THE CAUSES OF COLOR, "FIRE," AND OTHER GEM QUALITIES

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Man's first interest in gems arises from their beauty. Other important factors are durability, scarcity, and the dictates of oft-changing fashion.

The essential attributes of beauty in gems are color, brilliancy, luster, dispersion, transparency and, in a limited number, the phenomena of chatoyancy and asterism.

Color is accidental in many minerals, resulting from the presence of a small percentage of a foreign substance which serves as pigment. Examples of this type are: emerald, aquamarine, ruby, sapphire, topaz, tourmaline, amethyst, and rose quartz. The pigments are not integral parts of the chemical composition of these gems. In emerald, for instance, the coloring is a small amount of an oxide of chromium, distributed in very finely divided state, in the beryl crystal. The amount and uniformity of distribution of the oxide determines the quality of the green color. A stone in which the tone and intensity of the color are considered perfect, and without flaws, is very rare indeed. This is equally true of ruby and of blue sapphire.

In turquois, lapis lazuli, jade, rhodonite, and malachite, on the other hand, the colors are due to an element in each stone which constitutes an essential part of its chemical composition.

The great variety of deep rich colors in opals is produced by interference of light. In this gem the structure is such that some of the component colors of the white light which enters it are destroyed. The result is that the light from the stone which reaches the eye of an observer is the combined effect of the remaining colors.

THE SPARKLE OF DIAMONDS

The principal factor of beauty in all of the gems mentioned above is color. In these varieties brilliancy and luster are unimportant. Diamond, however, possesses these two qualities to a marked degree, and they, together with the property of strong dispersion, are the reasons for its beauty. Brilliancy and a striking luster are attributes of diamond because it possesses the property of affecting a pronounced retardation in the velocity of light. Dispersion is the property of separating white light into its component colors. A strong beam of white light passing through a prism will be thus dispersed. Dispersion in diamond is very strong and it is this property which produces the flashes of color called "fire." Along with these fascinating optical properties, diamond is the hardest of all known minerals.

Other gems which possess optical properties similar to diamond are demantoid garnet, sphene, and zircon. These, however, are much lower in the scale of hardness, and are therefore less durable.

Chatoyancy is an optical phenomenon which results from a very finely fibrous structure or from an inclusion of parallel striae. The minerals which best exhibit this property are *tiger-eye* (quartz) and *cat's eye* (chrysoberyl). When a mineral of this type is cut cabochon (i.e., with a high convex surface), a well defined, narrow band results from a concentration of reflected and diffracted light from the interior of the stone. The band lies perpendicular to the aggregate of fine fibers in the *tiger-eye* and the striae in the *cat's-eye*, and moves appreciably when the position of the stone is changed with reference to the light source.

"STAR" GEMS

The phenomenon of asterism is closely related to chatoyancy. Instead of one chatoyant band, as in the cat's-eye, there are in star sapphire, star ruby, and star quartz three chatoyant bands which intersect at angles of sixty degrees, thus producing a "six-rayed star." Asterism in garnet is most facinating. Two types of "four-rayed stars" and two types of "six-rayed stars" have been found on crystals of this mineral occurring in different localities. In the gem room of Field Museum there are two garnet spheres, each of which shows several "four-rayed stars." Each is formed by the intersection of two chatoyant bands. Two of the angles in each star are 109° 28′, and two are 70° 32′.

Beauty in all stones is brought out by proper cutting and polishing.

Most gems are minerals, and hence occur as constituents of rock formations. Exceptions are pearl, coral, amber, and jet—these are from organic sources and are not classified as minerals.

Some minerals form a great many varieties of gems—for example, beryl occurs as emerald, aquamarine, golden beryl, morganite, heliodor, davidsonite, and sixteen other varieties. The chemical composition and crystal structure are the same for all. Each of these beryl gems is recognized by its color, and the quality of color. Ruby, blue sapphire, green sapphire, amethyst sapphire, yellow sapphire, and thirty-five or more other sapphires are all varieties of the mineral corundum. Topaz not only occurs in several tones of yellow, but also of blue. It is inherently clear, transparent and colorless.

GEM VARIETIES OF QUARTZ

Quartz affords an excellent example of a mineral which occurs in many gem varieties. "Crystal" is the term generally used to designate the transparent, clear, colorless variety. Other varieties of this mineral are amethyst, citrine, rose quartz, smoky quartz, milky quartz, siderite, aventurine, and *tiger-eye*.

The above are crystalline varieties There is also a group of varieties of quart classified as cryptocrystalline. These con sist of heterogeneous aggregates of micro scopic crystal particles and fibers. Som of the better known of these varieties ar chalcedony, carnelian, sard, sardonyx, chrys oprase, heliotrope or bloodstone, and th many forms of agates. An excellent assort ment of gem varieties of quartz is exhibite in Case 13 of Stanley Field Hall.

Between seventy and seventy-five minera species occur in one or more varieties o gem quality. Many of these are not widel known and receive little attention in adver tising literature. Some are very rare Benitoite, for example, a beautiful blu stone, resembling blue sapphire, has bee found only in San Benito County, California

The gem varieties of all minerals, wit the exception of quartz, are limited i quantity. Specimens of gem quality ar found in comparatively few of the man mineral localities of the world.

Trustee Joseph Nash Field Called to Duty as Naval Officer

Mr. Joseph Nash Field, a member of th Board of Trustees of Field Museum, wa called on May 29 to active service as a ensign in the United States Navy, and i currently assigned to duty in the Head quarters of the Ninth Naval District a Great Lakes, Illinois. Ensign Field is th son of Mr. Stanley Field, President of th Museum. He was commissioned an Ensign United States Naval Reserve, on Novembe 1, 1938. Formerly Ensign Field was con nected with Marshall Field and Company as Superintendent of Customer Service.

Quinine in Guatemala

Guatemala is ably assisting in combatin the problem of a possible shortage of supplie of the important drug quinine which migh become unavailable from its present principa source, the Dutch East Indies, in the even of unfavorable developments in the inter national situation. This is reported by Mr Paul C. Standley, Curator of the Herbarium who recently returned from a seven month expedition to that country. Quinine planta tions, operated in Guatemala by Unite States capital, have been expanded rapidl and successfully, Mr. Standley says, an will be able to produce a supply of the bes grade of quinine adequate for a large par of American medicinal and industria demands (industrially quinine is said to b used, for example, in certain steel makin processes).

Pointing to other possibilities in increasin the self-sufficiency of the western hemis phere, Mr. Standley observed further tha Guatemala is operating the only commercia tea plantation outside the Orient.

*Dr. Walcott, although not a member of the staff of Field Museum, was for some time associated with the Department of Geology in special research on gems.