Gems & Gemology

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Notes on the Polariscope

by

HAROLD I. ROSENCRANS

Certified Gemologist, Longmont, Colorado

The finding of interference figures by use of the hand polariscope is one of my hobbies, and to me this is one of the most valuable tests we have in gem determination. If I can see and recognize an interference figure, my troubles are over as far as optic character is concerned. Anomalous double refraction won't bother me in the least.

Further, an interference figure not only assures me that the gem is doubly refractive but classifies it as either uniaxial or biaxial, giving me additional valuable information. Any crystalline stone which transmits light, whether colorless or colored, may be given this test.

The hand polariscope, as the name implies, employs the principle of polarized light. The manufactured material known as polaroid is used as the polarizing agent. Polaroid is a plastic film of cellulose acetate in which polarizing crystals are held in colloidal suspension. These crystals form in minute rod-like shapes, and lie parallel to each other. It is estimated that there are several thousand billion of these crystals to the square inch. This polarizing material is generally mounted between two thin glass plates for protection.

To determine optical character by means of interference figures in the polariscope, a strong, yet well-diffused, light source is essential. To obtain such a light source, I have developed a special illuminator, which supplies a strong, well-diffused light to the polariscope without the interfering side light so often encountered when the instrument is held in the hand toward the source of light. The heat from the lamp is well insulated from the instrument, and the door in the polariscope may be easily removed without disturbing the instrument. The upright position in which the polariscope is used with this illuminator is important for reasons which I shall explain later. This illuminator is especially valuable when hunting interference figures, for once you see them they can't get away, and may be observed at ease.

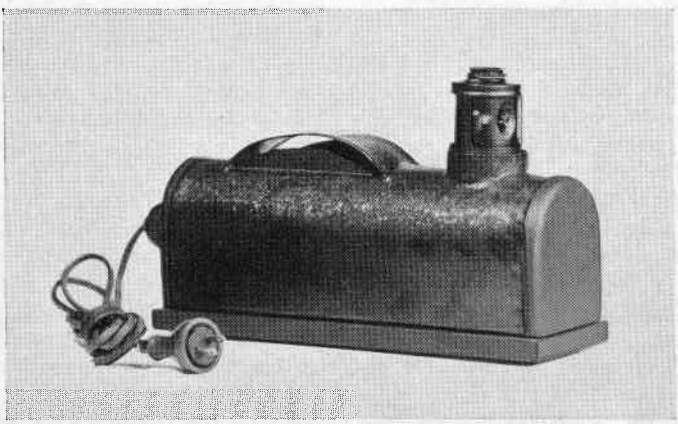
To be able to see an interference figure in a cut stone, the surfaces of the stone, at the points where the optic axis emerges, should be parallel to each other, or nearly so, and at right angles to the optic axis, which is the direction of single refraction. In faceted stones it is sometimes quite difficult to obtain a figure because of the angles which the facets form with the optic axis. In cabochon or sphere-shaped stones, the figures are not difficult to locate.

The optic axis or direction of single refraction is that along which the most easily recognized figure is seen. In a great many cases it is found either along the direction through the table to culet or parallel to the plane of the girdle.

Of course, we must have a stone which is anisotropic to obtain an interference figure. The search for a figure should start upon the location of a direction of single refraction in a doubly refractive stone.

Place the loupe over the analyzer; in a great many cases the interference is at once visible. With the illuminator, you do not have to hold the loupe in place, and thus you have both hands to operate the instrument. The loupe, or some other means of converging the light, is absolutely essential if the figure is to be seen. By turning the stone a trifle and revolving the cylinder, you can, as a rule, bring the figure in image of the stone on the surface of the polarizer. In this case note closely for extinction and illumination through the culet. If the stone is doubly refractive through the table and in all positions of observation when mounted with the edge of girdle in the wax, mount the stone with either the table or culet in the wax and repeat the searching process.

In looking for the direction of single refraction, look closely for any trace of interference colors; for these will show at and near the



Illuminator for Hand Polariscope, Showing Polariscope in Place.

the center of the field of vision. Sometimes it is necessary to adjust the stone slightly on the wax for the best results. Many times you will not be able to get a complete figure, but it is not necessary as long as you have a section showing a brush clearly.

