GEMOLOGICAL ABSTRACTS

C. W. Fryer, Editor

COLORED STONES AND ORGANIC MATERIALS

Forme, structure et couleurs des perles de Polynésie, suite II (Shape, structure, and color of Polynesian pearls, part II). J.-P. Cuif, Y. Dauphin, C. Stoppa, and S. Beeck, *Revue de Gemmologie a.f.g.*, Vol. 115, 1993, pp. 9–11.

This article describes a statistical study of the color of Polynesian black pearls that was conducted to help optimize production. The pigmentation of these pearls is associated with the mixture of probably three pigments of relatively low mass. The visible-range transmittance spectra of solutions containing pigments from various black pearls reveal significant variation in the importance of the transmission windows at 490 and 700 nm. Fiber optics were used to measure the reflectance of a pearl's surface without touching that surface (and thus risking damage to the pearl). The differences in reflectance spectra between a white, a black, and several gray pearls are illustrated. Statistical correlation of the various features of the spectra with culturing conditions may help explain which factors of the culturing process influence the final color of the pearl. Similar studies can be conducted in the near-infrared region of the spectrum, and might prove useful in separating Polynesian cultured pearls from other similar-appearing products, possibly treated or even imitation pearls. *EF*

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 his 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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Gemmology Study Club lab reports. G. Brown and S. M. B. Kelly, *Australian Gemmologist*, Vol. 18, No. 5, 1993, pp. 169–173.

Several materials are described in this series of brief reports. The first is calcareous bamboo coral that had been turned dark brown through silver nitrate treatment. Although the enhancement masked the longitudinal striations along the length of the branches, the material was easily separated from natural black coral by differences in heft and reaction to dilute hydrochloric acid. Other organic gem materials covered are carved buffalo and cow horn as well as grayish cultured pearls; the color of the latter may be natural, or it may be enhanced by dyeing or irradiation.

Also described are a modern Eskimo "spirit" carving in greenish gray soapstone; diamond crystals from Macquarie River gravels near Wellington, N.S.W., Australia; opaque, massive pink petalite; and trapiche emeralds. The authors ask for help from readers in identifying unusual ball-like masses of radially oriented fibrous crystalline inclusions in a colorless quartz crystal, and fine white powder in a bottle (labeled "Diamantine No. 2"). *RCK*

Gemstone business benefits from diamond stability. D. Hadany, *Mazal U'Bracha*, No. 52, 1993, pp. 101–103.

In a presentation to the Tel Aviv Congress of the International Colored Gemstone Association in Tel Aviv, Dan Hadany, managing director of the Israel Diamond Exchange, pointed out that the managed equilibrium between diamond production and sales greatly stabilizes the $100 billion jewelry market, balancing the nonregulated colored stone sector, which tends to fluctuate unpredictably between shortages and oversupply. The colored gem industry is also riding the coattails of the diamond engagement ring, wedding ring, and anniversary jewelry, cultural fixtures that are becoming increasingly popular as diamond-gemstone "mixed jewelry." The author believes that the diamond and gemstone industries can compliment, rather than compete with, each other if designers and manufacturers work together to develop emerging markets and create new jewelry pieces that combine diamonds and colored stones. *Andrew Christie*

An historical note on the colour phenomenon in precious opal. D. B. Hoover, *Australian Gemmologist*, Vol. 18, No. 5, 1993, pp. 145–148.

Although it was not until 1964 that a three-dimensional array of silica spheres was shown to be responsible for the play-of-color in opal, the optical principals behind the effect have been known for over 100 years. The author of this brief report substantiates this claim by referring to *Physical Optics*, by Robert W. Wood, first published in 1905. Mr. Wood referenced the even earlier work of G.G. Stokes (1819–1903), who equated the phenomenal colors in opal with a similar effect in polysynthetically twinned potassium chlorate crystals. Wood also quoted Lord Rayleigh, who claimed in 1888 that the effect resulted from a number of multiple reflecting surfaces, approximately equally spaced.

The author also describes how to make two types of imitation opals. The first involves growing small, twinned potassium-chlorate crystals—a potentially dangerous process. These are then embedded in Canada balsam and cemented to the back (painted black) of a meniscus lens. The spectral colors observed result from the presence of a great number of poorly reflecting, equally spaced surfaces.

The other imitation uses a method known as Lippman photography, which employs a very fine-grained black-and-white film backed with a first-surface mirror. The developed film has many equally spaced planes of silver particles that interact with light in a manner analogous to the twin planes in the previously described potassium chlorate crystals.

