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# GEMOLOGICAL ABSTRACTS

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## COLORED STONES AND ORGANIC MATERIALS

**Corundum 'type' categories.** W. J. Sersen, *Gemological Digest*, Vol. 2, No. 1 and 2, 1988, pp. 3–9.

The concept of corundum "type categories" was first described in 1981 by Henry Ho. The system is designed to describe the overall color appearance of individual rubies and sapphires. The various components that contribute to the stone's color appearance—such as hue, tone, and intensity, as well as pleochroism, extinction, windowing, brilliance, fluorescence, color zoning, and

inclusions—are all considered. This article provides a detailed description of the corundum type categories: "A" through "E" for ruby, and "A" through "D" for blue sapphire.

The author states that type categories are a useful aid for teaching colored stone grading. Also, they are a practical means of describing corundum preferences from one country to another. Sersen lists the "type" preferences for nine different countries, which should be of interest to those who buy rubies and sapphires for resale.

*Ron Conde*

**Crystal chemistry of double-ring silicates: Structures of sugilite and brannockite.** T. Armbruster and R. Oberhänsli, *American Mineralogist*, Vol. 73, No. 5/6, 1988, pp. 595–600.

The crystal structure of purple sugilite from the Wessels Mine, South Africa, was investigated to understand better the chemistry and crystallography of silicate minerals of this kind. The structure consists of rings of silicate tetrahedra which are interlinked by tetrahedra that contain lithium ions and larger octahedra that contain iron, manganese, or aluminium ions. Refinement of this crystal structure provided a clearer understanding of the structural and chemical variations possible within double-ring silicate minerals of this structure type.

*JES*

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*This section is designed to provide as complete a record as practical 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 we feel will be of greatest interest to our readership.*

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**The Empress of Lemuria.** D. Webb, *Lapidary Journal*, Vol. 42, No. 3, June 1988, pp. 38–40.

Mr. Webb reports on the fashioning of a single crystal of Brazilian quartz to a finished weight of 42.5 lbs. (96,260 ct). This crystal, which is scheduled to be listed in the 1989 edition of the *Guinness Book of Records* as "the largest cut and polished quartz generator in the world," was worked by Glenn Lehrer and Lawrence Stoller of San Rafael, California. The original weight before fashioning was approximately 68 lbs. The fashioning took approximately 18 months to complete, and required a block-and-tackle pulley set-up to hold the stone during part of the process. The "Empress," unveiled at the 1987 Tucson Gem and Mineral Show, basically conforms to the original shape of the natural crystal, with the prism faces, termination, and base surfaces polished.

Bill Videto

**Eye of a dragon.** S. E. Thompson, *Lapidary Journal*, Vol. 42, No. 3, June 1988, pp. 21–27.

Ms. Thompson explores the ancient mythology regarding the association of animals with many colored stones. Drawing heavily on classic references, she provides an engaging, informative overview of this unusual topic. This abstracter would have liked to have stones called by such names as "corvia," "liparia," or "bezoar stone" in the myths and fables correlated with what they may have actually been, but appreciates the fact that turquoise, amber, and emerald are examined in considerable depth.

Bill Videto

**Gas bubbles in fossil amber as possible indicators of the major gas composition of ancient air.** R. A. Berner and G. P. Landis, *Science*, Vol. 239, No. 4846, 1988, pp. 1406–1409.

These two researchers studied the gaseous contents of the air-bubble inclusions found in a number of samples of amber from various localities such as the Dominican Republic, the Baltic area, and Manitoba, Canada. The authors focused their efforts on studying the specific mix of gases trapped in the bubbles in order to determine the composition of the "ancient air" that existed when the bubbles were sealed (as long ago as 95 million years).

The authors first crushed the samples in a vacuum, and then analyzed the released gases by time-resolved quadrupole mass spectrometry. The detection limit of the authors' instrument was 10 parts per million, with an accuracy of about 3–5% of the amount of each gas detected.

The authors theorize that these gases (mostly O<sub>2</sub>, N<sub>2</sub>, and CO<sub>2</sub>) represent original "ancient air" modified only by the aerobic activity of microorganisms. They discount the possibility that the major gases may have reacted with their surroundings, thus affecting their present percentages.

The results of these "ancient air" analyses, when

compared with the gaseous makeup of our modern atmosphere, show that the atmosphere has evolved over time. The amount of oxygen present has decreased significantly from approximately 30% during the Late Cretaceous era (75–95 million years ago) to 21% today.

