GEMOLOGICAL ABSTRACTS

Dona M. Dirlam, Editor

COLORED STONES AND ORGANIC MATERIALS

The heat and diffusion treatment of natural and synthetic sapphires. R. Crowningshield and K. Nassau, *Journal of Gemmology,* Vol. 17, No. 8, 1981, pp. 528–541.

In discussing the heat and diffusion treatment of natural and synthetic sapphires, Mr. Crowningshield and Dr. Nassau reflect back on nearly 30 years of gem testing and relate this experience to identifying various types of heat and diffusion treatments that are currently being practiced. They discuss numerous specific accounts of treatments that have been encountered in the GIA Gem Trade Laboratory.

The authors first review the subject of heat treatment of corundum in the gemological literature, correcting several inaccuracies that have been reported. Information on the behavior of ruby and sapphire when subjected to heat treatment is available from the manufacture of the synthetic material as well as from other studies on natural material. On the basis of such information, the authors list nine distinct treatment processes that are currently being used on corundum. Four of the treatments correspond to processes that also occur in nature, two are used on synthetic material, and the remaining three treatments do not correspond to natural processes. The first six involve heating only; the latter three involve heating plus surface diffusion of impurities, such as TiO_2, Fe_2O_3, Cr_2O_3, NiO, and the like. A table lists the various types of treatment plus the results obtained from each treatment process. With

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.

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the aid of 16 color photographs, the authors outline the identification of these treatment processes.

Robert E. Kane

Die Eigenschaften der undurchsichtigen Schmucksteine und deren gemmologische Bestimmung (The properties of opaque gemstones and their gemological identification). E. Gübelin, *Zeitschrift der deutschen gemmologischen gesellschaft,* Vol. 30, No. 1, 1981, pp. 3–61.

The entire issue of this journal is devoted to Dr. Gübelin's article on opaque gemstones and techniques for identifying them. In his introduction, the author points out that unlike most of their nonopaque counterparts, opaque gemstones and especially those that are carved cannot be readily identified with the aid of a refractometer and a microscope. Testing methods such as specific gravity, absorption, and fluorescence are discussed, as are potentially destructive techniques such as the hardness test, the streak test, and chemical reactions. When describing the latter techniques, Dr. Gübelin provides a valuable reminder of how to perform them properly in order to avoid damage.

The greater part of the article consists of numerous tables of opaque gemstones, from agalmatholith to wernerite, grouped by color. For each category, Dr. Gübelin lists the properties of the gemstones and their occurrences, and provides special remarks. In addition, there are separate tables for groups such as cryptocrystalline quartz; jade substitutes; serpentine minerals; and turquoise, its substitutes and imitations. This compilation of opaque gemstones is a welcome addition to the field of gemology. *KNH*

Korite from Alberta, Canada. P. D. Kraus, *Lapidary Journal,* Vol. 35, No. 10, 1982, pp. 1994, 1996.

Korite, the aragonite portion of the fossilized ammonite *Placenticeras,* is a gem material that has been marketed in the past as ammolite and calcentine. It is mined commercially in two localities near Lethbridge in Southern Alberta, Canada.

It is interesting to note that while aragonite will normally convert to calcite after approximately 10 million years, these korite deposits have been radiometrically dated at about 70 million years. It is probable that the overlying shale layer allowed mineralization of the fossil shells, thus preserving the fossils.

This mineralization included small amounts (1% each) of iron and silica, and traces of titanium, copper, barium, and magnesium from the shale. The resulting material displays colors similar to those seen in fire agate as a result of the diffraction of light.

Because of the rather soft and flaky nature of korite, 95% of the commercially viable product is capped with synthetic spinel. The remainder is cut into completely natural stones. Korite Ltd. controls the production and claims that the company buries all materials that are not deemed fit for cutting. *RSS*

DIAMONDS

The genesis of natural, coated diamond crystals (in Russian). A. M. Asxabov and B. A. Mal'kov, *Papers of the Soviet Academy of Sciences,* Vol. 251, No. 4, 1980, pp. 954–956.

