Gems & Gemology

VOLUME XIX SPRING 1983

The quarterly journal of the Gemological Institute of America

SPRING 1983
Volume 19 Number 1

Gems & Gemology

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ABOUT THE COVER: Art Deco, which predominated in Europe and the United States in the 1920s and 1930s, is perhaps the most distinctive style of jewelry to have emerged in the 20th century. These two pieces–a platinum, yellow gold, diamond, and blue sapphire brooch (1⁹⁄₁₆ in. high × 1 in. wide; 3.9 cm × 2.5 cm) and diamond and onyx in platinum bar pin (2⅛ in. × ¼ in.; 5.4 cm × 0.6 cm)—illustrate the symmetry, materials commonly used, and color combinations that are among the many characteristics of Art Deco described in the article by Mark Ebert in this issue. Jewelry courtesy of Richter's of Palm Beach and Ebert-Richter. Photo © 1983 Harold and Erica Van Pelt—Photographers, Los Angeles.

Composition for Gems & Gemology *is by Printed Page Graphics, Fullerton, CA. The color separations are by Effective Graphics, Compton, CA. Printing is by Waverly Press, Easton, MD.*

 ISSN 0016-626X

Gems & Gemology

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Subscriptions in the U.S.A. are priced as follows: $22.50 for one year (4 issues), $60.00 for three years (12 issues). Subscriptions sent elsewhere are: $32.00 for one year, $85.00 for three years.

Special annual subscription rates are available for all students actively involved in a GIA program: $17.50 U.S.A., $27.00 elsewhere. Your student number *must* be listed at the time your subscription is entered.

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MANUSCRIPT SUBMISSIONS

Gems & Gemology welcomes the submission of articles on all aspects of the field. Please see the Suggestions for Authors for preparing manuscripts in the Summer 1981 issue of the journal or contact the Managing Editor for a copy. Letters on articles published in *Gems & Gemology* and other relevant matters are also welcome.

Gems & Gemology is published quarterly by the Gemological Institute of America, a nonprofit educational organization for the jewelry industry, 1660 Stewart St., Santa Monica, CA 90404.

Any opinions expressed in signed articles are understood to be the views of the authors and not of the publishers.

THE GEMS & GEMOLOGY MOST VALUABLE ARTICLE AWARD

RICHARD T. LIDDICOAT, Jr. Editor-in-Chief

Once again the ballots for the most valuable article in the 1982 issues of *Gems & Gemology* have been read and tabulated. We very much appreciate the time that our subscribers took to participate in the balloting. The comments on the ballots were particularly gratifying in their expressions of satisfaction with the journal. It is with great pleasure that I take this opportunity to compliment Alice Keller on her magnificent effort as managing editor of *Gems & Gemology*.

The winning article for 1982 was "The Jade Enigma," by Jill Hobbs, which appeared in the Spring issue. This is the second time that Ms. Hobbs has placed first in the balloting, and we congratulate her on her accomplishment. The next most appreciated article was Dr. Edward Gübelin's comprehensive discussion of "The Gemstones of Pakistan: Emerald, Ruby, and Spinel," which appeared in the Fall issue. The article that placed third also appeared in the Fall issue: "Gemological Properties of Chatham Flux-Grown Synthetic Orange Sapphire and Synthetic Blue Sapphire," by Robert E. Kane.

In recognition of their achievements, Ms. Hobbs, Dr. Gübelin, and Mr. Kane will receive cash awards of $500, $300, and $100, respectively. Brief biographies of the authors appear on the following page.

At this time, I would like to say a few words to thank our support staff of section editors, abstracters, and reviewers, whose continued commitment to—and willingness to work for—the excellence of *Gems & Gemology* is invaluable. I also wish to acknowledge those people whose names do not appear on a masthead but who were willing to take the time during the past year to help with the review process that is the backbone of the journal: Joe Borden, Edward Dominik, Bill Kerr, Jean Langenheim, Joseph Leavitt, David Morrow, and Ray Page.

One of the comments that we read most frequently on the ballots was the fine quality of the photographs published in the journal. We are fortunate that so many good photos are provided by the authors themselves, by gem photographer Tino Hammid, and by GIA staff photographer Mike Havstad. We wish to make special note that all of the cover photos for 1982 and many of the superb shots inside those issues were donated by the team of professional photographers, Harold and Erica Van Pelt. Our sincerest thanks for their invaluable contribution.

THE WINNERS

JILL M. HOBBS

After four years as a lecturer in the Colored Stones/Gem Identification Department of GIA's Resident Program and one year as assistant manager of the Home Study Department, Ms. Hobbs is currently assistant executive director of the GIA Alumni Association. In this position, Ms. Hobbs has primary responsibility for developing the association's special Gemology Update classes, which teach the latest developments in synthetics, treatments, and sources through lectures and lab sessions.

Ms. Hobbs is a native of Washington State. She is a graduate gemologist and received her B.A. from the University of California at Los Angeles.

EDWARD J. GÜBELIN

One of the leading gemologists in the world, Dr. Gübelin not only has developed his own gemological research laboratory, but also has published innumerable articles and given many lectures on all aspects of the field. He is particularly well known for his expertise in inclusions in gemstones; his book, *The Internal World of Gemstones,* is already a classic. In addition to his current research activities in Lucerne, Switzerland, Dr. Gübelin is honorary professor at the University of Stellenbosch, South Africa.

Dr. Gübelin was born in Lucerne and completed his studies at the universities of Zurich and Vienna. He is both a certified gemologist and a fellow of the Gemmological Association of Great Britain.

ROBERT E. KANE

Mr. Kane is supervisor of the Gem Identification Department at the GIA Gem Trade Laboratory in Los Angeles. His research specialty is the separation of natural and synthetic gemstones, on which he has written extensively. He is also a contributing editor for the Gem Trade Lab Notes section of *Gems & Gemology.*

Mr. Kane, a native of Albuquerque, New Mexico, left his jewelry manufacturing firm there in 1977 to obtain his Graduate Gemologist diploma in residence at GIA. He has worked at the Gem Trade Laboratory exclusively since his graduation from the program.

ART DECO: THE PERIOD, THE JEWELRY

By J. Mark Ebert

Although the Art Deco period extends roughly from 1910 to well into the 1930s, it was primarily a product of the "Roaring '20s." This was a wonderfully decadent era. It was an age of Prohibition and cocktail parties, of flappers and the Charleston, of racketeers and G-men, of nouveau riche *and credit spending. These were merely some of the manifestations of the social turmoil that resulted from the extreme disillusionment that followed the "war to end all wars," a violent reaction to and rejection of the strict Victorian ideals that had prevailed. Eat, drink, and be merry! The gospel according to Freud! Sexual revolution! Women were emancipated—voting, smoking, and drinking. The "modern" woman saw herself as sophisticated, worldly, even jaded, with brazenly short skirts, plunging necklines, short hair, and the "flagrant" use of rouge, lipstick, and other cosmetics. These, then, were the times that stimulated the Art Deco movement, the period and the jewelry.*

ABOUT THE AUTHOR

Mr. Ebert is president of Ebert-Richter, Inc., a Los Angeles–based buyer and supplier of diamonds and estate jewelry.

Acknowledgments: The author thanks Richter's of Palm Beach and Richter's of Nashville for the loan of a number of the pieces used to illustrate this article. Thanks are also given to Cartier, Inc., of New York City, who kindly allowed the use of several of the photographs from their book Retrospective Louis Cartier *(1982).*

Art Deco is the term applied to the design movement that predominated in Europe and the United States in the 1920s and 1930s until the beginning of World War II. The earliest manifestations of Art Deco were seen around 1910, growing out of the Art Nouveau genre, but the movement established its momentum primarily during the years immediately following the First World War. Although Art Deco is commonly associated with the jewelry designed and produced during this period, the movement itself was far reaching, embracing all types of art forms, everyday commodities, and even structures.

This article examines Art Deco both in terms of the era in which the movement took hold and the distinctive jewelry that is so representative of this design style. The events that contributed to the development of Art Deco are discussed, as well as the characteristics of the fine jewelry produced during this period. Also important to any discussion of Art Deco are the materials used, the types of pieces popular at that time, and the designers who nurtured this innovative style. The movement itself virtually died with the outbreak of World War II; yet it is now undergoing a revival as one of the most unique episodes in the development of design in the 20th century.

THE ORIGINS OF ART DECO

The Art Deco movement drew inspiration from a variety of different sources (see box). However, the excitement generated by the early visits of Sergei Diaghilev's Russian Ballet to Paris (the first of which was in 1909) is widely considered to have marked the beginning of the Art Deco style. Diaghilev's production of "Scheherezade," which made its debut in 1910, is often cited as a major influence. The sets and costume designs were bold and exotic, using intensely vivid color combinations such as red and black, blue and green (*Retrospective Louis Cartier,* 1982); the flavor was distinctly Oriental—both exciting and inviting.

The enthusiasm with which these revolutionary designs and color schemes were received had a significant impact on the decorative arts of the period. The influence and popularity of the Russian Ballet continued to be strong well into the 1920s. During this period, leading avant-garde artists of the day, such as Matisse and Picasso, were commissioned to work on the sets and costuming. Thus, the public was initiated, by way of the theater, into a number of important and serious art movements—expressionism, futurism, and cubism—all of which contributed to the development of the Art Deco style (McClinton, 1975).

Also during this period, the opening of King Tutankhamen's tomb (1922) produced an affinity for all things Egyptian. This influence was particularly noticeable in the decorative arts, in architecture, and in jewelry. Europe in the 1920s also saw a heightened interest in anything Negro: jazz music, American Negro dances, and African art were all in fashion.

Concurrently, many artists and designers had, albeit begrudgingly, accepted the rapid spread of industrialization and mass production. Whereas the design movements of the late 19th and early 20th centuries had been attempts to escape from this "industrial monster," the Art Deco movement was, in a sense, an attempt to form an alliance between art and industry, man and machine. For the first time, efforts were made to produce designs that could be adapted to mass production. In fact, the movement derives its name from the "Exposition des Arts Décoratifs et Industriels Modernes" (Exposition of Decorative Arts and Modern Manufacturers) held in Paris in 1925. The artistic instigators of this uneasy alliance were successful beyond their dreams. Their designs were applied to everything from toasters to ocean liners, from architecture to ceramics, from graphics to bookbinding, from furniture to jewelry. That such a distinctive style could have had such universal application is one of the fascinating aspects of the Art Deco movement.

The central theme of Art Deco was geometry, symmetry, and boldness of both design and color. Yet the movement was flexible enough to incorporate the ancillary influences of Egyptian, African, American Indian, and Oriental art as well as accommodate itself to the functionalism of industrial design. Both the spirit and affluence of the 1920s (Allen, 1931) allowed for the broad growth and development of this unique design

A CHRONOLOGY OF EVENTS THAT INFLUENCED THE ART DECO MOVEMENT

1760	Beginnings of the Industrial Revolution
1837	Tiffany opens in New York City, the first major U.S.–based jewelry firm
1837–1901	Victorian period (the reign of Queen Victoria of Great Britain)
1867	Discovery of diamonds in South Africa
1888	De Beers Consolidated Mines, Ltd. formed in South Africa
1890s	Synthetic (flame fusion) corundum appears in the marketplace
c.1890–1910	Art Nouveau period
c.1901–1910	Edwardian period (the reign of King Edward VII of Great Britain)
1909	The Russian Ballet opens in Paris
1910	The first performance of "Scheherezade" by the Russian Ballet in Paris
1914–1918	World War I
1919	Marcel Tolkowsky's treatise on the ideal proportions of a modern brilliant cut diamond
1920	In the United States: women win the vote, Prohibition enacted, and cultured pearls appear on the market
1922	The Earl of Carnarvon opens King Tutankhamen's tomb
1925	The Exposition des Arts Décoratifs et Industriels Modernes is held in Paris Josephine Baker electrifies Paris in "La Revue Nègre"
1929	The U.S. Stock Market crashes
1933	Prohibition is repealed
1939–1945	World War II
1966	The commemorative exhibition "Les Années '25" is held at the Musée des Arts Décoratifs in Paris
1982	"Retrospective Louis Cartier, Masterworks of Art Deco" exhibit opens in Los Angeles

Figure 1. The sophisticated lady in The Red Hat *(Gordon Conway, 1929) embodies the sleek confidence of the emancipated female of the 1920s, the peak of the Art Deco movement. From the prints and drawings collection of the American Institute of Architects Foundation, Washington, DC.*

style. And in jewelry in particular, the newly emboldened female of the postwar era (figure 1) welcomed the radical designs and bold color combinations that Art Deco represented.

CHARACTERISTICS OF ART DECO JEWELRY

In fact, the art of jewelry design and jewelry making lent itself well to the philosophy and design ideals of the Art Deco movement. This becomes obvious when we study the general characteristics and specific motifs and color schemes of Art Deco jewelry. It is important to bear in mind, however, that not all jewelry that was produced in the 1920s and 1930s was of the Art Deco style, and that not all Art Deco jewelry has the same characteristics. In fact, some purists prefer to think of this period as encompassing two separate and distinct movements: Art Deco (c. 1909–1925) and Art Moderne, or Modernism (c. 1925–WWII). However, we shall treat the post–1925 influences as merely an ongoing development of an already existing style, rather than as a whole new movement: early Art Deco jewelry tends to be more graceful and feminine; later Art Deco jewelry is more austere and geometric.

The motifs of Art Deco jewelry are quite diverse. They range from the colorful "fruit salad" flower basket (figure 2) to the Egyptian scarab, from the ziggurat to the lightning bolt, from the Hollywood-style palm tree to the sleek greyhound, from the Aztec pyramid (figure 3) to various Oriental forms (figure 4). Although early Deco jewelry tends to favor the more formalized floral motifs, and the movement accommodated a wide variety of themes, the vast majority of the jewelry designs tend to be very geometric and symmetrical, reflecting the influence of cubist geometry on the movement as a whole.

Color is also important in characterizing Art Deco jewelry. The bold whiteness of platinum combined with diamond or crystal is a fundamental scheme of Deco jewelry (figure 5). Infusions of color into this scheme were generally dramatic. Black and white was a favorite combination: black onyx or black enameling with diamond or crystal or both (figure 6). The fruit salad motif represents a popular extreme of this predilection: several colored gemstones—usually ruby, sapphire, emerald, black onyx, and possibly turquoise or coral—often combined with diamonds. Clearly, Art Deco was not a subtle style.

Figure 2. This Cartier brooch (1927)—with carved and cabochon emeralds, rubies, and sapphires, as well as faceted diamonds—represents the "fruit salad" motif commonly used in Art Deco jewelry. Photo courtesy of Cartier, Inc., New York, NY.

Early Art Deco jewelry was significantly influenced by the two design periods that immediately preceded it—Art Nouveau (the "radical chic" design movement of the turn of the century) and Edwardian (the conservative design style that coincided with the reign of King Edward of England, approximately 1901–1910). Early Art Deco jewelry adopted some of the more austere characteristics of the highly stylized and graceful Art Nouveau designs, but tended to formalize these motifs (Battersby, 1969). The free-flowing curves and naturalistic floral motifs of Art Nouveau became the more precise curves of perfect circles and ovals and the very stark, formalized flower representations of Art Deco. Later Art Deco jewelry was, to some extent, a reaction against the soft natural lines, pastel colors, and floral excesses of the highly feminine Art Nouveau style. The pastels were replaced by vivid colors and bold color combinations. The soft natural lines were replaced by harshly geometric and symmetrical motifs. Asymmetry and curvilinear designs were out; symmetry and rectilinear designs were in.

The Edwardian design movement was not radical like Art Nouveau or Art Deco; in fact, Edwardian jewelry was in the mainstream of conservative fashion and formal attire in the early 20th century. Art Deco, particularly early Deco, borrowed directly from some of the more popular motifs of Edwardian jewelry: the garland, the basket of flowers, and the bow motif, to name a few. Edwardian jewelry influenced Art Deco jewelry in two other significant ways: (1) it provided the basis for the materials that would be used in Deco jewelry, and (2) it introduced the techniques with which these materials would be worked (Becker, 1980). Edwardian jewelry was made primarily with

Figure 3. The pyramid design on this jabot pin by Cartier (c. 1920) was a popular motif of Art Deco jewelry. The sapphire, black onyx, diamond, coral, and platinum used serve to illustrate the bold color combinations of the period. The pin measures 10.2 × 2.3 cm. Photo courtesy of Cartier, Inc., New York, NY.

diamonds and platinum—numerous small diamonds mounted in an invisible setting of platinum, using "knife wire" setting and millegraining techniques with precise open-work designs. Art Deco jewelry designers used these materials and setting techniques as a starting point in their styles.

Figure 4. This minaudière by Cartier (1924) demonstrates the era's fascination with strong colors and Oriental motifs. Made from paneled wood and gold, this piece is encrusted with jewels and enamel work. It measures 12.1 × 6 × 1.9 cm. Photo courtesy of Cartier, Inc., New York, NY.

MATERIALS USED IN ART DECO JEWELRY

As mentioned above, the basic materials used in fine or precious Art Deco jewelry were platinum and diamonds. Platinum was favored for three main reasons: its great strength (thus enabling a gem to be securely set with a minimal amount of metal), its lasting high luster (resistance to tarnish) and its malleability (enabling the implementation of designs with precise and intricate shapes and outlines). White and even yellow gold were often used as more affordable alternatives during the Depression years of the 1930s.

Diamond was *the* gemstone of the period, and it was used in a variety of ways. Large solitaires were very much in vogue, as were items made from numerous small diamonds. The "knife-wire" and millegrain setting techniques of the Edwardian period eventually gave way to pavé setting. Early in this period, Tolkowsky (1919) published his dissertation on the "proper" proportions of a modern round brilliant-cut diamond, and, although most of the diamonds used in Deco jewelry were what are now considered "Old European" cuts, they were often "well cut" Old Europeans. Probably because of the cubist or geometric influence in the design of Art Deco jewelry, new cuts or shapes of diamonds were being discovered, implemented, and popularized: baguettes and emerald cuts, triangles and shield cuts, and pear and marquise shapes, to name a few.

Colored gemstones also played an important role in Art Deco jewelry. The most popular of these were rubies, sapphires, and emeralds, although just about any and all colored gems were used (e.g., black onyx, rock crystal quartz, jade, turquoise, coral, and mother-of-pearl). When worn as center stones, these gems were usually of fine quality and faceted. As accent stones, colored gems appeared in the form of cabochons, carved leaves or calibré-cuts (again, see figure 2).

The use of flame-fusion synthetic corundum (both synthetic ruby and synthetic sapphire) was also widespread. We do not know whether such synthetics were originally used to deceive, to increase the ease in matching size or color, or perhaps simply because of the limited gem identification techniques available at that time.

Figure 5. Bracelets were particularly popular during the Art Deco era. Typical is this wide flexible bracelet of diamond (approximately 25 ct total weight) and platinum. Photo by Tino Hammid. Bracelet courtesy of Richter's of Palm Beach.

Frequently, however, an exquisite Art Deco piece will be found to contain synthetic accent stones.

Pearls—both natural and cultured—played a prominent role in the jewelry of this period. Cultured pearls were first successfully marketed on a large scale during the 1920s and quickly became very fashionable. Pearls were used in a variety of ways: in chokers or long strands, as a contrast to colored gems (figure 7), to complement diamonds, and in the ever-popular sautoir.

Enameling was also prominent in Art Deco jewelry, although it was much less popular than it was during the Art Nouveau period. Cloisonné was the most common type of enameling used, with red and black being the most popular colors (again, see figure 4). This use of enameling probably resulted from the Oriental influence on Art Deco as well as the carryover from Art Nouveau.

No discussion of the jewelry of the Art Deco period would be complete without making mention of costume jewelry. The famous French couturière Coco Chanel is credited with making costume jewelry not only acceptable, but also chic (Becker, 1980). The popularity of costume jewelry during the Art Deco period prompted a number of innovations in jewelry materials. For example, advancements made in the field of plastics, particularly the use of bakelite plastic, were adapted to costume jewelry. Various types of imitation pearls also became popular. Other materials often

Figure 6. The bold black-and-white color scheme favored by many Art Deco designers is evident in this platinum, diamond (about 2 ct total weight), crystal, and black onyx bow pin. Photo by Tino Hammid. Pin courtesy of Richter's of Nashville.

Figure 7. Pearls, diamonds, and emeralds provide a striking combination in this Oriental-motif necklace by Cartier (c. 1925). The hexagonal carved emerald pendant weighs 86.71 ct. Photo courtesy of Cartier, Inc., New York, NY.

used in costume jewelry include aluminum, chrome, marcasite, glass, and rhinestone. It is interesting to note that for the most part during this period the public did not regard these costume jewels as cheap imitations, but rather as "frankly fake" ornaments: fun, daytime jewelry. When, in the 1930s, they began to be viewed and used merely as direct imitations, they quickly lost their popularity.

POPULAR TYPES OF ART DECO JEWELRY

The specific types of jewelry that are highly favored or, conversely, assiduously shunned during a particular era often reflect the sentiments of that period. During the Art Deco era, gone were the cameos, chatelaines, tiaras, diadems, and many other pieces typical of the Victorian period that dominated the 19th century (Flower, 1951). The

Figure 8. A typical item of the Art Deco period is the double-clip brooch. This platinum, diamond (approximately 7 ct total weight), and blue sapphire brooch is a good example both of this type of jewelry and of the use of bold, contrasting colors. Note the symmetry of the brooch: if the piece were bisected horizontally or vertically, each half would be a mirror image of the other. Photo by Tino Hammid. Brooch courtesy of Richter's of Nashville.

liberated woman of the 1920s wanted no relics of the repressed Victorian female. The short hair styles popular during this period also signaled an abrupt end to ornate hair combs and large hat pins (Lesieutre, 1974).

The plunging necklines of the 1920s lent themselves well to long pendants and other long necklaces. The sautoir, a long necklace made up of numerous strands of pearls or colored beads, and ending with one or two tassels, was particularly fashionable. The short hair styles, which exposed the ears, favored ornate earrings, often long, jeweled, and dangly. The short-sleeved or sleeveless dresses paved the way for a flood of bracelets and a variety of bracelet styles. Bangle bracelets became very popular and often were even worn on the upper arms. Flexible platinum and diamond bracelets were also extremely fashionable (Arwas, 1980), with styles ranging from the thin, single straight row of diamonds in platinum to the wide (up to two inches, 5 cm) platinum and diamond styles that often contained more than 25 ct of diamonds (again, see figure 5). These platinum and diamond bracelets were frequently accented with colored gemstones.

Perhaps the item of jewelry that is most typical of this period is the double-clip brooch (figure 8). The two identical clips could be attached together and worn as a single brooch, but more frequently they were worn separately as decorative clips on the lapels or belt of a dress or on the ever-popular cloche hat. Also particularly popular during this period was the jabot pin (see figure 3).