The author states that although Bragg diffraction is needed to explain play-of-color in natural opal, play-of-color in Lippman-photography or potassium-chlorate crystals can be explained by simple multiple reflection with wave interference. The observable color phenomenon, however, is the same. *RCK*

Possible prehistoric glasses in the gem trade in Sri Lanka. H. Harder, *Journal of Gemmology*, Vol. 23, No. 5, 1993, pp. 267–273.

Glass found in the gem gravels of Sri Lanka is sold locally as being of natural origin. However, the actual origin of this material has never been confirmed. The glass occurs in a wide variety of colors—including green, blue, and red—and the multicolored appearance of some of this material is unusual for tektite or other meteoritic glasses. An alternate theory is that this glass may be the remnants of ancient manufactured glass that found its way into the gem gravels. Chemical analysis of several samples of the Sri Lankan glass revealed compositions significantly different from those of known tektites, which tends to confirm the theory that the former are not natural in origin. The author concludes that this material is artificial and prehistoric, possibly of local manufacture or imported along ancient trade routes from India or Egypt. He closes the article with the comments that further research is needed and that, should this glass prove to be of prehistoric manufacture, its value as a collectible could be enhanced. Color photographs, a map, and tables of chemical data accompany the article. *CMS*

Unusual inclusion in an aquamarine. A. de Goutiére, *Journal of Gemmology*, Vol. 23, No. 5, 1993, pp. 286–287.

This very brief note describes a three-phase thin-film inclusion in an aquamarine. Four color photomicrographs illustrate the change that takes place in the inclusion as the stone is slowly heated. The reaction is unusual because of the slow rate at which the change occurs. *CMS*

DIAMONDS

Arkansas, Canadian pipes show promise in surveys. R. Shor, *Diamant*, Vol. 35, No. 361, 1993, pp. 15–16.

Two North American diamond sources are being studied: the Crater of Diamonds State Park in Murfreesboro, Arkansas, and the Lac de Gras area of northern Canada.

A ring, created by Henry Dunay and worn by Hillary Rodham Clinton to her husband's inauguration, gave a major public relations boost to the Crater of Diamonds State Park. The ring contains a 4.23-ct rough yellow diamond found in the park. A geologic survey revealed that the pipe is a hybrid of kimberlite and lamproite and contains at least 78 million tons of diamond-bearing ore. The similarity of the rock composition to that of the Argyle mine in

Western Australia explains the high percentage of colored diamonds at the Arkansas site. The economic viability of commercial mining has yet to be determined, as the average quality and quantity of diamonds found there is unknown. Environmentalists and park friends are pursuing court actions to prevent mining companies from doing further tests.

In Canada, mining giant RTZ Corp. has committed to spending up to $30 million on diamond-exploration options at Lac de Gras. Analysts consider this a signal that the area is economically viable because of RTZ's conservative nature. Kimberlite pipes sampled to date have yielded mixed results. *Nanette Colomb*

The core-mantle boundary. R. Jeanloz and T. Lay, *Scientific American,* Vol. 268, No. 5, May 1993, pp. 48–55.

In what may be one of the most unusual applications for faceted diamonds yet, scientists are using them to help duplicate the high pressure and temperature of the mantle-core boundary, some 2,900 km below Earth's surface. In a device called a diamond-anvil high-pressure cell, geophysicists compress—between the enlarged culets of two round brilliant diamonds—minuscule samples of minerals believed to exist in the boundary region.

Diamond was chosen for its hardness *and* transparency. A high-powered laser beam can be focused through it to heat the compressed sample to thousands of degrees Celsius. The sample can also be viewed through the diamond during the experiment.

Discovering the composition of what might be Earth's most geologically active zone could lead to better understanding of the earth's magnetic poles and tectonic plate movement. *Andrew Christie*

Crater of diamonds. R. R. Reneau, *Rock & Gem,* Vol. 23, No. 6, June 1993, pp. 14–16.

This article offers some interesting information about the unique Crater of Diamonds State Park. Located near Murfreesboro, Arkansas, Crater of Diamonds is actually an eroded volcanic pipe of kimberlite and lamproite. Originally discovered by Dr. John Banner nearly 100 years ago, much of the land that is now the state park was purchased by farmer John Huddleston, who found the first diamonds in the area. After the land was sold by Mr. Huddleston, a number of unsuccessful attempts were made to mine diamonds commercially. The area was finally purchased by the state of Arkansas in 1972, and Crater of Diamonds State Park was created.