This investigation into the well-known phenomenon of yellow or greenish coatings on diamond crystals from the Soviet Union opens with a structural and chemical description of the jackets. High-density dislocations lend a fibrous impression to the outer diamond surface, which differs sharply from the typically transparent octahedral crystal it covers. Micro-inclusions with a constant, higher silica content contribute to the jackets' turbid appearance, while the characteristic tints result from increased nitrogen content.

Asserting that early theories on the mechanism of their growth fail to explain features of the coatings revealed by X-ray diffraction studies, the authors present a detailed hypothesis based on a concentrated supercooling of the original melt. The higher inclusion of admixtures into the growing crystal, formerly assumed to be a causal factor in the deformation of its faces, is described here as a result. Concentrated supercooling of the normal planar faces of the diamond octahedron leads to a chambered outer structure, with the accretion of impurities then occurring in the hollows. This accounts for the nature of the materials found in borders between the finished fibers, and also corresponds to known processes of crystal regeneration.

Having explained the process by which the jackets formed, the researchers approach the question of where and when the jackets took shape. Lack of repetition in the casings points to a single instance of formation; and despite extensive dissolution explained as oxidation occurring late in the kimberlite magma, earlier slippages can be identified. These carry through to the basic crystal and thus indicate that the formation of the coating preceded this plastic deformation in the already-consolidated mantlerock of eclogites and peridotites. Thus, the tinted jackets so typical of Russian crystals lend insight into the larger question of how diamond itself was formed. *MPR*

High-temperature electroluminescence in diamond (in Russian). V. S. Tatarinov, Ju. S. Muxačev, and I. A. Parfianovič, *Physics and Technics of Semiconductors,* Vol. 13, No. 8, 1979, pp. 1642–1645.

Scientists at the Ždanov University of Irkutsk, the Soviet Union, first review previous work on the subject of electroluminescence (EL) in diamond. They then describe the discovery of a yellow-green electroluminescence in diamond crystals placed in a constant electric field of up to 6 kilovolts/cm at temperatures ranging from 300° to 750°C. This high-temperature electroluminescence (HEL) appeared in 12 of 600 natural specimens tested, as well as in one synthetic sample.

As part of ongoing detailed studies of the solid-state physics of diamonds, the spectral, thermal, and electrical characteristics of a natural crystal were examined and related by the authors to the process of HEL at an atomic level. In conclusion the authors present arguments for correlating this phenomenon with an S2 spectral center. They then suggest further applications of their studies, also describing an improved apparatus for applying voltage. *MPR*

The Monastery Mine. J. Gurney, *Indiaqua,* Vol. 29, No. 2, 1981, pp. 21–24.

The Monastery Mine has been known to be a diamond-bearing kimberlite pipe since 1876, but past preliminary investigations and some small-scale mining have always shown it to be unprofitable for large-scale production. Located in the Orange Free State in South Africa, the Monastery Mine was recently reopened for production using the most modern recovery methods.

The decision by the Monex Company, and more recently the Gemex Company, to proceed with mining was not made easily. The pipe is small and most of the diamonds are of very poor quality. The redeeming factor is a sprinkling of a few large stones of the very pure type IIa variety. The DeBeers' Letseng-la-Terai mine in Lesotho parallels Monastery in its need to discover a few large, top-color diamonds to remain profitable. The next important decision at Monastery was how to achieve a balance in setting the size of the mechanical jaws that crush the kimberlite so that both the small and the large stones could be recovered. By setting the width of the jaws at 30 mm, a diamond of up to 220 cts. can be liberated without risk; those larger may be crushed. *FLG*

Rubidium-strontium dating of the Udachnaya kimberlite pipe. M. Maslovskaya, S. Kostrovitskiy, V. Lepin, T. Kolosnitsina, L. Pavlova, B. Vladimirov, S. Brandt, *Doklady Akademii Nauk SSSR,* Vol. 242, No. 1, 1981, pp. 168–170.

An interesting topic in diamond research is that of determining the age of kimberlite pipes. Maslovskaya et al. first briefly review other efforts undertaken to apply radiometric age techniques to this problem. In radiometric dating, the age of the pipe is calculated by measuring the presence of a short-life radioactive element (such as carbon-14) or a long-life radioactive element plus its decay product (such as potassium-40/argon-40 [K-Ar] or rubidium-87/strontium-87 [Rb-Sr]).

