# Gems & Gemology

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*In This Issue:* *Page*



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# GEMOLOGY FROM A GEOLOGIST'S POINT OF VIEW*

*An address to Third Conclave, Eastern Division of the American Gem Society, Newark, N. J., March 11, 1940*

*by*

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As Dr. Foshag states in his very readable book, "Gems and Gem Minerals" (Smithsonian Scientific Series, vol. 3, p. 169): "Gems may be interesting for beauty alone, but to understand the sources of this beauty and know the romance of their history is to increase their enchantment manyfold. Even the business of their winning is not without its fascination."

One of the many pleasures I have derived from my association with the New Jersey Study Group of the American Gem Society in the past two years has been the keen interest taken by the members in what may be called the geological or mineralogical approach to gems, as well as in their properties in the cut form. In partial return for the valuable knowledge which I as a geologist have received by exposure to the Certified Gemologists' and Registered Jewelers' points of view, I propose in these brief remarks to call attention to the opportunities for field study, collection, and use of *local* gem materials. Admittedly the possibilities offered by New Jersey and adjacent states are limited in respect to the natural occurrence of valuable stones, but sufficient semi-precious and ornamental stones are available to enable one to explore a field which the geologist likes to regard as complementary to the science of gemology.

In thus "lobbying for my hobby," you will discern, but can hardly protest, a desire on my part to advertise mineralogical field work on such source materials as are available to this and other Study Groups. In dealing with college students, we in the geological teaching profession find such field work one of the most popular appeals of our science, providing an educational experience of as great value as that derived in the laboratory by using the aesthetic interest of students in gems as a cultural phase of mineralogy to get across fundamental optical and crystallographic concepts.

Mr. Shipley, in the course which you have studied, or are studying, emphasizes the knowledge and display of rough minerals as "sales tools." The argument becomes all the more cogent, I believe, if material of *local* derivation, however meager, is used to stimulate interest in gems generally and also in that qualification of gem stones which is called geographic fashionability.

Apropos of advertising, all of us have noted the current national campaign in non-scientific periodicals in connection with the diamond. The advertising possibilities have hardly been probed, I surmise, for gems in general—those miracles of nature which at once merit and exhaust the poet's superlatives. I leave to your imagination what a good Hollywoodian publicity man could do in this field if given a free hand—in what salacious terms he could portray beautiful (crystal) faces, symmetrical (interference) figures and so

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forth! I pass this suggestion on to the Advertising Committee without charge.

I wish to emphasize the unique opportunities which the general area in which we meet offers to students of gems in furtherance of my suggested extension of their activities, by way of museum collections of uncut and cut gem stones and also in the presence of enthusiastic mineralogical clubs such as those of Plainfield, N. J., and of New York and Philadelphia. Such opportunities are known to the older men in the New Jersey Study Group, but I find that some of the beginners are unaware of their existence. In particular, I feel that participation by gemologists in the meetings and field trips of such mineralogical clubs would be of mutual benefit.

With the beginners again especially in mind (and as a hint to other Study Groups) I have compiled a partial list of books on mineralogical localities within striking distance of Newark. These are available in most of the public libraries and will serve as a guide to the local field work that I recommend. This bibliography could be greatly expanded, but the list presented will open up further channels. I also present for your inspection a display of uncut and cut material from nearby sources.

Through Manchester's valuable work on "The Minerals of New York City and its Environs," or by field trips, we are, or can be, familiar with the occurrence of such gems, semiprecious and ornamental stones as the following within a radius of 50 miles from New York City:

*Manhattan Island:*
- Golden Beryl
- Aquamarine
- Brown Tourmaline
- Spessartite Garnet
- Smoky Quartz

*West Paterson, N. J.:*
- Prehnite
- Amethyst
- Datolite
- Agate

*Bedford, N. Y.:*
- Citrine
- Rose Quartz

*Valhalla, N. Y.:*
- Amazonstone
- Peristerite (Albite)

*Franklin, N. J.:*
- Fowlerite (Rhodonite)
- Leucophoenicite
- Willemite, etc.

*Montville, N. J.:*
- Serpentine

To mention only a few, in my observation the semiprecious stone possibilities, both for display and cutting, of such abundant New Jersey minerals as prehnite, and many of the colored minerals from the unique Franklin locality have scarcely been scratched.

In view of the fortunate presence of Dr. Samuel G. Gordon among us this evening, I shall refrain from mentioning the potentialities of Pennsylvania in respect to my suggestion, and will refer those interested either to that gentleman himself or to his comprehensive work on "The Mineralogy of Pennsylvania."