For a nominal fee, visitors may enter the park to search for diamonds as long as they do so without mechanized equipment. They are allowed to keep any that they find. According to Mr. Reneau, two mining methods are usually used. The first involves slowly searching as much ground as possible. The trick is to look for a diamond sparkling in the sunlight. The second method involves actual digging. Visitors stake out a small area and sift dirt through a screen that may be rented at the park headquarters. Thousands of diamonds have been found here, including the notable 40.23-ct Uncle Sam. The article also provides useful information on area accommodations and dining for those wishing to visit this unusual attraction. *JEM*

A notable red-brown diamond. J. E. Shigley and E. Fritsch, *Journal of Gemmology,* Vol. 23, No. 5, 1993, pp.259–266.

Drs. Shigley and Fritsch describe a 5.03-ct red-brown diamond of unknown provenance that was recently donated to the Smithsonian Institution. Microscopy revealed the presence of moderately strong red-brown graining along octahedral planes, as well as strong anomalous birefringence that correlates with the graining pattern. The stone luminesced weak yellow to both long- and short-wave ultraviolet radiation, and it exhibited moderately strong green luminescence to intense transmitted visible light. Spectroscopic data were difficult to obtain because the stone is so dark, but results revealed a feature centered about 550 nm that is typical of pink and purple diamonds; type-Ia infrared features; and an unusual infrared feature known as the "amber center," with its principal band at about 4150 cm^{-1}. Comparison of the spectrum of this stone to the spectra of other reddish diamonds indicates that the 550-nm feature is responsible for the red overtone. The source of this feature is thought to be plastic deformation of the diamond crystal structure. Color photographs and graphs of spectral data accompany the article. *CMS*

Notes from the Laboratory—17. E. C. Emms, *Journal of Gemmology,* Vol. 23, No. 5, 1993, pp. 274–277.

The Gemmological Association of Great Britain Gem Testing Laboratory reports on "three unusual diamonds" that were recently examined. The first was submitted to the laboratory because its cutter observed bright orange-yellow luminescence and phosphorescence while polishing the stone. The 0.49-ct finished stone was a greenish yellow color of "fancy" intensity, with an intense yellow fluorescence to long-wave U.V. and a yellow phosphorescence that persisted for more than five minutes. Storage overnight in the dark resulted in an intense yellow coloration that faded to a stable greenish yellow within a few minutes of exposure to light. Heating of the stone regenerated the intense yellow color and confirmed that this stone was a chameleon type. Spectral features were consistent with those observed in other chameleon diamonds.

The second unusual diamond was a 0.04-ct particolor, part pink and part colorless. The pink portion exhibited typical zoning, with no evidence of artificial coloration. The third unusual diamond was a 0.24-ct nonconductive "blue" diamond. Properties were consistent with those described for similar stones by E. Fritsch and K. Scarratt

(*Gems & Gemology*, Spring 1992, pp. 35–42). Color photographs of the three stones and their infrared spectra illustrate this feature. *CMS*

Opening JV Intertrade polishing factory in Moscow. *Diamant*, Vol. 35, No. 362, 1993, pp. 17–20.

A diamond-polishing factory, owned by the Russian-Belgian joint venture Intertrade, opened March 10 in Moscow. Belgian partners Kaszirer Diamonds NV and Oltuski Diamonds NV each own 20%; the Moscow City Council owns 33%; and a department of the Russian Ministry of Finance, Komdragmet, owns 27%. The percentages are based on contributions made by each partner. The technology and most of the machinery came from Belgium.

The Intertrade factory is modest in size compared to at least one other in Russia, which employs 2,000, but capacity is expected to increase. Intertrade will preferably process stones averaging 1.5 ct, achieving an initial capacity of up to 150 carats per polisher per month, or between 200,000 and 215,000 carats per year.

Kaszirer has been trading with the former Soviet Union for 23 years and wants Antwerp to remain the foremost world diamond trade center in Russia's eyes. They feel that more Russian polished goods will be exported in the future at reasonable cost, due to the low labor costs.

Nanette Colomb

Terrestrial carbon and nitrogen isotopic ratios from Cretaceous-Tertiary boundary nanodiamonds. I. Gilmour, S. S. Russell, J. W. Arden, M. R. Lee, I. A. Franchi, and C. T. Pillinger, *Science*, Vol. 258, No. 5088, December 4, 1992, pp. 1624–1626.