John I. Koivula

**Gemmological investigation of a large faceted East African enstatite.** J. I. Koivula, C. W. Fryer, and J. E. Shigley, *Journal of Gemmology*, Vol. 21, No. 2, 1988, pp. 92–94.

The properties of a 46.56-ct transparent brown enstatite, possibly the largest known, are described in this article. The stone was faceted from an approximately 75-ct rough crystalline mass from Tanzania. The R.I., S.G., spectrum, and X-ray diffraction pattern are typical of enstatite; microprobe analysis confirmed the identity. Examination with a microscope revealed numerous parallel acicular inclusions (some eye-visible) and, perpendicular to them, distinct color and growth zones. Five color illustrations accompany the article. CMS

**Observations on turquoise, lapis-lazuli and coral, and some of their simulants.** S. Taki and M. Hosaka, *Journal of Gemmology*, Vol. 21, No. 2, 1988, pp. 74–80.

This brief article (one-half page of text and five and one-half pages of photos) mentions a few helpful distinctive characteristics of turquoise, lapis lazuli, and coral – and their simulants and synthetics – as determined by X-ray diffraction and X-ray fluorescence. The photos illustrate structural differences that can be observed with a scanning electron microscope. While these criteria are potentially useful, there is no indication provided as to how all-inclusive they are for these three gem materials.

CMS

**Orientated lath-like inclusions of a new type in spinel.** K. Schmetzer, *Journal of Gemmology*, Vol. 21, No. 2, 1988, pp. 69–72.

On the basis of chemical and morphologic data, lath-like inclusions in a bluish violet spinel from Sri Lanka are identified as sillimanite. These constitute a new type of needle-like inclusion for spinel; previously only rutile and sphene needles have been identified. A discussion of the orientations of all three types of needle-like inclusions in spinel clarifies some potential confusion. Six black-and-white photomicrographs accompany the article. CMS

**Origin and significance of blue coloration in quartz from Llano rhyolite (llanite), north-central Llano County, Texas.** M. E. Zolensky, P. J. Sylvester, and J. B. Paces, *American Mineralogist*, Vol. 73, No. 3/4, 1988, pp. 313–323.

Blue quartz crystals found as small grains in a rock from

Llano County, Texas, derive their color from Rayleigh scattering of light by submicrometer-sized ilmenite inclusions, which were detected and identified by means of transmission electron microscopy. In some cases, larger, ribbon-shaped ilmenite inclusions ( $0.1 \times 1 \times 20 \mu\text{m}$ ) produce some chatoyancy.

Further geochemical investigations revealed that the smaller ilmenite inclusions originated during magma crystallization. As blue quartz is usually found in rock of middle to late Proterozoic age (part of the Precambrian), this may reflect that conditions favorable to early ilmenite saturation prevailed at that time. The exact nature of these conditions is, however, still unclear.

A particularly useful feature of this article is that it contains an impressive review of the literature on blue quartz. EF

## DIAMOND

**Bourses more than a place to sell.** V. Berquem, *Jewellery News Asia*, No. 48, August 1988, pp. 63, 64, and 66.

This article provides a brief history of the evolution of bourses from simple gatherings of diamond traders at local cafes, to a sophisticated network of diamond-trading centers around the world.

The first bourses began in Amsterdam and Antwerp in the late 1800s, after the South African diamond boom created a need for organization in the diamond trade. Today, bourses are found throughout the world, including London, Tel Aviv, Hong Kong, and New York, as well as Idar-Oberstein, Johannesburg, and Los Angeles. In addition to their role as centers for the sale and purchase of diamonds, bourses serve as sources of market information, arbitrators of disputes among traders, and a network for communicating with other diamond traders locally or worldwide.

This issue of *Jewellery News Asia* features the 24th World Diamond Congress of the World Federation of Diamond Bourses, which was held in Singapore from July 31 to August 3, 1988. Becky Booker

**Famous diamonds of the world XXVIII: Matan.** I. Balfour, *Indiaqua*, Vol. 45, No. 3, 1986, pp. 123–125. In this article in his series on famous diamonds, Ian Balfour offers an account of the mysterious 367-ct Matan diamond.

Balfour draws on the historical accounts of Sir Thomas-Stamford Raffles, British appointed lieutenant-governor of Java to support the notion that this diamond was originally found on the island of Borneo in the mid-1700s. In his 1817 *History of Java*, Raffles writes about the workings of the Borneo diamond mines and, in particular, about the Matan diamond.