Wristwatches became increasingly fashionable during the Art Deco era. Usually they were made in platinum and pavé set with diamonds and other accent stones or enameling (figure 9). Also popular were long-chained pendant watches and lapel watches, suitably jewel encrusted. The French firm of Cartier is appropriately credited with the design and manufacture of some of the most exquisite time pieces of this period.

As the cocktail party became the popular form of entertaining, so did the cocktail ring become a particularly fashionable piece of jewelry. Also during the 1920s, some normally mundane accessories became indispensable jewels for the woman of fashion. Articles such as compacts, minaudières (again, see figure 4), cigarette cases, and cigarette holders were often elaborately jeweled symbols for the liberated woman of the era.

IMPORTANT DESIGNERS OF ART DECO JEWELRY

Although a great deal of Art Deco jewelry was mass produced, the finest jewels of this period were individually designed and hand crafted by some of the most famous jewelry houses and independent designers of all time. A great number of these were found in Paris. It is generally believed that the Art Deco movement originated in France and achieved its greatest creativity there, whereas the movement was popularized and the jewelry mass produced in the United States. René Lalique, who is known primarily for his Art Nouveau jewelry and *objets d'art,* was also an important designer of Art Deco jewels. His designs were mainly of the early Art Deco style, and he worked primarily in colored transparent glass, rock crystal quartz, and enameling. Several other leading designers also managed to survive the transition from Art Nouveau to Art Deco. Henri Vever, Paul Brandt, and Georges Fouquet are among those who made significant contributions to both of these major design movements.

The list of important French designers and jewelry houses that were both innovative and prolific in the Art Deco style is too long to discuss each one in detail. Jean Fouquet (the son of Georges Fouquet), Gérard Sandoz, Raymond Templier, Jean Desprès, Mauboussin (particularly in the early Deco motifs), Boucheron, Van Cleef & Arpels (a relatively young firm at the time), Lacloche, Chaumet, and, as mentioned earlier, Louis Cartier (who specialized in clocks as well as the wristwatches he popularized) are but a few of the many important French names in Art Deco jewelry (Lesieutre, 1974).

However, not all of the leading Art Deco jewelers were French. Georg Jensen, a Danish silversmith and sculptor, produced some very creative jewelry and silverware designs. He worked primarily in silver and less expensive gemstones, and his designs tend to reflect the early Deco style. There were also some important American jewelry houses, foremost among which was Tiffany and Co. Tiffany produced some highly stylized Art Deco jewelry as well as a number of clocks and *objets d'art.* Black, Starr and Frost as well as Marcus and Co. also made significant contributions to the Art Deco style.

Luckily for the collector or appreciator of the fine jewelry of the Art Deco period, many of the designers signed their pieces. However, it does not follow that a signed piece of Art Deco jewelry is necessarily fine and desirable and an unsigned piece less fine or less desirable. Often the converse is true. The finest of Art Deco jewelry combines the finest gemstones available, the best workmanship, and the most interesting designs.

CONCLUSION

With the onset of the Depression, both the demand for fine jewels and the creative spirit necessary to stimulate innovative designs in jewelry were significantly weakened. The outbreak of World War II—when by necessity function replaced form—signaled an abrupt end to the Art Deco era. Although there was an attempt in the 1940s to revive this creative spirit, it was short lived. To this day, there has been no design movement as all-pervasive, enduring, or creative as Art Deco. Yet interest in the Art Deco period essentially lay dormant until the 1960s, when its revival was highlighted by the commemorative exhibition "Les Années '25" at the Musée des Arts Décoratifs in Paris. Even today, the popular appeal of this distinctive art form is evident in the response to the "Retrospective Louis Cartier" exhibit of Art Deco jewelry and time pieces held in Los Angeles earlier this year.

Figure 9. Wristwatches gained popularity during the Art Deco era; diamonds and platinum were typical decorations. Photo courtesy of Cartier, Inc., New York, NY.

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THE CAPÃO TOPAZ DEPOSIT, OURO PRETO, MINAS GERAIS, BRAZIL

By Peter C. Keller

For over 200 years, the only known source of imperial topaz has been a small mining district near Ouro Preto. One of the oldest and most productive mines in the district is the Capão do Lana. This article examines the history of the Ouro Preto district as well as the geology of the area and occurrence of the topaz. Special attention is focused on the relatively sophisticated recovery methods used at the Capão do Lana mine. Also discussed is the gemology of this most prized color variety of topaz.

ABOUT THE AUTHOR

Dr. Keller is director of education at the Gemological Institute of America, Santa Monica, California.

Acknowledgments: This study would have been impossible without the complete cooperation of the Capão mine owners, Wagner Colomboroli, Fernando Cello Gonçalves, and Edmar Evanir da Silva, who went out of their way to help. Dr. D. Vincent Manson and Dr. George Rossman both offered a great deal of technical advice, and Ruth Patchick did a superb job in the typing of the manuscript. Photo not credited were taken by the author. This study was made possible by a grant from the Deutsch Foundation.

Of all the colored varieties of topaz, the most sought after is the deep, rich sherry to red topaz most commonly known as "imperial" (figure 1). Imperial topaz comes from one small mining district just west of the colonial city of Ouro Preto, in Minas Gerais, Brazil (figure 2).

Today there are at least a dozen topaz mines in the Ouro Preto area. The most important of these are the Vermelhao mine, on the outskirts of the city, and the Boa Vista, Jose Correa, and Capão do Lana mines, near the village of Rodrigo Silva, about 15 km west of Ouro Preto.

This article focuses on the Capão do Lana mine, both because it has been recognized as the first to produce imperial topaz (Bastos, 1964) and because it has been one of the most prolific producers of this gem material. In addition, for the last several years, the Capão do Lana has been one of the most mechanically sophisticated gem mines in Brazil.

The author visited the mine on three occasions in 1978 and 1979 in conjunction with his participation in a documentary film entitled *Gems of the Americas*, which was coproduced in 1980 by the Natural History Museum of Los Angeles County and the Gemological Institute of America.

LOCATION AND ACCESS

Ouro Preto is located about 285 airline kilometers north of Rio de Janeiro, in the Serra do Espinhaço mountain range in the southwest corner of the state of Minas Gerais, Brazil. Once the capital of Minas Gerais, it is only 97 km by car from the modern-day capital, Belo Horizonte.

Figure 1. Rough and cut imperial topaz from the Ouro Preto area, Minas Gerais, Brazil. The crystal (6 cm high) and cut stones (19.21 and 17.78 ct, respectively) are courtesy of Pala International, Fallbrook, CA. Photo © 1982 Harold & Erica Van Pelt—Photographers, Los Angeles.

Figure 2. A view over the colonial city of Ouro Preto, Minas Gerais, Brazil.

Access to Ouro Preto from Belo Horizonte is very easy via BR-3, the modern highway that leads north from Rio de Janeiro. One takes BR-3 about 33 km south from Belo Horizonte to the famous iron-mining town of Itabira. From Itabira, another unnumbered, but paved, highway leads southeast about 64 km to Ouro Preto.

The Capão do Lana mine is located near the village of Rodrigo Silva, about 15 km west of Ouro Preto (figure 3). Access from Rodrigo Silva may be very difficult in the rainy season, which usually lasts from December through May, because of washouts of the dirt road.

HISTORY AND PREVIOUS WORK

The early history and production of topaz in the Ouro Preto area is known only through the early records of the Portuguese royal court. According to Rolff (1971), the earliest reference to the deposits was in 1751, when "Brazilian rubies" were reported found near Vila Rica, the original name for Ouro Preto. Currently, Brazilian ruby is the name occasionally applied to topaz from this locality that has taken on a red color as a result of heat treatment (which will be addressed later in this article). The official discovery of topaz in the Ouro Preto area is dated 1768, when the royal court in Lisbon marked the event with a splendid celebration (Rolff, 1971).

Not long thereafter, mineralogists began visiting and studying the topaz deposits. In the early 19th century, Mawe (1812) included the area in his pioneer travels of Brazil. Eschwege visited the deposits in 1811 and 1812, and published the first scientific description in 1833. Other important 19th century reports include von Spix and von Martius (1824) and Gorceix (1881).

There has always been a great deal of interest in the mode of occurrence of the topaz. The first detailed account was by Derby (1901). Because of the highly decomposed nature of the rock in the region, he called his study one in "mud geology"—"an attempt to reconstruct from earthy materials the original rock types from which they were derived." Derby observed that the topaz crystals were singly terminated and concluded that they originally grew in open cavities.

By the beginning of the 20th century, the deposits were no longer active; in fact, many thought that they had been exhausted (Bauer, 1904). In 1908, however, Atkinson reported that the old topaz mines of Boa Vista and Saramenha in the Ouro Preto district had been reopened. At that time, at least some of the mining was in alluvial deposits, for Atkinson reported that the topaz occurred in a gravel bed at a depth of about 5.5 m.

Bauer (1904) provided some of the only known early production figures for the area. He stated that at one time as much as 18 hundredweight (about 2,016 lbs, or 916 kg) of topaz per year was mined near Ouro Preto, but the average annual production was only 7 to 8 hundredweight. He went on to note that the Boa Vista and Capão do Lana mines were the most productive in the region, and that as many as 50 people were working in the mine at Capão.

Production figures for the 20th century remain very spotty, as accurate records are still not kept.

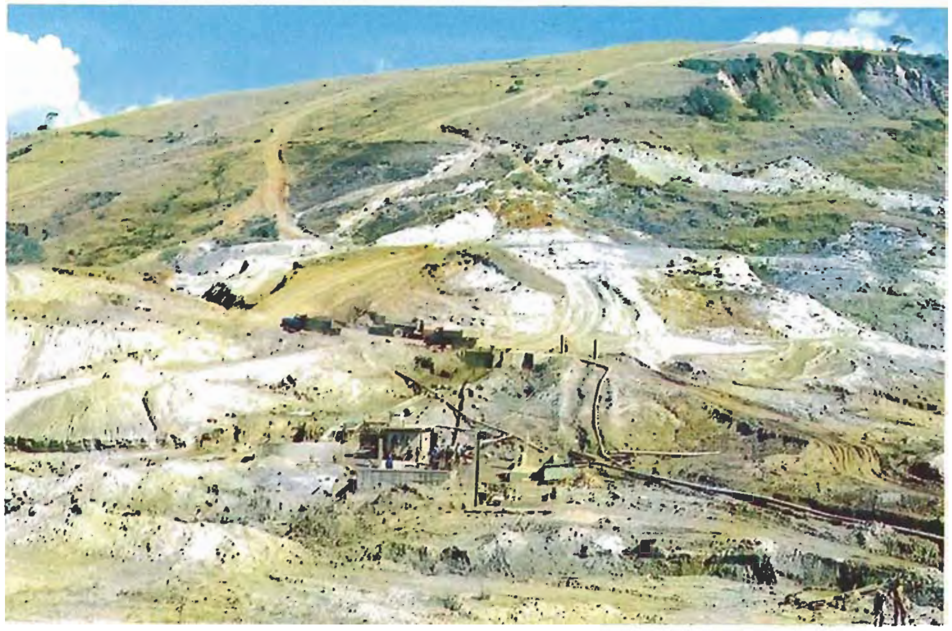

Figure 3. The Capão do Lana mine, near the village of Rodrigo Silva. This is one of the most mechanized gem mines in Brazil.

GEOLOGY AND OCCURRENCE

The mining district is situated in the Ouro Preto quadrangle of the Quadrilatero Ferrifero in southern Minas Gerais; this region is best known as one of the great iron-producing areas of the world. The region was mapped and studied in detail by a joint Brazilian-American effort just after World War II; the findings were published by Johnson (1962) and Dorr (1969).

All of the rocks in the region are strongly weathered, most to a depth of 50 m or more, thus producing thick lateritic horizons (Dorr, 1969). The region is underlain by granitic gneisses, granites, and similar coarsely crystalline rocks; as well as by three series of metasedimentary rocks of Precambrian age with a minimum aggregate thickness of about 14,000 m (Dorr, 1969).

The entire Ouro Preto quadrangle is underlain by rocks of the Precambrian metasediments belonging to the Minas series. The Minas series consists principally of a sericitic phyllite heavily charged with fine hematite and a ferruginous quartzite. The Minas series was intruded about 2700 million years ago by a granitic batholith that metamorphosed and domed and fractured the sediments; a second intrusion occurred about 1300 million years ago. One or both of these intrusions was probably responsible for the fluorine-rich hydrothermal solutions that invaded the rocks through fractures and gave rise to the distinctive topaz mineralization around Ouro Preto.

The topaz mineralization is limited to a chain of hills that forms a belt 20 km × 6 km running east-west, just west of the city of Ouro Preto. This belt extends from the Saramenha mine, about 4 km west of the city, to the Olaria mine, about 25 km to the west of Ouro Preto. The majority of the mines are clustered in the central area of the belt between the villages of Dom Bosco and Rodrigo Silva. The hills may be part of a large anticline (Rolff, 1971).

The topaz occurs in remnant hydrothermal quartz-potassium-feldspar veins in the highly decomposed country rock. The potassium feldspar is now totally altered to kaolinite. Other minerals found in the veins include euhedral quartz and euclase, and sub- to anhedral hematite and rutile.

The origin of the imperial topaz has been a subject of speculation and debate for over a century. The question asked most is whether the crystals are of pegmatitic origin. Gorceix (1881) noted the association of topaz with quartz as an indication that the deposits were pegmatitic, and was later supported in this view by Boa Nova (1929). The main argument against a pegmatitic origin is the fact that the topaz occurs only in a narrow stratigraphic horizon within the Minas series. Pegmatite dikes normally cut across stratigraphic units. Johnson (1962), however, points out that pegmatitic solutions could have been localized to one of the stratigraphic horizons by the differential competence of the beds during the emplacement of the dikes.

The most recent research into the origin of the topaz was done by Olsen (1971). Olsen concluded that fluorine-rich solutions that invaded the Minas series during one of the early intrusive episodes actually replaced the phyllites and that the topaz

Figure 4. Large earth-moving equipment initially strips away the deeply weathered country rock, which is now essentially a lateritic clay that contains remnant pockets of kaolinite and topaz.

Figure 5. High-pressure water cannons put the topaz-bearing clay into solution so that the "heavies" can be separated from the lighter clays. The slurry is then washed down a concrete sluice to a concrete apron below.

formed as a result of the replacement of preexisting kaolinite. Geochemically, this theory is plausible, and Olsen presents chemical equations to substantiate his conclusion. Such a complex hypothesis is not necessary, though. If, as the earlier researchers thought, there were fluorine-rich pegmatite-like fluids invading the Minas series, filling cracks formed when the rocks were domed by the granitic intrusions, quartz-feldspar veins with localized topaz pockets could have resulted. With the deep chemical weathering of all rock units in the region, the enclosed veins and pockets would also be weathered, leaving kaolinite and quartz "veins" in the lateritic clay soils and localized "nests" or pockets of topaz. These pockets of topaz in what appear to be pegmatite-like veins are exactly what we observe at the Capão do Lana workings today.

MINING METHODS AT CAPÃO DO LANA

The mining and recovery methods currently used at the Capão mine are among the most sophisticated of any gem mine in Brazil. The method is essentially hydraulic, with high-pressure water cannons used to separate the topaz and other "heavies" from the tons of laterite clay matrix. The water is supplied by a large reservoir constructed above the mine site.

Initially, large bulldozers and other heavy

Figure 6. Final washing of the "heavies" before they are sorted by hand. Photo by D. Vincent Manson.

earth-moving equipment strip the deeply weathered country rock (figure 4) and deposit it, along with any remnant topaz-bearing vein material, into large dump trucks. These dump trucks then transport their cargo to a large, concrete-lined washing pit. Here, over two tons of ore at a time are hit with a high-pressure water cannon. This action puts the entire load into a muddy solution which then runs down a long concrete sluice (figure 5), through a sieve, onto a concrete apron. The muddy slurry runs off into a stream below. The topaz, quartz, hematite, and any other "heavies" are left on the concrete apron where they are washed again with another high-pressure water cannon (figure 6). The remaining "heavies" are then shoveled into a sieve box about 2 m in diameter where they are rinsed one last time before about half a dozen sorters come in with small instruments to carefully pick through the remaining material for topaz (figure 7). After the hand-sorting is completed, the topaz is placed in a bag and the remaining residue is washed into the stream below, where a number of independent miners, or *garimpeiros,* wait to rework the material with simple sieves and shovels in hopes of finding topaz that has been overlooked (figure 8).

Each day approximately 900 tons of ore are processed, yielding an average of about 9 kg of topaz, of which only a small percentage is gem quality. The average yield at Capão is approximately 50 ct of topaz per ton of ore mined. It is important to note that all mining ceases during the rainy

Figure 7. Hand sorting the residual "heavies" for topaz.

season, which generally lasts from December through May.

Not all of the topaz is recovered using the highly sophisticated methods described above. Frequently, the bulldozers expose a kaolinite vein while scraping the surface. These veins are easily seen, as the pure white kaolinite contrasts with the dark, chocolate brown clay. It is the sole responsibility of one of the oldest and most trusted miners to follow the bulldozers and, when a vein is exposed, carefully search for any topaz pockets using only a knife. Working very slowly and carefully, he obtains yields that are often surprisingly large. These crystals also are usually in much better condition than the crystals subjected to the harsh treatment of the water cannon. Apparently, though, the high production that results from the mechanized mining compensates for the greater incidence of damage.

THE IMPERIAL TOPAZ FROM OURO PRETO

The topaz from the Ouro Preto district varies from pale yellow to a dark reddish sherry color (figure 9). In rare instances, dark red crystals, referred to in the early literature as "Brazilian ruby," are observed in nature. These reddish stones are, however, commonly produced artificially by a heating process called "pinking" (Webster, 1975). The pinking process involves the packing of yellow topaz in an inert material such as magnesite, or even sand, and then slowly heating the stones to 450°–500°C. The yellow fades at these elevated temperatures, but as the stone cools, a pink to red hue appears. The color has been considered permanent. In experiments at GIA, however, Dr. D. Vincent Manson has found that the color stability may be variable. Care must be taken not to apply too much heat, or to heat the topaz too rapidly,

Figure 8. Garimpeiros work with simple sieves below the main mining operation at Capão in hopes of recovering an overlooked topaz. Photo by D. Vincent Manson.

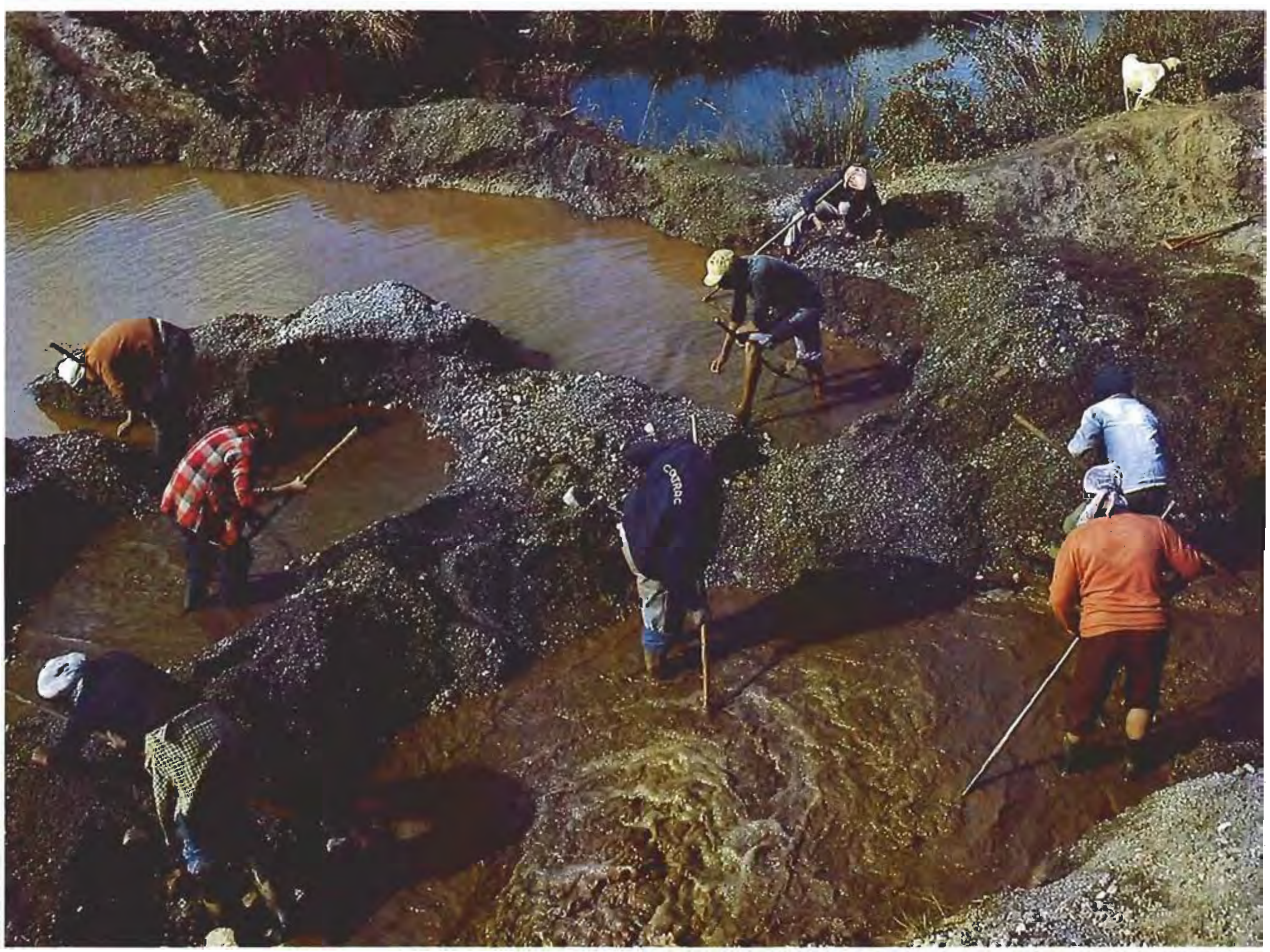

Figure 9. A representative sample of fine imperial topaz from Ouro Preto, 5.75–38.53 ct. Photo © 1982 Harold & Erica Van Pelt; courtesy of Jules R. Sauer, Brazil: Paradise of Gemstones, *Rio de Janeiro, 1982.*

Figure 10. Reputedly the largest imperial topaz crystal in existence today, this 27-cm long, 5-cm wide crystal is part of the collection of the Los Angeles County Museum of Natural History. Photo by Larry Reynolds.

to avoid fracture. It is interesting to note that a chromium absorption band on the spectroscope is usually not seen in a stone before it has undergone the "pinking" process, but will be quite apparent in the same stone following the process (Webster, 1975).

