
- Neisen R. Bank

Since last reported in the Spring Issue of *Gems & Gemology,* 23 have received their diplomas in the Theory of Gemology and are recognized as Gemologists by the G.I.A. They are listed below:

- Hymie Ehrlich
- Joseph M. McCabe
- Thomas N. Fisher
- Harold M. Harris
- H. Kittredge Hawkins
- Cecil King
- Hyman Mottenberg
- George E. Riester
- James F. Sample
- I. G. Seller
- Chester W. Thelen
- Maxine Scott
- Wm. C. E. Robinson
- Henry Groene

Gemological Digests

JAGERSFONTEIN TO OPEN AFTER SEVENTEEN YEARS

At the 61st Ordinary General Meeting of shareholders of the De Beers Consolidated Mines, Limited, June 10, 1949, announcement was made of the reopening in July of Jagersfontein Mine, which is leased to De Beers, after a shutdown of 17 years.

Preparations for reopening the mine were started early in 1946. In 1947, the main hoisting station was dropped to the 1,950 foot level. When in full operation it has been estimated that a further 250,000 to 350,000 carats of fine grade will be available to the trade.

Speaking in absence of the Chairman of the Company, H. F. Oppenheimer told shareholders; "The Jagersfontein gem diamonds are of exceptional quality and I have no doubt that a ready market will be found for them. In addition, the Jagersfontein Mine is also a producer of high class industrial stones. It is reason for great satisfaction that Jagersfontein should return to activity after so many years."

CLOSING OF BULTFONTEIN TO PRECEDE OPENING OF THE DUTOITSPAN MINE

On the first of July the Bultfontein Mine in Kimberley was closed and the Dutoitspan Mine opened in its place, according to a report made by the De Beers Consolidated Mines, Limited, to its shareholders.

This changeover is in accordance with the company's policy of always keeping two mines working in Kimberley and of allocating production between its three active mines in accordance with the nature of demand.

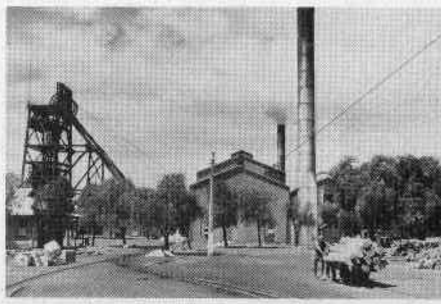
The Dutoitspan Mine is a large producer of yellow — or in the trade "Cape" — diamonds. The stock of this quality, which had been accumulated when the Dutoitspan Mine was last worked, has now been exhausted and further supplies of diamonds

● A view of Bultfontein Surface Plant as it is today. Head frame in middle of picture is identical in size and equipment with other two De Beers active mines.

of this class are urgently needed according to the De Beers report. The policy of the company will be to again accumulate a stock of these diamonds so that it can continue to meet the demand when the time comes again to close down the mine. Meantime, during the time the Bultfontein Mine will be on a maintenance basis, advantage will be taken of the period to carry out certain necessary primary developments.

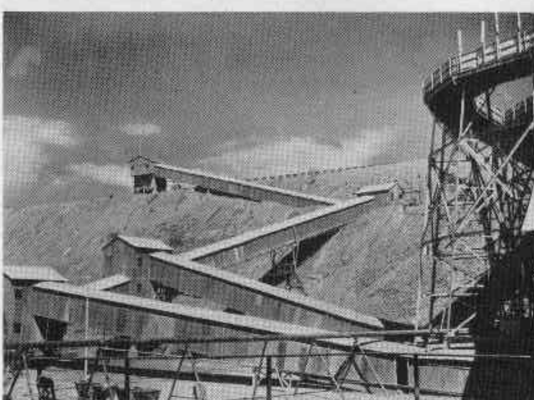
Bultfontein, which from 1888 to June 30, 1949 produced a total of 17,412,795 ½ carats, has always been a mine of predominately medium size stones. Statistics show that out of every 100,000 carats recovered only 11 are large crystals and these average 134.2 carats. Dutoitspan, on the other hand shows an average of 61 large stones of 137.9 carats in every 100,000 carats mined, although total production over the same period amounts only to 8,831,714 ½ carats.