Both K-Ar and Rb-Sr age dating methods have been applied to kimberlite pipes with controversial results. In an effort to circumvent the difficulties encountered by previous researchers, the authors chose two independent approaches in their use of Rb-Sr to date the Udachnaya pipe, the second largest Soviet pipe. One method dated the effect of kimberlite fluids on the host rocks, while the other dated the time of hydrothermal mineralization of quartz.

Samples were collected from the contact zone of a kimberlite vein into the surrounding host dolomites and from a hydrothermal zone within the Udachnaya suite. Determinations were then made on the strontium and rubidium ratios in these samples.

Isochrons (lines connecting rocks of the same age on the basis of radiometric ratios) were plotted from the data. The age for the kimberlite contact zone is 345 ± 30 million years and that for the quartz samples is 348 ± 40 million years. These are in agreement with the age 350 ± 15 million years that was previously reported.

In addition to providing an age for this important pipe, the authors have demonstrated the success of both techniques, which can be applied to other age determinations. *DMD*

GEM LOCALITIES

Emeralds from Itabira, Minas Gerais, Brazil. F. M. Bastos, *Lapidary Journal,* Vol. 35, No. 6, 1981, pp. 1842–1848.

This article discusses in detail the new emerald deposit that was discovered in 1978 on the Belmont Farm at Oliveira Castro Station about 18 km southeast of Itabira, Minas Gerais, Brazil. Access to the area is gained by dirt road from Itabira. The mine is situated in the Rio do Peixe (Fish River) Valley and is located immediately adjacent to the tracks of the Vitoria-Minas railroad, which services the famous iron mines at Itabira.

The emeralds were first found by the station manager at Oliveira Castro during construction of a dam for the station's water supply. The emerald crystal that the manager found was in a biotite schist matrix. He showed the crystal to the owner of the property who subsequently formed Belmont Gemas Ltda. and started mining operations. The mine is an open pit; although it was initially worked by hand, the operation is now automated, with mechanical shovels and bulldozers.

The emeralds occur as perfect hexagonal prisms commonly 1.5 to 2.5 cm long. Crystals up to 6 cm have been reported, however. The emeralds characteristically exhibit a light bluish-green color when viewed perpendicular to the c-axis. The crystals occur in biotite schist or as alluvium in a quartzite and schist gravel.

Reports indicate that up to 40% of the emeralds recovered are of cutting quality. Some of the stones studied by the author are comparable to the finest quality material found at Muzo and Chivor in Colombia.

Peter C. Keller

Garnets from Umba Valley, Tanzania: is there a necessity for a new variety name? K. Schmetzer and H. Bank, *Journal of Gemmology*, Vol. 17, No. 8, 1981, pp. 522–527.

Drs. Schmetzer and Bank raise the question of whether the type of garnet that has recently been referred to as "malaya" really justifies the adoption of a new variety name. They compare samples of the material from Umba Valley, Tanzania, with other garnets of the pyrope-almandine-spessartine solid-solution series, giving special attention to the property determinations that are readily available to gemologists. They found that while some members of this series can be distinguished from one another according to dominant end member of paired end-member series, pyrope-spessartine and pyrope-almandine specimens cannot always be separated by means of refractive index, specific gravity, and/or color. Spectroscopic determinations can be made, but these require considerable expertise as well as chemically analyzed standards for comparison; such tests are, therefore, not practical.

In light of this inability to distinguish gemologically between two of the types of garnets encountered in the pyrope-almandine-spessartine series, the authors recommend that all garnets from the Umba Valley be referred to by the term *pyralspite* and modified as needed by prefixing a color term. However, this term seems to this reviewer to be too general and, in particular, does not account for the often significant contribution made by grossular to the composition of garnets of the pyrope-spessartine series. Nor do the authors consider the all-too-common case in which the gemologist has no way of determining the locality from which his or her material originated. *CMS*

Modes of occurrence and provenance of gemstones of Sri Lanka. K. Dahanayake, *Mineralium Deposita*, Vol. 15, 1980, pp. 81–86.

Summarizing a major study of gem mining in Sri Lanka, Dahanayake describes the major gem localities and hypothesizes about their origin. First, he gives an overview of the geology of the island, which is underlain by Pre Cambrian rocks that can be divided into three parts: Highland, Vijayan, and Southwestern. The two gem areas near Elahera and Ratnapura lie within the Highland Group, and gem pits also occur in the Southwestern Group. Mining is done in the Vijayan Complex only around rivers draining from the other two groups.