When testing brilliant-cut stones, they may appear isotropic when viewed through the table because the light from the polarizer hits the facets at such an angle so that it is reflected back, instead of being transmitted through the stone. This condition often throws a reflected position of single refraction. By rotating the stone you may locate the optic axis on the girdle or you may note interference colors on the crown facets, but no color directly across the girdle on the pavilion facets. Rotate the stone one-half revolution. The colors will show on the pavilion facets, but not on the crown facets. You now know that the direction of single refraction is between these two positions, so adjust stone on the wax so these two points are in a line perpendicular to the plane of the polarizers.

When the direction of single refraction is located along the girdle or through the facets which are not parallel, it is often difficult to obtain a clear figure. This trouble may be easily overcome by the following test. Have some distilled water and a pair of stone tweezers handy. Of course, the stone must be clean, should be cleaned before your test is started. Use the tweezers or handkerchief to handle the stone, so no oil from the fingers will get on its surface. Dip the tweezers with points closed into the water and deposit a small drop of water on the stone at the point where the direction of single refraction intersects the surface of the stone.

The water will stand up on the surface in a hemisphere on all crystalline minerals. Now what we have done is this: we have, in effect, formed a lens which converges the light transmitted through the stone. Now by viewing the stone, we will see the interference figure complete and clear, but much smaller. Practice this test on a colorless, double refractive stone, and you will be surprised with the results.

Now to interpret these figures. If the interference rings are circular and the brushes form a cross at right angles to each other, the stone is uniaxial and belongs to either the tetragonal or the hexagonal system of minerals. If the rings are elliptical in shape and the brushes do not cross (in fact, two brushes are rarely visible at the same time in this type of figure when viewing faceted stones), the mineral is biaxial and belongs to either the orthorhombic, monoclinic, or triclinic system of minerals. Further, if by rotating the cylinder, the brushes of the figures remain stationary, the mineral is uniaxial. If the brushes rotate opposite to the direction the cylinder is turned, the mineral is biaxial.

The polariscope, used with this illuminator, is a much more valuable instrument than when used by hand. The instrument is in an upright position, and when the water test is used, the water will stay in position. If the instrument is held at an angle, the water has a tendency to creep to a lower level.

If you have ever tried to show anyone an interference figure by holding the instrument and loupe in hand, toward a light, you know how hard it is to retain the image.

A geologist and teacher at one of our State institutions came into my store one day not long ago. He is quite a collector of minerals and showed me a beautiful light-blue stone. Then he told me that a miner had found an aquamarine crystal in the mountains, and gave it to him. He decided to have it cut, and was on his way home from the cutter when he stopped in to see me. He was doubtful whether he had the right stone, for the lapidist had told him he thought it was topaz.

After making several tests, which all indicated the stone to be aquamarine, I placed it in the polariscope and obtained an interference figure. When he viewed it, he was much impressed and thoroughly satisfied that it was beryl, for the figure was uniaxial. If it had been topaz the figure would, of course, have been biaxial. Since that day he has brought me several stones to mount for him, and has sent many of his friends into my place of business.

Stamping Precious Metal

by
G. H. NEIMEYER
Chairman Jewelers' Vigilance Committee, New York, N. Y.

The National Stamping Law is supplemented by the following four Commercial Standards which cover the marking and sale of the articles covered by these standards in the following general manner, which applies in *all of these* Standards:

"Apply" or "Applied" includes any method or means of application or attachment to, or of use on, or in conjunction with, or in relation to an article, whether such application, attachment or use is to, on, by, in, or with:

(1) The article itself,

(2) Anything attached to the article, or

(3) Anything to which the article is attached, or

(4) Anything in or on which the article is, or

(5) Any bill, invoice, order, statement, letter, advertisement, or other writing so used or placed as to lend to a reasonable belief that the mark in said writing or writings is meant to be taken as a mark on the article itself.

All four Commercial Standards provide that if a quality mark is used, the name or registered trade-mark of the manufacturer or seller must also be used. Initials are not permissible in lieu of a name unless registered as a trade-mark.

Articles Made of Karat Gold
CS67-38

This standard covers the marking of articles made of karat gold.