For Connecticut, whose pegmatite minerals are well known, "The Minerals of Connecticut," by Dr. Schairer is an indispensable guidebook to the student interested in field localities.

More generally, the late Dr. Kunz's "Gems and Precious Stones of North America" (1892), although somewhat out-of-date, will reveal that in few localities is it impossible to cultivate the interest which I am advocating.

I do not wish to give the impression, of course, that merely casual examination of any mineralogical locality will yield valuable specimens useful for display. Rarity is as much a yardstick in our evaluation of gems as of metals. The search, however, like fishing, has certain rewards other than "big ones." The technique of exploration and explanation of the occurrence of semiprecious stones is the same as for precious stones; monetary returns are not as large, but intellectual rewards are equally great.

It may seem a narrow provincialism on my part to recommend the boosting of rough and cut stones from one's native heath when most of you are daily concerned with precious stones whose appeal is universal. The popularity of certain domestic semiprecious stones in such states as California and Maine, however, emboldens me to suggest that many others, if properly exploited, will have a peculiar appeal to the clientele of the district in which is the source.

In conclusion, let me state my opinion that the movement which the American Gem Society and the Gemological Institute of America represent is a most commendable one in regard to both methods and purpose. As a geologist, in urging a still closer contact of the relatively youthful science of gemology with the parent science of mineralogy (and particularly field mineralogy), I feel that this does not represent a diffusion of interest but rather a reasonable broadening of focus on the part of gemologists.

## Reference Works on Gems for Collectors in New Jersey and Neighboring States

"The Minerals of New York City and Its Environs," James G. Manchester. New York Mineralogical Club Bulletin, Vol. 3, No. 1, 1931.

"The Collection of Minerals," Herbert P. Whitlock. Amer. Museum of Natural History, N. Y. Guide Leaflet No. 49, 1930.

"Geology of the City of New York," L. P. Gratacap (Holt & Co.), 1909.

"Crystal Cavities of the New Jersey Zeolite Region," Waldemar T. Schaller, U. S. Geological Survey Bulletin 832, 1932.

"The Minerals of Franklin and Sterling Hill, Sussex County, N. J.," C. Palache. U. S. Geological Survey Prof. Paper 180, 1935.

"The Geology of New Jersey," J. F. Lewis and H. B. Kummel. New Jersey Geological Survey Bull. 14, 1915.

"The Mineralogy of Pennsylvania," Samuel G. Gordon. Philadelphia Academy of Natural Science Special Publication No. 1, 1922.

"The Minerals of Connecticut," J. F. Schairer, Connecticut Geological and Natural History Survey Bull. No. 51, 1931.

"Gems and Precious Stones of North America," G. F. Kunz. (Scientific Publishing Co., New York), 1892.

# Differences Between Burma and Siam Rubies*

*by*
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*Lucerne, Switzerland*

It is generally known that most rubies in the trade come from Burma and Siam. There is a considerable difference in price between the two, caused by the less pleasing color of the ruby from Siam, which latter usually is brownish orange and of lower intensity. While the distinct difference of color allows a good discrimination between both sources, the microscopic research permits a more objective examination and shows a clear distinction between the rubies from the two sources. The microscope helps towards a very accurate analysis of inclusions which are different in the rubies from Burma than those in the rubies from Siam, as shown by the accompanying photomicrographs.

Such photomicrographs can be taken by any gemologist who commands a microscope and a special camera (as described by Mr. Shipley in *Gems & Gemology*, Fall, 1939), wherewith he can thus produce indisputable proof of the provenience of the ruby tested.

Unfortunately I had not enough material from Ceylon on hand, but in the few specimens which I had examined I was able to notice the same peculiarities as in Burma rubies. However, as long as I do not dispose of sufficient material I do not wish to pronounce any statement concerning the rubies from Ceylon.

Already, about the middle of the past century, the manifold inclusions within the rubies aroused great interest among experts and an interesting literature began to pile up.

In 1882 the various inclusions of rubies were analyzed by W. Prinz,[1] who wrote that large inclusions of fluids are always absent in rubies and that even small liquid inclusions are more rare than in sapphires. He observed that flaws in rubies are more individualistic than those in sapphires and that the fluids within the canals of rubies (as far as it could be concluded by the expansion of these fluids when the stones were heated were never water or watery acids, but rather liquid $H_2CO_3$. W. Prinz also perceived the various solid inclusions and described them as small tetragonal needles and small hexagonal slabs. Obviously he did not know where his material came from, and, therefore, he does not mention any means whereby to discriminate the sources of rubies.