Balfour admits that the truth surrounding the existence of this diamond remains unclear, since it

changed hands during political disputes for much of its history. It is rumored that the diamond may ultimately have been lost at sea during World War II, as Japanese ships transported cargoes of gems they seized during the occupation of Borneo. One of these ships, purported to have five boxes of diamonds (including the Matan) on board, sank off the coast of eastern Sumatra. JLC

**Famous diamonds of the world XXIX: Emperor Maximilian.** I. Balfour, *Indiaqua*, Vol. 45, No. 3, 1986, pp. 126–128.

With his keen attention to detail, Ian Balfour describes the history of the Emperor Maximilian diamond. This 41.93-ct cushion shape was named after the Archduke Maximilian of Hapsburg, who in 1864 became emperor of Mexico.

Balfour relates that the diamond was one of two acquired by Maximilian during a botanical expedition to Brazil in 1860. The second diamond, a 33-ct cushion shape known as the Maximilian, was lost by one of its 20th century owners.

In his articulate manner, Ian Balfour outlines the tragic circumstances that surrounded Emperor Maximilian and the manner in which the 41.93-ct diamond eventually surfaced into the modern-day diamond market. Chicago jeweler Ferdinand Hotz acquired the diamond in 1919 and later displayed it at the Century of Progress exhibition held in Chicago in 1934. On Mr. Hotz's death in 1946, the Emperor Maximilian was sold to a private collector in New York. Subsequently, in 1982, the diamond was acquired at auction by Laurence Graff; in January 1983, Graff sold it with two other famous diamonds, the Idol's Eye and the Sultan Abdul Hamid II, to a private individual. JLC

**Will India be a force as a high-end diamond supplier?** R. Shor, *Jewelers' Circular-Keystone*, Vol. 159, No. 7, July 1988, pp. 308–314.

Russ Shor is well known for his up-to-date, accurate reporting on diamonds, and this article is no exception. India has blossomed as a diamond-cutting center in the 1980s. The last three years in particular have seen India's leading diamond houses move into the quality diamond market. This is a natural by-product of the strong competition that Bombay manufacturers are now feeling from the even lower-cost cutting centers developing in the Far East. In effect, leaders of India's diamond-cutting trade have seen a need, and the opportunity, to adopt the high-tech methods used to cut larger, better-quality rough.

This article also discusses the deepening relationship between Argyle and India. Interwoven throughout are the complex and often friction-filled relationships of the world's traditional and emerging diamond-cutting centers. Credit India's youthful and energetic executives, determined to adapt to a changing diamond-

cutting environment, with the present innovation and success.

In addition to the powerful role that it plays as a major cutter of Australian rough, India is striving to become a jewelry manufacturing center. Indeed, labor-intensive India may well become a source for finished diamond jewelry, as other Asian centers have done over the past decade. Relaxed government restrictions for both diamond and gold imports further enhance India's future potential in this area. *William E. Boyajian*

**X-ray studies of the growth of natural diamond.** M. Moore, *Industrial Diamond Review*, Vol. 48, No. 525, 1988, pp. 59–64.

After describing how the crystal structure of diamond diffracts X-rays, Dr. Moore explains the basics of X-ray topography and how it provides an image of extended defects present in a crystal. The use of synchrotron radiation is also described, because it allows for shorter exposures and a wavelength of 1 Å, which is the best condition to reveal crystal imperfections in diamond. The study of extended defects provides information about the growth history of any given diamond crystal. The author's observations are summarized below.

With relatively undisturbed growth conditions, diamonds grow slowly along their most stable (octahedral) faces; this is called faceted growth. Dissolution and regrowth can create notched octahedra. Diamond may also grow as fibers along octahedral directions, resulting in a rough cubic morphology. If faceted octahedral growth is followed by fibrous growth, the result is a coated stone.

Sometimes growth occurs on curved surfaces where the average orientation is cubic. This is called cuboid growth.

X-ray topographs have proved that dissolution starting at the corners of an octahedron and propagating down the edges can transform the original crystal shape into a rounded rhombic dodecahedron. Twins form early on during growth, and depending on whether faceted or fibrous growth occurs, they lead to a macle or to interpenetrating cubes. Tetrahedral diamonds are actually cleavages of larger octahedra.