Recently, there has been a great deal of concern in the industry regarding artificial gamma irradiation of gemstones to induce color. Imperial topaz has been part of this concern. Nassau (1974) exposed 31 samples of pale to medium yellow topaz to gamma irradiation for 5 to 30 minutes and found that while 14 of the 31 samples did not change significantly, 17 did acquire a distinct brownish overtone which when combined with the original yellow color yielded a rich "imperial color." Nassau noted, however, that the irradiation-induced color was not stable and that the stones faded to their original color when heated gently at about 200°C for a few hours, or when exposed to daylight for one or two days. To protect against such unstable stones, many dealers in Rio de Janeiro routinely place a sample from a topaz parcel in a window for a day or two and then compare the exposed sample with the rest of the parcel before they buy it.

Gemologically, the imperial topaz from the Ouro Preto area differs significantly from topaz derived from granitic pegmatities elsewhere. In addition to its distinctive color, the Ouro Preto topaz generally exhibits a lower specific gravity (3.53 versus 3.56) and a higher refractive index (1.63–1.64 versus 1.61–1.62) than the more common topazes. According to Webster (1975), this is

Figure 11. A large (57.35 ct) imperial topaz from Ouro Preto. Stone courtesy of Geminas Ltda., Belo Horizonte, Brazil. Photo © 1983 Harold & Erica Van Pelt—Photographers, Los Angeles.

due to a richness in hydroxyl in the Ouro Preto material versus a relatively high fluorine content for topaz from elsewhere. The topaz from Ouro Preto also shows a weak absorption doublet at about 6820 Å. The Ouro Preto topaz commonly contains tube-like inclusions running the length of the c-axis of the crystal.

Imperial topaz crystals vary greatly in size. Most commonly they are less than 2 cm in length, although very large crystals have been reported. Atkinson (1908) noted that there was a specimen in the museum in Rio de Janeiro that "was of beautiful color, transparency, and was absolutely flawless." The specimen weighed nearly 2000 g. Rolff (1971) reported a crystal in the Mineral Museum of the School of Mines in Ouro Preto that was 20 cm long and 10 cm in diameter. He also reported seeing a crystal in Rodrigo Silva that was 30 cm long and 5 cm in diameter. The latter is probably the same crystal that is now housed in the gem collection of the Los Angeles County Museum of Natural History (figure 10). This crystal, considered the largest found in recent times, measures 27 cm × 5 cm and weighs approximately 1800 g.

Faceted imperial topaz of large size is exceedingly rare. The 129-ct stone at the Smithsonian Institution in Washington, DC, is one of the largest known. The American Museum of Natural History in New York has a red imperial topaz that weighs 71 ct. Figure 11 illustrates an attractive 57.35-ct imperial topaz seen at the 1983 Tucson show.

CONCLUSION

Ouro Preto has been the only source of imperial topaz for over 200 years. Of the many mines that have been active during this period, Capão do Lana stands out, for both the quantity and quality of production. Because of the relatively high degree of sophistication of the mining methods used today at Capão, production of imperial topaz there has never been greater. The apparently large extent of the deposit suggests that imperial topaz production has a very bright future.

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HARRY WINSTON: A STORY TOLD IN DIAMONDS

By Laurence S. Krashes

In conjunction with the celebration of the 50th anniversary of Harry Winston, Inc., the author has investigated and updated many of the "named" diamonds handled by the late Harry Winston during his long career. Fourteen of the more interesting pieces are described here, some for the first time.

ABOUT THE AUTHOR

Mr. Krashes is assistant to the vice president of the Retail Division at Harry Winston, Inc., New York, NY.

The diamond histories recounted here will appear together with the stories of many other named diamonds in an upcoming book about Harry Winston by Mr. Krashes.

Fifty years ago, the now-legendary Harry Winston founded the jewelry firm that bears his name today. The specialty of Harry Winston, Inc., is diamonds. But not *just* diamonds: Some of the most important diamonds in the history of gemology were cut, bought, or sold by Harry Winston.

As part of our celebration of the firm's 50th anniversary, we have gone through the files at Harry Winston, Inc., to update and expand the reports on those stones that originally appeared in the GIA *Diamond Dictionary* (Copeland, 1964), and to add material that has surfaced recently to the public record. The following account is provided to introduce the personage of Harry Winston and to bring up to date some of the "named" diamonds whose history now bears his imprint.

HARRY WINSTON, 1896-1978

Called by some the "king of diamonds" (Tupper, 1947) and by others "the Tavernier of the 20th century," Harry Winston was indeed the most prominent diamond merchant of his time. Like the 17th-century French gem dealer and adventurer Tavernier, Mr. Winston traveled all over the world in search of the biggest and best in diamonds and other fine gems.

Born in New York, Harry Winston started in the jewelry trade at the age of 15 in Los Angeles, where his father had moved for his health and had subsequently opened a jewelry store on Figueroa Street. A resourceful purveyor of gems even in his early years, Mr. Winston would carry his father's wares from one saloon to the next, selling to newly affluent oil prospectors.

This resourcefulness became a hallmark of his business acumen when he returned to New York with his father. Still only in his late teens, Mr. Winston used the $2,000 he had saved while in California to set up a one-man firm, the Premier Diamond Company, in a small office at 535 Fifth Avenue. Recognizing the difficulties of breaking into the tightly controlled diamond market, he decided to look beyond the conventional sources of fine gems to the then unconventional: estate jewelry.

The key to the success of this venture was to establish good working relationships with the bankers in his area. Harry Winston got off to a shaky start, however. With a jaunty cap on his head, he arrived late at his first loan hearing. The bankers took the young man (only 5′1″ tall) for a messenger boy, and he was ordered to return to his boss with the message that the man was to appear in person if he expected to get his money. Mr. Winston finally got the loan, but for several years thereafter he was accompanied to such meetings by a tall, white-haired, distinguished-looking gentleman, who handled the formalities while Mr. Winston quietly guided the transactions.

Eventually, the bankers grew both to admire Mr. Winston's knowledge of diamonds and trust his judgment, thus firmly establishing him in the banking community. Using the *Social Register* and *Who's Who,* he proceeded to offer his services to the wealthy in the disposition of fine jewelry. Within five years after he opened his one-man company, Harry Winston was involved in transactions in which as much as a million dollars changed hands (Ross, 1954).

Among the estates Harry Winston handled were Arabella Huntington (widow of the railroad magnate Collis P. Huntington, and later of his nephew, H. E. Huntington), Emma T. Gary (widow of the former chairman of the board at U.S. Steel, Judge Elbert T. Gary), Mrs. I. W. Killam (the wife of a Canadian financier, whose jewelry included the Briolette of India as well as the Crown of Charlemagne diamond), and socialite Evalyn Walsh McLean (owner of the Hope diamond and the Star of the East).

Over the years, Mr. Winston also purchased and had cut some of the finest rough stones to emerge from the ground, including the Jonker, the Niarchos, the Winston, the Star of Independence, and the Star of Sierra Leone diamonds. His customers spanned royalty as well as leading business and professional figures the world over. And his love of beautiful jewels was such that he would go virtually anywhere to find them.

With the death of Harry Winston in 1978, management of the company passed into the capable hands of his son, Ronald, who now oversees over a thousand employees in a dozen countries. The tradition on which the House of Winston was built continues. The "named" diamonds that follow represent but a small portion of this tradition.

THE ARCOTS

These two pear-shaped diamonds, which originally weighed a total of 57.35 ct, were first recorded as having been given to Queen Charlotte of England in 1777 by the Nawab of Azim-ub-duala, ruler of Arcot, India.

On Charlotte's death in 1818, she specifically named the Arcot diamonds in her will, directing that they be sold for the benefit of her four surviving daughters. Purchased by Rundell, Bridges & Co., Crown Jewellers, the stones were held by that firm until 1927, when, as part of the sale of the company, they were offered at auction in London. The Duke of Westminster bought them for £11,000* and subsequently had them set in earrings for his duchess.

In 1930, the Parisian jeweler Lacloche mounted the Arcots in the so-called family headpiece of the Westminsters, together with 1,421 smaller diamonds and a 26.77-ct central round diamond. In June 1959, the third Duke of Westminster decided to sell the headpiece, including the Arcots, at Sotheby's. In one of the largest single-item sales up to that time, ownership of the headpiece was transferred to Harry Winston for $308,000. Mr. Winston removed the two Arcot Diamonds and had them recut so that each would be flawless. The 33.70-ct pear shape was recut to 31.01 ct and sold as a ring in 1959; the 23.65-ct pear shape was recut to 18.85 ct and sold as a ring in 1960.

THE BRIOLETTE OF INDIA

This legendary 90.38-ct diamond (figure 1) may be the oldest on record, perhaps older than the Koh-i-Noor. Legend states that in the 12th century Eleanor of Aquitaine, the first Queen of France and later Queen of England, brought the stone to England. Her son, Richard the Lionhearted, is said to have taken it on the Third Crusade. Word of the stone next appeared in the 16th century, when Henry II of France gave it to his mistress, Diane

**Editor's note: It is the policy of* Gems & Gemology *not to quote the current prices of gemstones. Prices on the named diamonds described here are included only as part of the historical record of these unique pieces.*

Figure 1. The Briolette of India, a 90.38-ct stone that may be the oldest faceted diamond on record.

Figure 2. The original Bruce Winston diamond, a 59.25-ct emerald cut.

de Poitiers. It can be seen in one of the many portraits of her that were painted while she resided at Fontainebleau.

After disappearing for four centuries, the stone surfaced again in 1950, when Harry Winston purchased it from an Indian maharaja. It was then sold to Mrs. I. W. Killam of Canada and later repurchased by Mr. Winston following her death about 10 years later. The Briolette of India was sold again in Europe in 1971.

THE BRUCE WINSTON HEART SHAPE

In 1969, Harry Winston fashioned a 59.25-ct emerald cut (figure 2) and five smaller diamonds from a piece of rough that weighed 205.70 ct. The large emerald cut was sold in 1970 and repurchased by Harry Winston, Inc., in 1980. At that time, to improve the quality of the diamond, the firm had the stone recut to a unique heart shape of 40.97 ct (figure 3). It was sold that same year to a client in Europe.

THE DEAL SWEETENER

In 1974, Harry Winston and Harry Oppenheimer, head of the DeBeers Consolidated Mines, Ltd., concluded an agreement whereby Harry Winston would purchase a lot of rough diamonds for $24,500,000. The transaction—the largest individual sale of diamonds in history—took less than a minute. When Mr. Winston asked Mr. Oppenheimer, "How about a little something to sweeten the deal," Harry Oppenheimer pulled a 180.80-ct rough diamond out of his pocket and rolled it across the table. Harry Winston picked the stone up, smiled, and said, simply, "Thanks."

This piece of rough was cut into five gem diamonds. The largest was a D-flawless 45.31-ct emerald cut, which was aptly christened "The Deal Sweetener." The others were an emerald-cut diamond of 24.67 ct and three pear-shaped diamonds of 10.80 ct, 4.19 ct, and 1.45 ct, respectively. All of these stones were sold that same year to clients of the firm.

Figure 3. The Bruce Winston diamond recut to a 40.97-ct heart shape.

THE HOPE

The 45.52-ct dark-blue Indian stone known as the Hope (figure 4) is undoubtedly one of the world's most famous diamonds, with a history heavily veiled by superstition and tragedy.

Jean Tavernier, the French adventurer and gem merchant, discovered the rough diamond (called, in its rough state, the Tavernier Blue and believed to have weighed about 112 ct) in southwest India in 1642. He subsequently brought the stone to France, where, Winston records indicate, King Louis XIV gave him a title and a fortune for it. But Tavernier's son squandered the fortune, and legend has it that when the old man, at 80, returned to India in quest of new wealth, he was killed by wild dogs.

Tavernier was only one of the many who legend claims handled the lovely blue gemstone and later suffered grave misfortunes. Louis XIV, who had a 69.03-ct stone cut from Tavernier's blue rough, supposedly wore the diamond only once, and shortly thereafter died from smallpox. Louis XV never wore the Great Blue, as it was then called. He did loan it to one of his mistresses, Countess DuBarry, who was beheaded in the French Revolution. It was passed down to Louis XVI and worn by his queen, Marie Antoinette; they, too, were both beheaded. Princess de Lamballe, a friend of Marie Antoinette, also was said to have worn it; she was killed by a mob during the French Revolution.

The diamond was stolen from the French Treasury in 1792. Recut to 45.52 ct, it turned up in London in 1830 and was purchased by Henry Philip Hope, a banker, for £18,000. Henry Hope died without marrying. The nephew to whom he left the stone in 1839 (Henry Thomas Hope) subsequently willed it to his grandson—the son of his daughter—on the condition that he adopt the official name of Hope. In 1894, the new Lord Hope married May Yohe, an American actress, who later had a glass model made of the large blue stone for a stage comeback, which proved unsuccessful. Lord Hope subsequently went bankrupt and his wife left him for another man. (May Yohe died in Boston in the 1940s; her only income at the time was a $16.50-a-week WPA job. She blamed the diamond for her bad luck.) In 1906, Lord Hope reportedly was forced to sell the Hope diamond to help pay off his debts. During the next few years, the Hope changed hands several times.

In 1908, the diamond was purchased by Sultan Abdul Hamid II of Turkey for $400,000. Legend continues that the dealer who handled the transaction was thrown over a precipice while motoring with his wife and child, and all were killed. And that in Turkey, it was worn by Zobeida, the Sultan's favorite, who later was executed by her master.

In 1911, Pierre Cartier acquired the Hope in Paris and sold it for $154,000 to Edward B. McLean, then owner of the Washington Post, as a gift for his wife. Despite the diamond's previous history, Mrs. McLean laughed at the legend that had grown around it. She often wore the Hope at parties with her 94.80-ct pear-shaped diamond, the Star of the East. When she was not wearing these

Figure 4. The legendary 45.52-ct Hope diamond was donated to the Smithsonian Institution by Harry Winston. Photo © 1981 Harold & Erica Van Pelt—Photographers, Los Angeles.

two superb stones, Mrs. McLean kept them in her favorite hiding place: the cushions of her sofa. Perhaps it is just coincidence that in the years after Mrs. McLean acquired the Hope, her son was killed in an automobile accident, her husband died, and her daughter, Mrs. Robert R. Reynolds, was the victim of an overdose of sleeping pills.

Following Mrs. McLean's death in 1947, Harry Winston purchased her entire jewelry collection. In 1958, he presented the Hope diamond to the Smithsonian Institution, Washington, DC, as a gift to the nation.

Mr. Winston, it should be added, demonstrated little concern about the infamy that surrounded the Hope diamond and carried it with him across the Atlantic on several occasions. He especially enjoyed recounting the following story about his personal experience with the legend of the Hope:

> A few years ago I traveled to Lisbon with my wife. Since our two sons were quite young at the time, we decided to return home on separate planes, as people with children often do. It was arranged that my wife would leave Lisbon for New York on the Friday evening, and that I would take a plane on the following day. My wife's plane took off on schedule, and landed at Santa Maria (in the Azores) for the usual refueling. There some slight engine trouble caused a delay of two or three hours. While waiting for repairs to be done, the passengers chatted among themselves, and the fact that Mrs. Harry Winston was on the plane was soon known to all. One man went as far as to refuse to continue the journey and asked to be booked on the next plane.
>
> On the way to the airport the next day I was handed a cablegram from my wife announcing her safe arrival. I hastily crammed it into my pocket with other papers. Climbing aboard the plane, I took a sedative and settled down, glad to notice that the adjacent seat was vacant and I could sleep in peace. I awoke from a pleasant nap when we touched down at Santa Maria to refuel, and got out to stretch my legs for a while.
>
> When we reboarded the plane to take off for New York, I found that the seat that had been vacant was now occupied. Its occupant was bubbling over with a story about his escape from traveling on the same plane as the wife of the owner of the 'Hope diamond.'
>
> 'I'm not superstitious,' he said, 'but why should I tempt fate? I decided then and there to change planes and here I am, safe and sound.'
>
> He talked animatedly for some time, but eventually grew quiet enough for me to drop off to sleep again. Then his voice broke in on my slumber: 'I wonder if that plane arrived safely?'
>
> I couldn't resist it. I fished the cablegram from my pocket and handed it to him, saying nothing. He gazed dumbly at me, and didn't open his mouth again that night.

THE JONKER

In January 1934, a 726-ct diamond was found in an alluvial deposit on the farm of Jacobus Jonker at Elandesfontein, near Pretoria, Republic of South Africa. The stone was of unusually fine color and purity. It was purchased by the Diamond Producers Association for $315,000 and later sold to Harry Winston for a reported $700,000. A marquise and 11 emerald cuts were fashioned from it.

The largest stone, called the Jonker diamond, was a 66-facet emerald cut that weighed 142.90 ct; it was recut in 1937 to 125.65 ct with 58 facets, to give it a more oblong outline.

The Jonker was sold to Farouk while he was still King of Egypt. After he went into exile in 1952, the location of the stone became a mystery until 1959, when rumors appeared that Queen Ratna of Nepal was wearing it. It has since been confirmed that the late Farouk did sell the great diamond to the little country in the Himalayas for a reputed $100,000. In 1974, the Jonker was sold in Hong Kong to an unidentified businessman for US$4,000,000.

The next two largest stones were emerald cuts that weighed 41.30 ct and 30.70 ct, respectively. They were both sold in 1940. The 30.70-ct stone was repurchased by Mr. Winston in 1951 and sold again in 1952.

The Maharaja of Kapurthala bought two of the smaller diamonds cut from this same piece of rough, and the other seven were purchased by private gem collectors. The smallest of the 11 stones cut from the original piece of Jonker rough was sold in October 1975, at the Sotheby Parke Bernet auction in New York, for $570,000.

THE NIARCHOS

A 426.50-ct diamond of exceptionally fine color was found in the Premier Mine, Republic of South Africa, in 1954. At the time, the late Sir Ernest Oppenheimer (Chairman of De Beers Consolidated Mines, Ltd., the owner of the Premier Mine)

Figure 5. The Nur-ul-Ain tiara. The name, which means "Light of the Eye," is derived from the central stone in the piece, an approximately 60-ct oval rose-pink diamond. Photo by Varouj Yazejian, Photo Vahe, Tehran.

valued it at $300,000. In 1956, this piece of rough was sold to Harry Winston as part of an $8,400,000 parcel. Mr. Winston had it cut into a 128.25-ct D-flawless pear-shaped diamond with 58 facets on the crown and pavilion and 86 facets around the girdle. In 1957, the large stone was purchased by Stavros S. Niarchos, Greek shipbuilder and industrialist, for a reputed $2,000,000. A 40-ct emerald cut and a 30-ct marquise were also obtained from the same rough.

NUR-UL-AIN TIARA

On the occasion of the marriage of his late Imperial Majesty Muhammad Reza Pahlavi Aryamihr Shahanshah and the Shanbanou Farah of Iran in 1958, several important pieces of jewelry were created by Harry Winston. The Nur-ul-Ain tiara (figure 5) ranks among the finest pieces in the world. The name *Nur-ul-Ain,* which means "Light of the Eye," refers to the central diamond of the tiara, an approximately 60-ct stone that is considered the largest oval rose-pink diamond in the world.

The Nur-ul-Ain is thought to have been cut from the original Darya-i Nur (meaning "Sea of Light"). The Darya-i Nur, perhaps the most celebrated stone of the Iranian Crown Jewels, is a crudely fashioned 176-ct rectangular pink diamond. Reportedly, the Nur-ul-Ain and Darya-i Nur, as we currently know them, were both fashioned from the same 300-ct faceted stone (known historically as the Darya-i Nur) in 1934 (Meen and Tushingham; 1968). The original Darya-i Nur was said to have been in the possession of the first Mogul emperor of India. In 1739, Nadir Shah of Persia invaded India and sacked the capital of Delhi. The treasure of over 1,000 years of Indian history, including the Darya-i Nur, was then brought to Persia.

The Nur-ul-Ain is mounted in platinum surrounded by yellow, pink, blue, and colorless diamonds above a border of undulating baguettes. Among the many additional treasures in this tiara are a 10-ct yellow pear-shaped diamond directly above the Nur-ul-Ain, and a cushion-cut pink diamond of approximately 19 ct on the left top of the tiara.

THE STAR OF THE EAST

The Star of the East is believed to have been originally the Ahmedabad, a 157.25-ct rough diamond purchased in India in the mid-17th century by Tavernier, the French gem merchant. He later had it cut to a 94.78-ct pear shape and reportedly disposed of it in Persia. It then resurfaced in the 19th century in the possession of Sultan Abdul Hamid II of Turkey, who also owned the Hope diamond. In 1908, the Star of the East was purchased by Mrs. Evalyn Walsh McLean, who later acquired the Hope as well.

Harry Winston acquired the Star of the East from Mrs. McLean's estate in 1949, and in 1951

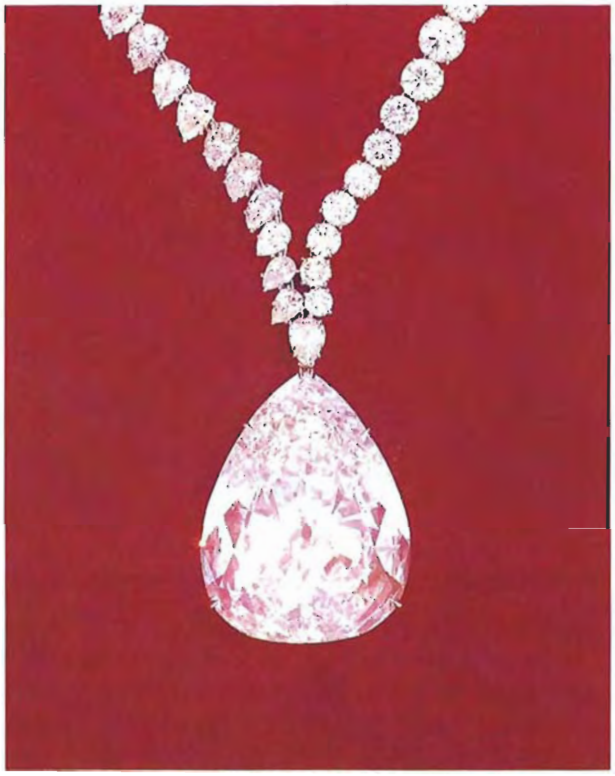

Figure 6. The Star of Independence, a 75.52-ct D-flawless diamond fashioned in the spring of 1976 from a 204.10-ct piece of rough.

he sold it to King Farouk of Egypt for $1,000,000. At the time of Farouk's overthrow (1952), the stone still had not been paid for. It took Mr. Winston several years of litigation to obtain access to a safe deposit box in Switzerland to reclaim the Star of the East.

The stone was resold in 1969. In 1977, the owner asked Mr. Winston to remount the diamond to be worn as a pendant to a V-shaped diamond necklace. Two D-flawless pear-shaped diamond drops of 28 ct each can also be attached to the necklace. The Star of the East may be worn as a drop to a fabulous dog collar of 142 round diamonds, weighing a total of 173.78 ct, as well.