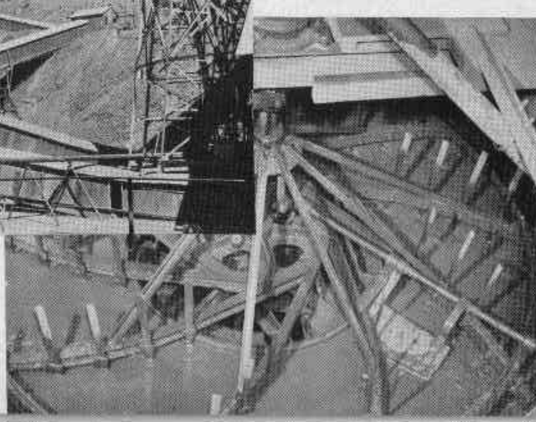
● Still locked in its stone jewel case, the gem from Dutoitspan here starts its journey upward.



● The Shaft Head Frame of the Hoist Engine House of Dutoitspan Mine as it appears today. The shaft head frames are 115 feet high.

● The tailings dump below, 110 feet high, serves three De Beers mines. Below to right is close-up of a washing pan used at Dutoitspan. Here crushed blueground, mixed with thin fluid mud, is fed into the rotary washing pan where the heavier minerals, including diamonds, sink to the bottom and are drawn off.





Gemological Digests

CONDITIONING OF PREMIER APPROACHING COMPLETION

The reconditioning of the Premier Mine, in which De Beers holds a large majority of both preferred and ordinary shares of stock, is now approaching completion and large scale production is predicted from the beginning of next year. Considerable delay was experienced in reopening the mine because of slow delivery of needed equipment.

The Premier produces a large variety of material and is, in particular a producer of industrial diamonds of the highest class. For this reason its reopening is of special importance in present circumstances. One of its greatest claims to fame is that it produced the Cullinan of 3106 carats. The 726 carat Jonkers also was found just a few miles from the Premier on Elandsfontein Farm.

Mining will take place by a new method of concentration, and recovery of the diamonds will be effected by a Heavy Media Sink and Float Plant, employing a practice quite new to the diamond industry. Because of the favorable results obtained during experimentation with this type of recovery at Premier, De Beers has decided to install a plant of similar design and 10 tons per hour capacity at Kimberley.

From 1896 until it was closed in March, 1932, the Premier Mine had been worked as an open pit, with a depth of 600 feet when pumping operations began in February, 1945. In the future the plant will be worked as an underground mine.

• Aerial view of the Bultfontein Mine, Kimberly, photographed in 1934.

Gemological Digests

OPPENHEIMER EXPLAINS EFFECTS OF OPENINGS

In addressing the shareholders of the De Beers interest at the annual June meeting in Kimberley, H. F. Oppenheimer outlined anticipated effects of reopening Premier, Dutoitspan, and Jagersfontein.

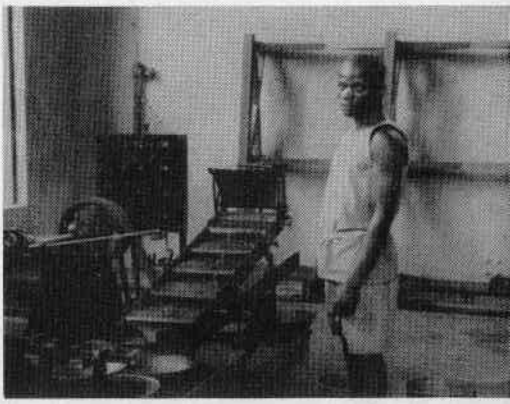
"The diamond market is much quieter now," he revealed, "than it has been for some years, and I therefore think it advisable to point out in regard to the opening of these mines, that in order to meet the demand last year it was necessary to exhaust accumulated stocks in the hands of certain producers. The opening of these mines is necessary to enable the De Beers Group to meet its proportion of a trade even substantially less than that of last year. Moreover, it is highly desirable that reasonable stocks should be built up in the hands of the producers. For some time our company has had only very small stocks, and this fact has proved a great inconvenience in the running of the trade."