The term "Solid Gold" shall mean only Fine Gold and fine gold is 24K gold.

The quality marks on a gold article are limited to the term "Karat," "Karat Gold," "Kt," "Kt Gold," "K" or "K Gold," preceded by a whole number indicating the 24th parts of fine gold contained in the alloy of which the article is made. Example: "14K." However, the manufacturer is not prohibited from indicating on the cards, tags, labels, etc., the gold fineness in terms of fine gold. Example: Article stamped "14K" may be described as follows: "This article is guaranteed to assay 584/1000 fine." (No tolerance allowed.)

No gold article less than 10K fineness shall have any quality mark applied to it.

No gold article made with a hollow center and then in any manner filled with metal, cement, pitch, or any foreign substance, thereby giving the article added weight or strength, shall be marked with a quality mark.

Comment:

As none of the points covered in this standard are specifically covered in the National Stamping Law, their addition to the regulation and control of the stamping or marking of articles made of gold is most important.

The elimination of the use of the term "Solid Gold" has been hailed as most beneficial because of the ambiguity of the term—it meant a different thing to different people, being used both in the physical and relative sense.

While it has been the general custom not to make articles of a gold quality less than 10K, some below that standard have appeared from time to time and, even worse, some of very low karat have been marked "Solid Gold." Both of these practices are now specifically prohibited through the adoption of this standard.

The elimination of the manufacture of hollow articles filled with metallic or non-metallic substances through this standard is also an important step, because the question of the right to partially fill a gold article has led to confusion and indeterminable argument.

Marking of Articles Made Wholly or in Part of Platinum
CS66-38

The principal provisions of this Commercial Standard are as follows:

Articles must contain, if made *without* solder, 98½% platinum metals; if made *with* solder, 95% platinum metals.

A soldered article containing 95% or more of platinum metals, of which over 90% is pure platinum, may be stamped "Platinum."

A soldered article containing 95% or more of platinum and iridium, provided the iridium is over 5% of the whole, may be stamped "Iridium Platinum." On such articles the percentage of iridium may be shown in thousandths. Example: (if 10% iridium) .900 Platinum, .100 Iridium.

Platinum on gold articles containing 5% or more of platinum (by weight) may be stamped with the karat of gold followed by the words "and Platinum." Example: "14K Gold and Platinum."

No quality mark can be used without an accompanying trade-mark.

The Commercial Standard covering articles made of platinum follows the laws prevailing in New York, New Jersey and Illinois very closely.

It was obviously unfair that the control of quality standards aimed at by the laws passed by the states named should be limited to those states, as no other standards governed the sale of platinum articles elsewhere. A manufacturer in New York or New Jersey could make platinum articles without reference to any law and sell such products in California or Pennsylvania. This is no longer possible as the provisions of this Commercial Standard will now be in effect throughout the United States.

Marking of Articles Made of Silver in Combination with Gold
CS-51-35

This Standard covers articles made of sterling silver and gold.

Where the gold entirely covers the silver, or if it is impossible to readily distinguish between the silver and white gold, a quality mark may be applied such as "Sterling +" or "Sterling and," which must be followed by a fraction and a karat mark which indicate both the amount of gold and the karat of the gold used. Example: "Sterling + 1/5-10K."

But the term Karat or K may not be used unless the alloyed gold content by weight is at least 1/20 of the weight of the entire article.

The mark "Sterling" must always come before the fractional or karat designation except when ½ or more of the article is alloyed gold, in which case the karat mark may come first. Example: "½ 10K + Sterling."

(To be concluded)

GEMOLOGICAL GLOSSARY

(Continued from last issue)

(With phonetic pronunciation system.)

Terms in quotation marks are considered incorrect.

Play of Color. A term somewhat loosely used. In instruction of the Gemological Institute of America, play of color refers to the phenomenon of prismatic colors seen in rapid succession when a mineral is turned, and caused by interference of light as in the opal. Differs from opalescence. See also Opalescence, Iridescence.

Pleochroism (plee-ok′roe-izm). The property in a mineral of exhibiting two or more differing colors when viewed in different directions by transmitted light, or when viewed by polarized light as through the dichroscope.

Pleomorphism (plee″oe-more′fizm). Same as polymorphism.