THE STAR OF INDEPENDENCE

In 1975, Harry Winston purchased an extraordinary piece of rough weighing 204.10 ct. The rough was cut into a 75.52-ct D-flawless, pear-shaped diamond (figure 6) in the spring of 1976. In honor of the American Bicentennial, it was named the Star of Independence.

Within 24 hours after the faceting was completed, the diamond was sold for $4,000,000—making it the most expensive diamond sold up to that time. It was set as a pendant to a V-shaped necklace with 38 pear-shaped diamonds totaling 29 ct and 35 round diamonds totaling 31.50 ct.

THE STAR OF SIERRA LEONE

This, the third largest rough diamond ever discovered, was found on February 14, 1972, at the separator plant of the Diminco Mine at Yengema, Sierra Leone. At 969.80 ct, it is the largest alluvial diamond ever discovered. Harry Winston purchased the "Star of Sierra Leone" in 1972. He cut it into 17 diamonds with a total weight of 238.48 ct; 13 of the stones were flawless. Originally, the largest stone was a 143.20-ct emerald cut, which proved to be flawed. Mr. Winston felt he wanted something special, so he ordered it recut; the result was a flawless 32.52-ct emerald cut.

Six of the other flawless stones were used in the Star of Sierra Leone brooch. Arranged like the petals of a flower, there are five marquise diamonds of 4.29 ct, 3.92 ct, 3.73 ct, 2.97 ct, and 2.86 ct, and a pear shape of 3.25 ct. The brooch was sold in Europe in 1975.

Ultimately, the largest stone recovered from the rough was a flawless pear shape of 53.96 ct. It sold in 1975 as the pendant to a V-shaped necklace that also contained 98 brilliants weighing a total of 40.83 ct.

THE VARGAS

With a rough weight of 726.60 ct, the Vargas qualifies as one of the largest diamonds ever found. It was discovered in 1938 in the San Antonio River, municipality of Coromandel, Minas Gerais, Brazil, by a native prospector and his partner, a farmer. It was named in honor of the then-president of Brazil, Getulio Vargas. The partners sold the stone to a broker for about $56,000, after which it changed hands several times. Harry Winston purchased the stone in 1939 for approximately $600,000. In 1941, he had it cut into 29 stones; all of the important ones were emerald cuts.

The largest stone cut, which weighed 48.26 ct, is now known as the Vargas diamond. It was sold to Mrs. Robert Windfohr of Ft. Worth, Texas, in 1944. The diamond was repurchased by Harry Winston in 1958, and recut to a flawless 44.17 ct. It was sold again in 1961.

Seven of the other emerald-cut diamonds—30.90 ct, 29.95 ct, 25.33 ct, 24.35 ct, 24.30 ct, 23.10 ct, and 17.91 ct—were used in a fantastic diamond bracelet made in 1947 for an Indian maharaja. Two additional emerald-cut diamonds, weighing 22.91 ct (sold in 1946) and 19.43 ct (sold in 1944), were set as rings. In 1968, the 19.43-ct diamond was repurchased by Mr. Winston and recut to a flawless 19.24 ct. It was sold in 1970, repurchased in 1974, and sold again in 1976 to an American client.

THE WEEKEND

In 1965, Harry Winston fashioned a D-flawless marquise diamond of 20.63 ct. At first the stone was not looked upon with any special regard, as Mr. Winston was responsible for cutting over 100 diamonds in the 20-ct range. Then late one Friday afternoon, several months after the stone was mounted as a ring, a customer well known to Mr. Winston arrived at our salon. The gentleman was accompanied by a beautiful, statuesque blond who clearly was not his wife. Without much fanfare, he selected the above-mentioned stone.

Knowing the man could well afford to pay, Mr. Winston gave him the stone on memo. Mr. Winston always delighted in relating how, the following Monday morning, the customer returned the diamond, saying: "Thank you, I had the most wonderful weekend of my life. I'll make it up to you soon." Hence, the Weekend diamond.

The Weekend diamond was sold shortly thereafter to a well-married American client.

THE WINSTON

A 154.50-ct colorless rough diamond was found in the Jagersfontein Mine, Republic of South Africa, in 1952. In 1953, Harry Winston purchased the rough in London for $230,800. It was subsequently cut to a flawless 62.05-ct pear shape and sold to a "certain King of Saudi Arabia." It was later returned to Mr. Winston who, in turn, resold it shortly thereafter to a private owner in Canada. At the death of the Canadian owner, the diamond was repurchased by Harry Winston. It was recut at that time due to a slight bruise to a D-flawless 61.80 ct. Mr. Winston matched it with the 58.60-ct Louis XIV diamond and sold the two as a pair of earrings in 1964. In November 1981, they were auctioned in Geneva, Switzerland, with a final price of $7,300,000.

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PADPARADSCHA: WHAT'S IN A NAME?

By Robert Crowningshield

For over 100 years, reference has been made to a unique sapphire, the color of a lotus blossom, the padparadscha. *Yet the precise hue represented by this rare stone has been a subject of discussion, and often controversy, ever since the term was first introduced. In an effort to establish some grounds for a common understanding, the author reviews the historical references to the padparadscha sapphire, examines the modern usage of the term, and states GIA's current interpretation of the trade name* padparadscha.

ABOUT THE AUTHOR

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Acknowledgments: The author is indebted to GIA Librarians Dona Dirlam, Santa Monica, and Lillian Hensel, New York City, for their assistance in searching the literature. Special thanks also go to Ralph Esmerian, Roland Naftule, the American Museum of Natural History, and the Los Angeles County Museum of Natural History for their cooperation in the preparation of the photographs.

Some years ago the Gem Trade Laboratory in New York was asked to identify a natural, rather intense pinkish orange sapphire as "natural sapphire, variety padparadscha" and we obliged. After all, it seemed to fit the description for the term which appears in GIA's own correspondence course, and we had seen such stones only rarely.

Then one day about five years ago we were asked to call a dark brownish orange stone "variety padparadscha" at the insistence of a jeweler's customer, who was buying it in an expensive ring. The jeweler, who had originally purchased the stone as an "African padparadscha," lost the sale when the laboratory report merely stated "natural brownish orange sapphire." From this point on, we agreed that we would no longer use the term *padparadscha* on our reports, especially since other definitions were found to be different from that given in GIA's courses.

The experience prompted us to do some research into the history, derivations, and general understanding of the term in the trade. The results of this investigation are summarized here.

HISTORY

Just how the romantic term *padparadscha* came about, when it was first used, and by whom is an interesting study in itself. Many have never questioned that the term was derived through the German language from *padmaragaya* (*padma* = lotus, *raga* = color), the yellow-pink Oriental lotus *(nelumbo nucifera)*, which is illustrated in figure 1. However, some in-depth library research has come up with conflicting, but interesting, results.

The earliest reference to the term in gemological literature is found in Keferstein (1849). On page 13 of *Mineralogia Polyglotta*, under "Our Ruby," he states that the term *padmaraga* in Sanscrit refers to lotus color or rose red. On the next page, Keferstein notes that the term also appears in Bengali: *padmaraga* and *padmaragmani,* "mani" being the suffix for stone. It is interesting to note that this earliest description of the padparadscha color is for some variant of red, probably toward pink, and not for orange, which seems to be a strictly modern development. (Holland [1898] also uses the term *padmaraga* for the finest color ruby.) Embrey and Fuller (1980) state the following for the first references to the term, the ones most commonly cited.

> Padparadschah, A.K. Coomaraswamy, Administration Reports, Ceylon, for 1904, part 4 Mineralogical Survey, 1905, p. E16 (Padmaragaya). M. Bauer, Edelsteinkunde Leipzig, 2nd Edit. 1909, p. 363 (patparachan). R. Brauns, Kunstliche Schmucksteine, Handwörterbuch der Naturwissenschaften, 1913, vol. 8, p. 968 (Padparadschah). German corruptions (with other variations) of the Sinhalese *padmaragaya,* from *padma,* lotus and *raga,* colour. A trade name for reddish-yellow gem corundum, now used more especially for the artificially produced material.

Here we see at the turn of the century the derivation of the term from the Sinhalese word *padmaragaya,* again meaning lotus color, but now pertaining to a reddish yellow gem, rather than simply red.

It is appropriate to note at this point that a healthy lotus blossom is, when about to open, a beautiful rosy red color. As the flower opens, one sees that the tips of each petal are pink shading into yellow, with the future seed pod in the center a bright yellow. Completely open flowers fade considerably so that the tips of each petal are pale pink shading into white. Possibly the early descriptions of lotus color vary because the blossoms vary. However, early descriptions do not mention orange, though reddish-yellow is mentioned.

In 1909, Max Bauer, the dean of gemological writers, used the term *patparachan* for "reddish yellow" gem corundum.* In his 1932 edition, by which time synthetic corundum of this color was plentiful, Bauer spells the term *padparadscha,* the spelling we continue to use today, and decribes it as "orange to reddish yellow."

The meaning of the term *padparadscha* continued to be a cause for confusion, however. An entry in G. F. Herbert Smith's 1940 and earlier

Figure 1. The Oriental lotus (nelumbo nucifera) *from which the term* padparadscha *was adopted. Photo © Miguel Rodríguez.*

editions of his text *Gemstones* illustrates this frustration: "Padparadschah, padparadscha or other corrupt form of the Sinhalese word, padmaragaya (lotus-color), has been introduced for the yellowish aurora-red gem material from Ceylon, but has become more commonly used for the synthetic material of similar tint. There is no real need for this fantastic term, and it may be hoped that it will pass into disuse."

Unfortunately, Smith's hope has not been realized. In recent years, possibly due to the influence of gem investment houses, requests for the Gem Trade Laboratory to use the term on reports have increased. Perhaps if the synthetic sapphire had never been produced and if Sri Lanka (Ceylon) were still the only source of these very rare colors of sapphire, the term would not be the problem that it has become. With the discovery of fancy-colored sapphires in East Africa (figure 2), especially Tanzania, there has arisen the desire on the part of dealers to use the term as a variety of sapphire because it is passingly familiar everywhere. Thus it seems that rather than eliminating *padparadscha* from the language, the trade is fostering its use.

**Prior to 1909, Bauer along with most gemological writers followed the common practice of using the term* Oriental, *to indicate that a gem under discussion was in fact corundum, in conjunction with the name of a common stone or other material to indicate color. Thus his "Oriental amethyst" is purple sapphire and "Oriental hyacinth" is orange sapphire.*

Figure 2. East African sapphires (3.96–6.54 ct) similar to those that have been referred to in the trade as "African padparadscha." Photo by Tino Hammid.

Had the term been used consistently only for reddish yellow natural gem sapphires (after first establishing what that color is!), it might have graduated from being a trade name to a bona fide variety name alongside ruby, amethyst, emerald, and alexandrite. As we see in table 1, however, later writers have attributed the name to a bewildering description of colors. Significantly, the popular perception of the color as reddish yellow shifted dramatically when Kunz (1915) quoted Claremont's 1913 description of what he calls padparasham: "It is a most rare and delicate orange-pink hue, the various specimens showing many different blendings of the pink and orange."

MODERN USAGE OF THE TERM

In our own time, the red-orange and brown-orange to yellowish orange stones from Tanzania, as well as orange, orange-yellow, and orange-brown heat-treated or surface-diffused natural sapphires (see Nassau, 1981, p. 129), have further complicated the nomenclature. Meanwhile, in addition to the flame-fusion synthetic material introduced by a number of manufacturers some years ago, Kyocera International, Inc., of Kyoto, Japan, is now marketing a nearly pure orange synthetic sapphire (method of synthesis unknown) under the name "Inamori grown padparadscha" (figure 3). Chatham Created Gems, Inc., has made and plans to offer a flux-grown orange-colored synthetic sapphire as "Created padparadscha" (illustrated in Kane, 1982, p. 141). Similarly, it is probably within the capability of others to manufacture orange to orange-red flux-grown synthetic stones. This would probably tempt the use of the term for marketing them.

Some purists insist that the term must be reserved exclusively for Sri Lankan sapphires of a delicate pinkish orange color. Others, citing the definitions of some authors (again, see table 1) which state merely orange, or, in some cases, brownish orange, as well as orange-red, have upset purists by merchandising fancy-colored sapphires from East Africa under the term *African padparadscha*.

Although the majority of definitions cited here mention orange as a requirement for using the term, the modifiers make it virtually impossible to visualize any one color as "right." For instance, "light, bright orange," "yellowish aurora-red," "intense, medium slightly reddish orange," and "somewhat brownish orange," are a few of the variations. "Salmon pink" further muddies the water. Perhaps one reason for the wide range of descriptions is the extreme rarity of fine orange-toned stones from Sri Lanka, with the result that many authors have not had the chance to experience a wide range of these stones or have based their observations on the rather more common, but still rare, synthetic stones. At one time the reason given for the scarcity of fine natural padparadscha sapphires was that they are so valued in the Orient (where saffron is a holy color in many places) that they never reach the West. It would appear, however, that just plain rarity may be the real reason.

TABLE 1. A chronological listing of the use of the term *padparadscha* in the available literature.

Color	Reference	Color	Reference
1. Reddish yellow[a] ("padmaragaya")	Coomaraswamy, 1904	22. Orange[a]	Gübelin, 1968
2. Reddish yellow[a]	Bauer, 1909	23. Reddish to somewhat brownish-orange[a]	Sinkankas, 1968
3. Reddish yellow[a] ("padparadschah")	Brauns, 1913	24. Orangy yellow to orange[a]	Parsons, 1969
4. Rare and delicate orange-pink[a]	Kunz, 1915; after Claremont, 1913	25. Orange (more orange than pink)[a]	Feasey, 1970
5. Orange-yellow[b]	Michel, 1928	26. Orange[a]	CIBJO, 1970
6. Orange to reddish yellow[a]	Bauer, 1932	27. Gorgeous orange[a]	Desautels, 1971
7. Light bright orange [a]	Gravender, 1933	28. Rare orange-red[c]	Mason and Packer, 1973
8. Salmon pink[b]	Spencer, 1936	29. Subtle pink-orange[c]	Arem, 1973
9. Orange to orange-red with tints of brown[a]	Juergens, 1939	30. Intense orangy pink (p. 33)[a]	Bank, 1973
10. Yellowish aurora red (p. 222)[c] Peculiar reddish yellow (p. 143)[b]	Smith, 1940	31. Light orangy yellow to yellow[c]	Shipley, 1974
11. Orange[b]	Kraus and Slawson, 1947	32. Slightly reddish orange[a]	Liddicoat, 1975 (and earlier editions)
12. Peculiar orange-pink[c]	Webster, 1947	33. Orange[a]	Webster, 1975
13. Golden red (p. 103)[c] Orange (p. 252)[c]	Pearl, 1948	34. Touch of pink in its orange[a] (as opposed to Tanzanian stones so labeled)	McNeil, 1976
14. Rare orange[a]	Foshag, 1950	35. Pinkish orange[a]	Anderson, 1976
15. Tangerine colored[a] Orange to pinkish orange[b]	McNeil, 1950	36. Orange pink[a]	Schumann, 1977
16. Reddish yellow (p. 115)[a] Orange (p. 124)[a]	Schlossmacher, 1954	37. Yellow with totally reflected tones of pink[a]	Arem, 1977
17. Reddish yellow[c]	Weinstein, 1958	38. Rare orange-yellow to orange[a]	Hurlbut and Switzer, 1979
18. Yellow-orange or tangerine (p. 357)[a] Orange-tangerine (p. 804)[a]	Cavenago-Bignami Moneta, 1959	39. Orange[b]	Nassau, 1980
19. Orange[a]	Weber, 1959	40. Tangerine colored[a]	Chernush, 1980
20. Orange[a]	Baerwald and Mahoney, 1960	41. Pinkish orange ("an unnecessary term")[c]	Newman, 1981
21. Orange (p. 180)[b] Peculiar brownish orange (p. 305)[b]	Anderson, 1964	42. Intense, medium slightly reddish orange[a]	GIA Colored Stones course, 1983

[a]*Refers to natural sapphires.*
[b]*Refers to synthetic sapphires.*
[c]*Refers to both natural and synthetic sapphires.*

IMPORTANT EXAMPLES OF STONES LABELED PADPARADSCHA

A few collections of precious stones on public view have one or more sapphires that the curators have labeled padparadscha. An 11.95-ct stone from the Hixon Collection at the Los Angeles County Museum of Natural History is labeled "Pink padparadscha—a bi-colored sapphire." Another stone in this collection, weighing 6.51-ct, is labeled "Padparadscha sapphire." Another stone nearby, of 16.36 ct, is called simply "Orange sapphire." (All three of these stones are illustrated in the Spring 1977 issue of *Gems & Gemology*, pp. 270–271.) Not in the Hixon Collection but part of the museum's general collection is a rather flat pinkish orange sapphire in a

Figure 3. A synthetic sapphire marketed by Kyocera International, Inc., in Kyoto, Japan, as "Inamori grown padparadscha." This stone weighs 1.05 ct. Photo by Tino Hammid.

Figure 5. The large orange sapphire (precise weight, 100.18 ct) in the Morgan Collection at the American Museum of Natural History in New York. Photo by Tino Hammid.

Figure 4. This approximately 14-ct stone, donated to the Los Angeles County Museum of Natural History in 1955 as a "padparadscha sapphire," was only recently determined to be a Verneuil synthetic. Photo by Mike Havstad.

ring which many people feel is "true" padparadscha color (figure 4). However, while we were preparing a photo for this article the stone was determined to be a Verneuil synthetic.

Figure 5 is the 100-ct orange sapphire in the Morgan Collection of gems at the American Museum of Natural History in New York City. This stone is perhaps the largest and finest orange Sri Lankan sapphire on public display anywhere. It has been used locally in New York as the "master padparadscha" by some gem dealers and collectors. It is a superb stone—the outstanding gem in its display case featuring numerous other fancy-color sapphires. It is oval in shape with a moderate "bow tie." In the "bow tie" area the color appears yellowish orange, while the ends appear intense reddish orange. This Morgan sapphire was the standard that one collector used years ago as a guide in selecting a 40-ct stone that he considered the "crown jewel" and most valuable stone in his collection. Unfortunately, when his estate was critically examined, the stone was found to be synthetic. However, not every knowledgeable collector and dealer considers the Morgan stone to be a "true" padparadscha. One astute collector complained that it was too orange at the ends and yellow in the middle with none of the tantalizing pinkish orange he looks for. Figure 6 is a 30-ct pinkish orange natural sapphire that most qualified dealers and many observers at GIA and the GIA Gem Trade Lab have agreed satisfies their understanding of the term.

CONCLUSION

It has been suggested that the GIA, in cooperation with other trade and educational organizations, should make an effort to standardize the term *padparadscha* with the aim of establishing criteria by which a true variety of corundum could be established.

Unfortunately, no tests that a gemologist can make are helpful. The stones from Sri Lanka that resemble the above-noted 30-ct stone fluoresce and have chromium absorption lines in the spectrum but no iron lines. Similar pinkish/brownish orange stones from East Africa have an iron line and weak chromium lines but have very weak to no fluorescence. Clearly, no set of chemical or physical constants exists to make the determi-

Figure 6. This 30-ct pinkish orange sapphire was believed by many observers from both GIA and the trade to agree with their perception of the term padparadscha. *Photo by Tino Hammid.*

Figure 7. The term padparadscha *has also been applied—and many feel aptly—to this 1126-ct sapphire crystal found recently in the Ratnapura district of Sri Lanka. Photo © 1983 Tino Hammid.*

nation. One half-joking suggestion is that if we are convinced of the derivation of the term as coming from the Sinhalese words meaning lotus color, we could have a master lotus blossom—or two. (A dying blossom would further allow the brown shades of sapphires to qualify!) However, we have no evidence that an orange variety of lotus exists.

In spite of the confusion in the literature regarding the descriptions of the term, knowledgeable veterans of the gem trade are in better agreement than this article so far indicates. For instance, all dealers who were shown the slide reproduced in figure 6 agreed that it was an excellent rendition of their understanding of the color of a padparadscha. All of those we spoke with who saw the spectacular 1126-ct pinkish orange sapphire crystal from Sri Lanka pictured in figure 7 also agreed that the color was aptly referred to as padparadscha.

It is clear that the term *padparadscha* was applied initially to fancy sapphires of a range of colors in stones found in what is now Sri Lanka. If the term is to have merit today, it will have to be limited to those colors historically attributed to padparadscha and found as typical colors in Sri Lanka. It is GIA's opinion that this color range should be limited to light to medium tones of pinkish orange to orange-pink hues. Lacking delicacy, the dark brownish orange or even medium brownish orange tones of corundum from East Africa would not qualify under this definition. Deep orangy red sapphires, likewise, would not qualify as fitting the term *padparadscha.*

This new description will replace that given in the current GIA Colored Stone course when it is next revised. Because of the subjectivity of the term, however, the GIA Gem Trade Laboratory, Inc., will continue its policy of not using *padparadscha* on identification reports, treating it in the same manner as the trade grades Kashmir sapphire and Siberian amethyst.

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NOTES · AND · NEW TECHNIQUES

A NEW CLASSIFICATION FOR RED-TO-VIOLET GARNETS

By W. William Hanneman

The recent article by Manson and Stockton on the classification of red-to-violet garnets should be welcomed by all gemologists. With this work, the Gemological Institute of America has opened the subject for review and revision. The following article presents an overall view of previous red-to-violet garnet classification schemes and proposes a new one that is well within the capabilities of every gemologist.

The major problem confronting gemologists with respect to garnets has been that of "not being able to see the forest for the trees." The modern tendency in gemology is to make more and more measurements on more and more specimens. This accomplishes the characterization of more and more individual trees. Development of a useful classification scheme for garnets requires that we stand back, look at the entire forest, and decide what it is that we wish to accomplish with our classification.

In regard to the red-to-violet garnets, the data reported by Manson and Stockton (1981) represent a prodigious effort. A plot of their data relating refractive index (R.I.) to specific gravity (S.G.) is shown in figure 1. The data points represent the "trees." Now, let us look at the forest.

The black line connecting the pyrope and almandine end members defines the positions we would expect for all pure garnets comprising the pyrope-almandine solid-solution series. Points lying off the line result from either experimental error or the presence of "other factors." Specifically, if we disregard analytical error, points lying above the line suggest the presence of a substance having a positive effect on R.I. and a lesser positive or negative effect on S.G. In this case, the cause may be chromium and calcium substituting for aluminum and magnesium, respectively. Points lying below the line suggest the presence of something that effectively lowers the R.I. relative to the S.G. Such an effect could be produced by manganese substituting for iron or by the presence of inclusions.