INCREASE IN OUTPUT INDICATED IN CONGO

According to the *African World*, as reported by the Diamond Trading Company, production in 1949 of both industrial and gem quality diamonds in the Belgian Congo is expected to exceed that for the year 1948. Anticipated recovery is 7,560,000 carats this year. Of this, 560,000, or 8%, are of gem quality which makes a slight increase over previous years.

The Congo, largest single producer of diamonds in the world for the past 16 years and responsible for the recovery of approximately 75% of the world's crushing bort, expects to reach production of from 7,500,000 to 8,000,000 carats of industrials annually from 1950 to 1958. This will mean a more than 50% increase over 1948 in which year 5,274,000 carats were produced. Record production to date was reached in 1945 with 9,927,000 carats.

Reporting on the Ten-Year Plan for the Congo Mines, figures for the years 1928, 1938, and 1948 were given as 1,649,225; 7,205,000; and 5,825,000 carats respectively.



In the Belgian Congo a native watches the Grease Table at the Tshikapa Central Plant.

NEW WAGE SCALE ADOPTED FOR U. S. DIAMOND CUTTERS

The Diamond Manufacturers & Importers Association of America, Inc., reports mounting activity in the diamond trade during the past several weeks which has resulted in diamond cutting shops opening under a new union contract, effective September 6.

This union agreement was preceded by

increased demand upon diamond importers, cutters, and wholesalers with a gradual strengthening of prices. An increase of 10 per cent or more is reported in wholesale prices for medium and larger sized diamonds. This increase is said to apply also for very small diamonds which have been weakest in price.

New wage scales for cutters under the new agreement have made it possible for American cutters to employ craftsmen at wages that maintain American living standards, and to reopen cutting shops which have for some time been either closed down entirely, or operating with reduced force or on a part time basis because of inability to compete with foreign markets.

G.I.A. LIBRARY GETS GIFT OF THREE BOOKS

Three new gemological books from foreign lands have recently been added to the library of the Gemological Institute of America. The first is *Diamanten* by Dr. Ing. Felix Hermann, consulting mining engineer and mining geologist of Paris. Printed in Austria, the book is concerned chiefly with the history of diamonds, including some of the more famous diamonds of the world. The second, *Les Gemmes et les Perles dans le Monde,* also authored by Dr. Hermann and published in Paris, is a historical review concerning the importance of gemstones in the civilization of the world.

The third book is *Jalokiviopin Perusteet,* the only gemological book published in the Finnish language. The author, H. Tillander, who holds both the American Gem Society's title of Certified Gemologist and the British Fellowship, is the organizer of the Gemological Association of Finland, with headquarters in Helsinki.

DIAMOND CLUBS CONTINUE GROWTH

Originating in the early part of the 16th Century when diamond cutting first became an important art, Diamond Clubs have done much to solidify and strengthen the industry and have been of particular value to members in communities where they exist.

In addition to a new club in Los Angeles, organized early this year, there are now six active Diamond Clubs in the world. These are located in Antwerp, Amsterdam, London, Paris, Vienna, and New York. Reports have also been received of a club now in the process of organization in Palestine.

The primary function of the Diamond Clubs throughout the world is essentially the same. They aim to foster trade and commerce in the diamond business; to secure freedom from unjust actions; to acquire, present and disseminate valuable business information among members; secure proper projective memo laws; enhance the prestige and dignity of the diamond business; establish and maintain high standards and ethical practices among dealers; obtain uniform and suitable insurance rates; declare the diamond dealers against discriminatory taxing; adjust differences, misunderstandings, and controversies between its members and others; promote intercourse among business men engaged in the diamond business; and to provide and regulate suitable quarters as a social club for its members.

Ambitious to make Los Angeles one of the diamond centers of the world, prominent diamond men of the city organized the Los Angeles Diamond Club early this year with Arthur V. Ballard elected first president. Official opening of the Club was held July 12 at its club rooms, 541 South Spring Street, Los Angeles.

Gemological Digests

OLD TURQUOISE OILING METHOD STILL USED

Editor's note: The following information concerning the deepening of color in inferior turquoise through the use of oil or paraffin was received in a letter from Mrs. Saul Bell, a student of the Gemological Institute of Albuquerque, New Mexico.