This article describes the methodology used to conclude that the tiny (10^{-3} micron) diamonds found at the Cretaceous-Tertiary (K-T) geologic boundary were formed during impact by a large asteroid that supposedly led to the extinction of dinosaurs, 65 million years ago. Diamonds from three boundary sites in North America and Europe were shown to have a cubic morphology, to occur in clumps, and to be typically 6 nm. Carbon and nitrogen isotope ratios and the carbon and nitrogen release ratios, obtained during heating experiments, suggested strongly that the diamonds were not from kimberlite or lamproite or of a type found in meteorites. They were, however, roughly similar to diamonds generated by explosive detonation of TNT. Hence, the article concludes that diamonds found at the K-T boundary were formed by a large asteroid (thought to have struck the Earth in the Caribbean north of the Yucatan Peninsula in Mexico). These diamonds might have been produced either by shock alteration of carbon, in the asteroid or the Earth, or by a quick chemical-vapor-deposition (CVD) type of mechanism, with meteoritic diamonds possibly acting as seed crystals.

Charles E. Ashbaugh III

GEM LOCALITIES

Australia's treasures from the deep. G. Van Zuylen, *Jewellery International*, No. 13, 1993, pp. 65–72.

Australia has become a leader in the production of South Sea cultured pearls, producing almost half the total market, most of this in fine white pearls. Other countries (such as Tahiti, Burma, and the Philippines) produce mostly non-white pearls. Australia's pearls are the product of many years of pearling experience in and around the port town of Broome.

Production starts with the collection—controlled by a quota system—of indigenous *Pinctada maxima* oysters from natural oyster beds. (Australian production uses mostly "wild" oysters, although pearl oysters may be bred in the future.) After these oysters are "seeded" (implanted with a mother-of-pearl nucleus and mantle tissue to initiate pearl growth), they are transported to farming bases. Once the oysters have been set at these farms, they are diligently cared for. Pearls form in 20 to 24 months.

Pearling in Australia is very advanced. Wild oyster beds are located by satellite and computer technology, and implantation of the nucleus is done by teams of highly skilled technicians. One area that needs to be developed is marketing. Previously, pearls were usually just sent to Japan to be sold. Now, pearl dealer Rosario Autore, former managing director of Devino Pty. Ltd., oversees much of the marketing of Australian pearls. Besides Japan, Mr. Autore has developed markets in the U.S., Italy, Germany, Hong Kong, and Thailand. Seven photos illustrate the article.

JEM

Faceted dark-green uvarovite from Outokumpu, Finland. U. Henn and H. Bank, *Australian Gemmologist*, Vol. 18, No. 5, 1993, pp. 142–143.

After an overview of the garnet group, the authors focus on uvarovite. This green $Ca_3Cr_2(SiO4)_3$ garnet is probably the least known to gemologists because it is rare and generally does not occur as transparent crystals in sizes large enough to facet. One source is Outokumpu, Finland, a site about 350 km northeast of Helsinki and 100 km from the Russian border.

The authors describe their examination of a 0.95-ct faceted uvarovite that was fashioned from an Outokumpu crystal. The stone gave a typical singly refractive reaction in the polariscope, had a refractive index over the limits of the standard gemological refractometer, and produced a specific gravity of 3.76. Chemical composition, determined by microprobe analysis, revealed a uvarovite-rich mixed specimen: 59.80% uvarovite, 38.24% grossular, and 1.96% andradite end-members. The absorption spectrum, as determined by a spectrophotometer, showed a broad, intense absorption band at 700 to 550 nm in the red, orange, and yellow and another from 480 nm in the blue, violet, and U.V. wavelengths. *RCK* wt.%) as follows: Ce^{3+} 27.93, La^{3+} 13.84, Nd^{3+} 7.32, Pr^{3+} 4.34, Ca^{2+} 7.62, C^{4+} 5.70, F^{-} 10.47, O^{2-} 22.78 [=100.00].

R. A. Howie

"Smaragdminen der Cleopatra": Zabara, Sikait und Umm Kabo in Ägypten ("Emerald Mines of Cleopatra": Zabara, Sikait and Umm Kabo in Egypt). G. Grundmann and G. Morteani, *Lapis,* Vol. 18, No. 7/8, 1993, pp. 27–39 and 90; **"Tsavorit," der grüne Grossular aus Kenya ("Tsavorite," the green grossularite from Kenya).** W. Schäfer, *Lapis,* Vol. 18, No. 7/8, pp. 57–66 and 90.