The author describes three types of gem pits: (1) eluvial, with blue sapphires and rubies found in coarse, unsorted gem-bearing sediments; (2) residual, with blue sapphires and rubies occurring in argillaceous sand over weathered gneisses and marbles; and (3) alluvial, with fancy sapphires, cat's-eye chrysoberyls, and alexandrites in addition to the blue sapphires and rubies, contained in well-sorted sand and gravel sediments. A schematic cross-section illustrates the relationship of the three types of pits to the geologic setting.

The author concludes with a discussion of the source material for these deposits, examining in more detail the nature of these deposits. He describes how the pegmatites and the garnetiferous/cordierite gneisses and marble could be responsible for the development of gemstones in each of the three pits. *DMD*

JEWELRY ARTS

The ancient craft of granulation. A re-assessment of established concepts. J. Wolters, *Gold Bulletin*, Vol. 14, No. 3, 1981, pp. 119–129.

In his review of accepted concepts of the history of gold granulation, Mr. Wolters makes the following points:

1. Granulation is a formal discipline within the art of the goldsmith; however, it is not a technique that is based on one specific joining process.
2. In granulation, as in other jewelry techniques, both metallic and nonmetallic solders have been used, the latter predominating in antiquity.
3. Granulation was never a "lost" art; it survived with continuity until far into the 19th century.
4. The description of, or references to, joining techniques on which granulation is based can be found in numerous literary sources over a period of more than 2000 years.
5. Modern attempts to establish by experiment the origins and characteristics of the technique have contributed little to our knowledge of it. They have usually ignored the technical features of ancient work, materials, and processes known in antiquity.

The above points are substantiated by the author's extensively documented research, including a bibliography of 122 entries. The points made will be enlightening to the historian as well as to the practicing goldsmith-jeweler. This article is an abstract of a book by Mr. Wolters on the subject of granulation that is to be published soon.

In this article he states that granulation with clearly recognizable traces of solder appeared first in Egypt as early as the Middle Kingdom, in Iran at the end of the Parthian period, in prehistoric northern and central Europe, in Imperial Rome, in Byzantium, as well as in central and southern Europe from medieval time onwards. He further states that the granulation work of all other cultures shows no remnant of solder alloys. He concludes with the statement that "none of the numerous attempts at experimental reconstruction of the historical granulation technique has taken adequate account of the above important considerations."

This reviewer is concerned, however, that in all of Mr. Wolters's research he fails to credit the work done by H. A. P. Littledale in 1933, which was published in

1936 in *The Scientific and Technical Factors of Production of Gold and Silverwork* by the Worshipful Company of Goldsmiths. Mr. Littledale, in his research, came to essentially the same conclusions as Mr. Wolters. Mr. Wolters's work would be more convincing if greater attention were paid to Mr. Littledale's discoveries, inasmuch as Mr. Littledale did take into account the technical features of ancient work and developed a consistent theory based on his assessment of ancient technology.

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Chinese jade. K. R. Tsiang, *Arts of Asia*, Vol. 11, No. 5, 1981, pp. 77–83.

In this article, Katherine Tsiang weaves a brief survey of Chinese jade around photographs of carvings from the Indianapolis Museum of Art. Her introduction traces the origin and use of the two jades, nephrite and jadeite, and follows with a discussion of developments in jade cutting.

The main body of the article is devoted to jade artifacts from the Shang dynasty to the present. It begins with early jade daggers and blades, and then covers the kuei, a ceremonial blade used in later centuries as an emblem of official rank. Other ceremonial and funerary jades such as plaques and body stoppers are discussed and illustrated. The author also examines the pi and the t'sung with the aid of photographs. Since the Chou dynasty, the pi has been regarded as a symbol of heaven and the t'sung, a symbol of the earth.

The article concludes with two pages of color photographs that cover jades from the Ch'ing dynasty to the present. *ET*

Simulated materials in jewelry. R. K. Liu, *Ornament*, Vol. 4, No. 4, 1980, pp. 18–26.