"There is an old Indian legend concerning the horrible fate of a youth who, having been sent by his father to make an offering of fine turquoise to propitiate the gods, substituted some very pale, inferior turquoise which he immersed in animal fat and warmed in the hot sun until the color became very blue. This story is borne out by the fact that turquoise has been found in ancient burials which archeologists claim shows under analysis to have been "oiled" with animal fat, so apparently the practice of oiling turquoise isn't something devised in modern times for deception of the tourist.

"Insofar as I have been able to learn, there has not yet been any stain or dye introduced, at least not in America, which turquoise will absorb, which will produce a color even remotely resembling any hue of natural turquoise. There is always someone in this part of the country trying to develop a good permanent turquoise dye, and the manufacturers of dyes and chemicals are very cooperative with such experimenters. The development of an acceptable method of coloring turquoise would result in the salvaging of vast quantities of material which is not saleable because of its poor color. Such material exceeds by far the output of good turquoise, and is a total loss to the cutter, who buys rough material run-of-the-mine.

"The falsely colored turquoise common in the market today is produced by "oiling" the unattractively pale, soft turquoise which occurs in the same deposits as the finest material, and which often cannot be detected until the cabochons have been roughed out.

"There are two methods of oiling in general use today. The more effective, although more difficult, method consists of submerging the cut and polished stones in a bath of melted paraffin, which is kept just above the melting point by putting it in the top section of an ordinary double boiler, with hot water in the lower section. The stones are left in the paraffin, which is either held at the melting point continuously, or reheated each day, depending upon the facilities of the operator, until the desired shade of blue is obtained. This may require a week or more. The better the turquoise to begin with, i.e., the harder and less porous, the longer it takes to absorb the oil, but the more lasting will be the resulting color. A not-too-chalky stone, oiled in paraffin, will hold its color upwards of a year if not exposed to direct sunshine or otherwise warmed too much.

"A simpler and cheaper method than the use of paraffin is the use of mineral oil. This does not require the use of any heat, although slight warming from time to time will hasten the absorption of the oil. This takes about as long or a little longer than the paraffin process, and is more likely to result in mottling of the stones due to denser, less porous areas within them; also the results are much less lasting as the stones will begin to change color in just a few months. Also they "sweat" little drops of oil much more readily than those oiled in paraffin.

"No ethical dealer will handle oiled turquoise, because all such stones will lose their color in a comparatively short time, becoming a dull green, somewhat like the color of Palmolive soap. The Indians say that the stone has "died" and it appears to have done just that. Moreover, there is absolutely no way to revive it. It could never be confused with the lively natural color of a "gem green" turquoise, which owes its color to higher than normal iron content, and which is often very beautiful. For some ceremonial purposes the Indian requires this natural green turquoise, either alone or in conjunction with fine blue stones, for the green is considered to be female, while the blue represents male characteristics.

"The U. S. Bureau of Indian Affairs forbids the selling as "Indian Jewelry" of any piece set with oiled turquoise, although this ruling is often ignored, as is their ruling forbidding the use of the name for machine-made jewelry. The four hundred odd members of the United Indian Traders Association are pledged under bond not to sell oiled turquoise. Stones too pale to be sold without oiling are sold by the pound to manufacturers of machine-made copies of Indian jewelry in Kansas City and Attleboro, Mass., who oil it and sell it to dime stores and curio shops all over the country. And of course the operators of machine shops here in the Southwest indulge in the same practice.

"An interesting sidelight on the artificial coloring of turquoise occurred here recently when the proprietor of a small gift shop announced that some Indian jewelry set with lavender turquoise had been acquired. This "lavender" turquoise was of course a light robin egg's stone which had, during the polishing, become impregnated with the red dopping wax. It is customary to wash turquoise in alcohol as soon as it is removed from the dopping sticks, to remove any of the wax which has penetrated the stones; these stones had not been, and consequently something new was added to the dealer's gift line."

