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The Emerald Mines of Muzo, Colombia, South America*

by

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Introduction

The emerald deposits of Colombia, South America, have been of great importance for centuries. Presumably the source of the great wealth in emeralds reportedly held by the Incas at the time of the Spanish conquest, they were worked by the Spaniards as early as 1594, and today they furnish the finest quality stones to the gem trade.

The deposits are located in the Cordillera Oriental (eastern range of the Andes) of Colombia, principally in the Departamentos or states of Cundinamarca and Boyaca. Some of the deposits, such as that near Nemocon, are of little more than scientific interest; others, as Chivor, Cosquez, and Muzo, are of commercial importance. It is the purpose of this paper to discuss the Muzo deposit.

The Mina Real de Muzo lies far down the western slope of the Cordillera Oriental, at an elevation of approximately 2,000 feet above sea level. The climate is warm, and very moist, and as a consequence the hills are covered with a dense jungle growth, which makes geologic work exceedingly difficult. The climate is said to be unhealthful, although at the time of the visit of the writer, which was in August, 1939, the weather was delightful, especially in contrast to the penetrating, damp cold of the highlands.

The area in which the deposits occur is drained by the Rio Itoco, an easterly-flowing tributary of the Rio Minero. The latter flows to the north, being called the Rio Carare in its lower reaches, and eventually joins the Magdalena, the great artery of commerce of Colombia. Since the Itoco and Minero are mountain streams, both in the stages of very early maturity, and dissecting a region that has reached late youth in the erosion cycle, at most, neither is navigable.

Although the Muzo Mine is scarcely 100 kilometers, airline, from Bogotá, the capital city of Colombia, it is still very difficult of access. A road is being constructed down the west face of the eastern Andes, connecting with the main highway along the broad crest of the range at Chiquinquirá. This road is single width for long stretches, but is rigidly controlled, and quite safe for ordinary driving. In 1939, it ended at a construction camp at La Vega de la Tigre, a distance of 210 kilometers from Bogotá, and still some twelve or thirteen kilometers from the little town of Muzo, which in turn is about eight kilometers from the mine. The road will eventually run to the town, but because of the

* G.I.A. Research Service.

difficulty of the terrain, it probably will be some time before it is completed. At present, it is necessary to go by mule or horse from the end of the road to the mine—a four to five-hour trip.

The Muzo Mine is directly under the control of the Colombian government, although at times in the past it has been operated under concession by foreign companies. It is closely and efficiently guarded by a detachment of the National Police, and entrance may be gained only by permission of the ministry under which it operates—the Ministerio de la Economía Nacional at the time of the writer's visit, but the Ministerio de Minas y Petróleos since 1940. It is under the supervision of an administrator, assisted by the officer in charge of the police detachment.

The most important paper on the Muzo district is that of Dr. Roberto Scheibe,[1] first director of the Comisión Científica Nacional of Colombia, based upon field studies made in 1914 and 1915. A more recent study by W. G. Fetzer, also employed by the Colombian government, has not yet been published, and was not available to the writer. It should be of very great interest when published. Other papers on the area are listed in the bibliography. The present writing is based upon observations made by the author during a brief visit while serving as consulting geologist to the Departamento de Petróleos of the Colombian Government in 1939.

The writer wishes to acknowledge the cooperation of all the departments of the Colombian government involved, in making possible the trip to the mines. He is particularly indebted to Dr. Benjamín Alvarado, chief geologist of the Departamento de Petróleos, who made all the arrangements, and to Dr. Benjamín Jaramillo, administrator of the mine, especially for the great courtesy and thoughtfulness shown the writer's wife and small daughter, both of whom accompanied him. He also wishes to express his appreciation of the never-failing kindness and helpfulness of his two assistants, Mr. Luís Camargo, and Mr. Florentino Hernandez.

Geology

The Cordillera de los Andes comprises, in Colombia, three separate ranges: the Cordillera Occidental (western Andes), the Cordillera Central (central Andes), and the Cordillera Oriental (eastern Andes). The first two are composed largely of crystalline rocks; the Cordillera Oriental is principally sedimentary, although schists and phyllites, of presumable Paleozoic age, with some intrusive rocks, also presumed to be Paleozoic, are known to occur on the east and west slopes of the range.