Although we often view efforts to duplicate gems and other jewelry materials as recent developments, simulants have been an integral part of the history of jewelry. As early as 3500 B.C., people used faience to imitate turquoise. In the first section, Liu uses both early artifacts and recent jewelry items to describe how accurately people have tried to duplicate these objects, from exact copies to mere look-alikes.

Then the author focuses on the detection of simulants, stating that one must know the object being copied as well as the materials used to simulate it. Separation of the original from the imitation is often difficult, since countless clues must be considered. He emphasizes that one must examine carefully signs of age and wearing to see that aging has not been artificially induced.

Liu incorporates 38 fascinating photographs of jewelry that contain teeth, beads, turquoise, lapis-lazuli, coral, onyx, malachite, shell, agate, and jade, with their ingenious copies made of bone, shell, glass, ceramic materials, metal, and plastic. Those interested in these remarkable pieces will find the extensive bibliography helpful. *NPK*

The utilization of diamond powder—optimum abrasive for the lapidarist. B. A. Cooley and H. O. Juchem, *Indiaqua*, Vol. 29, No. 2, 1981, pp. 97–103.

In part one of a series, the authors describe the use of natural and man-made diamond abrasives to cut diamond and colored stones. They also comment on the development and use of cutting equipment.

Diamond is used to cut diamond. Sawing diamond is accomplished with 4-inch bronze alloy blades, 0.05 mm to 0.16 mm in thickness. The blades are dressed with 20- to 100-micron diamond powder. Sawing speeds vary from 4200 R.P.M. to 7000 R.P.M. The faces are cut and polished on diamond-charged laps. The diamond powder used to charge the laps is in a paste form, and varies in micron size depending on the cutter's preference.

In the sawing and cutting of colored stones, electroplated or mechanically bonded diamond-charged saw blades, laps, and grinding wheels are often used. Diamond abrasives can increase productivity, improve cutting quality, and reduce cost. Even in countries with low labor costs, such as Thailand, the use of diamond abrasives is very common.

Cooley and Juchem include 21 photographs which illustrate the preparation and use of equipment in cutting. Although the article is detailed in some parts it is vague in others, and the reader may be left with many unanswered questions. *Dino DeGhionno*

RETAILING

The carat weight. H. Tillander, *Journal of Gemmology*, Vol. 17, No. 8, 1981, pp. 619–623.

The word *carat* has been used both with reference to the quality of gold and as a measurement of size or weight in other materials. The smallest unit of weight once used in England and on the European Continent north of the Alps was the grain, based on the weight of a local grain of wheat. By the 16th century, this was replaced in the European trade by the "carat grain," which eventually became equivalent to one-fourth of a carat as we now know it. In many trade centers, the term *carat* referred to the bean of the carob tree; it became well established in the mid-17th century, although the exact weight varied somewhat. It was not until 1893 that Dr. G. F. Kunz suggested that the carat be incorporated into the metric system and be accepted as equal to 200 mg. Most countries legalized the metric carat as the unit for weighing gemstones just prior to World War I. Modern carat weights are now internationally written to two decimal places (e.g., 1.32), but a third decimal may be quoted in brackets to facilitate identification. *ERL*

Gemstone and jewelry appraisal guide. W. D. Shoup, *Lapidary Journal,* Vol. 35, No. 7, 1981, pp. 1524–1535.

Shoup reviews all aspects of appraising, from the take-in through cleaning, quality determinations, metal identification, and pricing. The information given is intended to help those with a basic gemological education gain insight into appraisal procedures and techniques.

The author recommends that 10 steps be followed in doing an appraisal. First, determine the reason for the appraisal, which will affect the appraised value. For example, insurance appraisals are usually given at retail replacement value, while inheritance tax appraisals are normally figured at market value. Second, determine which items are to be appraised. Some pieces are not worthy of the appraisal fee, and the customer should be informed that the cost of the appraisal might exceed the value of the item to be appraised. Also, frequently customers will bring in items that are beyond the capabilities of the gemstone and jewelry appraiser, for example, artwork, figurines, and the like. Third, establish charges and estimate time requirements for each job in advance. Fourth, photograph the items to be appraised. Fifth, examine, measure, and plot the major identifying characteristics of each piece and identify the potential hazards of working with the piece to the customer. Sixth, clean, assay, weigh, and measure the jewelry. (Different techniques for jewelry cleaning are explained in detail here. Metals testing and formulas for determining gram weight are also covered in this section.) Seventh, analyze the jewelry's construction; the value of the item may vary depending on whether it was handmade, die struck, or cast. (An informative section on jewelry design and decoration is also included here.) Eighth, price the metal and labor. Ninth, analyze the gemstones. Tenth, price the gemstones. Included with steps 9 and 10 are charts that explain the different pricing and grading techniques used by the author.