In conclusion, X-ray topography of various shapes of natural diamond crystals demonstrates that growth usually occurs on octahedral faces or in octahedral directions, with the exception of cuboid growth. *EF*

## GEM LOCALITIES

**L'amethyste au Brésil. Classification et localisation des gites—inclusions (Amethyst in Brazil. Classification and localization of the deposits—inclusions).** J. Cassedanne, *Revue de Gemmologie a.f.g.*, No. 94, 1988, pp. 15–18.

Professor Cassedanne delivers the first in a two-part article dedicated to proposing and illustrating a classi-

fication for amethyst deposits in Brazil. Five main categories will be described: geodes in trapps (basaltic formations covering extended areas), deposits in fractures, granitic pegmatites, deposits in granitoids, and detrital deposits. This first installment describes trapps and one type of deposit in fractures, hydrothermal veins.

Amethyst-bearing geodes in Mesozoic trapps are all located in the Parana basin in southern Brazil. Most of the production today is in the Iraí area, in northwestern Rio Grande do Sul. How the geodes form is not yet understood, although we do know that they usually occur in stringers, with a green cortex of celadonite. The amethyst crystals found in these geodes rarely are longer than 10 cm, and only a very small portion of the production is gem quality. Most of the crystals are sold as mineral specimens. The various inclusions observed in this amethyst are listed. It is also noted that amethyst found in such geodes often fades on prolonged exposure to sunlight.

The hydrothermal deposition of amethyst in fractures almost always occurs in Precambrian rocks. Crystals, usually pyramidal, can reach 25 cm. The filling material may be clay, chalcedony, or milky quartz. Amethyst from this type of deposit may turn golden yellow, brownish orange, or green when heat treated. Crystals from the veins at Coruja and Montezuma turn yellow or green with heat treatment. These amethysts are described in some detail and possible inclusions are listed. A map and several illustrations of the deposits are provided. *EF*

**Emeralds from Somondoco, Colombia: Chemical composition, fluid inclusions and origin.** A. Kozlowski, P. Metz, and H. A. Estrada Jaramillo, *Neues Jahrbuch für Mineralogie Abhandlungen*, Vol. 159, No. 1, 1988, pp. 23–49.

The authors studied beryl samples from the Achiote emerald deposit, which is located in the Chivor region of Colombia, near the town of Somondoco, about 80 km east of Bogotá. The Cáqueza group, composed of limestones, black shales, and arenites, hosts the emerald-bearing veins, which probably resulted from fracturing associated with the San Fernando fault. The beryl samples studied were found at the Juntas No. 1 mine, in a quartz vein with calcite, pyrite, and albite/oligoclase. The samples range from almost colorless to dark green, and from 1 to 10 mm long. The techniques used for this careful study include the electron microprobe, chemical colorimetry, emission spectrography, thermogravimetry, and infrared absorption, as well as a heating and cooling stage light microscopy.

Fluid inclusions typically show about 75% water solution, 10% gas, up to 3% liquid CO<sub>2</sub>, and 12% to 15% NaCl crystals. Frequently, carbonate daughter crystals are also found, and liquid hydrocarbon was detected in some inclusions. The total concentration of salts in the water solution is close to 40 wt.%; in addition to Na and

Cl, the solution contains Ca in significant amounts. Other elements present are Si, Al, Fe, K, Mg, Mn, Ti, and Cr. The deficient stoichiometry of the beryl is discussed in great detail.

The authors estimate that the emeralds formed under a pressure of approximately 1 kbar, in the water solution described above, at temperatures around 470°C (derived from the temperature of homogenization of the fluid inclusions). Several indications are given that the source of beryllium and NaCl might be the surrounding rocks. If this is the case, calculations show that the emerald deposits of this region should actually be richer in gems than they are, and the authors propose a few possible explanations for why they are not. EF

**The emeralds of Fazenda Boa Esperança, Tauá, Ceará, Brazil: Occurrence and properties.** D. Schwarz, H. A. Hänni, F. L. Martin, Jr., and M. Fischer, *Journal of Gemmology*, Vol. 21, No. 3, 1988, pp. 168–178.

This thorough and concise article describes the occurrence and properties of the emeralds from the title locality in Tauá, Brazil. Maps of the geography, regional geology, and local geology accompany a detailed description of the occurrence, which is essentially pegmatitic. Associated minerals include quartz, albite, garnet, muscovite, biotite, beryl, columbite-tantalite, tourmaline, apatite, molybdenite, and bismuth or bismutite.