The sedimentary rocks range in age from lower Cretaceous through the Tertiary. The former are definitely of marine origin, and the highly organic shales and limestones of lower Cretaceous age are the source of the oil produced in the Magdalena Valley fields. The upper Cretaceous rocks are marine sandstones and shales, with the former predominant, and these rocks form the great western escarpment of the Cordillera Oriental. The Tertiary beds are of brackish water or continental origin, and are principally

[1] Scheibe, R., "Informe Geológico Sobre la Mina de Esmeraldas de Muzo," *Compilación de los estudios geológicos oficiales en Colombia.* Vol. I, pp. 169-198, (1933).

siltstones, sandstones and conglomerates.

The rocks in the immediate vicinity of the Muzo mine are black, carbonaceous limestones and shales, so highly carbonaceous, in fact, that they soil the fingers as does soft coal. No fossils were observed by the writer, but the lithology is similar to that of fossiliferous Villeta (lower Cretaceous) beds mapped by the writer farther south, and to the Palmira (also lower Cretaceous) known to occur somewhat to the north. On a lithologic basis, therefore, they are here classified as lower Cretaceous, which is in accordance with Scheibe's designation.[2]

Scheibe[3] recognized two principal subdivisions of the sedimentary rocks at the mine: the emerald-bearing beds, and what he called the "*cambiado.*" The exact meaning that he intended to convey by this latter term is not altogether clear, but without question he used it to give the idea that he believed the beds to have been somewhat changed, or metamorphosed. The emerald-bearing beds lie above the "*cambiado,*" and presumably had a wider distribution formerly than at present, having been stripped from much of the area by stream erosion.

The writer's observations were confined almost entirely to the emerald-bearing beds. These are the typical black limestone and shale of the Villeta formation, highly tilted and folded, and weathering to yellow and brown where exposed at the surface. They are cut by numerous veins of varying widths, and in these veins the emeralds occur.

The gangue minerals in the veins are calcite, which predominates, quartz, dolomite, and pyrite. In this gangue are the crystals of emerald. The exact order of crystallization has not been determined by the writer, but one specimen that he examined showed a well-formed dolomite crystal entirely surrounded by a larger emerald crystal, the whole in a matrix of calcite and pyrite. In many other specimens examined, dolomite was intimately associated with the emeralds, and it seems safe to assume that they are of the same generation; that is, they represent, together with the other minerals listed, a single period of vein filling, the emeralds having crystallized somewhat earlier than the dolomite.

Scheibe[4] describes veins occurring in the "*cambiado,*" which contain albite, fluorite, and barite, and mentions in this same formation certain beds that appear to have been albitized, and others containing ottrelite. He also calls attention to a pegmatite dike outside of, and to the southeast of the emerald-bearing area. All these he considers as evidence of the proximity of a granitic intrusion, which metamorphosed the beds he calls the "*cambiado,*" and gave rise to the solutions that formed the emerald-bearing veins. He frankly admits that he has been unable to prove the existence of such an intrusion, due possibly to the difficulty of thoroughly exploring the jungle-covered area. A window of granitic rock surrounded by metamorphics, known to occur some 18 kilometers from the Muzo mine, he concedes to be definitely pre-lower Cretaceous.

The writer saw no albite in the emerald-bearing veins that came under his observation, nor in the matrix surrounding the large num-

[2] Op. cit., p. 172.
[3] Ibid.
[4] Ibid.

ber of emerald crystals he examined in the laboratory at the mine. Furthermore, although the folding and faulting in the black limestones and shales indicated that they had been subjected to considerable stressing, there was nothing to indicate contact metamorphism, nor, for that matter, metamorphism of any sort. Neither do the lower Cretaceous or later rocks observed in other parts of the Cordillera Oriental show evidences of intrusion by granitic plutonics. Unfortunately, the writer did not see the pegmatite dike reported by Dr. Scheibe, and, therefore, has no judgment as to whether it is intrusive into the lower Cretaceous rocks, or, like the window of granite mentioned above, is older than lower Cretaceous and has been exposed by erosion.