Because their statistical analysis indicated a high correlation for R.I., S.G., pyrope content, and almandine content, Manson and Stockton divided the red-to-violet garnet series into three groups: pyrope, pyrope-almandine, and almandine. The divisions between groups were arbitrarily set at ratios of 60% pyrope:40% almandine and 60% almandine:40% pyrope, as determined by microprobe analyses. Data points in figure 1 are color coded to reflect this scheme. The lack of a clear boundary for pyrope, as well as the presence of several serious divergences, indicated that this approach was not completely successful.

Be that as it may, Manson and Stockton devel-

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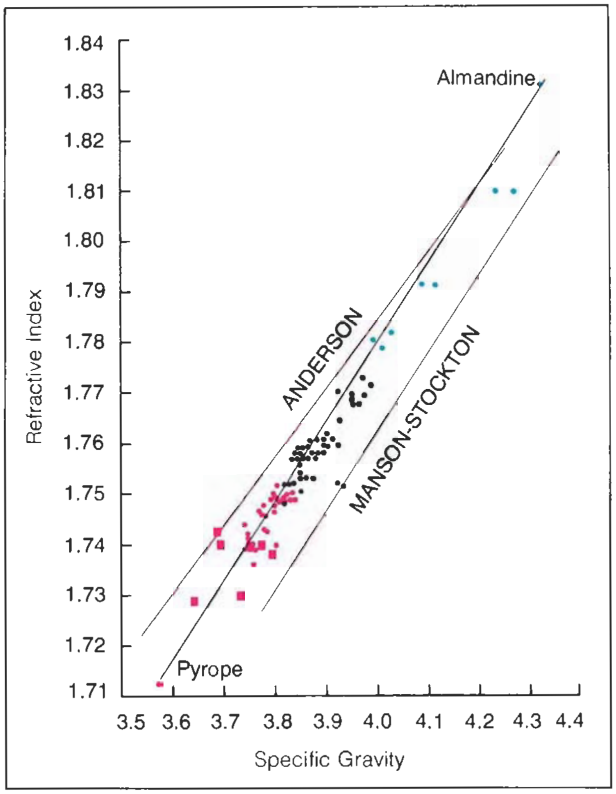

Figure 1. Data reported by Manson and Stockton (1981) relating refractive index to specific gravity and color coded to indicate ratio of pyrope:almandine as determined by microprobe analyses. Red indicates a ratio greater than 1.5:1, black indicates a ratio between 1.5:1 and 1:1.5, and blue indicates a ratio less than 1:1.5. Lines labeled Anderson and Manson-Stockton define an area within which natural red-to-violet garnets have been described. Chrome pyrope values reported by B. W. Anderson (1942) and Manson and Stockton (1981) are designated by red squares.

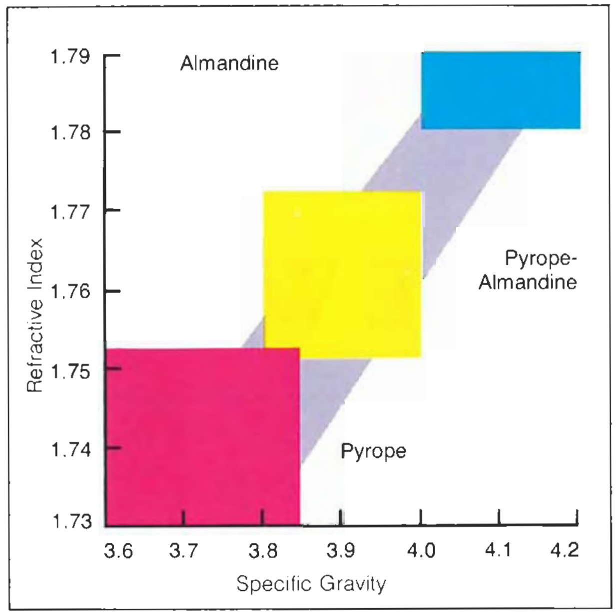

Figure 2. Graphical representation of refractive index and specific gravity limits for pyrope, pyrope-almandine, and almandine garnets as proposed by Manson and Stockton. The lavender areas, although lying between the Anderson and Manson-Stockton lines, are undefined. Note overlap of areas.

oped what they stated to be a "more specific definition of the widely accepted terms *pyrope, almandine,* and *rhodolite* for meaningful gemological classification." These authors proposed replacement of the term *rhodolite* as a garnet group by the term *pyrope-almandine,* and set R.I. and S.G. limits as illustrated in figure 2. In order to evaluate this new definition, it is useful to reexamine their data (as reproduced in figure 1) and relate it to previous publications of B. W. Anderson (1942, 1980) and R. Webster (1975).

COMPARISON OF THE B. W. ANDERSON AND MANSON-STOCKTON SCHEMES

Two red lines have been drawn in figure 1. Effectively, they form the limits of the red-to-violet garnet forest. The lower line, labeled Manson-Stockton, can be considered a "base line." All of the garnets studied by these workers lie above this line. The upper line, labeled Anderson, was derived from B. W. Anderson's diagram of the pyrope-almandine series, which was reproduced by Webster (1975, p. 149). This line can be considered an expression of the upper limit of the red-to-violet garnets, as determined experimentally by Anderson. The fact that it does not coincide with the theoretical pyrope-almandine line indicates the influence of other factors in "real-world" garnets.

For nearly 50 years, the Anderson scheme has been in use practically everywhere except in the United States. The scheme employs three divisions—pyrope, pyrope-almandine, and almandine—precisely those now advocated by Manson and Stockton. This author accepts without reservation the Manson-Stockton recommendation that the term *rhodolite,* as it has been used by U.S. gemologists, be replaced by the term *pyrope-almandine.* The question to be addressed here is whether the newly proposed Manson-Stockton scheme presents sufficient advantages to displace the B. W. Anderson scheme.

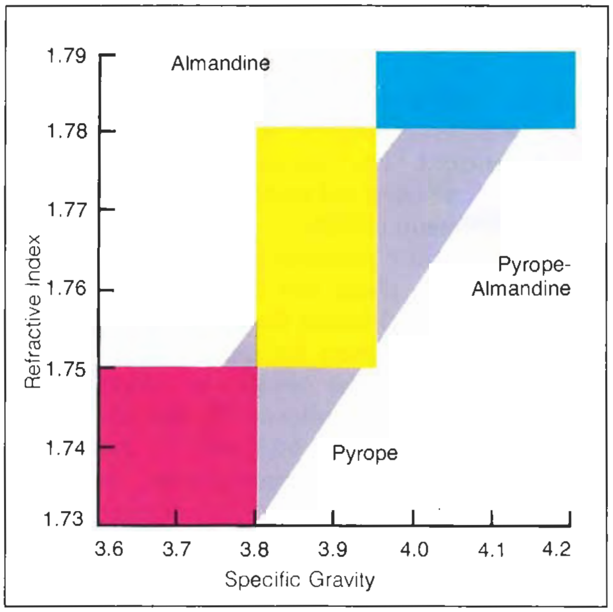

Figure 3. Graphical representation of refractive index and specific gravity limits for pyrope, pyrope-almandine, and almandine garnets as proposed by B. W. Anderson. The lavender areas, although lying between the Anderson and Manson-Stockton lines, are undefined.

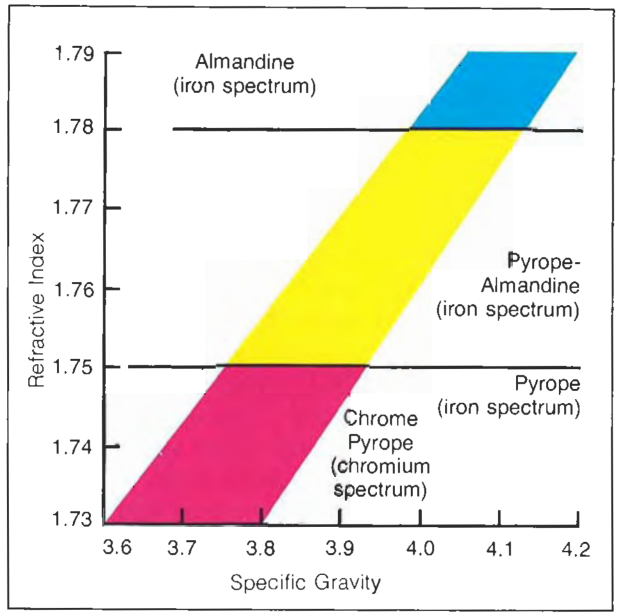

Figure 4. Graphical representation of proposed scheme for the classification of the red-to-violet garnets on the basis of refractive index and visible spectrum. All colored areas lie between the Anderson and Manson-Stockton lines.

It appears reasonably safe to postulate that almost all red-to-violet garnets likely to be encountered by a gemologist will have R.I.-S.G. coordinates somewhere between the Anderson and the Manson-Stockton lines. Therefore, the merits of any classification scheme ought to be related to how well that scheme covers all the possibilities. The R.I. and S.G. limits for the Anderson and Manson-Stockton schemes are graphically illustrated in figures 2 and 3. The lavender areas represent "possible" R.I.-S.G. coordinates that are not covered by the schemes and are potential sources of problems for gemologists. It is evident that neither scheme covers the entire range of possibilities.

If it is accepted that the purpose of a classification scheme is to enable the gemologist to make a decision on the basis of his test results, the presence of an undefined area or an area of overlap is undesirable inasmuch as it makes any such decision impossible. The Anderson scheme (figure 3) could be improved by changing the arbitrary limits of S.G. from 3.95 to 4.00 for the pyrope-almandine mixture, and from 3.80 to 3.85 for pyrope. The Manson-Stockton scheme (figure 2) suffers from a gap in R.I. values between 1.774 and 1.779. In addition, there is an overlap in the pyrope and pyrope-almandine ranges: i.e., R.I. = 1.751 to 1.752, S.G. = 3.81 to 3.86. These deficiencies are unacceptable in light of the fact that the divisions are purely arbitrary, and there is no fundamental characteristic that dictates that there should be any divisions at all.

Now, if neither of these schemes can be judged fully satisfactory, there is room for improvement. In the following paragraphs an alternative scheme is presented.

BACKGROUND FOR PROPOSED GARNET CLASSIFICATION SCHEME

If one's concern is limited to only the red-to-violet garnets, the assumption can be made that the red color is due to the presence of iron and/or chromium. It is generally accepted that the iron is associated with the almandine end member and the chromium with the pyrope. Consequently, irrespective of their calcium or manganese contents, all red-to-violet garnets have traditionally been considered members of the pyrope-almandine series.

The spectral characteristics of the red-to-violet garnets are well described in the Manson-Stockton article. However, since pure pyrope garnet is colorless, it is the iron (almandine) that produces the color and the spectrum that is the hallmark of the pyrope-almandine series.

Spectral evidence also indicates that pyrope forms another series in which chromium substitutes for aluminum and produces a red color. Mineralogically speaking, one might call this a pyrope-knorringite series. However, gemologically speaking, this series does not appear to be very extensive and this author proposes that its gem members be classified under the color variety chrome pyrope. This nomenclature is believed to be gemologically consistent with varieties such as chrome tourmaline and chrome diopside. With its intrinsic chromium content and unique absorption spectrum, chrome pyrope deserves recognition as a distinct variety and should not be buried in the pyrope-almandine series.

Finally, the determination of physical constants should provide information on which to base a decision as to classification. Both R.I. and S.G. measurements reflect the same elements of composition. Anyone who has tried to identify gems by S.G. measurements is well aware of the difficulty of obtaining accurate results as well as the problems caused by inclusions. The R.I., however, is determined more easily and precisely. Consequently, the scheme proposed here employs R.I. determinations only, without S.G.

PROPOSED RED-TO-VIOLET GARNET CLASSIFICATION SCHEME

Acceptance of the preceding ideas leads to the conclusion that the red-to-violet garnets could be classified into two categories: pyrope-almandine series and chrome-pyrope color variety. Insofar as neither the colorless pyrope nor the almandine end members are known as gems, it would be reasonable simply to call all the members of this series pyrope-almandine mixtures for the purposes of a gemological classification. They are all characterized by a typical almandine (iron) spectrum. Tradition, however, militates against this, so the old divisions are retained.

The proposed scheme is very simple. Chrome pyrope is characterized by its chromium spectrum and by R.I. values below 1.750. Members of the pyrope-almandine series are characterized by their iron spectrum. Pyrope exhibits an R.I. of 1.750 or less, while almandine exhibits an R.I. of 1.780 or more. Specimens exhibiting intermediate R.I. values are designated pyrope-almandine. The scheme is illustrated in figure 4.

In the final analysis, this scheme is little more than the B. W. Anderson scheme with the S.G. limits removed. The problem of differentiating chrome pyrope from red spinel has been fully covered by Anderson (1980).

The remaining problem is that of assigning a classification to those low R.I. (<1.750) garnets that show spectral bands due to both chromium and iron. The criterion for making this distinction is based on the results of Manson and Stockton and is as follows: If the three iron absorption bands at 504, 523, and 571 nm can be observed with a hand spectroscope, the stone should be classified as pyrope; chrome pyrope will exhibit absorption bands at 675 and 687 nm, and will absorb virtually all light below 570 nm. If sufficient chromium is present to mask at least two of the iron bands, the stone should be classified as a chrome pyrope.

SUMMARY

Because of gaps and overlaps, the Manson-Stockton scheme for red-to-violet garnets cannot be considered acceptable. A different interpretation of their data leads to the B. W. Anderson scheme, which is already in use outside the United States. The S.G. limits of this scheme, however, are too narrow. Given the problems of determining S.G. measurements, a simplified scheme based on R.I. and spectral considerations has been presented. The "official" recognition of the color variety *chrome pyrope* is recommended.

EPILOGUE

If any revisions to garnet classification schemes are to be accomplished, it is imperative that input be received from many sources and a consensus reached. In an attempt to encourage a dialogue on this subject, D. V. Manson and C. M. Stockton, whose work was discussed above, have been invited to comment on this paper. Their response follows.

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A RESPONSE TO "A NEW CLASSIFICATION FOR RED TO VIOLET GARNETS"

By D. Vincent Manson and Carol M. Stockton

The comments by Dr. Hanneman on our initial garnet article (*Gems & Gemology,* Winter 1981) are appreciated. We would agree with his assessment that the article is a discussion of "trees," since it was intended to be primarily a report on data obtained to date. Indeed, in the final sentence of our article, we stated that "the precise role of color in the classification of all gem garnets, as well as the roles of the other properties examined in this study, must remain unresolved until we have completed the examination of garnets in the other ranges of color and chemical composition." Since, as Hanneman points out, "the merits of any classification scheme ought to be related to how well that scheme covers all the possibilities," we intend to reserve our conclusions as to the gemological classification of any and all garnets until we have examined samples of as many different types of gem garnets as we reasonably can. Only after an adequate sampling of "trees" can we stand back and consider the forest as a whole.

We would agree with Hanneman's statement that "all red-to-violet garnets have traditionally been considered members of the pyrope-almandine series." However, we do not believe that such an idea should be accepted purely as an act of faith, without confirmatory evidence. (In fact, our article presented, among the other data, two red stones that each contained more spessartine than either pyrope or almandine; please refer back to our figure 11.) In any case, gem garnets have not previously been characterized in adequate detail from the gemological point of view. Therefore, we have been documenting properties of a large collection of gem garnets to determine whether and to what extent the data support or contradict traditional gemological and mineralogical classification. While "deficiencies" in our data may present difficulties, they nonetheless represent observed facts and, unlike a scheme, cannot be changed at desire. Additional data may fill "gaps" in our data or may contradict current assumptions, but the ideas presented thus far are based on the information currently at hand.

We would briefly like to point out that in our article we did not recommend discarding the term *rhodolite* nor did we equate it with the term *pyrope-almandine.* In fact, the only comment we ventured on this subject was that "rhodolite, according to the original definition of the variety, falls within the region to which we would also apply the term *pyrope.*" This original description and its reference were included in our article.

The creation of a classification system requires an understanding of the nature and purpose of classification itself. Fundamentally, a classification is a means of describing as many relevant characteristics of a material as is both possible and practical. While various scientific techniques make it possible to observe and measure many gemstone properties, the availability of tests and instruments to the gemologist on a day-to-day basis places practical limitations on the usefulness of this information. Deciding what is and is not relevant to gemology is ultimately a key issue. We are not yet convinced of the irrelevance of chemical composition among the garnets.

Vital to any discussion of classification is the clear and unambiguous use of certain terms, including *group, series, species,* and *end member.* In our articles, we used these terms consistently according to their established mineralogic meaning.

However, one term of particular importance to gemolgy is *variety,* a level of classification where the differing needs of gemology and mineralogy require special attention. In our final article on garnets, we will present a gem garnet classification based on all the data we have gathered. The ideas expressed by Hanneman are not unreasonable if one wishes to devise a classification system for a portion of the garnet "forest," such as the red-to-violet garnets. However, input from many sources will be essential to reach a consensus among gemologists on the issues involved in a valid classification system that covers all gem garnets.

Editor's Note: Dr. Hanneman has indicated his intention to continue this discourse after the final classification article is published.

A SPECIAL THANKS

The Gemological Institute of America wishes to extend its sincerest appreciation to all of the people who contributed to the activities of the Institute through donations of appropriate gemological materials. We are pleased to acknowledge many of you below:

Pat Adams
A. E. Alexander (estate)*
Benjamin O. Anderson
G. Andrasko
Dr. Pranab Bagchi
Robert Bartlett
Artur Birkner
Donald E. Booth
Kirk A. Brelsford
Laurence D. Broussard
Carter F. Buller
Jerry Call
Thomas Chatham
Carl Chilstrom
Crystal Earth
Crystal Optics Research, Inc.
Richard T. Daniels
D. Sandra Dixon
Daniel J. Duke
Gary Evangalides
Everts Jewelers
Dr. and Mrs. Joseph Farrar
Dr. Jack Fine
Mr. and Mrs. Si Frazier*
Jeff Gendler
Dr. James P. Gills
Kenneth E. Gordon
T. J. Gray
Dr. E. J. Gübelin
M. F. Guinn
Dr. William L. Harville
F. P. Heffelfinger
Elise T. Hinrichs
Lee C. Hunt
Industrie de Pierres Scientifiques
Intergold*
Jim Jewelers
Dr. J. Ronald Johnson
Robert E. Kane
Dr. Peter C. Keller
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Sam Koulish
Dr. Neil D. Kravetz
Jeffrey J. Kurtzeman
Dorothy J. Lapon
Bill Larson
Richard Larson
Charles L. Leavitt, Jr.
André Light
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John McVickar
Mr. and Mrs. Frank Melanson
Michael Menser
Paul B. Merkel
Frank Miley
Shin Minyano*
Russell F. Morrison
Allan C. Mulder
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Ama Nishtar
Gail Osterman
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ALEXANDRITE, Cat's-Eye

Recently brought to the Santa Monica laboratory for identification was the fine 4.02-ct cat's-eye alexandrite illustrated in figure 1 as it appears when viewed with incandescent light. In addition to the very distinct change in color from red to blue-green (in natural or fluorescent light), the transparency of this stone was exceptional as a result of the high clarity; the majority of the fine needles causing the chatoyancy were concentrated in a layer at the base of the cabochon. Another interesting feature of this stone was the bluish appearance of the eye when viewed in fluorescent illumination.

Figure 1. Cat's-eye alexandrite as seen in incandescent light, 4.02 ct.

DIAMOND

Carved Diamond

Very flat diamond crystals are a real problem for diamond cutters, who frequently must sacrifice considerable weight to achieve anything approximating proper proportions in a faceted stone or else must make an unsatisfactory shallow stone, a "fish-eye." One innovative solution seen in the New York laboratory was a thin crystal that had been carved in the shape of a fish (figure 2). The natural surface characteristics of the crystal even resemble the scaly appearance of a fish. One would assume that in the case of this 2.87-ct stone, the weight retention was excellent.

Figure 2. Carved fish-shaped diamond. The stone weighs 2.87 ct and measures 18.38 mm × 8.95 mm × 2.26 mm thick.

Pink Diamonds

Some time ago in New York, we heard of an attractive pink diamond that lost its color when the stone was boiled in acid. Later it was determined that the stone had been "painted."

Recently, a round pink diamond weighing more than 3 ct (figure 3) was submitted to the New York laboratory for a full quality analysis. The stone showed strong blue fluorescence when exposed to long-wave ultraviolet radiation, so it was not surprising to see a distinct 4155 Å "cape" line with the hand spectroscope. When the stone was being graded for clarity, however, we realized that the color was in fact due to a coating—possibly an enamel. Using a technique developed years ago by Eunice Miles (whereby the stone is illuminated with both the fluorescent overhead light of the microscope and diffused transmitted light created by placing a white tissue over the light well underneath), some of the pavilion facets showed dark marginal lines paralleling the edges of the pavilion mains and a few "craters" where the coating was rejected, probably due to dirt. At 63× magnification (figure 4), the coating could be seen readily on the girdle. In all such cases, it is essential to examine the surface of the stone carefully to avoid overlooking the presence of a coating and inadvertently pronouncing the color natural.

Figure 5 shows a beautiful 3.31-ct "salmon" pink, heart-shaped diamond, brought into the New York lab, that the cutter says came off the wheel as intense a pink as he had ever seen. The owners were overjoyed when they saw the stone after it had been boiled out. When viewed

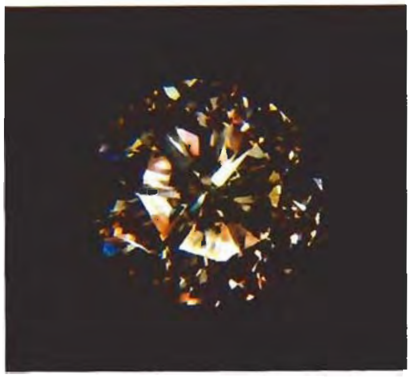


Figure 3. Pink diamond, 3 ct.

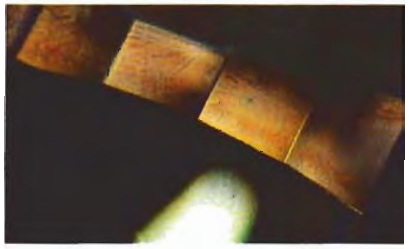


Figure 4. Pink coating on girdle of diamond shown in figure 3. Magnified 63×.

Figure 5. Pink heart-shaped diamond, 3.31 ct. Magnified 10×.

through the table toward the shoulders of the stone, totally reflected areas were actually red. Within a few days, however, the red had disappeared and in its place was a more common brownish pink. Boiled in acid, the stone temporarily regained some of its exciting red color, only to lose it again in a few days. Later, the stone was heated to a much higher temperature in an alcohol flame; the red again returned, but only temporarily.

We are told that this behavior is not unusual with yellow diamonds. Frequently stones appear intense yellow while hot from the wheel but assume a more normal color when finished and offered for sale. This is the first time such a color change in naturally colored pink stones has been reported to us.