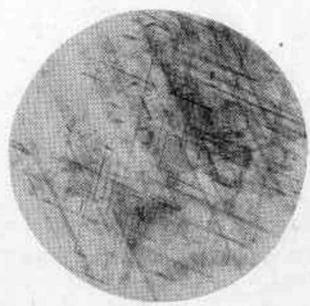

*Figure 1*
*Rutile Needles in Burma Ruby.*

It is the merit of G. von Tschermak[2] to first have determined the

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small and hairlike needles (not the "silk") to be rutiles and to have this made known.

It is this kind of inclusion which is of greatest interest when distinguishing between Siam and Burma rubies. Burma rubies, larger stones in particular, reveal systems of long and hair-thin needles of rutiles which are following certain and determined directions of the crystal-structure, i.e., cutting one another at angles of 60° respectively 120°. This is to be observed when looking

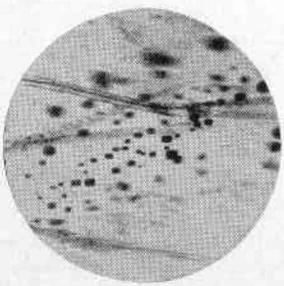

*Figure 2*
*Inclusions in Burma Ruby.*

in the direction of the optic axis. Thus, these rutiles are oriented after the hexagonal habit of ruby. It was impossible for me to determine whether the rutiles in the cut material which was at my disposal were lying parallel to the edges of (0001): (1120) (Lasaulx[3] mentions this phenomenon to be typical for rubies from Ceylon) or parallel to the edges of (0001):(1011) (as is the case in rubies from Miask also described by Lasaulx). Since both are very important faces of the hexagonal habit and moreover essentially divisional planes, which particularly favor the formation of inclusions, the imbedding of rutiles is but natural.

The orientation of these rutile-needles is the same, always and throughout the entire stone, and even twins, that occur quite often are pierced by the needles in the same direction. It is but natural that the angles change if the stone is observed in another direction. Yet, it is to be noticed that the needles are lying parallel to the basis of the crystal, i.e., perpendicular to the optic axis. On the other hand, this knowledge helps to find the direction of the optic axis. Figure 1 shows a system of rutile-needles as mentioned.

The refractive index of these formations is so high that they appear black by transmitted light.

Besides these most subtle and silky crystals larger inclusions of rutiles may be found which allow the crystal-form of the prism to be noticed as well as the combination of one prism, which is horizontally striped, with one of the pyramids. This is shown by Figure 2.

Cavities in the shape of irregularly curved pipes are more seldom, but they do occur. Sometimes they seem to be filled with fluid and sometimes they contain a gas bubble in the middle, which moves like a water-level when the stone is inclined to either side. The refractive index of these inclusions is lower than that of the ruby, which causes them to be almost invisible.

As a contrast to the above-mentioned inclusions in Burma rubies most quaint formations will be observed in rubies from Siam, whereas inclusions typical for the rubies from Burma are absolutely absent here. The principal inclusions in Siam rubies are *large systems* of thinnest and finest cavities and swarms of very small and *thin slabs with hexagonal shapes.* The latter ones are lying parallel to and above one another, and canals of larger and smaller sizes are meandering between them. See Figures 3 and 4.

The refractive index of the liquid inclusions is lower than the one of the ruby as well as of the included slabs, which, after all symptoms, and since their R. I. is equal to the one of ruby, are in my opinion also small crystallizations of ruby. These formations either had the shape of negative crystals right from the beginning (while the ruby was growing) or later crystallization took place forming parallel oriented crystals which are regularly shaped in the center of the formations whilst the rims show irregular forms. It can be noticed that round and strongly encircled bubbles, which are filled with gas or another nonmiscible fluid, are always lying in

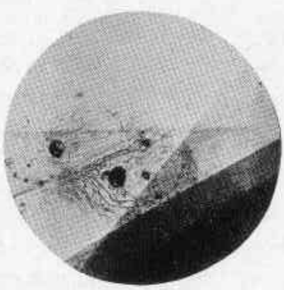

*Figure 3*
*Hexagonal Inclusions in Siam Ruby.*

the vicinity of the fine canals previously mentioned. (Figure 3.)

No inclusions of this kind were ever observed in rubies from Burma, and rutiles are never found in rubies from Siam. In addition, it must be mentioned that rubies from Siam show a great number of liquid inclusions which are oriented in rows forming flag-like systems. (Figure 5.)