Shoup has done an excellent job of summarizing a subject that is both vast and complicated. He has included a number of helpful hints, cautions, and key points to be aware of at each step. This article supplies assistance to the beginner and useful information to the veteran appraiser. *Marcia Hucker*

The glory—and the nothing—of a name. M. E. Thomas, *The Goldsmith,* Vol. 160, No. 3, 1981, pp. 64–66.

Royal Lavulite and Royal Azel are the commercial names given to the new material identified by various professional sources as manganoan sugilite, a purple mineral that lies between 5.5 and 6 on the Mohs hardness scale, is dichroic, and has refractive indices of 1.605 to 1.611.

It is the royal purple color of sugilite in its translucent, finest quality that inspired the trademarked names, although the author points out that an opaque, grey-purple, lower-quality stone and a semitranslucent, rose-purple, middle-grade stone are also marketed under these names. The sugilite controversy is such that both commercial parties—those marketing the stone as Royal Lavulite and those selling it as Royal Azel—claim to control the world's supply and, consequently, to have more of the top-grade material. As a result, the author indicates, this relatively new gem is becoming engulfed in a confusion of commercial interests.

Gemologists will find this account fascinating not only for the information about sugilite, but also for the description of what happens when a new deposit or new gem material is discovered. *JCL*

Travels in China. P. Read, *Canadian Jeweller,* Vol. 102, No. 6, 1981, pp. 134, 135, 137.

In this description of his recent trip to China, Mr. Read focuses on the jewelry trade in Peking, beginning with his visit to the main office of the China National Arts and Crafts Corporation. This corporation consists of six divisions: (1) a hardstone jewelry department that sells polished and carved tiger's-eye, rose quartz, agate, turquoise, jade, and lapis-lazuli; (2) a gold jewelry department that sells 14K, 18K, and 24K gold jewelry set with gemstones; (3) a silver jewelry department that deals in gold-plated silver filigree ornaments and antique silver jewelry; (4) a costume jewelry department that specializes in enameled copper jewelry and enameled cloisonné horses; (5) a gems and pearls department that sells loose gemstones; and (6) a petit-point department that deals in handbags, eyeglass cases, and the like.

Having read articles describing China's deposits of diamonds, rubies, and sapphires, Mr. Read was eager to see examples and perhaps even visit the sources. He was disappointed, however, when the corporation's employees either professed to be unaware of such occurrences or expressed the opinion that Chinese rubies and sapphires were small and of poor quality. Nor was he able to substantiate the reports of kimberlites in the south and west. He was also unable to see any of the Chinese diamond-cutting operation in Peking, because the factory is out-of-bounds to visitors.

In a section entitled "Doing Business," Mr. Read describes the difficulties he encountered dealing with a foreign language, interpreters, and foreign customs. He gives a few pieces of advice: the "pecking order" of a group is assumed from the order in which its members enter the room or are introduced; you should remain standing until your host invites you to sit down; the drinking of green tea is a necessary business ritual, as are the formal "banquet" provided by the host and the dinner given in return by the guests; expertise with chopsticks earns a bonus mark.

The author concludes with his impression of China and Chinese gemology. He felt that the surprisingly basic questions asked after his talks illustrate the isolation of the Chinese from the mainstream of gemological knowledge. But he feels that they are now eager to catch up with Western technology, and that they have traditional artistry and craftsmanship to offer in trade. *ET*

SYNTHETICS AND SIMULANTS

Characterization of crystals with gem application. M. O'Donoghue, *Progress in Crystal Growth and Characterization,* Vol. 3, 1981, pp. 193–209.

In his introduction, O'Donoghue states that the purpose of this article is to bridge the gap that exists between gemologists and crystal-growth scientists. The gemologist is interested in separating natural from synthetic gemstones, while the crystal-growth scientist is attempting to produce material with particular properties. In sections organized by the method of crystal growth, he reviews the historical development of the different processes and describes the mechanics of each.