We are reminded of another pink diamond, a magnificent 16-ct pear shape, which turned an ordinary brown following exposure to long- and short-wave ultraviolet and then X-radiation in rapid succession. Gentle warming in the light well of a Gemolite for a few minutes restored the pink color. A series of small rough pink diamond crystals were later exposed in the same manner. Fewer than half of the 16 specimens responded to the irradiation and warming in the same way. Clearly, all pink diamonds do not respond alike to irradiation and subsequent warming.

EMERALD

Imitation Emerald

Submitted to the Los Angeles laboratory for identification was the matched set of jewelry shown in figure 6, which consists of a necklace, a pair of earrings, and a combination ring and pendant. The client explained that when the combination ring and pendant was recently steam cleaned, the center stone lost a considerable amount of color. Subsequent testing showed that all of the green stones were untreated natural emeralds with the exception of the center stone in the combination ring and pendant, which proved to be a natural beryl that was coated with a green substance that imparted most of the color to the stone.

Examination of the treated stone under the microscope readily revealed a green coating in most of the surface fractures and cavities. The steam cleaning had apparently removed the green surface treatment from most of the stone, leaving small amounts only in these areas.

When the stone was tested with a cotton swab saturated with acetone, a very noticeable green stain appeared on the swab. Also, the green coating could be flaked off very easily with a sharp point such as the pin end of a brush probe. In addition, the coating melted when a thermal reaction tester was used.

This stone was treated in a manner very similar to that used on several stones seen recently in the laboratory and reported in the Summer 1982 issue of *Gems & Gemology*, pages 102 and 103. Indications are that the treatment on this stone is some type of paint (perhaps a transparent glass paint), although similar results have been obtained with green cement or plastic.

Tubules in Emerald

Recently encountered in the New York lab was a 1.57-ct flux-grown synthetic emerald that had all the properties of a flux-grown synthetic—low refractive index and birefringence, low specific gravity, and red fluorescence to ultraviolet radiation—but atypical inclusions (figure 7). A few spicules somewhat resembling those seen in hydrothermal synthetic emeralds, though without the crystal caps on the ends, were present, but some inclusions were darker and more tubular. By coincidence, we received for testing at the same time a high-property natural emerald which also had several long tubules (see figure 8) as well as numerous needles with random orientation seen near the girdle.

FLUORITE AND ROSE QUARTZ NECKLACE

The New York laboratory received a necklace that was reminiscent of pin to represent a "sham"-rock leaf. Buff top-cut stones have a cabochon crown and a faceted pavilion.

Figure 6. The large stone (11.68 mm × 8.90 mm × 6.50 mm) in the combination ring/pendant at the center of this suite is coated beryl; the other stones are natural emeralds.

the pink and green grossularite garnet strand pictured in the Summer 1982 issue of *Gems & Gemology*. However, testing proved this one to consist of round pale green fluorite beads alternating with rose quartz beads (figure 9). We were surprised that there was no damage or cleavage evident in the fluorite beads.

GARNET AND GLASS DOUBLETS

Figure 10 illustrates the first non-faceted garnet-and-glass doublets seen in our New York lab. They are buff-topped, green, heart-shaped stones with garnet cabochon tops and green glass pavilions set with a natural red spinel and diamond in a

OPAL

Cat's-Eye Opal

Not too long ago, we examined in the New York laboratory a rough specimen of banded, translucent, brownish to green material that we tentatively identified as common opal, with no play of color. Later, we were allowed to examine and photograph a 1.5-ct chatoyant orange-brown cabochon (figure 11), said to have been cut from a clear band of this material. Testing by X-ray diffraction in the Santa Monica lab established the presence of cristobalite. A cristobalite diffraction pattern superimposed on an amorphous background indicates that the ma-

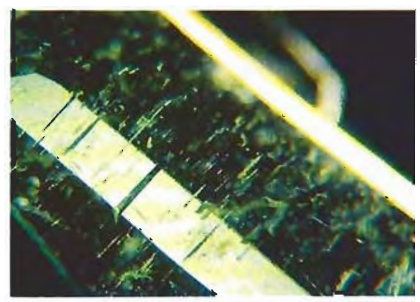


Figure 7. Tubules in a synthetic emerald. Magnified 30×.

Figure 8. Tubules in a natural emerald. Magnified 37×.

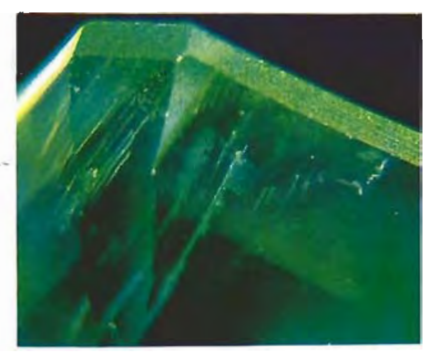


Figure 9. Fluorite and rose quartz necklace. The beads are approximately 8 mm in diameter.

Figure 10. Pin set with three buff-top garnet and glass doublets as well as a natural red spinel and a diamond. Magnified 10×.

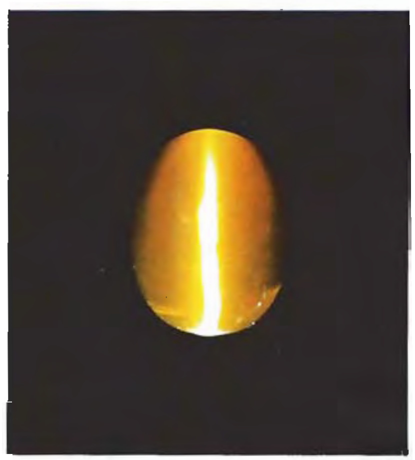


Figure 11. Cat's-eye opal, approximately 1.5 ct.

terial is opal. This is the first cat's-eye opal of this type seen by the lab.

Treated Opal

A section of oolitic opal is shown on page 104 of the Summer 1982 issue of *Gems & Gemology.* It is very similar in appearance to a dyed (sugar-treated?) oolitic opal seen recently in New York. Each of the round dots of the oolitic structure had absorbed the black dye, as had several fractures. Such stones must be examined very carefully before the color is pronounced natural.

PALEONTOLOGICAL GEMOLOGY

Aficionados of fossils will appreciate the perfection of the calcareous replacement of a trilobite, measuring approximately 32 mm × 38 mm, seen recently in the New York lab and shown here in figure 12. The fossil had been cleaned so carefully from its host rock that it could be definitely identified as the species *Phacops rana.* Mounted with care, it could be successfully worn in jewelry.

Other examples of the gemological use of fossilized organisms include amber, the multi-colored fossilized ammonites found principally in the Province of Alberta (Canada), petrified wood, and opal sometimes found replacing either animals or plants.

PEARLS

Cultured Button Pearls

A 3½-inch (9 cm) long, antique-appearing bar pin set with what seemed to be nine variously colored button pearls and two old-style-cut pear-shaped diamonds proved to the New York lab that appearances alone can be deceiving. The pearls, which resembled the American freshwater pearls seen in abundance 35 years ago, fluoresced to X-rays. The X-radiographs, too, suggested that most of the pearls were of natural origin; however, several showed centers that we associate with tissue-nucleated cultured pearls. Figure 13 shows one of each type.

Our client kindly volunteered to submit more than 100 half-drilled loose button pearls from which we were able to select buttons to match the colors of those on the bar pin (figure 14). X-rays of the loose pearls showed freshwater tissue-nucleated cultured origin. We have yet to learn by what process these symmetrical button pearls, with such flat unworked bases (as shown by the pearls on the left side of figure 14), could be cultivated.

Pearl Mysteries

A hank of more than 30 strands of small, variously colored, very baroque pearls came into the New York laboratory recently (see figure 15). They are unlike any we have ever seen here before. The darker-colored pearls fluoresced when exposed to long-wave ultraviolet radiation, suggesting natural color, saltwater origin. Whether the pearls are natural sac pearls or, as their irregularity suggests, some form of blister pearl, is not known to us. The possibility that they are the result of some type of cultivation exists. We would welcome information from our readers.

Some months ago, at the New York laboratory, we were asked to identify a number of white button pearls set in a platinum and diamond necklace. X-ray fluorescence indicated freshwater origin and the appearance and X-radiograph of the pearls indicated that they were natural. When the buttons were removed from their settings and X-rayed, however, the faint but characteristic central voids of tissue-nucleated freshwater cultured pearls appeared on the radiograph.

Figure 14. Loose freshwater tissue-nucleated cultured pearls arranged to show the various colors and the flat, unworked drilled bases.

Figure 15. A hank of small baroque pearls (largest is about 3 mm).

Figure 12. Fossilized trilobite, 32 × 38 mm, suitable for mounting in jewelery.

Figure 13. X-radiograph showing the structure associated with a natural pearl (left) and a tissue-nucleated cultured pearl (right).

This same group of button pearls, ranging up to 9.5 mm in diameter, is shown backside up in figure 16. Note that half of them have a peculiar, unnatural "balloon tire" or "doughnut" appearance in contrast to the flat backs of the drill-hole side of the multicolored small buttons shown in figure 14. This, of course, could not be seen in the mounted pearls. Why there is a difference, we do not know, since we do not know the method of cultivation of either type.

The fact that we have only recently been shown such symmetrical freshwater tissue-nucleated button shapes in quantity suggests that they are grown purposefully and are not, so to speak, accidental. On a short visit to pearl farms on Lake Biwa in Japan, the New York Lab

Figure 16. Drilled tissue-nucleated cultured button pearls viewed backside up.

Notes editor saw nothing that would indicate a process for producing such consistently well-shaped buttons. Possibly they are of Chinese or Tennessee River origin. Again, we would welcome information from knowledgeable readers.

QUARTZ, A Rare Cat's-Eye

A translucent, oval, brownish green cat's-eye cabochon set in a ring was received in the Santa Monica laboratory for identification and weight estimation. Figure 17 shows this attractive stone, which closely resembled a fine cat's-eye chrysoberyl. The refractive index, taken by the spot method, was 1.54 or 1.55 with weak birefringence. The optic figure could not be obtained because of the many parallel tube-like inclusions throughout the stone which caused the chatoyancy. There were no absorption lines visible in the spectroscope, thus eliminating the possibility of apatite. Nor did the stone show any reaction to ultraviolet radiation.

The indications were that the material was quartz. Using X-ray diffraction methods, we were able to prove conclusively that the material was indeed quartz. This was certainly one of the nicest quartz cat's-eyes this laboratory has ever encountered. The weight estimation formula suggested that the stone weighs approximately 19 ct.

Figure 17. Cat's-eye quartz ring, approximately 19 ct.

RUBY AND SYNTHETIC RUBY ASSEMBLED STONE

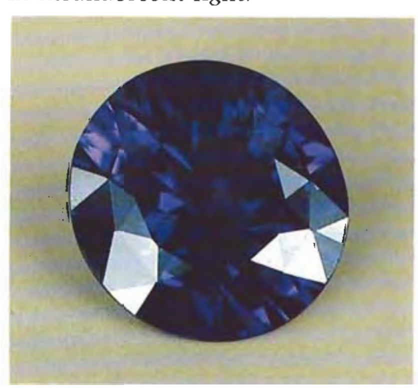
Figure 18 shows the reflection from the cement joining the portions of a 2.5-ct, very thin, natural and synthetic ruby doublet submitted to our New York lab for identification. Had the separation plane been less obvious, the deception might have been more successful. Since most stones of this type consist of nonfluorescent Australian greenish to blue sapphire crowns cemented to strongly fluorescent synthetic ruby pavilions, exposure to ultraviolet radiation is usually a quick means of detection. The top and bottom of this stone fluoresced almost equally. Inclusions in the natural section could be seen easily and the stone might have been accepted as natural without question if examined carelessly.

Figure 18. Reflection from the separation plane of a ruby and synthetic ruby assembled stone. Magnified 10×.

SPINEL, with Color Change

The Santa Monica lab had the opportunity to examine a most unusual natural spinel. The 12.45-ct oval mixed cut displayed a change of color from dark blue in daylight to purplish blue in incandescent light (figure 19). The most remarkable characteristic was its absorption spectrum. In addition to the usual iron lines, there were absorption bands centered at 5400 Å, 5800 Å, and 6300 Å. These bands are generally present in the absorption spectrum of a synthetic stone that owes its coloring to cobalt rather than iron.

Figure 19. Color-change natural spinel, 12.45 ct, shown in incandescent light.



UNCLASSIFIED ODDITIES

Back in the Summer 1971 issue of *Gems & Gemology*, we published a picture of an unusual broken cabochon that proved to be opal. We said then that "we have never seen anything even closely resembling this material." Several months ago, one of our Canadian readers with a long memory sent us an item she thought resembled the one in the photograph in that old back issue.

The item shown in figure 20, as received in Santa Monica, appeared

Figure 20. Broken concretion showing a bead-like core approximately 13 mm in diameter.

to be a broken concretion of some sort measuring approximately 13 mm in diameter. The thin outer covering was light beige in color, with a rough texture to it. The concentric layers inward were translucent and light brown in color, and surrounded the semitransparent, nearly spherical, bead-like core. Figure 21, taken at 63×, shows the very finely striated

Figure 21. Striated structure of the surface of the bead-like core shown in figure 20. Magnified 63×.

structure of the surface of this inner bead.

A hot-point test, judiciously applied, evoked an odor of burning hair, indicating an organic origin. Our reader found the object in a can of tuna fish purchased as pet food. Although we know it is of organic origin, we have no idea what creature created it, or how it was formed. Those of us in the Santa Monica lab must confess, once again, that "we have never seen anything even closely resembling this material."

* * *

Errata: *On page 230 of the Winter 1982 issue of* Gems & Gemology, *the absorption spectra for parisite and siderite were inadvertently reversed in printing. The spectrum in figure 8 is actually parisite; that shown in figure 9 is siderite.*

ACKNOWLEDGMENTS

Andrew Quinlan, from the New York laboratory, supplied the photos for figures 2–5, 7–16, and 18. Shane McClure, from the Los Angeles lab, is responsible for figure 6. Chuck Fryer supplied the photos for figures 20 and 21, and Tino Hammid provided the photos for figures 1, 17, and 19.

GEMOLOGICAL ABSTRACTS

Dona M. Dirlam, Editor

COLORED STONES

Asterism in Sri Lankan corundum. Th. G. Sahama, *Schweizerische Mineralogische und Petrographische Mitteilungen,* Vol. 62, 1982, pp. 15–20.

The occurrence of asterism, or star effect, in some gem-quality corundum has been known since antiquity. This optical phenomenon is due to light reflecting from a precipitate of needle-like inclusions in a regular arrangement in the basal (0001) plane of the corundum host crystal. It has been recognized for some time that these inclusions are rutile (TiO_2), but their small size in most corundums has usually precluded detailed study. This article presents further data on the nature of these rutile needles as they occur in a heavily included bluish corundum crystal from the Elahera area of Sri Lanka.

Two possible modes of origin have been suggested for these rutile needles in corundum: (1) exsolution of the rutile from a pre-existing corundum-rutile solid-solution phase with falling temperature, and (2) mutual crystallization of both corundum and rutile in a regular arrangement. The latter explanation may be appropriate for the heavily included crystal examined in this study, but the evidence is not wholly conclusive.

JES

Ferroaxinite—another new gem from Sri Lanka. H. A. Hänni and M. Gunawardene, *Journal of Gemmology,* Vol. 18, No. 1, 1982, pp. 20-27.

The title of this article may be somewhat misleading because ferroaxinite is not a newly discovered gemstone. What is new is its discovery in Sri Lanka. Axinite is a rather complex calcium aluminum borosilicate in which the calcium is frequently partially replaced by iron, manganese, and magnesium. The relative content of these elements can vary considerably.

This section is designed to provide as complete a record as possible of the recent literature on gems and gemology. Articles are selected for abstracting solely at the discretion of the section editor and her reviewers, and space limitations may require that we include only those articles that will be of greatest interest to our readership.

Inquiries for reprints of articles abstracted must be addressed to the author or publisher of the original material.

The reviewer of each article is identified by his or her initials at the end of each abstract. Guest reviewers are identified by their full names.

Depending on which element is dominant, three end-member compositions can be described: ferroaxinite, manganaxinite, and magnesioaxinite. The ferroaxinite found in Sri Lanka has a very high iron content which could be responsible for its specific gravity exceeding the recorded range for this material. The authors hypothesize that the source of this material is in the southern part of the island, most probably the Tissamaharama district, where general conditions are conducive to the formation of axinite.

The article includes three tables listing the measured properties of the sample stones and three photomicrographs of inclusions to illustrate the similarity of inclusions in Sri Lankan stones to those found in Brazilian material. These consist mainly of liquid feathers with two-phase fillings reminiscent of inclusions in tourmaline and topaz. *SFM*

Hornbill ivory. G. Brown and A. J. Moule, *Journal of Gemmology,* Vol. 18, No. 1, 1982, pp. 8–19.

Brown and Moule make an important contribution to the study of the organic substance known as hornbill ivory. Although the clear, concise description of hornbill ivory, the derivations of its various names, and the short synopsis of its use are noteworthy, the chief contribution of the article is in the description of the appearance of this material under the microscope.

The authors examined blocks of hornbill in three directions: vertically along the long axis of the beak (longitudinal section), vertically across the beak (cross section), and horizontally. Six photographs illustrate their research, including the arrangement and appearance of pigment granules in the hornbill casque. Thus, this article provides data that are both interesting and valuable for identifying hornbill ivory. *JMH*

Quality grading of jadeite. D. Healey and R. M. Yu, *Lapidary Journal,* Vol. 36, 1983, pp. 1670–1674.

Drs. Healey and Yu discuss the factors involved in the quality analysis of green jadeite. Their discussion identifies all key factors, but fails to place them into a systematic grading scheme. The evaluation factors are: color, texture and transparency, clarity, and form and craftsmanship.

The authors deal solely with green jadeite, colored by chromium. Using the *Munsell Book of Color,* they state that the most desirable green jadeite is 2.5G 4.5/11. Color mottling is addressed only indirectly.

Texture and transparency are grouped together next. However, the discussion concentrates on transparency, which is to be determined by texture, color, and perfection. Healey and Yu chose incongruent terms for classifying jadeites of differing transparency. From best to worst, pieces would be categorized as glassy, icy, coarse fibrous, and chalky. To judge transparency, the authors recommend directing diffused white light onto a metal plate with holes in which a stone covers one hole and neutral density filters (selected to match the amount of light transmitted by the stone) cover the other.

The categories for clarity are flawless, nearly flawless, lightly included, moderately included, very included, and highly included. Unfortunately, the authors do not adequately describe what distinguishes one category from the next. For example, the color of inclusions as it affects clarity is only discussed for the flawless and nearly flawless categories.

The form and craftsmanship section of the article depicts the most desirable cabochon form, but does not describe a system for evaluating the shape of cabochons. In short, the article presents only a discussion of, rather than a system for, the quality grading of green jadeite. *JMH*

The ruby rush. I. A. Mumme, *Australian Lapidary Magazine,* October/November, 1981, pp. 13–18.

In 1886, jewelers and mineralogists in Adelaide, Australia, incorrectly identified as rubies some red gem crystals discovered by David Lindsay on a surveying expedition near the Harts Mountain Range. From that moment, the great ruby rush was on. The news spread quickly, and before too long intense mining operations were being carried out. Bad news for all, though, came some months later from England: the red gemstones Lindsay had uncovered were not rubies, but garnets.

In a fascinating, but brief, historic account of the Great Ruby Rush of 1886, I. A. Mumme lets us examine those hard times as miners searched in vain for rubies only to find out later that the gemstones were garnets. Although no rubies were ever uncovered, mining in the area continued for some years as gold and other minerals were found. Even today, amateur gem hunters keep Adelaide jewelers busy identifying those famous red crystals. *GAR*

Star quartz asterism caused by sillimanite. C. F. Woensdregt, M. Weibel, and R. Wessicken, *Schweizerische Mineralogische und Petrographische Mitteilungen,* Vol. 60, 1980, pp. 129–132.

The asterism or "star" effect that results from the scattering of light by tiny, needle-like inclusions is known in many gem minerals. Asteriated corundum provides, perhaps, the best example; here, the acicular inclusions have been shown to be the mineral rutile. In this article, the authors report a new occurrence of asteriated quartz from Sri Lanka in which the needle inclusions were found, surprisingly, to be sillimanite (Al_2SiO_5). This translucent, white variety of star quartz is from the Niriella area near Ratnapura. The needle inclusions in this material are arranged parallel to the (0001) plane of quartz in three sets which intersect at a 60° angle. The identification of sillimanite was made by both qualitative X-ray fluorescence microanalysis and transmission electron microscopy methods. The sillimanite needles are elongate along their *c* crystallographic axis and average about 20 nm in thickness. In the (0001) plane, the [001] direction of sillimanite is parallel to the [100] direction of quartz. The star quartz from this area occurs in sillimanite-bearing metamorphic rocks. The authors speculate that the quartz and sillimanite formed simultaneously during metamorphic recrystallization. *JES*

Tsavorite. J. L. Ramsey, *Jeweler/Lapidary Business*, May/June 1982, pp. 16–17, 46–48.

Calling green grossular garnet, or tsavorite, the "gem for the 1980s," Ramsey begins by reviewing the brief history of this material since it was discovered in East Africa in the 1960s by geologist Campbell Bridges. He compares the excitement generated by this modern discovery to how people thousands of years ago must have felt about unearthing emeralds or rubies.

Ramsey then discusses the political and logistical difficulties of mining in Kenya and Tanzania, before turning to a brief note on the geologic occurrence of this garnet. In a section on color, he states that the term *tsavorite* is reserved for a stone with a fine, saturated green hue. In the final section, Ramsey explains that tsavorite is both very easy and very difficult to cut: easy because it does not pose orientation problems in that it lacks cleavage and is monochroic, but difficult because of the fractures and "bubble veils" that can crack during faceting. *MKC*

DIAMONDS

Deformation of country rock in the formation of kimberlite pipes. B. M. Nikitin, *International Geology Review*, Vol. 24, No. 9, 1982, pp. 1057–1063.

Diamond-bearing kimberlite pipes are generally believed to form by some kind of explosive-injection mechanism in the earth's crust. This article summarizes data on the country rock around kimberlite pipes to further elucidate this mode of origin.

Kimberlite pipes have a roughly spherical outcrop cross section that gradually tapers with depth. These pipes have three generalized parts: an uppermost, flared opening; a funnel-shaped vent; and a lowermost feeder channel. Differences in the nature of the rock both within and around the pipe are evident with increasing depth. Specifically, deformation and fracturing of the country rock are most pronounced near the uppermost opening. Within the pipe, the extent of brecciation is also greatest near the opening. Each of these features is consistent with the model of pipe formation by a forceful, explosive emplacement of a gas-rich kimberlite magma along zones of weakness in the earth's crust. *JES*

Diamonds of Kalimantan (in Japanese). K. Maeda, *Four Seasons of Jewelry*, No. 39, 1981, pp. 72-76.