It seems to be a fact that the rubies from Siam are often twinned, thus forming very thin and numerous laminae. Obviously this phenomenon as well as the different types of inclusions in Burma and Siam rubies must be brought in connection with the genesis of the rubies of the two sources whose rocks differ in their order and chemical composition and paragenesis. Vide Stutzer-Eppler.[4]

These are my observations concerning microscopic characteristics of both Burma and Siam rubies by means of which any gemologist may be able to prove his assertion on their respective origins.

G. von Tschermak[2] described rubies from Ceylon, containing inclusions of rutile, which seem to exhibit the same properties as the rubies from Burma. He mentions colorless inclusions that were lying parallel to the hexagonal faces of the crystal-form and in addition to them very fine nets of brown, most thin and silk-like needles also oriented perpendicularly to the optic axis. I am not able to prove these observations, since I had not enough Ceylon rubies on hand.

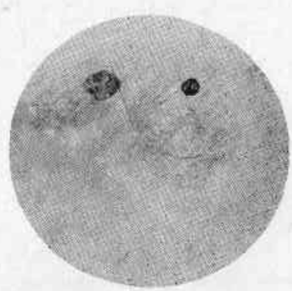

*Figure 4*
*Inclusions in Siam Ruby.*

It may be interesting to add a short discussion on the subject of coloring elements. The difference of color is likely to originate from an intermixture of iron in Siam rubies which seems to be entirely absent in beautiful, purely red rubies from Burma. Here chromium principally accounts for the color. The manufacturing of synthetic rubies at least yielded the experience that the material in the *statu nascendi* must be absolutely free of iron in order to avoid the brownish orange color which is characteristic for Siam rubies. By an admixture of chromium alone the beautiful, vivid red color of Burma rubies can be attained.

The difference of coloring matter is clearly manifested by the luminescence under ultra-violet rays. While Burma rubies radiate a strong and glowing red fluorescence, Siam rubies appear darker and their fluorescence light is of dull gray-red. Yet, the distinction of this phenomenon changes within wide spaces and needs the sensitive eye of an experienced expert.

The dichroism differs also. Burma rubies display red and yellowish red, Siam rubies more brownish tints.

It is to be expected that more complete researches on the subject of the luminescence-light under various kinds of rays (short and long waves) may lead to even more exact means of distinction. However, the microscopic analysis is the surest and, above all, the easiest and most advantageous to arrive at conclusions and to convince.

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[1]Annal. de la Soc. Belge de Microscopie, 1882.

[2]Mineralog. Mitt. 1878.

[3]Annal. de la Soc. Belge de Microscopie, 1885.

[4]Lagerstatten der Edelsteine und Schmucksteine, Berlin, 1935.

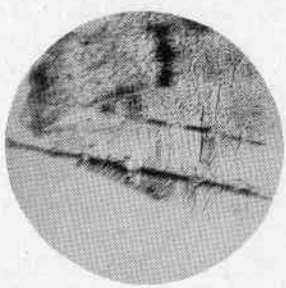

*Figure 5*
*Liquid Inclusions in Siam Ruby.*

# BOOK REVIEWS

***"Refining Precious Metal Wastes,"* by C. M. Hoke, published by the Metalurgical Publishing Co., New York, $5. (May be obtained from G.I.A. Book Dept.)**

Miss Hoke, of the Jewelers Technical Advice Co., is well known to many jewelers of the United States. In this text she calls upon her long experience in the refining of precious metals to prepare a book of the highest possible practical value. Though the book is primarily concerned with the refining of precious metals in the average good-sized jewelry store, it covers also the saving of precious metal particles, the working of precious metals including melting and casting, hazards incident to refining, and the prevention of accidents, including much information from the National Safety Council.

Laws and recommendations concerning precious metals and jewelry are covered in detail with the Federal Trade Commission rulings on this subject being largely drawn upon.

The book closes with a list of dealers from whom equipment for refining and processing metals may be secured and also of those who buy precious metals. Following this is a very comprehensive bibliography on the subject of precious metals and an index which, in our limited use of the book, has proved quite adequate.

The book is not entirely well planned, and in some places is rather difficult to follow clearly. For instance, many chapters have at their end a list of questions and answers containing much valuable information which would be much better included at its proper place in the text.

However, despite this rather minor objection the text is very clearly written and constitutes almost a laboratory syllabus for a course in refining precious metals. The jeweler who can afford the time and expense to carry out the processes described in detail would gain much first-hand information on refining which would undoubtedly serve him in good stead in a business way.

Though not of such direct practical value to the jeweler, the chapters on the processes used by certain large refiners and certain mines are particularly interesting. In these chapters are covered the purification of raw gold at the Homestake mine, the refining of precious metal at the Rariton Copper Works and bullion refining at the United States Assay Office in New York City.