Microprobe analyses of six specimens reveal typical compositions for natural emeralds, with low Cr, little or no V, but relatively high Fe. The Tauá emeralds contain numerous mineral inclusions: Biotite/phlogopite, tremolite, allanite, molybdenite, and apatite have been identified (microprobe analyses of the first three are provided). Also observed were orangy-red irregular crystals that could not be identified. Eleven excellent photomicrographs illustrate the inclusions.

In general, the quality of the Tauá emeralds is poor by gemological standards. Large-scale mining operations were halted after it was determined that they were not economically feasible. CMS

**Mineraliensuche in Nevada und Utah (Mineral prospecting in Nevada and Utah).** E. Schuhbauer, *Lapis*, Vol. 13, No. 5, May 1988, pp. 11–27.

For the mineral collector seeking unusual specimens of great beauty, Nevada and Utah hold singular promise. Areas covered in this article include the White Caps mine in Nevada, the Steamboat Hot Springs, the Copper Basin in Battle Mountain, Nevada, the Thomas Range and, of course, the Violet claims in the Wah Wah Mountains of Utah. Also provided is a list of 17 important mineral sites throughout the area and a map that identifies the location of each. A collection of exquisite mineral photographs, as well as several locality shots, illustrates the article. Some of the beautiful minerals depicted are red beryl, green beryl, topaz, garnet, and zircon. RW

## INSTRUMENTS AND TECHNIQUES

**Etch figures on beryl.** J. I. Koivula, *Journal of Gemmology*, Vol. 21, No. 3, 1988, pp. 142–143.

A brief text accompanies the four superb photomicrographs that are the main purpose of this note. Mr. Koivula's color photos illustrate the most common etch features encountered on natural beryl crystals. The author refers the reader to John Sinkankas's "excellent book" *Emerald and Other Beryls* for detailed drawings of numerous other etch figures. CMS

**Notes on the inclusions in a greyish kyanite.** A. Ghera, G. Graziani, and E. Gübelin, *Journal of Gemmology*, Vol. 21, No. 2, 1988, pp. 83–87.

This article presents a thorough chemical, optical, and physical description of a grayish blue gem-quality kyanite crystal and its crystalline inclusions. Microprobe analyses are provided for the kyanite and four of its inclusions: andalusite, apatite, calcite, and zircon. Also described are needle-like euhedral channels filled with minute andalusite crystals, yellow slabs formed by thin lamellae (probably lepidocrocite) intergrown with brownish red iron oxide and hydroxide platelets, and colorless transparent crystals (apparently kyanite). Minute needles, possibly TiO<sub>2</sub>, were also observed intergrown with apatite crystals. Conditions of formation for this kyanite sample are drawn from the properties and inclusions observed. Nine photomicrographs clearly illustrate this excellent descriptive study. CMS

## JEWELRY ARTS

**Gold chains and mesh—I.** J. Wolters, *Aurum*, No. 31, 1987, pp. 46–57.

In this first of a two-part article, the author skillfully leads us through the history of chain making in a brief but concise manner. He describes the various types of chain and mesh devised, and outlines the development of machines for chain making in the 18th and 19th centuries. The earliest examples of gold chain were found in the tombs of Ur, dating from around 2400 B.C. Known as the foxtail or column chain, this style continued to dominate for the next 3,000 years. The various types that subsequently gained favor are also discussed in detail.

Although the article does not cover chains embellished with gems or enamel, since it is limited to "chains made of precious metal wire, tubing or sheet," it is nevertheless an important account of this aspect of the jewelry manufacturing arts. The article is peppered with references and is well illustrated with photos, engravings, and drawings of chains, meshes, and the machinery developed to make them. EBM

**Precolumbian jewelry from Peru.** T. Gessler, *Ornament*, Vol. 11, No. 3, 1988, pp. 50–55.

As Gessler, curator of the Queen Charlotte Island

Museum in British Columbia, Canada, states, this article provides a "rare glimpse at authentic South American precolumbian design in jewelry." The author points out how unusual it is to find intact bead jewelry from the Inca and pre-Inca periods, because most of the cords on which they were strung are perishable. It is much more common to find individual beads from dismantled necklaces or bracelets. Included in Gessler's 13 photographs, however, are necklaces of shell with some silver that are strung on their original cord. Not only does this intact jewelry give an accurate idea of the materials used, but it also provides examples of the designs employed. This well-researched article is a "must read" for anyone interested in pre-Columbian jewelry. DMD

**The unconventional Elizabeth Gage.** J. Fallon, *W*, May 2-9, 1988, p. 57.

Jewels by Elizabeth Gage exhibit a unique blend of styles derived from classical, baroque, and contemporary designs. Her motto for designing jewelry is "no rules."