This issue of *Lapis* is entirely dedicated to gems. Besides a number of smaller articles (e.g., on color-change hackmanite from Canada and tourmaline from Saxony), it contains an updated German version of "Status of Ruby and Sapphire Mining in the Mogok Stone Tract," by R. E. Kane and R. C. Kammerling (see *Gems & Gemology,* Vol. 28, No. 3, 1992, pp. 152–174). The article by Grundmann and Morteani is a welcome addition to the scarce literature on Egyptian emeralds and provides information gathered during a visit to the mines in February 1992. Along with a historical overview, the authors give a geologic description of the locality and show that the emeralds occur in schists along a system of thrusts. Schäfer's article offers information on the tsavorite occurrences: geologic setting and conditions of formation, the mines and mining methods, and some production figures and criteria for quality assessment. All articles are written in German and are illustrated with color photographs. *Rolf Tatje*

INSTRUMENTS AND TECHNIQUES

The Raman microprobe in gemology [in French]. *Revue de Gemmologie a.f.g.,* special issue, 1992.

This special issue is devoted to the use of Raman spectroscopy in gemology. Raman spectroscopy is a nondestructive technique that detects characteristic molecular vibrations in a material.

The first of the two articles, by H.-J. Schubnel, is an overview of the usefulness of Raman spectroscopy for gemologists, accompanied by several detailed examples. Mr. Schubnel's paper largely uses material from his pioneering 1977 article. He states the absolute necessity of a catalog of Raman spectra to compare spectra of unknown materials with those of well-characterized minerals and organic materials.

The second article, the main part of this special issue, contains such a catalog. Authors M. Pinet, D. C. Smith, and B. Lasnier provide structural and spectroscopic details for about 80 gem materials. They focus on the use of a Raman microprobe (with the help of a microscope) to obtain spectra from very small areas. First, they present the elementary physical processes responsible for the Raman effect. Then they explain the acquisition of a spectrum and how the Raman microprobe works, before pointing out advantages of this technique (nondestructive, fast, microscopic; works on solid, liquid, and gaseous materials, even if included in a transparent solid). The Raman spectrum of a gem, or an inclusion in a gem, represents a "fingerprint" of its structure, much like an X-ray diffraction pattern. Even if all individual peaks cannot be attributed to specific molecular vibrations, overall it is a useful identification tool. The various factors that can affect the quality or usefulness of a spectrum are also listed.

This issue is illustrated with 28 color and 17 black-and-white photographs of equipment or inclusions. Although the articles are written in a language other than English, the numerous spectra alone make this special issue an extremely valuable reference for those interested in this spectroscopic technique. *EF*

Test report on the Hanneman Mini-cube II. P. G. Read, *Journal of Gemmology,* Vol. 33, No. 6, 1993, pp. 360–361.

The increased production of diffusion-treated sapphires has made immersion inspection a particularly valuable gemological test. The author describes a simple immersion cell (manufactured by Hanneman Gemological Instruments) designed for use with a "pocket torch" (a "penlight" to American gemologists). The Mini-cube is a useful portable tool for identification. Different sizes are available. *CMS*

JEWELRY HISTORY

Out of Africa: The superb artwork of ancient Nubia. D. Roberts, *Smithsonian,* Vol. 24, No. 3, June 1993, pp. 90–100.

This article is a study of, and tribute to, an enigmatic people whose cultural remnants still exist in the modern world, although their civilization does not. In addition to a number of permanent displays that recently opened, an exhibition that includes Nubian jewelry and other jeweled personal objects is now traveling to various museums around the U.S. Many of these items have helped archeologists and anthropologists uncover some of the secrets of this lost civilization. Confounded by wars and cultural assimilation between the Nubians and their northern Egyptian counterparts, items once thought to be of Egyptian origin are now attributed to the Nubian culture. There is lively debate as to this question of origin, and Egyptologists are enjoying renewed interest in their field because of the questions now posed by these artifacts. The article includes photos of some of the more important artifacts, as well as a map for geographic orientation. *JEC*

Steven Kretchmer: Today's alchemist designer. R. Weldon, *Jewelers' Circular-Keystone,* Vol. 164, No. 1, January 1993, pp. 70–71.