***"The Book of Diamonds,"* by Willard Hershey, published by the Hearthside Press, division of the Chemical Publishing Co., New York. $2.00.**

It is our understanding that this book (which claims to cover "Diamonds, including their qualities, lore, properties, tests for genuineness, and synthetic manufacture"), has been withdrawn from publication. There is certainly ample reason for its being withdrawn, though surely the jewelry trade would have little to fear from its release. In it Doctor Hershey reveals himself as a rambling and erratic writer. He repeats, and in many cases even contradicts, himself. The book abounds in the most fantastic of errors and for this reason, at least, should prove of interest to the jeweler who has studied the diamond thoroughly. Many of the errors are so ridiculous as to be quite amusing.

To give just a few: Doctor Hershey informs his reader that "the topaz . . . is identical with the ruby and sapphire in everything but color . . .", that "Graphite and diamond pass insensibly into one another" and "that any diamond in the rough is full of imperfections."

In his description of the important diamonds of the world, Doctor Hershey very peculiarly lists the "Austrian Yellow" Diamond as an entirely separate stone from the Florentine. Also, under the headings of the Orloff Diamond and the mythical diamond known as the "Moon of the Mountains," Doctor Hershey becomes very involved with Catherine the Great of Russia, the Armenian merchant Shafrass, and Prince Gregory Orloff.

One is forced to conclude from these errors that the book was given little thought in preparation and received but the most superficial sort of a proofreading.

The chapter on the synthesis of diamond is, of course, of particular interest to the gemologist. However, it contains little of value, since it simply repeats previous reports as to accounts of synthesis, including those of Doctor Hershey. However, it indicates that there is still no doubt in Doctor Hershey's mind that he has synthesized diamonds, even though certain of the statements—especially one relating to the specific gravity of methylene iodide—indicates that Doctor Hershey has taken heed of certain of the corrections which appeared in the article in *Gems & Gemology* for Winter, 1938.

# GEMOLOGICAL GLOSSARY

*(Continued from last issue)*

*(With phonetic pronunciation system.)*

***Terms in quotation marks are considered incorrect.***

Semitranslucent. A class of diaphaneity between translucent and opaque. Passes little light through thick sections.

Semitransparent. A class of diaphaneity between transparent and translucent. Objects may be seen, but imperfectly, through thick sections of semitransparent material, and seen quite clearly through thin sections.

Semiturquoise. Soft pale-blue turquoise.

Sepiolite (see'pi-oe-lite"). A mineral species; white to gray or light yellow; opaque; hardness, 2-2½; refractive index, 1.52; specific gravity 2.0. Used as an ornamental material, especially for fine pipes, cigar and cigarette holders, etc.

Serpentine (sur'pen-tin or tine). A mineral of occasional use as gem or ornamental material. Translucent to opaque, brown, green, yellow, to white. Hardness 2½ to 6, refractive index 1.50-1.55, specific gravity 2.6.

Sequoia (see-kwoi'a). A genus of conifer forming one of several links between the firs and the cypresses. Named in honor of Sequoyah, who invented the Cherokee alphabet.

Shade (shade). Usually refers to dark tone in a color. Sometimes used as synonymous with hue. See *Tone, Hue.*

Shale (shale). A fine-grained sedimentary rock, formed from beds of clay, mud, or silt.

Sharps (sharps). Thin, knife-edged pieces of diamond crystal.

Sheen (shene'). A term rarely used to refer to orient in a pearl. See *Orient.*

Sherry Topaz (sher'i). Sherry-colored topaz.

Shining. Producing an image by reflection, but one not well defined.

Shot Bort. Spheres of translucent diamond with more cohesion than ordinary bort. Used for rock drilling. See also *Ballas.*

Siam Ruby (sye-am' or see"am'). Dark, somewhat garnet-colored ruby usually found in Siam. Also ruby of this color grade, whatever its source.

"Siamese Aquamarine" (sye"a-meze' or mese'). Blue zircon.

Siberian Amethyst (sye-bee'ri-an). Rich or dark-colored amethyst, often reddish purple.

Siberian Aquamarine. Very light greenish blue beryl.

"Siberian Chrysolite." Demantoid garnet.

"Siberian Ruby." Red tourmaline.

Siberian Topaz. Very light-blue topaz.

Siberite (sye-bee'rite). Violet-red tourmaline.

Sicilian Amber (si-sil'i-an). Simetite.

Siderite (sid'er-ite). A translucent blue variety of quartz.