Most of her creations are one-of-a-kind pieces fabricated in gold with an unusual mix of gems accented by enameling and granulation. In fact, about 40% of her business is in special commissions. Only her enameled-gold Zodiac Ring Series is produced in quantity.

Gage's creations are sold exclusively at her shop in London, with the exception of the few days each year that she exhibits in New York and occasional special showings. Perhaps the secret to her success is her exclusivity: Owners of her pieces feel that they are members of a special elite. By not allowing commercialism to consume her, she has been able to maintain control over her business; thus, there is little likelihood of her creations ever becoming overdone or trite. EBM

## SYNTHETICS AND SIMULANTS

**Characterization of Russian hydrothermally-grown synthetic emeralds.** K. Schmetzer, *Journal of Gemmology*, Vol. 21, No. 3, 1988, pp. 145-164.

Dr. Schmetzer's meticulous attention to detail is evident in this thorough study of 13 faceted Russian synthetic emeralds. Following a review of previous work reported on similar material, he cites the observation of anomalous absorption features, as well as traces of nickel and copper, as the stimulus for his current work.

Chemical, optical, and physical data for one representative sample are provided in their entirety. In general, although the standard gemological properties of the synthetic overlap with those of natural emeralds, chemical analysis and microscopy provide means of separation.

An extensive discussion of optical and infrared absorption features and how they relate to color and chemistry is included. Descriptions of inclusions and

growth features essentially confirm previous reports; 18 photomicrographs will aid the gemologist in identifications.

Of special value in this article is Dr. Schmetzer's review of the Russian literature on synthetic beryl, most of which is published only in Russian. In fact, the bibliography as a whole is a useful resource. CMS

**L'Emeraldolite, une nouvelle matière (Emeraldolite, a new material).** D. Robert, *Revue de Gemmologie a.f.g.*, No. 94, 1988, pp. 9-10.

"Emeraldolite" is a several-millimeters-thick epitaxial overgrowth of synthetic emerald on natural "ivory-white" beryl. Because it is not similar to anything found in nature, it should not be an identification problem for gemologists. "Emeraldolite" can be used for jewelry purposes in the rough, taking advantage of the multitude of small sparkling crystals; it is particularly suited to cameos and other types of carving, as one can play on the contrast of the green overgrowth with the "ivory-white" seed. Two color and six black-and-white photographs accompany the short description of this new synthetic gem material. EF

**Hallmarked synthetic emerald.** A. Hodgkinson, *Journal of Gemmology*, Vol. 21, No. 3, 1988, pp. 179-181.

Nine photomicrographs illustrate features recently observed by Mr. Hodgkinson in two specimens of Lennix synthetic emerald. These include growth lines; multiphase inclusions of gas, flux, and phenakite; ball-like aggregates of phenakite crystals; and features that mimic the negative-prism cavities that are characteristic of emeralds from India. This note serves to remind gemologists that the Lennix synthetic emeralds require special attention, since their inclusions are numerous and frequently look natural. CMS

**Lechleitner synthetic rubies with natural seed and synthetic overgrowth.** K. Schmetzer and H. Bank, *Journal of Gemmology*, Vol. 21, No. 2, 1988, pp. 95-101.

This very thorough article describes new material produced by Lechleitner that consists of natural corundum overgrown with a layer of Verneuil synthetic ruby. While more difficult to identify than the earlier synthetic ruby overgrown on synthetic corundum, this new Lechleitner product does have a variety of distinctive characteristics. The optical absorption spectrum reveals features arising from a combination of  $\text{Cr}^{3+}$  in the overgrowth layer and  $\text{Fe}^{2+}/\text{Ti}^{4+}$  in the natural seed, although it is not stated whether these features can be seen with a hand spectroscope. Also useful is the presence of molybdenum as detected by X-ray fluorescence. Of more use to the trade gemologist, however, are microscopic features such as angular growth planes, negative crystals, and rutile needles characteristic of Sri

Lankan corundum, in conjunction with flux residues, needle-like inclusions (not previously described), and growth boundary features. These are well illustrated in 18 black-and-white photomicrographs. Two color photographs of the material also accompany the article.

CMS

**Low-pressure, metastable growth of diamond and "diamondlike" phases.** J. C. Angus and C. C. Hayman, *Science*, Vol. 241, No. 4868, August 19, 1988, pp. 913-921.