This informative article showcases the work of one of America's most popular designer/goldsmiths—Steven Kretchmer—Jewelers of America's New Designer of the Year Award winner for 1992. A graduate of Rhode Island School of Design, he began his career with the renowned jewelry firm Faraone in Italy. After returning to the U.S., he earned a Master of Fine Arts degree from the University of Michigan. Subsequently, he worked for Harry Winston, Inc., researching exotic golds, specifically to find ways to produce blue gold. He currently has a design studio in Los Angeles. Illustrated with breathtakingly beautiful photographs, the article details his accomplishments in tension setting, mokume-gane, and blue gold. *KBS*

The stolen gold of Troy. R. Covington, *Art & Antiques*, Vol 9, No. 8, October 1992, pp. 74–79 (part 1); **Twisted fate of the Trojan gold,** Vol. 9, No. 9, November 1992, pp. 75–79 (part 2).

This fascinating two-part series traces the history of the treasure of Troy, a 4,000-year-old trove found in Hisarlik, Turkey. Part one describes its discovery by archeologist Heinrich Schliemann in 1873. In 1881, Schliemann donated the collection to the German government. It remained in Berlin until 1945, when invading Russian soldiers removed it from Germany. Since then, rumors have circulated about this treasure and other confiscated artworks.

In part two, Mr. Covington details the events that led to the treasure falling into Russian hands. Political conditions now permit greater access to historical records, and investigators have located information on these missing art collections. Some 36 miles (58 km) north of Moscow, in a 16th-century monastery at Zagorsk (renamed Sergiev Posad), the Pushkin Museum stores about 16,500 works of confiscated art. Among these are reportedly more than 4,600 extraordinary pieces—gold diadems, necklaces, earrings, cups, silver vases, and jars—that make up the treasure of Troy. Part two includes a photograph of Schliemann's wife, Sophie, wearing part of the "Jewels of Helen"—a headdress with 16,000 tiny gold leaves and a necklace with 8,700 small gold components.

At the time the articles went to press, the Russian government still had not acknowledged possession of the collection. *Alicia G. Powers*

JEWELRY RETAILING

Season closes on antique high. V. Becker, *Retail Jeweller*, Vol. 30, No. 801, July 15, 1993, p. 14.

Healthy buying activity by trade and private buyers from Europe, the United States, and the Middle East was reported at Sotheby's July 1 auction in London. A continental buyer purchased two unmounted diamonds (5.7 ct and 5.96 ct) for £54,300 and £52,100, respectively. A 1930 diamond plaque brooch was sold to a European dealer for £26,450, and a private buyer purchased a 1950 diamond bracelet for £23,000. A European dealer paid £12,650 for a cabochon sapphire ring.

Egyptian-style jewelry is always desirable, and jewels made at the time of the opening of the Suez Canal are rare and in demand. The cover lot included an 1870 gold-and-enamel fringed necklace, made in the Egyptian revival style, which brought in £7,500. A diamond-and-pearl bracelet from about 1900 sold for £5,000. *Maha DeMaggio*

Selling to the senses. M. Ondovcsik, *Accent*, Vol. 18, No. 5, May 1993, pp. 44–46.

This short article focuses on how to influence buyers through the use of touch, smell, sight, and sound in retail design and display. It offers several helpful tips regarding the jewelry industry, and comments on many subtle, but important, effects. For example, Ruth Mellergaard, director of the International Design Group in New York, recommends placing display cases at an angle or curve, because they are more intriguing to the customer, who is induced to take more time going through the aisles. J'Amy Owens, president of Retail Planning Associates in Seattle, recommends placing more popular items toward the back of the store, so that customers will pick up impulse items on the way. Scent can have dramatic effects on a person's attitude; women will spend more time at a counter when a floral scent is present, and men will be more attracted by spicy smells like cinnamon. Colors can set a person's mood; burgundy, purple, and blue entice people to buy big-ticket items. This useful article offers several clever ways to help your business become more profitable.

Elizabeth A. Keller

PRECIOUS METALS

990 Gold: An unsung alloy. F. Keller-Bauer, *JQ Magazine*, Vol. 47, 1993, pp. 94–96 (reprinted from *Gold Technology*, May 1992).

The 990 gold alloy, which includes less than one weight percent of titanium, is now available to the jewelry industry. Christian Bauer GmbH played a leading role in developing this 23.75k alloy, which wears much like 18k. In addition, titanium is known to be a nonallergenic metal.

Along with the Precious Metals Research Institute in Schwäbisch Gmünd, Germany, Christian Bauer developed a method of alloying gold with titanium in a vacuum atmosphere utilizing argon, followed by a specialized homogenization process. This technique produces a hard alloy ideal for cold working. When an additional hardening process is carried out, the alloy is ready for lathe turning.