The relative closeness of the granitic intrusive postulated by Dr. Scheibe implies a high temperature origin for the veins, not only those in the "*cambiado*," but the emerald-bearing ones as well, and Lindgren seems so to consider them.[5] However, typical high-temperature minerals, such as the pyroxenes, amphiboles, garnets, magnetite, tourmaline, topaz, are altogether absent. Certainly some of the lime-silicate minerals would be expected in rocks as calcareous as these. The calcite, dolomite, and quartz of the emerald-bearing veins suggest much more strongly mesothermal deposits, as do also the fluorite, barite, and albite mentioned by Dr. Scheibe as occurring in the other veins. All of these might also occur as gangue minerals in low-temperature deposits, and the irregularities of the veins, in width, extent, directions, and distribution, further suggest an epithermal origin as a possibility. It is the opinion of the writer that the veins, and therefore the emeralds as well, are the result of mineralization in the lower part of the epithermal zone, or the upper part of the mesothermal zone; in other words, at relatively low temperatures.

Exploitation

The Muzo deposits are worked entirely by open-cut methods, and equipment is of the simplest nature, consisting of picks, shovels, and bars. The individual deposits or "*bancos*" are developed by a series of benches, about a meter in height, the waste being gradually moved down into the bottom of the canyon on the side of which the deposit occurs. Water is stored upstream behind a small dam, and when a certain amount of waste has accumulated in the bottom of the canyon, the water is released and the waste flushed out into the Rio Itoco.

When a vein is encountered that experience tells the worker or foreman may contain emeralds, the administrator and the officer in charge of the police detail are called to the spot, and the vein opened up under their supervision. Any emeralds found are taken to the laboratory near the administration building, and the matrix carefully removed. Gem quality material is sent to Bogotá, where it is deposited in the Banco de la República.

The Muzo, as well as the Cosquez mine, being controlled by the government, is operated only as the market demands. It is at present shut down, and has been since January 1, 1939. A recent official government report[6]

[5] Lindgren, W., *Mineral Deposits* (3rd ed.). McGraw-Hill Book Co., Inc., New York, p. 858, (1928).

[6] *Informe del Ministro de Minas y Petróleos al Congreso Nacional en sus sesiones ordinarias de 1940*, p. xxiv. Bogotá, (1940).

states that there is on hand in the Banco de la República a stock of emeralds whose value is approximately $700,000.00, Colombian currency (nearly $400,000.00, United States currency). This includes the unsold portion of the emeralds exhibited by the Colombian government at the International Exposition in San Francisco in 1939, out of whose total value of nearly $65,000.00 (U.S.), approximately $14,000.00 (U.S.) were sold in the United States.

The Muzo deposits are by no means worked out. While the very shallow depth of the emerald-bearing ground indicated by Scheibe[7] on his cross-section seems to be borne out by the workings, there is still a considerable area of known ground that has not yet been exploited. In addition, it is quite possible that careful prospecting in the area between the Muzo mine and the Cosquez deposits, some twelve kilometers to the north, may reveal hitherto unknown areas of emerald-yielding material.

[7] Op. cit., plate No. 4.

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SYNTHETIC EMERALDS ON U. S. MARKET*

A San Francisco lapidary has recently been advertising for sale, both rough and cut synthetic emeralds. The Institute has secured five cut stones, the largest of which weighs 0.07 carats, and six tiny rough crystals, the largest of which weighs just under 0.02 carats. These stones are typical synthetic emerald material, exhibiting the pronounced "wisp-like" inclusions which have been reported in previous articles.† These "wisps" are made up of masses of tiny liquid inclusions, and are best studied under the dark field illumination of the diamondscope, or of the diamond imperfection detector. In most cases low magnification (10x to 100x) reveals the synthetic emerald more readily than does higher magnification.

* A.G.S. Research Service.

† *Gems & Gemology*, July, 1935, page 281 fol; Winter, 1937, page 131 fol; Summer, 1938, page 163 fol.