Pleonaste (plee′oe-nast). Black spinel.

Plumose (ploo′mose or ploo-mose′). Feather-like.

Pocket. A cavity in rock, often filled with minerals.

Point Cut. Diamond of octahedral form with original faces polished.

Polariscope (poe-lar′i-skope). An instrument employing essentially two polarizers and a means of rotating a specimen between them. Used to determine optic character (single or double refraction), etc.

Polarity (poe-lar′-i-ti). Of crystals, the property of having differing types of termination at the two ends of a prismatic crystal. May be reflected in pyroelectric properties, conduction of electric current, etc.

Polarized Light (poe′lar-ized). Light of which the vibrations have been limited to a single plane; as contrasted with ordinary light, which vibrates in all planes at right angles to its direction.

Polarizer (poe′lar-ize″er). A device employed to produce polarized light: Nicol prism, polaroid sheet, tourmaline plate, glass reflecting plates, etc.

Polaroid (poe′lar-oid). An organic plastic sheet in which tiny polarizing crystals are held. Light transmitted through polaroid becomes polarized. See also Nicol prism.

Polish. A smooth surface, usually produced by friction or abrasion.

Polishing. The act of producing a polish, especially on the facets of a gem stone.

Polymorphism (pol″i-more′fizm). The occurrence of two or more minerals having the same composition, but differing in physical, and often also in certain chemical properties. Dimorphism refers to groups of two, trimorphism to three, etc. See also Dimorphism.

Polysynthetic twinning. A system of thin laminae due to repeated twinning, which may comprise the whole of a gem mineral.

Porcelain (por′see-lane or pors′lane). A vitreous, translucent pottery product, usually glazed.

Porphyry (por′fi-ri). A rock containing individual crystals much larger than its fine-grained matrix.

Portability (pore″ta-bil′i-ti). Capable of easy transportation. A factor affecting value of a gem-stone.

Positive Crystal. A doubly refractive crystal in which the index of refraction for the extraordinary ray is greater than for the ordinary ray, and the former is refracted nearer to the axis than the latter, as quartz and ice. See also Negative Crystal (b).

Potch (poch). Miner's term for an opal which may be colorful, but without fine play of color.

Potstone (pot′stone). Soapstone (impure talc).

Prase (praze). Opaque green variety of quartz.

Prase Opal. Common green opal.

Precious Cat's-Eye (presh′us). Chrysoberyl Cat's-Eye.

Precious Coral. Red coral.

Precious Garnet. Fine quality almandite (garnet).

Precious Jade. True jadeite or nephrite, more often the former.

Precious Moonstone. See Moonstone.

Precious Opal. Opal showing a fine play of color. See also Common Opal.

Precious Stones. As contrasted with "Semi-Precious" stones, include the more important and comparatively more valuable gems such as diamond, ruby, sapphire, and emerald. However, in a strict sense, all true gem materials are precious.

Precious Topaz. True topaz, distinguished from citrine (topaz colored quartz). Also incorrectly applied to yellow to brown sapphire.

Precipitate (pree-sip′i-tate). The solid produced (generally in powdery or minutely crystalline form) when chemical reaction produces an insoluble compound.

Prehnite (prane′ite or pren′ite). A translucent, green to yellowish green gem material. Refractive index about 1.63, specific gravity 2.9, hardness 6-6½. See also Chlorastrolite.

Premier (pree′mi-er or preem′yer, formerly pree-meer′). A color grade of diamond, comparatively colorless in strong, direct light or daylight, yellowish to brownish in diffused artificial light.

Pressed Amber. An amber substitute produced by consolidating fragments of amber under pressure, usually with linseed or other oil as a binder.

Pressed Glass. Glass objects formed by forcing glass heated to a viscous state into molds. Process used to produce the cheapest sort of imitation gem stone.

Prism (priz′m). (a) (Optics) Transparent medium contained between plane facets, usually inclined to each other. (b) (Crystallography) A form having all its faces with the exception of bases parallel to one axis.

Prismatic (priz-mat′ik). (a) (Optics) Resembling the colors formed by the refraction of light through a prism. (b) (Crystallography) Having elongation in one direction, commonly parallel to one of the crystallographic axes; also parallel to the faces of a crystal, as prismatic cleavage.