Unfortunately, the jewelry industry and consumers have not been very receptive to the new alloy, possibly due to the belief that all high-karat alloys are too soft for everyday wear. Education about this alloy is needed. This interesting report is accompanied by several photographs of wedding rings made by Christian Bauer from 990 gold.

JEM

Gem-quality scapolite from Sinjiang Region, West China. Z. Peili, *Australian Gemmologist*, Vol. 18, No. 4, 1992, pp. 115–117.

Gem-quality chatoyant scapolite—in colorless and pinkish purple to purple hues and light to dark tones—was discovered in the Kashi area, Sinjiang Uighur Autonomous Region, China, in 1989. The material, found in strata whose wall rock is composed of biotite-plagioclase-schist and tremolite-dolomite, occurs in three contexts: scapolite-titanite-diopside skarn, scapolite-titanite breccia, and scapolite-titanite eluvial slope layers. The crystals found in skarns and breccia, 3%–5% of which are considered gem quality, are relatively dark in tone; those from the eluvial-alluvial deposits, roughly 1%–3% of which are gem quality, are typically lighter in color.

The euhedral crystals, usually tetragonal prisms with longitudinal striations on prism faces, range from 0.5 to 1.5 cm in diameter and from 1 to 3 cm in length. Some are transparent and relatively free of inclusions, while others are translucent due to fine, densely packed tubular inclusions. Gemological properties determined are: R.I. 1.540–1.535, with 0.005 birefringence; dispersion 0.017; uniaxial negative optic character; pleochroism, dark purple parallel to the c-axis and light to very light pinkish purple perpendicular to it; dark orange U.V. fluorescence (long- and short-wave); S.G. 2.51–2.59; Mohs hardness of 6.27 [sic] to 6.4. Magnification revealed dense filiform and tubular inclusions, light purple columnar crystals, negative crystals, and columnar zircon crystals.

The author also describes the gemological properties of titanite (sphene) found in association with the scapolite, and indicates that recent prospecting has revealed additional occurrences of the latter in the Kashi area.

RCK

The mineral industry of California. J. Burnett, *California Geology*, Vol. 46, No. 3, 1993, pp. 74–75.

California produced US$22,070,000 worth of gemstones from 1990 to 1992, but gemstones only rate one line in an accompanying chart. Gemstone quantity is "not available," and types are not listed. To be fair, portland cement, the state's big money-maker at approximately $1.67 billion for the three years, doesn't fare much better—one line in the chart and eight words in the text. (Although one wonders when portland cement became a mineral.) For reasons not given, gemstone production jumped almost sevenfold from US$1.501 million in 1990 to 10.450 million in 1991; the total for 1992 was 10.119 million. *Irv Dierdorff*

Orissa's production to increase. V. Kuriyan, *Jewellery News Asia*, No. 106, June 1993, pp. 66–74.

Orissa, a state on the east coast of India, could become an important source of gemstones. Corundum, garnet, aquamarine, chrysoberyl, and iolite are among the gems being mined there. It is believed that inventory already held by local traders is substantial. This, coupled with the fact that much of the material is not sold as originating from Orissa, could explain why the jewelry industry is not more aware of Orissa as a gem source. Although Orissa Mining Corporation (OMC), a government-owned company, is in charge of mining operations in the area, independent miners (not licensed by the government) are responsible for most of the gem production. Historically, OMC's activity has been in industrial ores and granite, not gems. This inexperience has produced some set-backs. As a result, to encourage organized mining and the development of a cutting industry in Orissa, the government is looking for private companies that can mine and process gemstones profitably. The article includes a number of photos of the mining operations and a map of the area. *JEM*

Petrographic and microthermometrical studies of emeralds in the 'Garimpo' of Capoeirana, Nova Era, Minas Gerais state, Brazil. J. L. Souza, J. C. Mendes, R. M. S. Bello, D. P. Svisero, and J. V. Valarelli, *Mineralium Deposita*, Vol. 27, No. 2, 1992, pp. 161–168.

Studies of this locale have revealed two main lithostructural units. The first consists of gneissic rocks of granitic composition that belong to the basement complex. The second is a highly weathered metasedimentary-metavolcanic sequence composed of metapelitic schists, amphibolites, schists derived from ultramafic rocks, and quartzites. Quartz and pegmatoid veins occur near the contacts between the gneissic rocks and the metasedimentary-metavolcanic sequence. The emerald mineralization is mainly concentrated within the intercalations of meta-ultramafic schists near the contact with the pegmatitic veins.