The Vargas Diamond

by

SYDNEY H. BALL, Ph.D. AND PAUL F. KERR, Ph.D.*

Brazil, considering that its output since the discovery of diamonds some 220 years ago has been about 17,000,000 carats, has produced relatively few large stones and most of these have come from what has long been known as the Bagagem district in western Minas Geraes. Coromandel, Patos, Tiros and Patrocinio are localities associated with diamond production from this district which lies about 200 miles west of Bello Horizonte, the state capital. In this district were found the Star of the South (uncut 261.88 metric carats), discovered in July, 1853; the English Dresden (uncut 119½ carats), found about the same time; the Estrella de Minas (uncut 179.3 carats), found in 1911; Minas Geraes (uncut 172.5 carats), the Southern Cross (uncut 118 carats), in 1929, and a 178-carat stone in October, 1937. In addition, several other sizeable diamonds are said to have come from the same region. Many, however, had apparently forgotten the district's record, judging at least from the surprise expressed in many quarters when the "Presidente Vargas" was found in 1938, and reiterated when the "Darcy Vargas" (uncut 455 carats) was found early in 1939.

The "Presidente Getulio Vargas" diamond was found in the gravels of the Santo Antonio river in the municipality of Patrocinio, Minas Geraes, in July, 1938. Patrocinio is located at the base of the western extension of Minas Geraes, approximately seventy-five miles from the southeastern corner of the State of Goyaz and an equal distance from the northeastern corner of the State of São Paulo. There are several stories as to the identity of the finder, but he apparently was a Brazilian prospector, Clarindo de Souza, who was working in partnership with Joaquim Evancio, the farmer, on whose land it was found. The partners sold it to a broker for 1,190 contos (say, $56,000). The story goes that in the transaction the garimpeiro, as frequently happens with mining men, profited little in the transaction. The broker took the diamond to Bello Horizonte, where it was sold to a merchant, Oswaldo Dantés dos Reis. The reported consideration was some 5,000 contos (say, $235,000). The stone was christened "Presidente Getulio Vargas," in honor of the chief executive of Brazil. Senhor Dantés dos Reis sold the stone to a Dutch syndicate represented by the Dutch Union Bank (Hollandsche Bankunie) of Amsterdam for a sum reported to be £80,-000. From November 11, 1938, to early in 1940, the diamond rested in the safety deposit vault of that bank. Early in 1940 it became known that Harry Winston, of Harry Winston, Inc., of 620 Fifth Avenue, New York, N.Y., had purchased an option to buy the stone for some $600,000. It will be remembered that Mr. Winston

* The writers wish to thank Mr. Harry Winston and the members of the staff of Harry Winston, Inc., for courtesies extended.

was also the purchaser of the Jonker diamond, a stone within 0.6 carats of the weight of the "Presidente Getulio Vargas." To the layman, it may be of interest to state that the stone was sent from Europe to America by registered mail for 70 cents, although it was insured by Lloyd's for $750,000. In March, 1941, the cutting of the Vargas diamond will begin in the Winston cutting shop in his office. It is understood that the stone will be cut into twenty relatively small, considering the crystal's size, emerald-cut stones ranging from 5 to 50 carats in weight.

The five largest diamonds found in the two thousand years or more of the diamond industry are:

The Cullinan, found in South Africa, weight 3,025.75 carats;

The Excelsior, found in South Africa, weight 995.2 carats;

The Great Mogul, found in India, weight 787 carats;

Presidente Vargas, found in Brazil, weight 726.6 carats;

And the Jonker, found in South Africa, weight 726 carats.

The Vargas diamond is a remarkably fine piece of rough without carbon spots, and blue-white in color. Originally limonitic stain was concentrated along a small fracture and a more or less opaque brownish film coated a large part of the crystal. The film was easily removed with acid. The only other flaw is a small incipient fracture, suggesting that in mining some tool, perhaps a pickaxe, had struck it. This shows a slight tendency to produce Newton's rings in faint colors of brilliant hue. It is, in shape, a roundedly triangular and relatively thin mass of rough, and, strangely enough, in outline it strongly resembles the shape of Brazil. The Jonker was frosted on almost the entire surface, although clear on the inside. The Vargas, except for one side which is microscopically striated on the surface, resulting in a frosted appearance, is a clear piece, resembling, except for its weight, a piece of clear glass. Indeed, through it, print can be easily read. It is 2.8 inches long, 2.2 inches wide, and 0.9 inch thick. The stone weighs 726.6 carats. Its specific gravity is reported to be 3.53, an unusually high figure for a diamond (evidently determined before the iron oxide was removed).