AVENTURINE

Continued from Page 211

Verkhne Udinsk on the Selenga river near Lake Baikal, U.S.S.R., and a pale sunstone is found at Mineral Hill, Delaware County, Pennsylvania. What has been probably the most intriguing result of 'looking up' localities for sunstone, is the note by Dr. Herbert Smith[6] that spangled stunstone has come from Modoc County, California. This note had apparently been taken from *Gemstones,* the Imperial Institute handbook[7]; however, on referring to the State of California's bulletin "Minerals of California[8]," this mineral is stated to be *not* oligoclase but a labradorite with inclusions of metallic copper and was reported as such by Olaf Anderson in 1917[9].

In conclusion, I advise every earnest worker to procure specimens of these three "varieties" of aventurine and examine their structure by lens or microscope, for personal observation can teach much more than the written word, or even photomicrographs.

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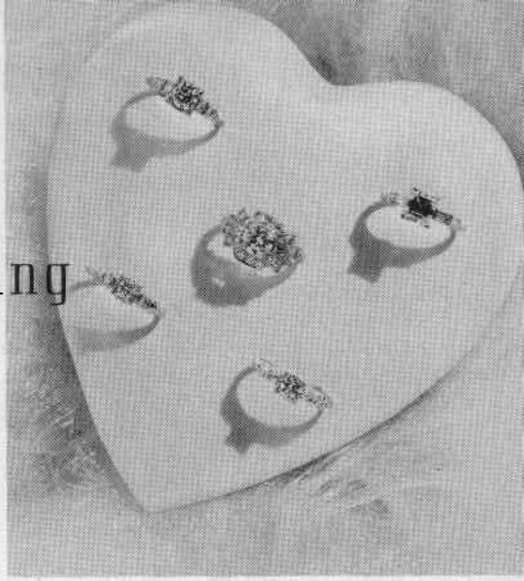
(6) Smith (G. F. H.) ibid p. 361.
(7) *Gemstones.* Imperial Institute Handbook. London. 1933. p. 99.
(8) *Minerals of California.* Bulletin No. 136. 1948 of State of California. Department of Natural Resources. p. 143.
(9) Anderson (O.) Am. Min. Vol. 2. 1917. p. 91. Min. Abs. Vol. 1. 1922. p. 392.

The Diamond as an Engagement Ring

by KAY SWINDLER



Although today it is not compulsory that a young man bestow upon the lady of his choice a ring to signify their intention to wed, and there is likewise no obligatory rule that the diamond shall be used for such purpose, yet custom has made the practice almost universally popular — at least in this country.

Why an engagement ring? And why should the selection be a diamond? Since this is one of the most happy occasions in the life of two individuals, the young man's wish to present his loved one with the most beautiful and lasting of jewels is in keeping with his wish for a shared life of beauty, unchanged by time. The very name of diamond suggests triumph and eternity of love since it is from the Greek word "adamas" meaning "unconquerable." It was really in the 15th century that both the art of cutting gemstones and the general use of the betrothal ring came into being. Both might be said to be the forerunners of the diamond engagement ring since with the new methods of cutting, the diamond became the most precious of gemstones and most popular for this purpose.

CUSTOMS AND ORIGIN

Many customs have accompanied the wedding and betrothal ceremonies down through the ages — both with and without items of jewelry playing an important role. Actually the bethrothal ring came before the wedding ring. In early Biblical times a signet ring was often worn and a ring was considered as a pledge for performance of a promise. This may have been one of the early beginnings of the popularity of a ring to seal a promise of bethrothal. The circular form of the ring was accepted in days gone by as a symbol of eternity, thus indicative of the stability of affection. In an old Latin work we find: "The form of the ring being circular, that is round, and without end, importeth thus much that mutual love and hearty affection should roundly flow from one to the other as in a circle, and that continually and forever."

Early Christian writings state that the ring was presented for a sign of mutual fidelity, or as a symbol of joining hearts by such pledge. By the end of the Middle Ages, the wedding and bethrothal rings had merged into one. This change seems to have taken place in England about the time of the Reformation. This did not, however, mean the complete abandonment of the betrothal ring, but rather the substitution of another and frequently less simple ring to mark the betrothal. Of course the change was gradual and the usage varied in different countries.