Because of diamond's remarkable properties as a crystalline solid, its synthesis has attracted much scientific attention. Following the successful development of a process to crystallize diamond in the mid-1950s, research on diamond synthesis has taken two different but parallel directions. The first is the high-pressure growth of diamond from a molten metal solvent-catalyst at pressures where diamond is the thermodynamically stable phase of carbon. This process has been used to produce small synthetic diamonds for industrial use and, more recently, single crystals up to several carats in size. The second area of research is the growth of diamond at low pressures, where it is a metastable phase. This article provides an excellent summary of the historical development of the latter research area and the current understanding of the processes involved.

Synthetic diamond grown at low pressures is produced as a thin film on a substrate material. Initial efforts succeeded in forming diamond thin films only at extremely slow growth rates. Recent developments, however, have led to a number of processes that can grow diamond thin films at much faster growth rates. The thin films produced thus far consist of a polycrystalline aggregate of diamond. Because hydrogen plays an important role in the crystallization of carbon at low pressures, some of these films are not identical to diamond; rather, they are called "diamondlike" carbons and hydrocarbons, with physical properties that are slightly different from those of thin-film polycrystalline diamond. Nevertheless, these thin films also have a number of potential technological applications. This article compares the properties of all three classes of materials and concludes with some observations of likely future developments in this area. In addition, it provides an extensive 107-item bibliography. For those interested in a review of diamond thin films, the article presents current information in a journal that is readily available.

JES

**Synthetic opal.** A. Hodgkinson, *Journal of Gemmology*, Vol. 21, No. 2, 1988, p. 73.

The author notes two characteristics that may help identify some synthetic opals manufactured in Japan in the early 1980s: a "venetian blind" effect visible with immersion and polarization under magnification, and

lack of fluorescence and phosphorescence to long-wave ultraviolet radiation. The venetian-blind effect is illustrated.

CMS

## TREATMENTS

**Die Abkühlungsgeschwindigkeit als Ursache für die Bildung entweder von Sternkorunden oder von kornblumenblauen Saphiren (The influence of cooling history to produce either star corundum or cornflower blue sapphire).** H. Harder and A. Schneider, *Neues Jahrbuch für Mineralogie Monatshefte*, No. 8, August 1987, pp. 344-346.

The authors discuss the role of iron and titanium in the coloration of blue sapphires. They believe that  $\text{Fe}^{2+}$ - $\text{Fe}^{3+}$  charge-transfer alone, without the participation of Ti, could give a blue coloration.

Corundum containing Ti can follow two types of cooling behavior during its geologic history. If it cools slowly, as is typical of regional metamorphism, titanium oxide exsolution creates rutile inclusions, resulting in a star sapphire. If the corundum cools very fast, as in a volcanic environment, no exsolution occurs and cornflower blue sapphires are created.

EF

**Investigation of cat's-eye zircons from Sri Lanka.** M. Gunawardene and M. Gunawardene, *Journal of Gemmology*, Vol. 21, No. 2, 1988, pp. 88-91.

The recent abundance of cat's-eye zircons from Sri Lanka prompted this study, which revealed that most were being produced by heat treatment. Comparison of samples (the exact numbers are not given) of natural and heat-treated material disclosed a number of distinguishing characteristics: R.I., S.G., absorption features visible with a hand spectroscope, and microscopic features. Differences in the spectra suggest that the heat-treated material is high-type zircon, whereas the natural cat's-eyes are of the intermediate type. The most notable difference, however, is that the chatoyancy in natural cat's-eye zircons is due to parallel hollow or growth tubes, whereas the heat-generated phenomenon is caused by minute oriented disc-shaped fissures; both types of features can be observed with a gemological microscope. Photomicrographs illustrate these characteristic features.

CMS

**NRC encore: More topaz blues.** S. Mitchell, *American Jewelry Manufacturer*, Vol. 36, No. 5, May 1988, pp. 32-42.

After prolonged negotiations with the AGTA, the Nuclear Regulatory Commission (NRC) announced in January of this year that, due to the importance of blue topaz to the jewelry industry, they would "act expeditiously on the licensing of domestic reactors and importers." Added to this was the warning that "failure to obtain a proper license could result in enforcement action." As of the date this article was published, no

licenses had been forthcoming, despite the good intentions of many laboratories and importers who have applied. In this overview, the author leads us through the governmental labyrinth, pointing out the pitfalls and dead ends that exist. Even though the article cannot answer all the questions that have been raised, it does bring many of them into sharp focus: Are the regulations fair? When will they be put into effect? Will they be enforceable? What will be the costs? Everyone is wondering what will happen next. EBM

**Role of natural radiation in tourmaline coloration.** I. M. Reinitz and G. R. Rossman, *American Mineralogist*, Vol. 73, No. 7/8, 1988, pp. 822–825.