O'Donoghue emphasizes the separation of the natural stone from the synthetic or the diamond from the diamond simulant, pointing out the varieties of inclusions found in each. Following the bibliography, he includes 11 line drawings of the common types of identifying inclusions. *DMD*

Polymeric synthetic opal (in Japanese). A. Kose, *Gemmological Review,* Vol. 3, No. 5, 1981, pp. 2–7.

Noting the advances made in the creation of synthetic and substitute gemstones, Akira Kose, author and researcher in colloid chemistry at the Institute for Applied Optics in Tokyo, explains that opal synthesis was first made possible in the 1960s. Man-made products can be divided into two groups: (1) those that have the same chemical composition as the natural, referred to as synthetics; and (2) those that duplicate natural beauty but have a different chemical structure, referred to as simulants. Kose's highly technical article focuses on an analysis of the institute's own polymeric opal simulant, which has the chemical composition of styrene-divinyl-methacrylate.

The process involves combining styrene-divinyl benzene copolymer with polymethyl methacrylate. Through the stages of mixing the ingredients, emulsion, and sedimentation, a closely packed structure of microspheres results. Sedimentation from the white, milky emulsion state takes up to one year, and provides an excellent case study for explaining crystallization and changes of matter. Dissatisfied with existing theories, Kose and his colleagues concentrated their search on new theories, which led to this process.

The final polymeric opal-like product closely resembles natural white opal with a beautiful play of color. The diameter of the microspheres is in the 2000–5000 Å range, compared with the 2000–3000 Å range for natural opal. Kose enumerates the other characteristics of this opal simulant, including specific gravity (1.19), hardness (2.5), refractive index (1.6–1.49), thermoconductivity (slight), and surface character (hydrophobic).

The polymeric simulant maintains its beauty better than natural or synthetic opal, since it contains no water and is more resistant to acids and alkalis. Softening can occur beyond 130°C, but with cooling the stone returns to normal.

Illustrations include one diagram depicting opal structure and four photographs taken at 1500× magnification that detail the crystallization process of the polymeric simulant. *ALS*

Editor's Note: Although the author has titled this article "Polymeric Synthetic Opal," the chemical composition of this material places it in the simulant category.

Report on coloured cubic zirconia. P. Read, *Journal of Gemmology,* Vol. 17, No. 8, 1981, pp. 602–605.

The high luster and dispersion of colored cubic zirconia makes it an attractive and durable gem material, but these properties also prevent it from qualifying as an effective simulant of natural gems other than sphene and fancy-colored diamonds.

Read examined seven colored Ceres crystals grown by the skull crucible process from which faceted stones were cut and also studied for their properties. The specific gravity of these stones ranged from 5.95 to 6.06, although the range has been reported from 5.54 to 5.95. This deviation may be attributed to the stabilizer (Y_2O_3) employed in the Ceres product. Refractive index ranged from 2.09 to 2.18. Luster tested on a reflectivity meter was consistently lower than on colorless specimens, but thermal conductivity was virtually the same.

Fluorescence to long-wave ultraviolet radiation varied, depending on the color of the crystal. The pink crystals fluoresced yellow-green, the orange crystal red, and the lilac a bright peridot green, while the other colors (red, green, brown, and purple) were inert. Short-wave ultraviolet radiation caused a faint green fluorescence in the pink and lilac crystals, a pink fluorescence in the orange cyrstal, a pale green and pale brown in the green and brown crystals, with other colors being inert. No phosphorescence was displayed to either long-wave or short-wave ultraviolet radiation.

Characteristic absorption spectra for the seven crystals are illustrated and indicate that rare-earth dopants were used in their manufacture. Prominent spectral lines were caused by the oxides of cerium in the orange and red varieties, and by the oxides of erbium and neodymium in the pink and lilac crystals. The purple color may be due to ferrous oxides, while the olive-green and light brown shades might be due to the use of transition elements. Other manufacturers have employed oxides of terbium to produce various shades of green, and oxides of praseodymium to yield an amber color. Oxides of thallium and holmium have also been used. *ERL*

Synthetic emeralds. G. Brown, *Wahroongai News,* October 1981, pp. 15–19.