Perhaps the earliest allusion in Christian literature to the betrothal ring appears in one of Tertullian's writings, dated from the end of the second century A.D. He says:

"Among our women the time honored rules of the ancestors, which enjoyed modesty and sobriety, have died out. In former times women knew nothing of gold except the simple betrothal ring, which was placed on one of their fingers by the fiance." This would seem to mean that the custom had been long established even then.

The Anglo-Saxon presented the keys to his house along with a ring of gold. Sometimes the ring was presented on the end of a sword — indicating his willingness to fight for his loved one.

Just when the first betrothal ring was used is obscure, but it is believed that the exchange of betrothal rings dates back to classical times. Earlier even than that, the betrothal or wedding rings were those given by lovers to the objects of their affections. The wedding ring appears to be of Roman origin and was usually given at the betrothal as a pledge of the engagement. The oldest rings were made of iron, later came rings of gold.

PLACEMENT OF THE RING

Pliny tells us that "It was the custom first to wear rings on a single finger only, the one namely that is next to the little finger." (Lavish ornamentation of the Romans later saw their fingers heavy with rings.)

The custom of placing the betrothal or wedding ring upon the fourth finger seems undoubtedly to owe its origin to the fancy that a special nerve or vein ran directly from the finger to the heart. The pagan writer Macrobius, who offers this theory, states he derived his information from an Egyptian priest. Macrobius also explains the wearing of rings on the fourth finger as a desire to guard the ring from injury as this is the best protected finger. Isadore of Seville, writing in the early part of the 7th century, also declares that the betrothal ring was placed on the fourth finger. It seems likely that this rule was generally followed in the Roman Empire up to its end.

Another explanation of the choice of the fourth finger of the left hand for the placement of the ring, although not so popularly accepted, is that the fashion was created in Paris by the Baron d'Orchamps — a French oracle. This popular mystic informed his clients that evil influences could be warded off and good fortune attracted if a diamond were worn on the fourth finger of the left hand. Regardless of the results obtained from this practice, since his clients were of the fashionable crowd, this custom was rapidly adopted.

Another writer tells us the fourth finger of the left hand was chosen for the placement of the betrothal ring because that is the weakest finger and cannot be used inpendently. A ring on this finger signified subjugation of the wife to the husband. In this country and century women are far from being dependent or subjugated, but the finger is still considered the appropriate place for wearing the engagement ring.

The belief that the fourth finger should be used for placement of the ring extended at least into the 15th century for at the betrothal by proxy of Lucrezia Borgia with Giovanni Sforza, the record specified that twin gold rings were used set with precious stones and that they were to be placed on the left hand "whose vein leads to the heart."

During the reign of George I of England (1714-1727) it was not unusual to wear the wedding ring on the thumb, although it had been placed on the fourth finger at the marriage ceremony. Possibly this custom may have arisen because exceptionally large wedding rings were favored by fashion at that time.

From evidence discovered, it is believed that in very early times, rings were worn on the right hand. There is good evidence that at an early period among the Gauls the betrothal ring was placed on the right hand, and not on the left. A gold ring found on a finger bone of the left hand of a skeleton in an ancient burial place resembles exactly our wedding ring of today. This is believed to date from the 7th century.

During the Renaissance rings were strung upon men's necklaces or hung from a thin cord around the neck. They might even be worn on the hat. Rings so worn were frequently betrothal or engagement rings.

TYPES OF RINGS USED

Plain iron rings were first used for betrothal and they were still favored by some even after the advent of the gold ring. In ancient Rome, the ring represented a pledge made to the groom by the bride's father or guardian. In turn, the bridegroom presented a ring as evidence of his pledge to the bride.

It would seem that since the beginning of the Christian ceremony the significance of the ring is tied closely to the religious ceremony. Early specimens by Byzantine artists show figures of Christ engraved upon the bezel of the ring. This was believed to indicate bestowal of a blessing on the newly wedded pair, or to signify spiritual union. These rings probably dated from the 10th century.

A gold betrothal ring of the 4th century B.C. bears a Greek inscription which may be translated as follows: "To her who excels not only in virtue and prudence, but also in wisdom."