Prismatic Layer. A layer, in pearl or mother-of-pearl, composed of minute crystals of aragonite arranged with their principal axes perpendicular to the surface of the layer.

(To be continued)

GEM SOURCES OF THE SOUTH ATLANTIC STATES

by

GEO. C. BARCLAY

Certified Gemologist, Norfolk, Virginia

Acknowledgements: The author of this paper wishes to acknowledge with thanks the assistance rendered by Arthur Bevan, State Geologist, University of Virginia; Dr. H. J. Bryson, North Carolina State Geologist, and Richard W. Smith, State Geologist of Georgia, and for the material and facts they so willingly contributed.

Although gem material has been found in the South Atlantic states, namely Virginia, North and South Carolina, and Georgia for a great many years, there is very little generally known by the public at large about it. Yet the finding of these minerals has contributed, from time to time, some very valuable and important information and scientific data, as well as some very beautiful and valuable specimens and gems.

The variety of gem minerals which have been encountered have been found in the crystalline rocks of the Piedmont province of these states. The Piedmont Plateau is the highland beginning at the eastern slopes of the Blue Ridge Mountains and extending eastward, joining the Coastal Plain at what is known as the Fall Line. The width of this plateau varies somewhat throughout its northeast-southwest course, just as the present Atlantic coastline varies relative to the mountain range, which extends from Maine to Georgia. Of the states mentioned, Virginia and North Carolina have the honor of being the real contributors of the greatest amount, variety and most valuable gem stones, namely: the corundum gems, including both blue sapphire and ruby; beryl, including extremely fine aquamarine and fine emeralds; emerald matrix, the rhodolite garnet, essonite garnet, almandite garnet, hiddenite and the quartz group. In rare instances diamonds, a few having been found scattered in the gravels in both states.

The geology of the Piedmont section dates back to the very earliest crystalline rocks, most of them going back to the very beginning of geological history, locally called the Pre-Cambrian Basement Complex.

Very many different types of crystalline rocks and minerals are found in this crystalline belt, but for the most part the granites, gneisses, schists and slates predominate. These older rocks were cut by later intrusions of similar composition during the very severe earth disturbances before and during the forming of the Applachian Ranges. These intrusions and disturbances set up metamorphic conditions which altered many of the then existing rocks to entirely different rocks. The intensely folded and crumpled nature of these rocks shows how great was the pressure exerted during metamorphism.

It is in the older rocks that most of the corundums are found. It is also thought that they are, in some instances, a secondary mineral derived by the alteration of the older chrysolite or chromiferous rocks. In the decomposed and altered chrysolite, called dunite, corundum is found in place. This is only one phase of corundum occurrence, although much the most conspicuous. It has been found in the crystalline schist and more or less decomposed basic rocks with garnets. This would lead one to believe that this phase of corundum occurrence was of secondary origin. It is evident, however, that in most cases, from the study made, that most of the corundum occurrences are the products of true igneous action, having either crystallized out from a molten rock directly or formed at the contact zones of such rocks with others which it penetrated, by mutual chemical action under the influence of great heat.

The pegmatites of the Piedmont Belt in some sections are rich in gem minerals, outstanding among these are the beryls, including fine aquamarine and fine emeralds and the rare green variety of spodumene called hiddenite. The following are minerals found in these pegmatites of sufficient purity to be a source of gems: essonite, almandite, beryl, quartz, albite, oligoclase, orthoclase, gahnite and spodumene (var. hiddenite).

In the study of this paper one must bear in mind that the author has sought to draw your attention chiefly to those gem localities situated in Virginia and North Carolina because, as before mentioned, these two states are responsible for the greater amount of gem material thus far produced in the Southeast.