This brief review addresses our current knowledge of the growth and detection of synthetic emerald. The first part of the article includes fairly detailed outlines for the growth of synthetic emeralds by molten-flux techniques, the flux-transport growth technique, and hydrothermal growth. These outlines are accompanied by informative diagrams showing the growth apparatus. Following the discussion of synthetic emerald growth techniques, the author reviews the properties of natural emerald versus flux and hydrothermal synthetics. Because inclusions can be so important in the separation of natural stones from synthetics, the author outlines the types of inclusions that can be expected in both. The article then concludes with a comprehensive table for the identification of most known synthetic emeralds. However, no reference is made to synthetic emeralds from Japan or the U.S.S.R.

Peter C. Keller

Editor's note: Abstracts of articles that discuss the hydrothermal and flux-grown emeralds from the Soviet Union as well as synthetic material from Japan appear in this section of the Summer 1981 issue of Gems & Gemology.

MISCELLANEOUS

Exposure in jewelry photography. *American Jewelry Manufacturer,* Vol. 29, No. 5, 1981, pp. 84–88.

This article introduces the reader to the particular difficulties associated with photographing jewelry. It specifically addresses the subject of making proper exposures.

Many jewelry items commonly photographed are small, such as rings and brooches. In order to capture the detail of each piece, the camera needs to be brought in closer so that the image fills the picture area. Unfortunately, as the photographer moves in closer to an object, its depth of focus—that is, those areas that are in sharp focus—diminishes. The depth of focus can be increased by closing the lens down to a smaller aperture, f-16 or f-22. However, a serious problem arises from closing the lens down: a longer time exposure is needed because less light reaches the film. The time exposures may vary from 1/60th of a second down to one second and require the use of a tripod.

The last subject discussed is the use of hand-held meters versus the camera's meter. Many studio photographers prefer a hand-held meter in the *incident* mode, which is pointed at the light source rather than the object. Alternatively, the photographer may want to use a Kodak 18% gray card placed at the object in conjunction with the camera's built-in meter. Both methods give the same results—a properly exposed photograph. *Mike Havstad*

The growing pains of gemmology. B. W. Anderson, *Journal of Gemmology,* Vol. 17, No. 8, 1981, pp. 515–521.

On the 50th anniversary of the Gemmological Association of Great Britain, the author briefly reviews milestones in the history of gemology as well as drawbacks (e.g., the former variation in weight of the carat from country to country). Early books on gemstones and gemology were A. H. Church's *Precious Stones* (1883), G. F. Kunz's *Gems and Precious Stones of North America* (1890), Max Bauer's *Edelsteinkunde* (1896), and G. F. Herbert Smith's *Gemstones* (1912). Another stimulus to the science was early lectures, including two in 1897 at the Royal Society of Arts by Professor Henry Miers (who 40 years later became president of the Gemmological Association). The production of Smith's refractometer (first marketed in 1907) and the opening of a pearl and gem testing laboratory (Hatton Garden, 1925) were essential to the development of the science of gemology.

Anderson points to the establishment of gemology "in almost every civilized country" in 1931, with an organization in Germany, a laboratory in Paris, and GIA in the United States. The first "vehicle for the exchange of gemmological information" was *The Gemmologist.* Anderson concludes by mourning the end of that monthly, which left the gemological scene in 1962. *SLD*

The occult powers of gemstones. P. J. Abramson, *Lapidary Journal,* Vol. 35, No. 8, 1981, pp. 1710–1714.

In this well-written article, Abramson pairs popular gemstones with the powers that have been ascribed to them from the Middle Ages to the present. She cites stones that are purported to provide protection against general evils and others that supposedly ward off specific evils: amber and star stones protect against the evils of witchcraft, ruby against infectious diseases, and garnet against skin diseases, while emeralds are said to prevent epileptic seizures. She also comments on the positive powers of stones such as sapphire, which is said to improve intelligence. Some gemstones require special use to release their powers: the wearer of a sapphire must rub his or her tongue over the stone from time to time, and a ruby is most effective when embedded in the flesh. The author describes over 20 stones in this article, which is easily read and is a helpful reference to "powers of gemstones" for the jeweler.

DME