That the ring was sometimes given conditionally is shown by a curious old German formula which says: "I give you this ring as a sign of marriage which has been promised between us, provided your father gives you a marriage portion of 1,000 reichsthalers."

One of the betrothal rings coming down to us is tinged with the tragedy of the unhappy Mary, Queen of Scots. This ring bears the letters HM in a monogram bound by a true lover's knot. Inside the hoop is engraved "Hendril Darnley, 1655." It is believed this betrothal ring was given by the ill-fated Mary to her future husband, Lord Darnley.

One form of ring worn during the 15th century was the gimmel ring. This was composed of twin or double hoops. The outer side of the two hoops was convex and elaborately ornamented, while the inner side was flat and often bore some inscription. The two hoops were wrought so exactly alike that together with the stones used they appeared to be one ring, yet could be separated and one hung from the other. Their bezels were occasionally formed of clasped hands. Ordinary one-hoop rings also bore the same design and were known as fede rings.

Later used as a betrothal or engagement ring was the posey or poesie (posy) ring. This was generally of simple form, with a verse, a name or a motto engraved inside. The posy ring, suitably inscribed, was also used as a wedding ring. This belonged principally to the 17th century and was almost exclusively English. The elaborate betrothal ring seems to have been used at this time as a wedding ring as well. During this period the diamond was used almost entirely as an ornamental ring and little attention was paid to the mounting. It seems that the ring itself was little else than a means of displaying the diamond.

The beauty of sentiments expressed on rings of the 18th century is nowhere more charmingly given than on an English wedding ring at South Kensington which is formed of two hands in white enamel, holding between the thumbs and first fingers a rose diamond in the shape of a heart set in silver and surmounted by a jeweled ornament. It bears the date of 1706. Other rings of similar style have the bezel formed of two precious stones in the form of hearts united by a knot.

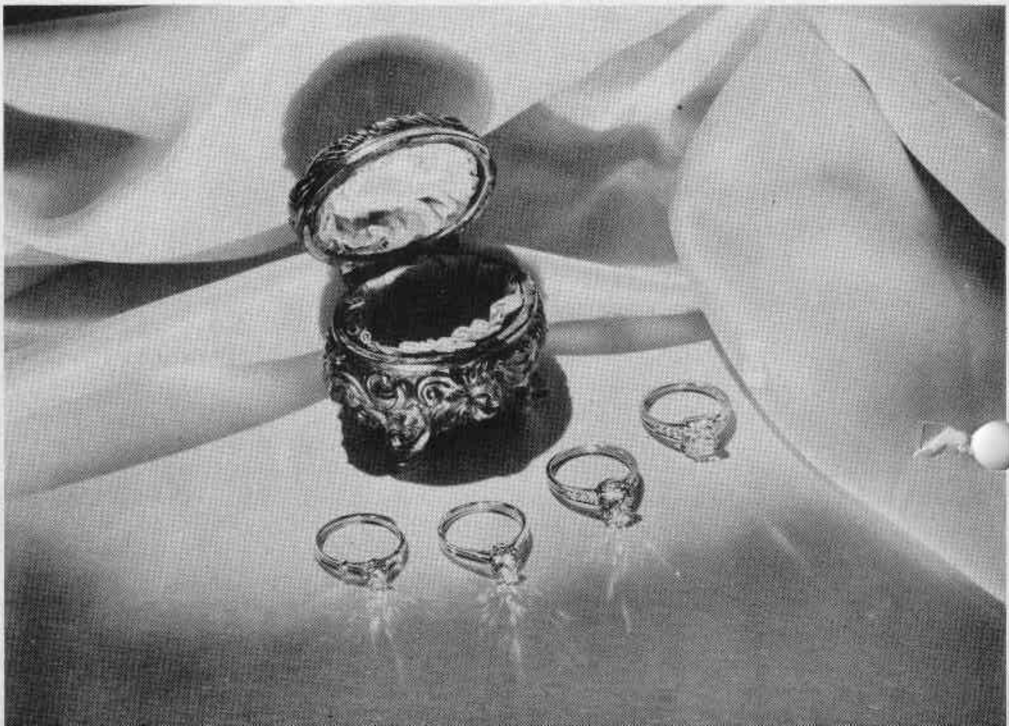
EARLY USE OF THE DIAMOND AS AN ENGAGEMENT RING