Corundum-Sapphire and Ruby

The first mention of corundum being found in North Carolina was made in 1849. Professor Charles U. Shepard came in possession of several pounds of coarse blue sapphire broken from a large crystal reported to have been picked up at the base of a mountain on the French Broad River in Madison County, North Carolina. The first attempt to mine corundum gems within the state was in 1871 when a Mr. C. W. Jenks opened a mine near Franklin in Macon County. This mine was known as the Culsagie Mine. This venture proved very unprofitable from a gem standpoint. Although quite a number of fine gem crystals were obtained, the cost of operation far exceeded the revenue received. After a few years of mining for gems only, the owners devoted their mining operations to corundum for abrasive purposes. Many tons of this material were produced during the following years. Many fine gem crystals of blue sapphire have come from this mine. Also, the largest corundum crystal ever found came from here. It weighed 312 pounds and measured 22″ in length, 18″ in breadth and had a thickness of 12″. It was a steep and somewhat irregular six-sided pyramid, terminated above by a rather uneven plane. Its color was grayish blue. It was not of gem quality, however. A fine blue cut sapphire from this mine, weighing one carat, is in the United States National Museum, along with a number of fine red and blue crystals and a 3¼-carat wine-yellow sapphire. Probably the finest emerald-green sapphire in the world came from the Culsagie Mine, this specimen measured 4″x2″x1½″, a part of it is very transparent and could be cut into some very fine gems. This crystal is in the Morgan-Bemont collection in New York.

(To be concluded)

A GEMOLOGICAL ENCYCLOPEDIA

(Continued from last issue)

by HENRY E. BRIGGS, Ph.D.

OPAL (Continued)

Cacholong—a bluish white, very porous variety with the appearance of porcelain. A dry piece when touched to the tongue seems to adhere to it.

Hydrophane—a white to cloudy variety of dehydrated opal which becomes more or less transparent when immersed in water. When soaked in water some samples will show a little color play, which will vanish when the opal has dried.

Tabasheer—a siliceous deposit found in the joints of bamboo. When immersed in water some samples will show quite a bit of color play, but lose it upon drying.

Moss Opal—are to the opals what moss agates are to the agates. They have inclusions of manganese dioxide resembling moss or other organic matter.

Siliceous Sinter—a deposit found about hot springs and geysers. This formation is very unlike opal in appearance and is extremely odd shaped oftentimes. It is occasionally called geyserite.

Tripolite or Diatomaceous Earth—siliceous fossils of minute sea organisms. It is porous and of a chalky appearance.

Common opal is very widely distributed and samples may be found in almost every land. However, the precious opal suitable for gem use is not so widely distributed. Precious opal deposits of importance are found in Australia, Hungary, Honduras, Nevada, Mexico and in California.

Opals are usually cut cabochon, but occasionally we see fire opals which are faceted. Opals are imitated, but with very little success. Any opal which shows a good color play may be safely taken for the genuine article if it is not a doublet.

TOURMALINE

Tourmaline is one of the most colorful and beautiful of gems. It ranges in color from the jet black to colorless, and shows itself in most all the prismatic shades. It is very strongly dichroic and, cut with the table parallel to the axis, will show this property, adding to the beauty of this already wonderful gem.

Tourmaline is fairly hard, being 7 to 7½, and will give satisfactory wear if given reasonable care. In specific gravity it exceeds the weight of quartz, being 2.9 to 3.2. It has no well-defined cleavage, but parting perpendicular to the axis is common. It usually occurs in prismatic crystals, differently terminated, with three, six, nine, or twelve sides. The sides of the prism faces are usually striated with grooves parallel to the axis.

Being hexagonal, tourmaline is uniaxial. It is optically negative in character and has strong double refraction. The mean index of refraction is near 1.632 and the dispersion is .016. The strong dichroism of tourmaline serves to identify it. All of the transparent colored varieties will show the dichroism very plainly under a dichroscope, and often this is the only instrument necessary to identify the gem. When properly cut the gems show dichroism through the table, although some stones of very light tint are cut with the table perpendicular to the optic axis.

The composition of tourmaline is complex as well as variable. The formula is usually written $H_{20}B_2Si_4O_{21}$. Fluorine, lithium, magnesium, calcium, manganese, iron, aluminum, etc., it is believed, replace the hydrogen in this formula. It is the alkaline tourmalines which are of good color and transparent. The common gem colors and names used in the jewelry trade for them are: Achroite, colorless; Rubellite, red to pink; Indicolite, blue; "Brazilian emerald," green; "Brazilian sapphire," cornflower blue; "Brazilian peridot," yellow-green; "Peridot of Ceylon," honey yellow; siberite, violet; and schorl, an iron tourmaline, is black. We also have a brown tourmaline which is rich in magnesia. A peculiar characteristic of tourmaline is the varying of color in a single crystal. Sometimes one crystal will have many shades of two or even three colors. Sometimes the core of the crystal will be of one color and the outside of another, and again the color may be zonal.