In June 1981, the Akira Chikayama Gem Research Institute sponsored an eight-day inspection tour of the diamond-mining district in Kalimantan, an Indonesian territory on Borneo Island. One of 11 staff members on the tour, Maeda describes the locality, transportation, mining methods, superstitions surrounding diamond mining, and the brokerage of goods. Six photographs and a map accompany his discussion.

Diamond production started in Kalimantan around 500 to 600 A.D. However, the most famous stone, the 166.85-ct Tear of Queen Ratu Intan, was not discovered until 1965. The discovery of this diamond and, subsequently, of a 50.53-ct stone prompted the Indonesian government to finance a mining operation in Senpaka, in the central part of the island. These efforts proved unproductive, however, and the project was terminated in 1977, with digging confined to the southern part of the island. At present, the yearly volume at Kalimantan is only 30,000-50,000 ct, which averages just 1.5-2.5 ct per worker per year. Although they have only the primitive mining methods of digging and panning, workers are motivated by their dream of finding a stone the size of the Intan.

The author reported that although the diamonds cut in Marutapura often require recutting, the quality of goods is better than he expected and the colored diamonds in shades of yellow, violet, and brown are particularly attractive. *ALS*

Famous diamonds of the world (XIII): The "Wittelsbach" diamond. I. Balfour, *Indiaqua*, Vol. 32, No. 2, 1982, pp. 135–137.

Along with the Hope diamond, the Wittelsbach is one of the very few dark blue diamonds in existence. At 35.50 ct, the Wittelsbach is smaller than its more famous counterpart, the Hope (45.52 ct). Although both stones originated in India, they were cut from different pieces of rough.

The Wittlesbach was first noted in history in 1664 in the possession of Philip IV of Spain. The "Great Blue Diamond," as it was then called, passed in 1722 into the ruling House of Bavaria, the Wittelsbachs, with the marriage of the Archduchess of Spain to Prince Charles Albert. The last Wittelsbach king to wear the diamond was Louis III, who abdicated in 1918. Christie's of London attempted to auction the Wittelsbach in 1931, but the stone was withdrawn from the sale under mysterious circumstances. Its subsequent whereabouts were not recorded until 1962, when Belgian diamond dealer Joseph Komkommer formed a consortium to purchase the diamond. It was then sold to a private collector in 1964.

Mr. Balfour has written a well-researched and interesting article. The illustrations that accompany the text are at times pertinent, and at other times irrelevant. *FLG*

The transport and sorting of diamonds by fluvial and marine processes. D. G. Sutherland, *Economic Geology*, Vol. 77, No. 7, 1982, pp. 1613–1620.

Sutherland shows that alluvial diamond deposits are amenable to systematic analysis and presents certain observations concerning this type of diamond occurrence.

The hardness, structural stability, and chemical inertness of diamond all suggest that once crystals are released from their primary source rock they should tend to persist in the sedimentary record and thus be subject to transport by fluvial and marine processes. Diamonds originating in rather restricted source areas can be transported and distributed across regions of tens of thousands of square kilometers. During transport, they suffer abrasion and breakage, which lead to the attrition of the larger crystals. From a study of distribution patterns, the author demonstrates how diamonds are sorted by size, shape, and quality during downstream transport. With greater transport there is a reduction in size and a complementary increase in quality in a diamond population as the poorer quality diamonds are destroyed.

These observed effects are of considerable relevance to the diamond industry, because they allow predictions to be made that can serve as the basis of exploration for new diamond occurrences at primary sources as well as alluvial deposits. *JES*

GEM LOCALITIES

Gem quality gahnite from Nigeria. B. Jackson, *Journal of Gemmology,* Vol. 18, No. 4, 1982, pp. 265–276.

Jackson describes a new locality for gem-quality gahnite ($ZnAl_2O_4$), a species within the spinel mineral group. Octahedral crystals of cuttable size (up to 1 cm in diameter) occur in a complex pegmatite near the town of Jemaa, Nigeria. This material is moderately abundant at this locality, but the full extent of the pegmatite deposit is not currently known. The author discusses the chemistry and properties of gahnite from this area. It is interesting to note that although no change of color was found in material exposed to X-rays, a distinct change from blue to green did occur when the material was heated in an oxidizing atmosphere above 1000°C for one hour. This change is interpreted as resulting from the oxidation of the small amount of iron present in the gahnite.

A majority of the gahnite crystals are rich in inclusions; columbite, hematite, zircon, mica, and a transparent mineral thought to be beryl are among those identified thus far. Two-phase inclusions and other types of negative crystals are also abundant. Photographs and further details of the inclusions are provided. *JES*

On the treacherous trail to the rare ruby red. R. Nordland, *Asia,* Vol. 5, No. 3, 1982, pp. 34–41, 54–55.

Rod Nordland, the Asian correspondent for the *Philadelphia Inquirer,* recounts his adventures in the notorious Golden Triangle. Members of an insurgent group known as the Shan State Army (SSA), whose activities straddle the Burma-Thailand border, guided the author through this extremely lawless region. At first hand, Nordland observed the scene at an SSA-controlled village where the insurgents levy "duty" on the gems and opium smuggled through their territory. After the stones are registered at the SSA customs hut, the smugglers cross the border into Thailand where the stones are sold in the presence of an SSA agent. He then escorts the seller back into Burma to pay the duty.

Nordland's description of the open-air gem markets and the gun-toting miners and dealers seems like a combination of the Oriental bazaar and the American Old West. The article's gemological content is that of a layman writing for laymen. Eleven photos, nine of them in color, plus a map, illustrate this worthwhile article. *BFE*

INSTRUMENTS AND TECHNIQUES

Distinction of natural and synthetic rubies by ultraviolet spectrophotometry. G. Bosshart, *Journal of Gemmology,* Vol. 18, No. 2, 1982, pp. 145–160.

The author analyzed the absorption spectra of 94 natural and 46 synthetic rubies using a spectrophotometer. The natural stones studied were from Burma, Sri Lanka, Kenya, Tanzania, Thailand, Pakistan, Cambodia, Brazil, and Australia; the synthetic stones were from productions by Verneuil, Chatham, Kashan, and Knischka processes.

The author compares the spectra of the various samples, focusing on the center position, width, and profile of the absorption minima in the ultraviolet (UV) region. The distribution of these data is presented on a graph that separates into natural and synthetic rubies. The author concludes that since there is no overlap of the two populations, this is a valid method for separating rubies. Therefore, in instances where chemistry, fluorescence, inclusions, or other indicators are not conclusive, the author recommends a thorough UV investigation. *SCH*

Energy dispersive X-ray spectrometry: A non-destructive tool in gemmology. W. B. Stern and H. A. Hänni, *Journal of Gemmology,* Vol. 18, No. 4, 1982, pp. 285–296.

One of the most promising of the various new analytical techniques being used to solve gemological problems appears to be X-ray fluorescence spectroscopy (XRF). A sample is exposed to a beam of primary X-rays, which results in each of the chemical elements in the sample giving off secondary X-rays, or "fluorescing." These secondary X-rays can be described in terms either of their wavelengths or their energy, thus leading to two principally different spectroscopic applications. In conventional wavelength-dispersive (WDS) XRF, the secondary X-rays are scattered by wavelength by an appropriate medium (a crystal of some substance) and are detected sequentially by a movable goniometer. In energy-dispersive (EDS) XRF, the secondary X-rays are separated by a detector into distinct energy levels simultaneously. Since the dispersing power of a detector in an EDS system is more limited than that of a WDS analyzing crystal, special computer programs are needed to refine the X-ray energy spectrum produced by the sample.

XRF methods have great potential usefulness in gemology in that they provide a rapid and nondestructive means of chemically analyzing gem materials. The inherent features of the EDS-XRF configuration would appear to make it the more applicable of the two systems to gemology. The authors of this article demonstrate the value of this technique by illustrating the X-ray energy spectra of natural and synthetic ruby, emerald, and alexandrite, and also several samples of coral. They discuss how differences in the detected elements in the samples give some indication of the provenance of these gem materials. They suggest that the XRF method will be employed on a widespread basis in the future for gemstone identification. *JES*

Optical absorption and electron spin resonance in blue and green natural beryl. A. R. Blak, S. Isotani, and S. Watanabe, *Physics and Chemistry of Minerals,* Vol. 8, 1982, pp. 161–166.

Some green beryl is known to change to blue on heating. The authors of this article report spectroscopic data on two gem beryls from Brazil that display this color-change behavior.

The crystal structure of beryl consists of silicate tetrahedra in six-membered rings which are arranged to form long, open channels. These rings are further linked by Be^{2+} and Al^{3+} ions. Impurity constituents can substitute for these ions, can be located interstitially between them, or can occur within the open channels. Water molecules occurring in the channels are oriented either perpendicular (type I) or parallel (type II) to the direction of a channel. Infrared spectra indicate that type I water is predominant in blue beryl, whereas type II water is found in green beryl. The green-to-blue color change noted during heating results from a reduction in valence state of the trace amounts of impurity iron.

This article illustrates some of the methods of investigation used and types of data that are needed to understand the causes of color in gem minerals and the behavior of these minerals in response to treatment processes. *JES*

Thermoluminescence in elbaite. T. Calderón-García and R. Coy-Yll, *Journal of Gemmology,* Vol. 18, No. 3, 1982, pp. 217–221.

Any material with a temperature above that of absolute zero (−273°C) radiates energy as a result of the thermal vibrations of its constituent atoms. At temperatures less than 550°C, this radiation of energy occurs chiefly as heat; whereas above this temperature, the material becomes incandescent and radiates energy in the form of both heat and light.

Luminescence is the general term used to describe an energy-release phenomenon taking place at temperatures below 550°C, where a material absorbs one form of energy and then re-emits this energy in the form of visible light. A number of external sources for this absorbed energy are recognized. In thermoluminescence, the emission of visible light is due to heating. This article reports preliminary results from a study in which a single crystal of elbaite tourmaline was gradually heated from 50°C to 475°C. The authors present thermoluminescence spectra as well as emission spectra for the sample taken before and after it was exposed to X-radiation, which presumably also produced some color change in the crystal.

Unfortunately, the authors offer little in the way of explanation of these observed changes in either the thermoluminescence or emission spectrum of elbaite. They do indicate that further studies are in progress to understand this behavior. *JES*

JEWELRY ARTS

The Chester Beatty collection of Chinese carved rhinoceros horn cups. J. Chapman, *Arts of Asia,* Vol. 12, No. 3, 1982, pp. 73–83.

On his death in 1968, Sir Alfred Chester Beatty left his collection of Oriental art, one of the finest ever assembled by a Western collector, to the people of Ireland. Chapman, who is the Far Eastern curator of the Beatty Library and Gallery of Oriental Art in Dublin, Ireland, describes one group, a unique collection of 200 rhinoceros horn cups.

The author praises Beatty's remarkable ability to select quality pieces as he discusses cups from the early 12th to the late 19th centuries. Photographs of 28 carved horns (seven in color) are keyed to the text, illustrating the different forms as well as motifs used by the Chinese carvers. Chapman concludes by reminding us how rare these exquisite carvings are, even in good collections of Chinese decorative arts. *KJW*

Editor's Note: Chapman has another article on an unusual rhinoceros cup in the August 1982 issue of Connoisseur.

Enamelling on gold: A historical perspective. D. Buckton, *Gold Bulletin,* Vol. 15, No. 3, 1982, pp. 101–109.

For more than 3,500 years, gold has been the preferred base metal for enameling. Because of its properties and its compatibility with glass, gold does not require the special preparations needed with other metals.

In this article, Buckton describes the three ways enamels are applied to metals, touching on how economics have shaped the historical development of enamel from a poor man's substitute to a desirable decorative element. While discussing the various techniques, their origin and execution, Buckton develops the historical aspect of his theme with dates and places of introduction and the subsequent diffusion of artistic influence. These events are not discussed chronologically, however, and it takes concentration by the reader to put the picture into perspective.

From this article, richly illustrated with photographs of pieces from museums worldwide, the reader discovers that techniques have not changed greatly and that this art form is now and will be in the future "an attractive medium for artists and craftsmen."

Archie V. Curtis

Netsuke: the wondrous toggle. S. O'Neill Dorn, *Museum,* Vol. 3, No. 1, 1982, pp. 30, 32–33.

Sylvia Dorn has packed a tremendous amount of information about netsuke into this article. It is particularly valuable to the collector because she traces the origin of the netsuke, its history as a collector's item, and the successive increases in price since netsukes became popular.

Although people have been collecting netsukes since they were invented, netsukes didn't really catch on as an investment until the late 1960s.

In the 1890s, the average cost of a netsuke was under one dollar. By the 1950s, most netsukes sold for less than a hundred dollars outside of Japan. Within the country, the netsuke still counted for little. Early last year, however, a collector paid a record auction price of $78,000 for a single piece.

Dorn concludes with a discussion of the present production of netsuke and with some advice for today's collector. She feels that those who seek what has become known as best—requiring a signature, rarity, subject, and pedigree—are competing for comparatively few pieces. Yet there are countless numbers of interesting netsuke outside the mainstream market that offer exciting possibilities for collections based on new materials, subjects, and techniques. *ET*

Piqué jewelry. V. Becker, *Art & Antiques,* Vol. 5, No. 6, 1982, pp. 42–45.

Piqué work was an exacting and difficult technique of inlaying gold or silver on tortoiseshell and ivory. Its application to jewelry developed, flourished, and disappeared in the Victorian era; according to the author, though, it is currently gaining 20th century admirers. While this may be true as regards piqué work as a collectible, the extreme difficulty of the technique makes it unlikely that there will ever be a revival of this charming minor art form.

The author correctly gives credit to the definitive series of articles on piqué work written with authority and style by the passionate collector Major Herbert C. Dent and published in the *Connoisseur* in 1920. Since there is, sadly, nothing new on the subject, an element of repetition creeps into the present article to disappoint the serious jewelry historian but not necessarily distract the general reader. Even though the handsome, if nonrepresentative, photographs do much to rescue the piece, the author presents what amounts to a rewrite of her previous work on the subject, which appeared in *Retail Jeweller* in 1979. Her readers have come to expect something fresher from this prolific and exuberant writer. *Neil Letson*

St. George triumphant. B. Livie, *Connoisseur,* Vol. 212, No. 850, 1982, pp. 67–70.

This article focuses some long overdue attention on a historical *objet d'art* that is little known outside of Germany. The St. George reliquary in the treasure room of the Munich Residenz is a dazzling summation of late 16th-century goldsmithing, enameling, and lapidary arts. Bruce Livie, a Munich gallery owner and art historian, devotes most of his article to the historical background of this piece. A full-page color photo, plus four small closeups of various details, supplement the verbal description.

The gold equestrian figure of St. George slaying the dragon was commissioned by Duke Wilhelm V of Bavaria in 1586. Supporting this figure and housing the alleged relic of the saint is an elaborate silver gilt base, which was commissioned by Wilhelm's successor and finally completed in 1641. The figure and base stand 50 cm (about 20 inches) high and are richly decorated with pearls, rubies, emeralds, diamonds, and enameling. Sections of the composition include the horse carved from brown and white chalcedony, and a rock crystal sword brandished by the armored figure of St. George. Of particular gemological interest is Livie's brief inventory of the numerous gemstones used in this work.

Readers fascinated by the human and historical elements behind precious objects will find this article worthwhile. Mr. Livie shows how this reliquary reflects the aesthetics of the German courts in the early baroque era as well as the religious and political fervor of that time. *BFE*

Soul in jade. D. DeVoss, *Connoisseur,* Vol. 213, No. 851, 1983, pp. 86–91.

In publishing David DeVoss's article on Thailand's priceless "Emerald Buddha," *Connoisseur* presents what is probably the first photograph printed in the West of that country's most sacred religious talisman. It is a 2,000-year-old statue of Buddha, so venerated that only the reigning king may touch it, yet seen by thousands each day who come to worship at its golden shrine.

Inaccurately termed "emerald," the statue is actually a water-smooth carving, 19 in. wide and 26 in. high (48 cm × 66 cm) of a "rare jade found only in Siberia and along the China-Burma border." Legend dates the strangely luminiscent figure to about 493 B.C., and its tumultuous history and awesome religious significance far outweigh its enormous intrinsic value.

Last year the city of Bangkok and its hundreds of

Buddhist shrines and temples underwent a massive restoration in connection with celebrations marking the bicentennial of the present royal dynasty. Central focus of the project was the $10 million refurbishing of the Grand Palace and the Royal Chapel which houses the "Emerald Buddha."

While the description of the statue itself leaves some technical gemological questions unanswered, the article and the dazzling photographs add significantly to a limited body of information on this unique jeweled object. *Neil Letson*

RETAILING

The care and maintenance of gems. F. C. Bonham, *PreciouStones Newsletter,* Vol. 5, No. 7, 1982, pp. 14–17.

Mr. Bonham provides simple, easy-to-follow guidelines to the basic care and maintenance of fine gems. He argues that the value, as well as the beauty, of the stone may be maintained and enjoyed through intelligent care and wear.

As a useful guide when cleaning stones, Mr. Bonham provides a gem maintenance chart. This guide includes the Bonham Durability Scale, whereby the author has assigned each stone an overall durability value based on the Mohs hardness scale and a predetermined chemical stability value. Depending on a gem's individual properties, stones with a "Bonham Durability" rating of 7.5 or higher may be washed in an ammonia solution. Less durable stones should be cleaned with warm water and a mild soap.

Steam and ultrasonic cleaners should be used only by professional jewelers. Stones already damaged or with the potential for cleavage may be harmed further if such cleaners are used improperly. Also, the mounting should provide protection responsive to the gem's individual nature. Fragile stones should sit low in the mounting in order to avoid blows from direct contact.

Gems highlighted for additional consideration include emeralds, opals, and pearls. Chemically sensitive gems and those with perfect cleavage also require extra protection.

As a gemologist, Bonham stresses the importance of understanding a gem's physical properties before proper care can be applied. The article outlines a basic common-sense approach to the maintenance of gems. *ERH*

Employee screening. Part II, an industry under seige. M. E. Thomas, *Goldsmith,* Vol. 161, No. 7, 1982, pp. 27–29.

This second of two articles on employee screening discusses psychological stress evaluation (PSE) and paper-and-pencil honesty questionnaires.

The working principle behind PSE involves the change in voice frequencies under psychological stress; in stressful periods, the autonomic nervous system, rather than the central nervous system, suppresses and changes the pattern of tiny voice tremors, a phenomenon that is recorded on the audio tape and can be detected when charted on paper by the PSE instrument.

After comparing PSE and the polygraph tests, and then highlighting the conflict between the two industries, the author concludes that the most important aspects of the polygraph are present in PSE, that is, the fear of facing the machine and the necessity of having a competent examiner.

Thomas concludes with a discussion of the paper-and-pencil tests, which are less expensive than either the polygraph or PSE. She reports specifically on the working principles behind, as well as the effectiveness and rating systems of, two well-known written tests: the Stanton Survey and the Reid Report. *ALS*

SYNTHETICS

New frontiers in diamond synthesis. J. Collings, *Optima,* Vol. 30, No. 2, 1981, pp. 102–109.

Although the title suggests an article on synthesis, this is actually a history of diamond use other than as a gemstone. Diamonds have served as engraving tools since 350 B.C. (India) and as cutting tools and abrasives for nephrite since slightly later (China). Diamonds had these limited applications until modern times, when more sophisticated techniques were applied to the production of metal alloys, thus requiring the attributes of diamond to work them. Collings gives a fascinating account of the history of this interrelationship. In the 1930s the industrial use of diamonds was further stimulated by armament production, which continued through World War II.

In 1947 DeBeers, under the leadership of Sir Ernest Oppenheimer, established the Diamond Research Laboratory to study the physical properties of diamonds, investigate better retrieval methods, and develop new applications for diamond tools as well as support research at the university level. Allmana Svenska Electriska Aktiebolaget (ASEA) reported the first synthetic diamond production in 1953, and the General Electric Company announced a successful synthesis in 1955. As the demand for industrial diamonds grew, the number of natural diamonds was insufficient and large-scale production of synthetics resulted. DeBeers Industrial Diamond Division eventually obtained their own manufacturing facility (Debid). World demand is now estimated at 110 million carats annually; almost 90% of this is satisfied by synthetic products, largely produced by General Electric, Debid, and Eastern Bloc countries. Although there has been a steady 10% growth in demand annually, competition has resulted in extremely low selling prices for many of the easily produced particles. New composite materials such as cubic boron nitride, amber boron nitride, syndite, and amborite are meeting present industrial needs. The possibility of developing similar desirable materials, not now essential, is far from being fully explored. *ERL*

BOOK REVIEWS

Michael Ross, Editor

DIAMOND CUTTING, 2nd Edition

*By Basil Watermeyer, 404 pp., illus., published by Centaur, South Africa, 1982. US$27.50**

The second edition of Basil Watermeyer's *Diamond Cutting*, like the first edition published in 1980, is a unique book. In all my reading on and about the diamond trade, there has always been an emphasis on the lore of the trade and a modicum of information on the actual processing of the stones. At best, a thoroughly written, encyclopedic account of the diamond industry would have a short, usually very outdated chapter on design and cutting. Watermeyer's book handily takes care of the lack of written material on this heretofore little understood and exotic profession.

In his introduction, Mr. Watermeyer explains how diamond cutting has always been a secretive process, the skills being well-guarded secrets passed on begrudgingly from master to apprentice. This not only ensured the mystique of the cutter but also, more significantly, restricted any advances in technology. (Until very recently—and to some extent even today—much diamond cutting was done in the same manner as it was accomplished in the Middle Ages.) Watermeyer and his well-organized and thorough text represent a significant break in this tradition.

The book covers every aspect of processing diamonds, from the identification and classification of rough, to the detailed operation of automatic cutting machines and the fashioning of new, innovative cuts. The last subject is covered in exceptional detail—probably due to the fact that the author invented the Barion cut. The subjects not covered, for example, radiation bombardment to affect color, are few and relatively insignificant.

In general, the various chapters, which are well illustrated with photographs and detailed diagrams, will serve to enlighten people unfamiliar with cutting processes. Yet Watermeyer also goes into detail that will probably not be understood by, or of any use to, anyone who is not actually sitting at the cutting bench. It is at this point not just a basic primer but more a detailed manual, giving step-by-step instructions for every phase of cutting—from the decisions regarding what shape to cut, right down to the finer advanced points of polishing. One example of this is Watermeyer's excellent advice that a small girdle facet be placed on an imperfection to protect the stone during the girdling process.