No definite information is available as to when the diamond ring became the choice for the engagement ring. However, in Pliny's accounts of life and nature during the splendor of First Century Rome, we find that in the betrothal ceremony a Roman girl was "covered from head to foot with pearls and emeralds." It is doubtful if diamonds were much known to the gem-loving First Century Romans, although Pliny does speak of the *adamas* and it is at least in one instance described as a crystal of true octahedral shape. However, it was not until centuries later when methods of producing facets were discovered that the diamond as a gemstone found much of a place among fashionable jewelry. Once introduced, however, anything as beautiful as the diamond was certain to be greatly desired and it is possible this demand stimulated prospecting later in India.

The history of the use of diamonds for jewelry really begins with the 15th century. The first record which we have of the use of a diamond for an engagement ring seems to be that contained in a letter written in 1477 by Dr. Moroltinger to the future Emperor Maximilian just before his betrothal to Mary of Burgundy, daughter of Charles the Bold. The letter reads: "At the betrothal your Grace must have a ring set with a diamond and also a gold ring. Moreover, in the morning your Grace must bestow upon the bride some costly jewels."

The engagement ring is a symbol rather than a style, but the diamond is by far the choice of the multitude of brides. With the increasing living standards in this country at least, and with a more steady distribution of wealth, it is not over optimistic to expect more and more diamond engagement rings to be sold. The wise jeweler will concern himself with the problems and queries of the prospective bridegroom and help him conscientiously in selecting a ring which will bring joy and happiness through the years.

• Four modern engagement rings. The two rings at left are of gold, each with a brilliant-cut diamond solitaire. The third is of platinum with a large brilliant-cut diamond and additional small diamonds on shoulders. The fourth has an emerald-cut diamond, nearly two carats in weight, with six side diamonds.



Contributors in this Issue

PROF. DR. K. SCHLOSSMACHER is well known to students of gemology and mineralogy through his *Edelsteinkunde* (1932) and *Praxis der Edelsteine-Bestimung* (1937). Born in 1877, he studied under the late Prof. Max Bauer and in 1917 became an assistant at the Mineralogical Institute of the University of Heidelberg. In 1919 he went, as a state geologist, to the Geological Survey in Berlin. At the suggestion of the Association of German Jewelers, he founded the first Gemological Institute of Germany. In 1926 he was appointed to a professorship at the University of Koenigsberg where he remained until the end of the war. His departure from that post interrupted many scientific researches which he was making. One of his contributions to the identification of gemstones was a photoelectric instrument by which absorption curves can be measured to the exactness of 0.5%. He was particularly interested in synthetics. In the spring of 1948, after three years of wandering, he was offered the position of Director of the Gemological Institute of Idar-Oberstein where he is now engaged in attempting to rebuild the industry and to continue his work in the interest of gemological science.

ROBERT WEBSTER of the London Gemmological Laboratories is by this time well-known to readers of *Gems & Gemology.* Biographical information on the author of *Aventurine* will be found in the Winter 1948-49 issue of this publication.

ROBERT M. SHIPLEY, founder of the Gemological Institute of America and the American Gem Society, was born in Missouri in 1887. He attended Wichita University and the University of Wisconsin. After operating a large retail jewelry business for 16 years, he recognized the need for education among jewelers and spent two years on the Continent in research in scientific and art museums, and completed the English gemological courses. He also lectured at the Louvre and other museums in Paris. Returning to America he conducted a gemology course at the University of Southern California. This was the forerunner of the establishment of the Gemological Institute which he founded in 1931. Since its incorporation in 1943 as a non-profit institution, he has continued as Director. Until June, 1946 he served also as Executive Director of the American Gem Society. Since the final disassociation of the A.G.S. and G.I.A. in 1947, his only connection with the A.G.S. has been a life membership, an honor which was bestowed upon him in 1947. In April of this year he was made the first and only Honorary Certified Gemologist. He is also a Fellow of the Gemmological Association of Great Britain.