The stone is the upper two-thirds of an extremely flat and elongated octahedron, part of the lower half of which is missing, the lower boundary being a cleavage face. In the cleaver's opinion, it forms a single crystal; a re-entrant or two throw some doubt on this conclusion, but, after all, cleaving will tell the story. The octahedral faces are so irregular that goniometric readings would appear to be valueless, particularly as all but the cleavage surfaces are distinctly curved.

BOOK REVIEWS

Quartz-Family Minerals. **by H. C. Dake, Frank L. Fleener, Ben Hur Wilson. Published by Whittlesley House, Division of McGraw Hill Book Co. New York, 1938.**

This text states as its aim the complete coverage of quartz and allied minerals especially from the viewpoint of the mineral collector. In this it is successful, some three hundred pages being filled with material pertaining solely to the silica minerals. Unfortunately, much of the material included is worthless and some is completely incorrect. The book is well prepared, being printed on a good grade of paper and profusely illustrated. The arrangement of material is well handled, particularly in view of the difficult problem presented in this respect. Unfortunately, the handling of the material does not come up to the excellent manner of its presentation. The authors are guilty of not only incorrect statements, but even of several errors in English grammar.

Quartz-Family Minerals should prove of very definite value to the host of amateur mineralogists, collectors and lapidaries who are springing up throughout the United States. There is much good information on sources and on the type of material produced by cutting the various ornamental varieties of quartz.

Jewels and Gems, **by Lucile Saunders McDonald. Published by Thomas Y. Crowell Co. New York, 1940.**

Miss McDonald's book is illustrated with some striking drawings by Vera Bock and with the color plates which were used by Marcus and Company for their series of excellently prepared advertising booklets on precious stones. *Jewels and Gems* is elementary in scope and is not too well written. However, the factual content in the main is correct, though several surprising or amusing errors are present. The book deals mainly with the history and romance of gems and contains a goodly proportion of interesting fiction. Very little of the superstition concerning gemstones or of their talismanic virtues is incorporated and altogether the book makes interesting reading. The index with which *Jewels and Gems* closes is remarkably complete; however, an index of any sort might be considered unnecessary for a book of this type.

Book Reviews

(Continued)

5,000 Years of Gems and Jewelry, **by Frances Rogers and Alice Beard. Published by Frederick A. Stokes Company, New York, 1940.**

This book, obviously planned for public consumption, is divided into three parts; part one, history, romance and superstition of gems; part two, the properties of gems, fashioning qualities and substitutes; and part three, a description of the more important individual gemstones.

The book contains also an appendix of four parts. The first of these is a "summary of gemstones" in which gems are tabulated with their hardness, transparency, colors and usual cuttings. Second, is birthstones in which the recommendations of G. F. Kunz are featured. Third, a selected bibliography which is very scanty. Fourth, a glossary which, while too brief, is comparatively accurate.

The book closes with an index which is better than average for a book of this type.

Part one of the book is by far the most interesting, contains some well-presented historical stories of gems, together with much superstition and talismanic lore. The second and third parts are too brief to be of much real value, though they do have the marked advantage of being comparatively free from serious errors.

—R. S., Jr.

Pearl Colors

by

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The qualities of pearls are not widely understood in the trade today. This is partly due to the fact that but a relatively small number of jewelers stock fine Oriental pearls, and partly to the great difference in value which results from comparatively slight differences in quality.

Of the qualities affecting pearl values, color is one of the most important. Yet the color of a pearl is often difficult, sometimes quite impossible, for a novice to judge.

The color of the majority of pearls is due to two separate effects: the color of the body or background of the pearl, and the predominant hue of the orient, which is often called the "overtone" of the pearl.