Sight. The opportunity afforded buyers by the Diamond Trading Company (formerly by the Syndicate) to inspect parcels of rough diamonds offered for sale.

Silica (sil'i-ka). A white or colorless, extremely hard, crystalline silicon dioxide, found pure as quartz, or opal, in many rocks and sands, and combined with various bases in all the silicate minerals.

Silicate (sil'i-kate). Any mineral or rock of which silica is an important constituent.

Siliceous (si-lish'us). Of, pertaining to, or containing silica.

Silicified (si-lis'i-fide). Converted into quartz.

Silk. White, glistening streaks (inclusions) in certain gems, especially ruby.

Silky. A luster suggesting silk, as in tiger-eye.

Sillimanite (sil'i-mane-ite). A rather rare gem mineral. Aluminum silicate, orthorhombic system. Refractive index 1.66-1.68, specific gravity 3.24, hardness 6-7. White to brownish green, resembling jade. *Fibrolite* is a transparent blue variety. *Fibrolite Cat s-Eye* is grayish green.

Silt. A fine-grained, uncemented alluvial deposit.

Silver Cape. Diamond with slight tinge of yellow. Same as Top Cape.

Simetite (sim'e-tite). Amber from the waters off Sicily. Red to orange yellow or brown, usually darker than succinite. Also yellowish green, due to fluorescence.

"Simulated Stones." Term applied to manufactured stones.

Single Cut. A brilliant form cut with but eighteen facets.

Single Refraction. When a ray of light enters a crystal of the isometric system, or an amorphous substance, it is refracted in the normal manner; this is single refraction. See also Double Refraction.

Sinople (sin'oe-p'l). Quartz having red hematite inclusions.

Skeleton Crystals. Those with edges defined, but with faces not fully filled in, as crystals of ice on window panes.

Skief (skeef). The cast-iron disc on which diamonds are cut and polished.

Skin. As applied to pearls, the outer layer of nacre.

Skinning. Same as peeling. (Pearls.)

Skip. A bucket used for hoisting ore, etc., in narrow or inclined mine shafts.

Slate. A dense metamorphic rock that splits readily into broad, thin sheets.

"Slave's Diamond." Colorless topaz.

Slitting. Making a saw cut part way into a mineral so that by wedging pressure it can be cleaved or fractured prior to further fashioning.

Slugs. Nacreous excrescence; irregularly shaped pearly masses from fresh-water shells.

Smaragd or Smaragde (smar'agd). Emerald. (German.)

Smaragdine (sma-rag'din). Of or pertaining to emerald. (Obsolete or rare.)

Smaragdite (sma-rag'dite). A light-green mineral, the Verde di Corsica Duro of the arts.

Smaragdolin (sma-rag'doe-lin). Trade name of emerald-green variety of beryllium glass, sometimes sold as a "Reconstructed Emerald" or "Synthetic Emerald."

Smaragdus (smar'agd-us). (Latin.) Ancient name for emerald and other green stones.

Smithsonite (smith'sun-ite). A light-green to blue or yellow carbonate of zinc, of occasional use as a gem. Hexagonal system. Translucent to opaque. Refractive index 1.62-1.85, specific gravity 4.3, hardness 4½-5.

Smoky Quartz. Yellow to yellow-brown or grayish brown variety of quartz. Often slightly cloudy.

Smoky Topaz. True topaz of smoky color.

"Smoky Topaz." Smoky quartz.

Soapstone. Steatite.

Sodalite (soe'da-lite). A mineral of limited use as a gem, chiefly a substitute for lapis. Refractive index 1.49, specific gravity 2.24, hardness 5½-6.

Soda-jadeite. Synonym for jadeite. See Diopside. Jadeite.

Soldered Emerald (sod'erd). Same as Emerald Triplet.

Soldier's Stone. Amethyst.

Solidification (so-lid"i-fi-kae'shun). The process of changing from a liquid or gas to a solid, as, for instance, the solidification of molten alumina to solid in the synthesis of corundum.

"Soochow Jade" (soo"choe'). Term applied to a combination of jade and quartz and also to serpentine and even to dyed soapstone.

Sorters. Men employed at the South African diamond mines to sort diamonds from the final concentrates, or to sort the diamonds into the desired parcels.

"South African Jade." Green grossularite (garnet).

Space Lattice. See Lattice.

Spandite (span'dite). The term spessart-andradite, contracted to spandite, is applied to garnets intermediate in chemical composition between spessartite and andradite.

Spanish Emerald. Emerald of the finest quality (presumably from South America).