Tourmaline is strongly pyroelectric, and where the terminations are distinctly different will develop marked polarity. The mere heat of sunlight will cause the crystals to take on sufficient electrical charge to pick up bits of paper, lint, ash, etc. In Holland, tourmaline was long known as *aschentrecker,* which literally means "ash drawer," because of this unusual property. All tourmalines are almost entirely opaque to X-rays. Tourmaline is usually cut step, trap, table, or brilliant when sufficiently transparent. As the names would indicate, they are used to take the place of other more expensive gems; however, the dichroscope will usually show up the fraud. Tourmaline is imitated with glass, doublets, and recently with synthetic sapphire and spinel appropriately colored. However, the strong dichroism of tourmaline should serve to show up this type of fraud also.

Tourmaline is widely distributed, but really fine gem grades are not so plentiful. Gem tourmaline is found in Brazil; in Maine, California, Massachusetts, Connecticut, New York, Pennsylvania and Montana of the United States; in Madagascar; Ceylon; Saxony; Island of Elba, and Siberia.

CHRYSOLITE

Chrysolite is a green mineral which is often classed in gem books as olivine or peridot, which are really names of varieties rather than the name of the mineral. The darker green varieties are called olivine, or evening emerald, and the yellowish greens are called peridot. Those which are very light in color are called by the name of the mineral chrysolite.

(To be continued)

Photography in Gemology

(Continued from last issue)

The results of the focusing are studied on the ground glass and the small gooseneck lamp.

The photoflood bulb, referred to toward the beginning of this article, is turned on and moved carefully around the stone, while the effect of the varying positions is continually noted on the ground glass. Positions with strong facet reflections, which tend to mask the interior of the stone, are avoided. After locating positions which light up the back facets without producing an unpleasant reflection from the top facets, the photographer moves the lamp several times through the path necessary to light each of the spots in turn in order to memorize the necessary motion of his arm. The film or plate is now placed in the camera in place of the ground glass, the aperture of the camera stopped down sufficiently to necessitate an exposure of several seconds. Opening the shutter, the photographer again carries the lamp through the path which he has planned. Of course, each of the various positions of light registers in turn on the film and the effect, after the exposure is made and the negative developed and printed, is the same as though a battery of many lights had been used, each very carefully set in a position to prevent unpleasant reflections. Some practice is necessary in order to master this system and the first few attempts will probably cause many objectionable facet reflections, but after a few experiments, anyone can learn to move the lamp through its course and achieve the effect desired.

As mentioned above, photoflash bulbs or spotlights are sometimes used. Either of these has the disadvantage of being stationary and cannot be used when it is necessary to light every side of a stone, unless four or more separate sources are available. The spotlight can, of course, be set up and its effect judged on the ground glass before an exposure is made. However, with the photoflash lamp, which burns for a small fraction of a second, it is necessary to judge the probable effect of illumination by using an ordinary electric light bulb. Here the gooseneck lamp is of value in locating the point where the light will have the most effect. Without moving the desk lamp, remove the ordinary lamp and replace it by the flash bulb, which is to be flashed immediately after the shutter of the camera has been opened. Immediately following the flash, the shutter should be closed to prevent stray light entering the camera and fogging the film. The photoflood bulb may be used in place of the flash, but longer exposure is necessary, and the resulting prints seem in some cases to lack the crispness of those made with flashlamps.

If the illuminator base of the Diamondscope or the Diamond Imperfection Detector is used as the source of illumination, the stone should be carefully adjusted and turned from side to side until the light through all the back facets is approximately equal. The Diamondscope can then be shifted with respect to the camera in order to bring the stone in the center of the camera field. The black background, which in the Diamondscope gives dark field illumination, gives much more satisfactory results than does the translucent background, since the latter tends to create a very dead white field and, in many cases, to cause halation which destroys the sharpness of the image of the stone.