The body color is the color of the mass (background) of the pearl; every pearl has some definite body color. Oriental pearls usually are some tone between medium and very light cream (yellow of low intensity), or white. Some pearls, particularly those from fresh-water molluscs, exhibit pronounced body color in red, purple, blue, and gray to dead black. These are generally known as "colored pearls," and are distinct from "fancy pearls." Often a pearl exhibits more than one basic or body color; the result is a "two-color" pearl.

Superimposed upon the color of the background, in fine pearls, is a secondary color due principally to the orient. This secondary or overtone effect is not always present. In the finest Oriental pearls this color is pink (very light red) and is known in the trade as rosé (pronounced roe-zay'). Other colors include yellow, orange, green, and purple.

In some cases the rosé overtone may be combined with a certain amount of blue or green; this constitutes a *fancy* pearl. Fancy pearls have really three colors: a basic color of cream (dark to very light to almost white), then a superimposed rosé with a blue or green tint. The blue with the rosé may also give a purple tint due to the combination of the colors rosé and blue. This is very desirable. The green tint remains more constant (cream, rosé green) and these are less desirable.

Pure and even color is essential. Muddy, thick, or dingy colors are much less valuable. As described above, colors of fine pearls include both body color and the color of the overtone. Upon this basis pearls may be classified into the three general groups: white, black, and colored.

White pearls include those of which the background or body color is white or some tone of cream. The white group is further divided into:

1. *White.* Pearls of which the background color is white or very nearly so, and which have no pronounced overtone except perhaps a faint blue cast.

2. *Cream.* Pearls of which the body color is dark, medium, or light cream, and which exhibit no overcast color. Light cream is approximately the equivalent of very

light yellow of low intensity (yellow-brown); dark cream approximately the equivalent of medium yellow-brown.

3. *Light Rosé.* Pearls with body color white or nearly so and with pink (rosé) overtones. Light rosé and cream rosé are the most valuable pearl colors.

4. *Cream Rosé.* Pearls exhibiting cream background with rosé overtones. The cream background may be light, medium, or dark; and these variations are described as "light cream rosé," etc. Cream rosé pearls are much more valuable than those of a straight cream color.

5. *Fancy* is the term applied to a pearl with a background color of dark, medium, or light cream, or white, which has an overtone of more or less pronounced purple, violet, blue, green, orange, etc. in addition to a rosé effect. A very pronounced rosé overtone may in itself be considered fancy; if it appear on a cream background, the effect is known as "cream fancy rosé." A green overtone is the least desirable.

In the classification of black pearls fall not only truly black pearls, but also gray specimens. Classed under black also are bronze, blue, blue-green, and green pearls which exhibit a pronounced metallic sheen. Pearls having an iridescent peacock-green sheen are the most desirable. An intense, even color is essential in any pearl of the black classification; dingy (low intensity) colors are much less valuable.

Colored pearls are those which exhibit a pronounced hue as background color, and these differ from fancy pearls which exhibit strong overtone colors. This hue is usually a light to medium tone of red, purple, violet, blue or green. These colors are more common in fresh-water than in Oriental pearls.

Two-color pearls are a type of colored pearl in which the same hue does not extend uniformly over the surface. Even if one side be very fine, a round two-color pearl is less desirable for a necklace than one having a more usable color over all. Such two-color specimens may, however, be used in rings or other jewelry pieces.

A GEMOLOGICAL ENCYCLOPEDIA

(Continued from last issue)

by HENRY E. BRIGGS, Ph.D.

APATITE

Apatite occurs in many beautiful colors and cuts into very excellent looking gems; however, the low hardness of 5 is a real disadvantage since it will not wear in rings satisfactorily. It has a gravity of 3.1 to 3.2, a mean index of refraction of 1.64, the crystallization is hexagonal and it is, therefore, uniaxial. The optical character is negative, the luster vitreous to greasy, dichroism distinct in deep-colored specimens. It occurs in colorless, green, blue, violet, yellow, purple, red, and pink. The composition of apatite is calcium fluor- or chloro-phosphate, $Ca_5(F,Cl)(PO_4)_3$. Important localities for gem grade apatite are Germany, Bohemia, Switzerland, Ceylon, Maine and Canada.