Previous studies have shown that both gamma and X-radiation develop and intensify the pink color in elbaite tourmaline. In addition, heat treatment at 600°C removes the pink coloration from both natural and laboratory-irradiated elbaite. Comparison of the optical absorption spectra of colorless and pink elbaite indicates that the oxidation state of the manganese changes from 2+ to 3+ during radiation exposure. The  $Mn^{3+}$  produces the pink color. Both naturally pink and laboratory-irradiated elbaite show the same spectroscopic features. In experiments using different amounts of radiation exposure, the authors found that the concentration of  $Mn^{3+}$  in a pink elbaite correlated with the dose of radiation received by the sample.

From these observations, the authors conclude that the color in naturally pink elbaite is due to natural radiation exposure. This conclusion is supported by measurements of radiation levels in tourmaline pockets in Southern California pegmatites. The radiation dose computed from these measurements generally corresponds to the dose that will induce pink color in elbaite by laboratory irradiation.

The authors also conclude that natural pink color develops in elbaite only if irradiation occurs after the pegmatite has cooled below the temperatures known to bleach such color. Thus, most pink elbaite initially formed in a colorless state and only later attained a pink color through the oxidation of manganese via ionizing radiation.

The results of this study suggest that the gemological separation of naturally colored from laboratory-irradiated deep pink elbaite may be impossible because, in both instances, the cause of color is radiation exposure. JES

**Thermal stability of yellow colour and colour centres in natural citrine.** K. Schmetzer, *Neues Jahrbuch für Mineralogie Monatshefte*, No. 2, February 1988, pp. 71–80.

Several bleaching and irradiation experiments were performed on natural citrines to better understand the thermal stability of the various color centers. The author

deduced from these experiments the presence of five different color centers, which are defined by either their optical absorption or their thermal behavior. Two electron energy band models are proposed for the bleaching of these centers, but no comment is made as to the physical description of the color centers themselves. EF

## MISCELLANEOUS

**Contemporary jewelry.** J. Tenhagen, *Lapidary Journal*, Vol. 42, No. 5, 1988, pp. 49–52.

Written as a broad overview, this article describes Tenhagen's approach to evaluating a modern jewelry item. Focusing on a woman's cluster ring that contains colored and white stones, the author outlines the steps he would take in the appraisal process. The article includes brief discussions of proper gemstone identification, quality estimations, measuring, manufacturing considerations, and price estimates.

This article is not intended to address the complete appraisal format, for which proper training is recommended. However, it does present one person's approach to the appraisal procedure. JLC

**An introduction to mineralogy.** F. H. Pough, *Lapidary Journal*, Vol. 42, No. 4, July 1988, pp. 21–34.

Dr. Pough discusses the major categories and divisions that comprise the subject of mineralogy. The subcategories of composition, physical properties, crystallography, and modes of formation are covered briefly in lay terms. Dr. Pough's illustrative writing style is easy to follow and understand. Bill Videto

**Notes from the laboratory—12.** K. Scarratt, *Journal of Gemmology*, Vol. 21, No. 3, 1988, pp. 131–139.

Mr. Scarratt's latest report includes a thorough description of recently encountered specimens of Lennix synthetic emerald, Adachi synthetic beryl (red, purple, blue, and watermelon), and Kyocera synthetic emerald, star ruby, alexandrite (including cat's-eye), blue sapphire, and opal. Also briefly described are the continued encountering of glass- and plastic-filled cavities in rubies, a compact disk-like tension halo in a heat-treated sapphire, and a "fashion stone" of unknown nature that is being marketed as "fluorolith" and exhibits pronounced green phosphorescence when it is exposed to visible light. For archeo-gemmology buffs, Mr. Scarratt cites an 1830 edition of R. J. Bridges' *Familiar Lessons on Mineralogy and Geology*, in which an unusual test for diamond is described that involves two pennies. Twenty-nine informative color and black-and-white photographs accompany the text, although the reader may encounter some brief confusion from the irregular order of figures 18–26. CMS