"Spanish Lazulite." Cordierite.

"Spanish Topaz." Smoky quartz changed to yellow by heat.

Spar. Miners' term applied to such minerals as calcite and fluorite; lense calc spar, fluor spar.

Species (spee'shees). A mineralogical division. All the varieties in a species have the same basic properties such as refractive index, specific gravity, and hardness; but they may vary widely in form, color, and transparency. See also *Variety*.

Specific Gravity (spe-sif'ik). Relative weight of a given specimen as compared with an equal volume of distilled water at 4° C.

Spectra (spek'tra). Plural of Spectrum.

Spectrometer (spec-trom'ee-ter). A form of spectroscope with scales for reading angles, etc.

Spectroscope (spec'troe-skope). An optical instrument for forming and examining spectra.

Spectrum (spek'trum). An image formed when a beam of light is subjected to dispersion as by a prism, so that its rays are arranged in a series in the order of their wave length.

Spessart-andradite. See Spandite.

Spessartite (spes'ar-tite). One of the species in the garnet group. Silicate of manganese aluminum. Transparent, orange-red to brownish red. Refractive index 1.80, specific gravity 4.15, hardness 7¼.

Sphene (sfene). A yellow to green, brown, or gray, transparent gem mineral. Silica-titanite of calcium, monoclinic system. Refractive index 1.90-2.03, specific gravity 3.4, hardness 5-5½.

Spherical Aberration (sfer'i-kal). See Aberration.

Spherulite (sfer'oo-lite). A spherical crystalline body having a radiated structure, in some vitreous volcanic rocks, as obsidian and perlite. It is commonly an intergrowth of quartz and feldspar.

Spinach Jade (spin'aj or ech). Dark-green spinach-colored jade, usually nephrite. Least valuable of green-colored jades.

Spinel (spin'el or spi-nel'). A gem species of the isometric system. A magnesium aluminate. Transparent red, orange, yellow, blue, violet, and purple. Rarely green or colorless. Refractive index 1.72, specific gravity 3.6, hardness 8.

"Spinel Ruby." Red Spinel.

"Spinel Sapphire." Blue Spinel.

Splendent. Very bright by reflected light.

Splintery Fracture. Breaking into elongated splinter-like fragments.

Splints. Sharp-pointed splinters of rough diamond or cleavages less than one carat.

Spodumene (spod'ue-mene). A gem species occurring in transparent red, purple, yellow, green, and colorless varieties. Monoclinic system, a silicate of lithium and aluminum. Refractive index 1.66-1.68, specific gravity 3.16, hardness 6-7.

Spread Brilliant. A brilliant too wide in proportion to its depth.

Square Cut. A form of step cut in which the girdle outline and the table are square.

Square Method. A method of computing the value of pearls. See Base.

Stained Stone. A gem the color of which has been altered by staining or dyeing. See also Altered Stones.

Staining. The alteration of the color of gems by staining or dyeing.

Stalactite (sta-lak'tite). An inverted conical formation, attached to the roof of a cave by the percolation of mineral-bearing water.

Stalagmite (sta-lag'mite). A conical or cylindrical formation on the floor of a cave, produced by the dripping of mineral-bearing water from the roof.

Stalky. Consisting of slender columns, or long, stout fibers.

Star. The appearance, in certain phenomenal gems, of two or more intersecting bands of light, resulting from corresponding sets of striae of various types.

Starolite (star'oe-lite). A trade-name for an asteriated quartz doublet showing a six-rayed star by reflected light.

Staurolite (sto'roe-lite). A mineral of the orthorhombic system. Transparent brown staurolite is fashioned as a gem stone. The cross-stone or fairy-stone variety — opaque brown to black interpenetrating twins—is used for ornament without fashioning.

Star Stone. Any gem displaying the phenomenon of a star.

Star Ruby. Ruby displaying a star.

Star Sapphire. Sapphire (usually gray or blue) displaying a star.

"Star Topaz." Asteriated yellow corundum. ("Oriental topaz.")

Steatite (stee'a-tite). A soft (1-1½) mineral occasionally used for ornamental purposes because it is so easily fashioned. Gray to grayish green, but may be dyed any color.

Steinheilite. Cordierite.

*(To be continued)*

# A GEMOLOGICAL ENCYCLOPEDIA

*(Continued from last issue)*

*by* HENRY E. BRIGGS, Ph.D.

## QUARTZ (Continued)

Quartz is optically positive and is uniaxial. The mean index of refraction is 1.55 and the dispersion .013, both relatively low and consequently colorless quartz gems are lacking in brilliancy and fire. Quartz is optically active, that is, it will rotate the plane of polarized light as mentioned above.