Since the book is written by a cutter, the terminology throughout is that of the cutter, not of the gemologist, although the author does make an effort to list the various terms for a given subject. An example of this confusion in terminology is the author's discussion on the swindling of a stone, referring to the improved weight recovery gained by undetectable deviation from a normal make. A student of GIA, however, uses the term *swindling* solely to indicate a diamond with a very spread table, which is actually only one of many ways to save weight—and not an undetectable one.

To round out the book, there are a few final chapters on weights, the three *C*s, and the world's largest cut diamonds. A chapter on new developments is an important addition to the second edition, especially as it covers new faceting techniques for fancy-shaped diamonds. But the most welcomed addition is an extensive index at the end of the volume.

In summary, as much as I feel that the information covered in this esoteric book will benefit any student or participant in the diamond industry, it is best recommended to diamond cutters and others in the industry who are seriously interested in becoming as knowledgeable as possible in this field.

GARY WEISSBROT
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JEWELRY ON DISPLAY, 2nd Ed.

*By Mariann Coutchie, 87 pp., illus., published by Signs of the Times, Cincinnati, OH, 1982. US$16.95**

Competition for consumers' dollars and current economic conditions have made training an absolute must for the jewelry retailer and wholesaler alike. To excel in today's competitive market, jewelers must be up-to-date on new simulants and treatments, but they should also extend their knowledge to include marketing and display.

A very important and frequently neglected area of gemological training is the jewelry store itself. Window and counter displays can, by themselves, effectively market merchandise, and should be given top priority by the retailer. Even the most beautiful pieces will not sell unless they are presented to the customer in a pleasing manner. Yet it is surprising to note how many jewelers and sales personnel have no formal training or experience in jewelry display.

MariAnn Coutchie is one of the country's leaders in the art of store planning and jewelry display. Not only was she the author of GIA's Jewelry Display Course, but she has also written her own book, *Jewelry on Display*. The second edition of the book includes updated information on lighting, planning, and display props; it is an excellent reference guide and handbook which details types of composition, themes, and color coordination. Accentuated with more than 130 black-and-white photographs highlighting window ideas, window signs, and award-winning displays, the book contains

**This book is available for purchase at the GIA Bookstore, 1735 Stewart Street, Santa Monica, CA 90404.*

87 pages of helpful hints and creative suggestions. The presentation of the material is well balanced and flows gracefully from one topic to the next.

Two areas of consideration not discussed at length in the book, however, deserve serious attention by the displayperson. First, security in windows and counters must be scrutinized, and second, precautions about placing light- or heat-sensitive materials in the window should be examined. The displayperson must not only be trained in artistic display procedures, but should also have some concrete gemological knowledge as well.

While this book may not give you all of the answers to the intricacies of window display, it certainly is a valuable tool for the novice salesperson and experienced displayperson alike.

NOEL KRIEGER
Instructor, GIA

CLASSIC MINERAL LOCALITIES OF THE WORLD: ASIA AND AUSTRALIA

*By Philip Scalisi and David Cook, 226 pp., illus., published by Van Nostrand Reinhold, New York, NY, 1983. US$29.50**

This is the first in a series of volumes describing the classic mineral localities of the world. It was written as a reference manual for anyone interested in gems or minerals: from the professional gemologist or mineralogist to the amateur or hobbyist.

The book is divided into two parts: the first includes Japan, China, Burma, Sri Lanka, India, Afghanistan, Iran, and the U.S.S.R.; the second deals with Australia. For each locality there is a brief geographical description and a discussion of historical development, including discovery and subsequent mining, famous specimens, and some gemstone lore. The geology of the deposits is briefly described, as is the characteristic crystallography of typical specimens. Of special interest to those collecting mineral specimens from these localities are the crystal drawings found throughout the book. Most of these were taken from the *Atlas der Krystallformen*, by Victor Goldschmidt, which was published in nine volumes between 1913 and 1923. The text is also well illustrated with maps, black-and-white photographs, and drawings of locations, and black-and-white and color plates of fine gem and mineral specimens. Most of the location photographs were taken in the early 1900s, so their quality is sometimes poor. And although the old photographs evoke the classical nature of these localities, current photographs of the areas still being mined would make the text more useful.

Since this is a text of classic localities, many deposits are not covered, and some readers may be disappointed that their favorites were not included. A couple of examples of omissions are the ruby deposits of Thailand and Cambodia and the nephrite deposits of China. However, there are enough gemstone deposits described to warrant space for this book on every gemologist's shelf. Among the most notable are Burma's rubies and jadeite, Kashmir's sapphires, India's diamonds, the gems of Sri Lanka and of the Ural Mountains (U.S.S.R.), and Australia's opals.

This book is a pleasure to read. It will be enjoyed by the casual reader as well as the researcher. We can look forward to the other volumes in this series.

GARY HILL
Resident Colored Stones/Gem Identification Instructor, GIA

GLASS ENGRAVING

*By Barbara Norman, 190 pp., illus., published by Arco, New York, NY, 1981. US$25.00**

According to the introduction, *Glass Engraving* is intended as a guide to future glass-engraving hobbyists. The book begins with a brief overview of the history of glass engraving and continues with discussions of current methods of engraving, how to photograph and display engraved glass, and how to pack glass for safe transport. It concludes with a lengthy chapter describing the work of 30 or so modern-day glass engravers in the United Kingdom, United States, Canada, and Australia.

Ostensibly a how-to-manual, the book falls well short of this mark. The discussions of how to choose glass to engrave, what tools to use, how to set up a work space, and especially how to do diamond-point engraving, drill engraving, acid etching, and gilding, are cursory and could serve only to whet the appetites of interested readers—certainly not to instruct them in actual techniques. In great contrast, the discussions of how to photograph, display, and transport glass are overly detailed, long, and tedious.

The book is illustrated with 59 black-and-white plates randomly grouped into three clumps, positioned haphazardly in the text with no relation to specific topics being discussed. Individual plates are never explained by the author or specifically referred to in the text.

The chapter on contemporary glass engravers is irrelevant and pointless. The work of each craftsman is superficially described in a paragraph or two and generally not illustrated in the plates. And it seems doubtful that you will find an opportunity to view this handiwork firsthand, since most of these engravers live in remote hamlets scattered across the globe.

There are four appendixes—designs (motifs) to trace, some suppliers of tools and equipment, where to see exhibits of engraved glass, and 13 books for further reading—all sketchy, random, and incomplete.

Gems & Gemology readers will find little in this book to enrich their lives. At best, a mild interest in glass engraving might be piqued.

JENNIFER PORRO
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GEM NEWS

Stephanie Dillon, *Editor*

DIAMONDS

DeBeers reports that world sales of diamond jewelry rose in 1982 to 33 million pieces from 32 million pieces in 1981, and Christmas sales of jewelry exceeded expectations.

Interest in medium- and higher-grade diamonds is picking up, and small polished diamonds are in short supply, according to Antwerp dealers.

A new diamond imitation has been circulating during the past year. It is a doublet consisting of a diamond crown and a cubic zirconia pavilion. The difference in girdle textures is immediately evident in the case of loose stones. In the case of mounted stones, however, British gemologist Alan Hodgkinson suggests the following tests: (1) look for a "picture frame" effect as the table facet is reflected off the junction plane; (2) hold a pin over the table—the pin will reflect from the table and from the junction plane as well; (3) use a fiber-optic light to pinpoint the reflection from the table and junction plane (*Retail Jeweller*, June 3, 1982).

Australia. A new company, Argyle Diamond Sales Ltd., will be marketing the 95% of Argyle diamonds produced for Conzinc Riotinto Australia and Ashton Mining Ltd. Initial mining of alluvial diamonds is expected to produce 5 million carats annually until mid-1985, when operations will commence at Kimberlite pipe AK1. The pipe should produce 2.9 million tons of kimberlite over a 20-year period, at a rate of 20 to 25 million carats per year (four to five tons of material). Mining in the area is foreseen for possibly 40 years. The deposit at Ellendale is not yet considered economically feasible. Four hundred and forty workers will work the mine.

Exploration in Western Australia during the three months prior to September 30 yielded 139,000 ct of diamonds. One hundred and twenty-six thousand carats were produced from 50,000 tons of ore, the largest crystal weighing almost 12.2 ct.

Belgium. Despite the recession, the import of diamonds into Antwerp, chiefy rough, maintained through the first 10 months of 1982 a 6% increase over the comparable period of 1981.

Twenty percent of Antwerp's 8,000-member diamond work force are unemployed, and a similar number are only partially employed, according to industry figures. To increase the competitiveness of this cutting center, the Industrial Committee of the Diamond High Council in Antwerp is conducting a retraining school. The aim is to teach techniques for additional cuts that are currently in demand in the world market.

Botswana. "Orapa House," Botswana's new sorting headquarters, has been opened in Debswana, so that the nation's growing diamond production can be sorted and priced within the country. Orapa, Letlhakane, and Jwaneng, Debswana's mines, are expected to produce 9.5 million carats of gem and industrial diamonds by 1985.

China. This past fall, the geological bureau of Shandong province recorded the discovery of a 96.94-ct diamond at the Chenjiafu diamond placer mine near Tancheng. Two other large diamonds were found in that area in 1979 and 1981; they weighed 158.79 ct and 124.27 ct, respectively. In addition to these stones, numerous diamonds of over 10 ct and large quantities of chrome-containing gem garnets were found in the same location. According to the bureau, a general survey of the area is being conducted to search for the as-yet-undiscovered primary deposit.

Guinea. Production of diamonds and gold in the Baule Basin of Guinea is scheduled to start in early 1984. Aredor, a joint venture of the People's Revolutionary Republic of Guinea (50%), Bridge Oil of Australia (45%), Industrial Diamond of London (2.5%), and Simonius Vischer of Switzerland (2.5%), is expected to process 400,000 cubic meters of diamond-bearing gravels per year and to maintain that level of production for 14 years. The rate of diamond recovery is estimated at 0.05 ct per cubic meter. Up to 80% of the diamonds are purported to be of gem quality.

Israel. Ramat-Gan's net diamond exports for 1982, which had been predicted to reach $800 million, rose to $900 million before the year's end. Exports to Hong Kong, the U.S., and Japan increased, while net imports (primarily of small stones) rose nearly 30%.

As a result of a labor dispute in Israel's diamond factories, workers are receiving a 10.9% pay increase retroactive to September 1, 1982. The increase met the approval of the nation's manufacturers, labor unions, and government.

Japan. As of April 1, 1983, the 3.1% customs duty on polished diamonds has been abolished. Leading beneficiaries of the action are Israel, Belgium, and India, which combined represent 73% of Japan's annual polished diamond imports.

Diamond jewelry sales in Japan reached $3.2 billion in 1981, over five times the amount recorded for 1971. Figures for 1982 are expected to be on a level with 1981.

Portugal. Illicit diamond traffic in Portugal is estimated at 1.5 million carats. The Angolan government, suffering the loss of revenues from its Diamang mines, has requested help from Portugal in curbing the smuggling.

Singapore. South Asia Diamond Company, the Singapore polishing plant organized in the Kallang Basin industrial estates, completes its first year's operation with an output of 1,250 to 1,500 ct per month. The company polishes diamonds with computerized machines. The staff of 40 workers has been trained by cutters from Britain, Belgium, and Israel.

South Africa. A diamond weighing 64.94 ct was recovered in the latter part of 1982 at the Octha Mine near Sendelingsdrift on the Orange River. It has been speculated that the crystal would yield a round brilliant of at least 26 ct. The color of the rough is estimated at F or G and the clarity at flawless to VVSI.

U.S.A. Visitors to the Crater of Diamonds State Park, Park County, Arkansas, found approximately 1,300 diamonds—the majority of which are suitable only for industrial use or as mineral specimens—in 1982. The mining is considered a recreation; 68,000 people visited the park during the year.

Venezuela. Venezuela's annual output, down from 800,000 to 750,000 ct in 1981, is expected to drop to less than 500,000 ct for 1982. Approximately 21% of the production is of gem quality.

COLORED STONES

Cat's-eye Chrysoberyl. A large quantity of cat's-eye chrysoberyl was discovered on a ranch in central Zimbabwe, close to the Sandawana emerald deposits. Inasmuch as most cat's-eye material comes from secondary deposits—decomposed pegmatites or alluvials—this discovery may lead to the actual source of the stones.

Emeralds. Machinery made in the area of Ramat-Gan, Israel, is being used by the Israel Emerald Cutters Association to produce large quantities of emeralds in calibrated sizes. The new equipment improves cutting efficiency while increasing the yield from rough stones.

In 1982, three emerald deposits were discovered in Pakistan, at Charbagh, Makad, and Gujar Killi in Swat. The Gujar Killi emeralds will be mined by open-pit methods. Existing emerald mines at Mingora, Swat, will be modernized. Deposits of aquamarine and golden topaz have been located in northern Pakistan. Topaz occurrences at Katlang, in the Mardan district, are currently under study.

The Santa Terezinha deposits in the Brazilian state of Goias, discovered within the past two years, may be mined only by native Brazilians, by order of the government. To date, the largest reported clean stone is a 60-ct crystal.

Pearls. Japan's export of cultured pearls decreased considerably during 1982; records for the first eight months show a 14% drop when compared with the same period for 1981.

Small Biwa and Keshi pearls are difficult to obtain, but medium-sized pearls are in sufficient supply. It is not presently known what quantities the spring Biwa harvest will yield.

Chinese freshwater cultured pearls are plentiful.

Quartz. An amethyst deposit has been discovered in the Brazilian state of Goias, 35 km from the Santa Terezinha emerald mines.

Demand for fine, large amethysts is reportedly strong. Supplies of commercial grades from Africa and South America are adequate (see the following section on "Tucson" for a description of amethysts from another new source in Brazil), although Zambian exports have been interrupted for political reasons.

Fine citrines are also showing increased popularity; supplies in all sizes and grades are plentiful.

Taaffeite. In December, the discovery of another taaffeite was reported. The 2.41-ct specimen was included in a parcel of assorted rough purchased in Thailand. The stone is colorless, waterworn, and irregular in shape. The ordinary ray has an R.I. of 1.717, and the extraordinary, 1.720, with a birefringence of 0.004 and a specific gravity of 3.59. There are iron oxide stains in cracks, and the crystal contains small planes of liquid and crystal inclusions. Only about 50 specimens of taaffeite have been identified to date.

Topaz, Radioactive Irradiated. The Brazilian government is investigating unauthorized irradiation of gemstones at its two nuclear reactor facilities following the recent discovery that some irradiated topaz exhibited excessive levels of radioactivity. Stones irradiated by high-energy electron beams or by gamma radiation do not retain appreciable radioactivity and are quite safe for jewelry use. Stones that have been treated in atomic piles, however, are exposed to neutron radiation, which can cause lasting radioactivity. American gem dealers are concerned that Brazil may end all irradiation of stones to curtail the supply of irradiated topaz—in the interests of economics as much as of health.

Tourmaline. The Himalaya Mine in Southern California is continuing to produce pink, green, and bicolored

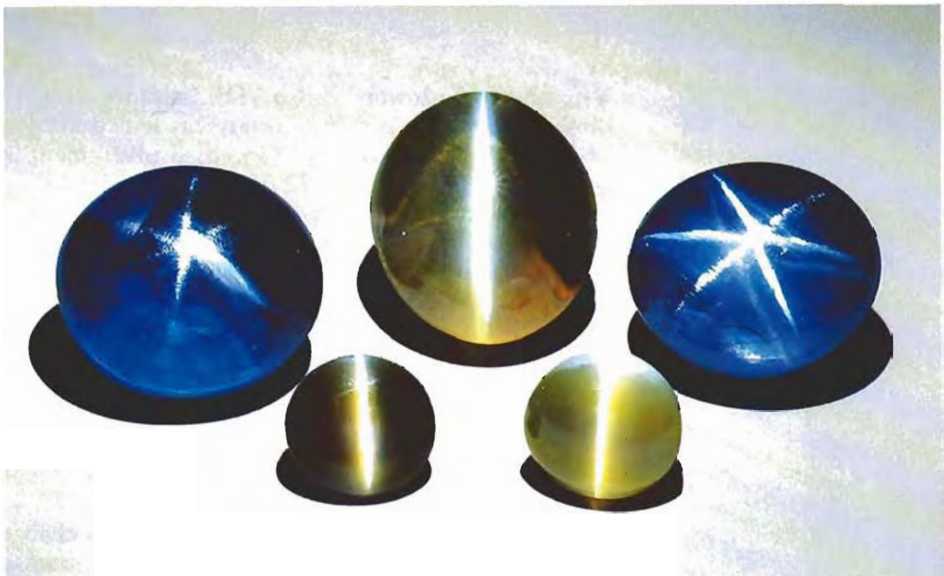

Figure 1. These star sapphires and cat's-eye chrysoberyls are representative of some of the fine gems seen at the February 1983 Tucson gem and mineral show. Upper row, left to right: 70.26 ct, 63.07 ct, 78.52 ct. Lower row: 12.08 ct, 17.08 ct. Photo © 1983 Tino Hammid.

tourmalines. The crystals are generally one-half to two inches (1–5 cm) in length, although some are three inches (7.5 cm) or longer. A substantial proportion of the material is recovered as gem "pencils." The average yield for one month is 100 to 200 pounds of all qualities. Approximately 80% is bead material, 10% fine bead, 8% cabochon, and 2% suitable for faceting. The largest stone cut from a Himalaya crystal thus far is a 75-ct bicolor.

Synthetics. The Ramaura Created Ruby, introduced this year at the February Tucson show, is being produced and will soon be marketed in Southern California. It has been manufactured in a range from dark red to lighter red with pink overtones, and in orangy to purplish hues. Flux grown, it displays characteristic flux inclusions, in addition to growth zoning and some color zoning. The manufacturer reports that the material will be doped to produce a characteristic fluorescence. This synthetic will be discussed at length in an article currently being prepared for *Gems & Gemology.*

In the experimental stage is a hydrothermal emerald with mid-range optical and physical properties. It is nonfluorescent and close to inclusion-free.

TUCSON, 1983

Initiated in 1955 by the Tucson Gem & Mineral Society, what began as a two-day show for eight small mineral dealers has become a two-week event involving hundreds of dealers gathering from around the world to exhibit gems and mineral specimens in eight hotels in addition to the Tucson Community Center. There was more activity at Tucson in 1983 than has been seen there the past two years, and participants hoped the attitude presaged an improved business climate for jewelers and gem dealers in the months to come.

Sri Lankan rubies and sapphires were seen in abundance. In recent months, fancy-colored sapphires have been more readily available in the Far East, although blue stones, particularly in calibrated sizes, have been scarce in fine quality.

Attracting a great deal of attention was a 1,126-ct pinkish orange sapphire crystal (illustrated on page 35 of this issue) reported by its owner to have been recently removed from Ratnapura in January. It was expected to yield a cut stone of at least 200 ct. The same concern displayed four translucent deep blue star sapphires, in weights ranging from 70.26 to 87.06 ct, and several fine cat's-eye chrysoberyls (see figure 1).

Yogo sapphires were also seen. These lighter and brighter blue sapphires, mined in Montana and promoted by a Denver-based firm, will be marketed in finished jewelry pieces throughout the U.S., Europe, and Japan by the end of 1983.

Spinels, especially in reds and pinks, have been plentiful in Bangkok, and were shown by numerous dealers. Topaz was in good supply, especially in rough form, and several faceted imperial topazes were on display.

There was a great deal of tourmaline, including indicolites and rubellites. Rubellites from last year's discovery in Ouro Fino (near the southern tip of Minas Gerais, Brazil) were displayed, including a 48.32-ct faceted oval-shaped stone. Approximately 85% of the faceted stones from the mine's yield are smaller than 4 ct. There have been, however, a number of 9-ct stones; the oval stone, known as the Princess of Ouro Fino, is the largest yielded by the mine. The fine red material, of exceptional clarity, was found in two pockets, both of which are now depleted.

Emeralds were plentiful. Two particularly large stones, one of 44.07 ct and the other of 47.30 ct, were shown by different companies. What is reported to be

Figure 2. This 667-ct Muzo emerald crystal (2¼ in. high × 1½ in. wide) was on display at the Tucson Community Center. Stone property of Allan Caplan, New York, NY. Photo © 1981 Harold & Erica Van Pelt—Photographers, Los Angeles, CA.

one of the finest emerald crystals known to exist today was on display at the Tucson Community Center (see figure 2). The 667-ct deep-green crystal came from the Muzo mine in Colombia.

In spite of repeated reports concerning the rarity of tanzanites and tsavorites, especially in substantial sizes, a number of both were shown. (The tanzanite mine is closed, and the Tanzanian military has halted mining of the dumps. However, the Tanzanian government is in the process of taking over the mine, and should be releasing more material in the near future. A number of Kenyan tsavorite mines have closed; the cost of production—gasoline for vehicles is a serious consideration—became prohibitive.)

A new find of aquamarine, displayed in rough form, came from Hunan, China. The crystals were less than 10 cm in length, and of a medium blue reminiscent of Pakistan material.

There were a number of fine Burmese peridots, including one of 77.5 ct. Another dealer had six stones of 40 ct each, all cut from the same crystal.

A fine 14.74-ct alexandrite exhibited a color change from plum to olive green. There was also an intense green 4.35-ct faceted demantoid, which displayed an easily eye-visible horsetail inclusion under the table.

Amethyst was seen in quantity. Fine-colored amethyst has been coming from Para State, Brazil, since last summer. The material is intense, with red overtones, and is found in crystals of up to 40 ct. Many dealers were also displaying synthetic amethyst.

Sugilite was abundant *en cabochon* and in carvings, as well as in a few faceted stones.

A golden yellow fluorite of 1,031 ct was displayed in the main show at the Tucson Community Center. It is reported to be the world's largest faceted eye-clean fluorite.

Also on exhibit at the main show were some sizable crystals of spodumene and tourmaline from a pegmatite discovery made a year ago in Nuristan, Afghanistan. Morganite in feldspar, quartz in feldspar, and lepidolite mica were also found in the pegmatite. Approximately 25% of the spodumene and tourmaline has been cut into stones. Some of the tourmaline was sent to China for carving. It is reported that the mine owners were able to smuggle the bulky material out of the country despite the Russian occupation.

ANNOUNCEMENTS

AGTA Design Contest

The American Gem Trade Association has announced the first competition to promote the design of colored-stone jewelry. The contest is open to participants throughout the world from students to professional jewelry designers. At least 80% of the gems in the finished piece submitted *must* be colored stones, and no more than 20% may be diamonds. Awards will be made during the AGTA Fair and Conclave in Tucson, Arizona, February 1984. Rules and applications are available from the AGTA Spectrum Award Commission, P.O. Box 32086, Phoenix, AZ 85064. The deadline for entries is July 29, 1983.

GASA

The Gemmological Association of South Africa has been established in Johannesburg. The president is Arthur Thomas; Ian Campbell (founder of the Rhodesian Gemmological Association) is secretary.