A gem, when being photographed, should never be held in wax or any similar medium which moistens the stone. Placing the culet of the stone in beeswax in order to obtain a photograph invariably causes an unpleasant ring to appear around the pavilion facets at the points to which the beeswax extends. A very satisfactory method of holding gems, in order to photograph them with a vertical camera, is to have a small piece of soft material into which the stone can be gently pressed in order to hold it with its table up; or a block of catalin or similar material drilled with conical holes into which the pavilion facets of the stone may rest will hold the stone upright. The stone may, of course, be held in stationary tweezers, such as those of the Diamondscope, if the appearance of the tweezers in the print is not objectionable.

Many commercial photographers in photographing gems spread a thin film of chalk or similar "deadening" coating over the entire upper surface of the stone in order to cut down the bright facet reflections. This practice, while successful in eliminating the bright facet reflections, gives very disappointing photographs, since it robs the gem of all its brilliancy. The methods outlined above will eliminate unpleasant reflections and retain the essential impression of brilliancy. Mountings sometimes pick up very "hot" highlights from the illuminating source and for this reason it is sometimes beneficial to coat a mounting with a thin white or gray wash, but the practice is never recommended on the gems themselves, whether or not they are mounted.

If the camera used has an adjustable lens, much of the focusing can be obtained by simply moving the lens panel while the back of the camera is stationary. However, if a camera which does not permit this lens to plate motion is used, the strongest close-working* lens practical must be used with it and focusing done by moving the entire camera toward or away from the object. Once the focus is obtained, it is usually advisable to stop down the lens (i.e., to close the lens aperture, if such an adjustment is available) to very nearly its smallest opening. This makes a longer exposure necessary, but inasmuch as the stone and camera both are (or should be) motionless, the length of exposure is not important. Furthermore, a longer exposure gives better opportunity for shifting the light source as explained above. Stopping down the lens, of course, has the primary value of increasing the depth of focus and the sharpness and clearness of the final print.

*Called "Portrait lenses" when used on the cheaper cameras.

(To be continued)

BOOK REVIEWS

Gems and Gem Materials, **by Edward Henry Kraus and Chester Baker Slawson. Third Edition. McGraw-Hill. New York. 1939.**

This text is a new and much larger edition of the well-known *Gems and Gem Materials.* Dr. Chester B. Slawson, Assistant Professor of Mineralogy, under Dr. Kraus, at the University of Michigan, has taken the place of junior author. Edward F. Holden, who worked with Dr. Kraus on the first edition, was drowned in 1925. The book very definitely embodies the approach of the mineralogist, rather than that of the gemologist. However, it is by competent mineralogists and factually sound, especially where it deals with the realm of mineralogy as contrasted with that of gemology. The authors have also added much pertinent information from direct contact with the jewelry trade and with gems.

Dr. Kraus's visits to the factories in which synthetic stones are manufactured in Switzerland and Germany have enabled him to write a very good section on the production of synthetic stones. Unfortunately the material which deals with the detection of the synthetic product is so elementary that it is of little practical value.

Another field which the authors have covered well is that of diamond fashioning. Their theory on the variation of hardness with respect to crystal direction in diamonds is summed up well. Excellent photographs illustrate the material on diamond fashioning. Special mention is due those referring to the fashioning of the Jonker diamond.

Another fine section, from the standpoint both of text and illustrations, is that dealing with fashioning of colored stones in the Idar-Oberstein region of Germany. This material, which likewise is drawn from first-hand observation, deals largely with the quartz gems.

An attempt is made to divide the gem species into the classification of precious and semiprecious. Diamond, ruby, sapphire and emerald alone are classed as precious. The only qualification of this classification is the statement: "It may be emphasized here that there is no sharp distinction between the precious and the semiprecious gems."

The four color-plates which the book includes are perhaps the finest color reproductions of gems available. These are the same plates which were used by Dr. Eppler in his German text on gem stones.

The great majority of the minerals which have any use as gems are described. The jeweler reader may feel that the inclusion of so many minerals in a book of this size has stolen space from the more important gems, which might have been covered in more detail. However, the amateur mineralogist and the dealer in all types of gem minerals will undoubtedly welcome the concise descriptions of the seldom-seen gems.

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(Continued from last issue)

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(To be continued)