In composition, quartz is comparatively simple, being silicon dioxide $SiO_2$. It is found in a very pure state occasionally, but usually it is contaminated with various impurities. It is found pseudomorphous after many things, such as wood, shells, bones, etc. It is itself often replaced by other minerals.

### Crystalline Varieties

Rock crystal is the most common of the crystalline varieties. It is pure quartz of water transparency. It is usually cut into ornamental objects such as balls, vases, ash trays, etc., but also is occasionally cut into gems and sold as "Mexican Diamond," "Lake George Diamond," "Hot Springs Diamond," etc. Also, rock crystal has met with considerable favor in the form of faceted beads. However, much of the goods offered as rock crystal in beads are nothing more than glass. The principal localities for rock crystal are Japan, Madagascar, Brazil, Arkansas, Switzerland, and Canada. However, rock crystal is so widely distributed that fine samples may be found in almost every land.

Amethyst, the purple or violet variety of crystalline quartz, is remarkable for its occurrence in well-defined crystals. The color varies in density from a mere tint to a deep purple. The deep purple (the rich "royal purple") is the most valuable and also the rarest. The color in amethyst is usually very uneven and streaked. This condition may sometimes be altered by heat treatment at from 375° to 450° centigrade. However, such gems, of course, loose much of their value to the true gem lover, for any altered gem is valued less than the natural by a connoisseur. It is a difficult matter to detect gems which have been altered in this way; hence, if a slight unevenness of color can be detected in a gem, it indicates that the stone has not been altered and no great doubt can be cast upon it.

Some amethysts will become yellow to colorless when so treated, but the temperature will doubtless have to be raised 50 to 100 degrees over the point given above. Much of the so-called "topaz" is made by heat treatment of amethyst. The color of this gem is probably due to iron or to iron and manganese.

The amethyst is dichroic, although some samples are weak in dichroism. However, the darker specimens nearly always show this property plainly. The twin colors are reddish purple and violet. The principal localities for amethyst are: Uruguay, the Ural mountains, Brazil, Ceylon, Mexico, Madagascar, Persia, North Carolina, the Lake Superior district, New York, California, and Maine.

Siderite is the name given to a rare variety of quartz having a blue color similar to that of sapphire. This also is called "sapphire quartz." It is exceedingly rare and is seldom met with on the market. The color varies from a light shade to a deep Berlin blue. A few fine crystals are coming onto the market from Brazil, but the supply is meager and very unsteady.

Smoky Quartz is a variety with a smoky yellowish to smoky brownish color, and sometimes the color is so deep as to appear black in reflected light. This variety is slightly dichroic and is offered under a host of names which tend to make the gem appear more valuable, such as: "Scotch Topaz," "Colorado Diamond" and "Radium Diamond." The color is likely due to the action of radium or radio-active waters; however, some samples show the color to be due to iron and other impurities. The dark brown pieces will usually change to a golden yellow color when subjected to heat treatment. The treating of certain of this material yields a large percentage of the materials offered by the jewelry trade as "topaz." The color of all smoky quartz is very unstable and all the shades will alter with heat treatment, although some of them will become colorless. Principal localities for smoky quartz are: Scotland, Ceylon, Alps, Colorado, Maine, Montana.

Citrine is the name applied to yellow crystalline quartz. Much of the citrine of commerce is made from amethyst and smoky quartz by heat treatment. It does occur in nature, however, the principal locality being Brazil, although some small quantities are found in the south-central states. The color of citrine is due to iron and the mineral is slightly dichroic.

Milky Quartz is the name applied to whitish opaque varieties of this mineral. It is seldom cut into gems unless it is gold bearing. Occasionally gold quartz is offered in cabochons, pendants, etc. The principal localities for such material are California, Colorado and Alaska.

Rutilated Quartz, also known as Thetis Hairstone, is merely rock crystal which has inclusions of needle-like crystals of rutile. Many other minerals occur in quartz in the same manner and the gems cut from these materials are sold under a host of names. The principal localities for rutilated quartz are: Brazil, Madagascar, North Carolina, Montana and Russia.

Rose Quartz is a massive rose-pink variety, sometimes tinged with violet. It is slightly dichroic and will vary from semi-transparent to translucent. The color is undoubtedly due to manganese. Often it is found to be opalescent or asteriated. It is cut cabochon style usually and sold, as are most of the quartz group, under a great many deceptive names. The principal localities are Japan, Brazil, France, Maine, South Dakota, California, and Montana.

*(To be continued)*