EUCLASE

Euclase occurs in monoclinic prismatic crystals, hardness 7½, specific gravity 3.1, color blue, green, or bluish, greenish or colorless, mean index of refraction 1.65, biaxial and optically negative, pleochroism weak, luster vitreous and transparent. The composition of euclase is beryllium aluminum silicate, $Be(AlOH)\ SiO_4$. It is not a well-known gem, probably because of its rarity. It is indeed a beautiful stone when cut and strongly resembles the aquamarine variety of beryl, which is often sold as euclase in order to get more money for it. However, it is an easy matter to distinguish between euclase and aquamarine, for the two minerals are entirely different in character. Important localities are Russia and Brazil.

IOLITE

Iolite, also known as dichroite and cordierite, is remarkable for its strong pleochroism. Iolite is orthorhombic, but is usually found in massive form. The hardness is 7 to 7½, specific gravity 2.6, luster vitreous. The mean index of refraction is near 1.55, it is biaxial and optically negative, the composition is magnesium, iron aluminum silicate, $(Mg,Fe)_4Al_8(OH)_2(Si_2O_7)_5$. The color of iolite is light to dark blue, and it is transparent to translucent. Since the index of refraction is very low, the gem would have little appeal were it not for the strong pleochroism which is readily noticeable with the naked eye. This, however, is a redeeming characteristic of the gem, and by it iolite has gained quite a little favor. The most important locality for gem iolite is Ceylon where it is sold as "water sapphire."

FELDSPAR GROUP

Under this head we have several gem materials which we will treat as a group. The crystallization of all except orthoclase is triclinic, orthoclase being monoclinic. The mineral occurs both in well defined crystals and in cleavable masses. The cleavage is perfect in two directions, one being more perfect than the other. The hardness is 6 to 6½, specific gravity 2.5 to 2.8, luster vitreous to pearly, transparent to opaque, mean index of refraction 1.52 to 1.58, all are biaxial, albite and labradorite being positive while all others are negative. Feldspars are colorless, green, red, bluish, yellow and white.

Orthoclase of gem variety is colorless and transparent and is called adularia, when it is opalescent it is called moonstone. Albite of gem quality occurs colorless and shows chatoyancy, sometimes of a very striking bluish color.

Oligoclase also occurs as a moonstone with chatoyancy or opalescence. Microcline occurs in a cleavable mass of green color, somewhat like that of jade. It cuts into very pleasing stones for cheaper jewelry, and is sold as Amazon stone or amazonite.

Oligoclase occurs in an aventurine form called sunstone. It is of a reddish color with bright reflections from inclusions of minute crystals of iron oxide.

Labradorite is a variety with a beautiful change of colors, such as blue and green and occasionally yellow, red, gray or purplish.

The composition of this group is as follows: orthoclase ($KAlSi_3O_8$), potassium aluminum silicate; albite ($NaAlSi_3O_8$), sodium aluminum silicate; microcline same as orthoclase; anorthite ($CaAl_2Si_2O_8$), calcium aluminum silicate; oligoclase intermediate between albite and anorthite; labradorite intermediate between albite and anorthite.

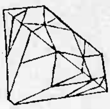
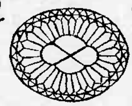
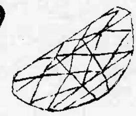
Principal localities for gem varieties are: orthoclase—Switzerland, Elba, Ceylon, Brazil, Madagascar; amazonite—Ural mountains, Pennsylvania, Colorado and Virginia. Sunstone comes principally from Norway. Labradorite comes mainly from Labrador, as the name implies.

EPIDOTE

Epidote, as a gem, has met with little favor, although it is a very attractive gem when of good quality and well cut. It has a hardness of 6 to 7 and a specific gravity of 3.3 to 3.5. The luster is vitreous and the color yellowish to brownish green, and occasionally colorless, brown or red. Pleochroism is strong, crystallization monoclinic, mean index of refraction 1.75, biaxial and optically negative. The composition is a silicate of calcium, iron and aluminum, $Ca_2(Al,Fe)_2(Al.OH)(SiO_4)_3$. Principal localities for gem epidote are: Alaska, France, Norway, Italy and Tyrol.

(To be continued)

Important Diamonds of the World

Robert M. Shipley

THE GREAT MOGUL

Jean Baptiste Tavernier, famous traveller and gem expert, who spent a great part of forty years in the East, is the only authority we have for details regarding the Great Mogul.

The diamond was found about 1650 A.D. in the Kollur Mine on the River Kista in India. It came into the possession of the Emir Jemla, who farmed the famous diamond mines. Jemla was enormously wealthy and was Vizier to the King of Golconda. But jealousy and intrigue were soon afoot and Emir Jemla fled and placed himself under the protection of Shah Jehan, the Grand Mogul of the all-powerful empire to the north of Golconda. Jemla lavished jewels on Shah Jehan and among the gifts was the Mogul. Shah Jehan had a nice taste in jewels, owning the Kohinoor also and when deposed by his son Aurangzeb and shut in the fortress prison of Agra, carried the bulk of his jewels with him.

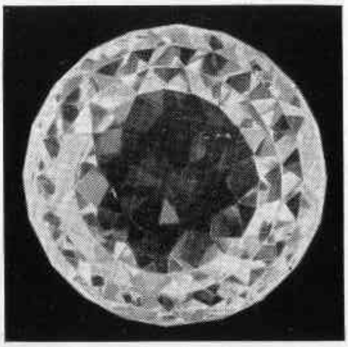
Tavernier was summoned to the presence of the Mogul Aurangzeb to see the splendor of his jewels and he gave an interesting and circumstantial account of his visit. "The first piece that Akel Khan (Chief Keeper of the King's jewels) placed in my hand was the great diamond, which is rose cut, round and very high on one side. On the lower edge is a slight crack, and a little flaw in it. Its water is fine, and it weighs 319½ ratis, which makes 280 of our carats." (In another place he gives a more exact figure 279 9/16 carats.) Travernier states that the stone weighed, in the rough, 787½ carats, but that the cutter, Hortensio Borgio, had cut it so poorly and reduced its weight so much that the King, instead of rewarding him for his work, fined him 10,000 rupees and would have taken more had he possessed it.

"If the sieur Hortensio had understood his trade well, he would have been able to take a large piece from this stone without doing injury to the King, and without having so much trouble grinding it, but he was not a very accomplished diamond cutter." (Ball's Translation of Tavernier's "Travels in India".)

Tavernier further described the jewel—"The stone is of the same form as if one cut an egg through the middle;" a rather vague description, perhaps a small hen's egg if we try and link the Mogul up with the Orloff, as the great living Russian gem authority, Fersman, would have us do in his excellent work on the Orloff, written in 1926. Tavernier also published a sketch of the diamond from which the model has been constructed that serves as the present facsimile of the stone.

Tavernier is usually very accurate in his statements, if we may judge him by his descriptions of diamonds still in existence, yet in spite of the record, a great diversity of opinion exists regarding the query—"What was the Great Mogul?"

Maskelyn believed that Tavernier never saw the Mogul which was in the possession of the imprisoned Shah Jehan, and what he saw was the Kohinoor. However, the Orloff, save for size, is singularly like the description of the Mogul, and Doctor Fersman is sure that they are the same.



The Model of the Great Mogul

THE STAR OF SOUTH AFRICA (OR DUDLEY)

The history of this stone goes back to the earliest discovery of diamonds in South Africa. During the excitement resulting from the recognition in 1867 by Mr. John O'Reilly of the fact that some pretty pebbles used as playthings by the daughter of a Mr. Van Niekirk, with whom he was staying, were diamonds, a report reached Mr. Van Niekirk's ear to the effect that a native African had a much larger stone of the same kind. Mr. Van Niekirk immediately hunted up the native and purchased the stone, although it cost him nearly all he possessed—500 sheep, 10 oxen, and a horse. He shortly after sold the diamond to a firm of South African jewelers for $56,000 (£11,200). The stone weighed, in the rough, 83½ carats, and was cut by the purchasers to an oval, three-sided brilliant of 46½ carats of great brilliancy and of the finest water. It then was sold to the Countess of Dudley for $125,000, who had it mounted in a head ornament surrounded by 95 smaller stones.