Microthermometric studies of the fluid inclusions in the emerald grains indicate that crystallization occurred in the pressure and temperature ranges of 2000–2750 bar and 450°–650°C. The data suggest that the mineralizing solutions had a late hydrothermal-pneumatolytic origin characterized by low pressures, indicating the paragenesis talc + tremolite + carbonate + biotite/phlogopite + chlorite in the emerald wall rocks. *R. A. Howie*

Physical and chemical properties of gem parisite from Muzo, Colombia. U. Henn, H. von Platen, W. Hofmeister, and H. Bank, *Neues Jahrbuch für Mineralogie Monatshefte*, No. 6, 1992, pp. 258–264.

The authors present the properties of parisite, a pegmatite mineral found in Muzo, Colombia, and often as inclusions in emeralds from this locality. Faceted, transparent yellow-brown gem-quality parisite, a fluorine carbonate, reveals refractive indices of n_o=1.671, n_e=1.772; density 4.33–4.34 g/cm^3; and lattice constants of a=7.1102, c=83.834 Å. The optical spectrum shows a line group typical of Nd^{3+}. Microprobe analysis yielded a chemical composition (in

U.S. attracts the most 1992 nonferrous exploration spending. *California Mining Journal*, Vol. 62, No. 4, 1992, p. 5.

This article explains a few conclusions drawn from Metals Economics Group's recent study—"Corporate Exploration Strategies: A Worldwide Analysis." The study indicates that of the 161 companies surveyed worldwide, US$1.7 billion was spent in 1992 toward exploration for precious, base, and other nonferrous hard-rock metals, as well as any industrial minerals sought by the mining companies. Among the 10 largest spenders on exploration were De Beers and Argyle Anglo American Corp. The United States led the world with $363 million, or 21.4% of the budgeted expenditures for those same companies. Australia was second with $324 million, or 19.1%. Canada fell to third place from $430 million in 1991, to $302 million (or 17.8%) in 1992. Latin America followed at $256 million, or 15.1%. The rest of the world (Africa, Europe, and the western Pacific region) showed a 13% decrease from 1991 ($522 million) to 1992 ($453 million). The complete study is available for $6,750 from the Metals Economics Group, Halifax, Nova Scotia, Canada. *Lawrence E. Marmorstein*

TREATMENTS

Radiation-induced colour change in natural and synthetic emerald. K. Schmetzer, *Journal of Gemmology*, Vol. 23, No. 5, 1993, pp. 288–293.

Early, unsystematic experimentation with radiation treatment of emeralds indicated that radiation turns synthetic emeralds black or violet, but leaves natural emeralds essentially unchanged. The observed changes have been attributed to a yellow color center, presumably related to the oxidation of iron, and a violet color center, possibly associated with an electron-hole occurrence. This differential response to irradiation has been proposed as a means to distinguish natural from synthetic emeralds.

The present study entailed a more systematic exploration of these phenomena. Initially, slices of six natural and six synthetic (three each flux and hydrothermal) emeralds were subjected to cobalt-60 gamma-cell, linear-accelerator, and nuclear-reactor radiation treatment. In the second phase, 228 natural, 31 hydrothermally grown, and 41 flux-grown emeralds were exposed to X-rays. None of the irradiation methods produced the violet color center in any of the samples. At least two types of yellow color centers, which generate a strong absorption band in the ultraviolet, were produced. These are responsible for the observed changes in color, that is, from green to yellowish green or greenish yellow in the natural stones, and from green to greenish black or "smoky" black in the synthetic emeralds. The resulting color depends on the intensity of the U.V. band, such that its tail extending into the visible range more or less radically affects the color of the emerald subject. Type-A yellow color centers were produced by all types of radiation tested and were bleached by daylight, U.V. radiation, or low heat. Type-B yellow color centers appeared to be confined to iron, are not produced by X-rays, and were relatively stable.

Exposure to gamma rays, electrons, or neutrons should not be used in gem testing for several reasons. Neutron-irradiated samples cannot be returned to a client for a considerable time because of residual radioactivity. Electron irradiation often induces cracks. Gamma irradiation can result in an appreciable change in the color of natural emeralds; although the change can be reversed by heating, the annealing process can also produce cracking. X-rays, however, may offer a viable test if other methods fail or are unavailable. Some natural Colombian emeralds, and all Biron synthetic emeralds, respond to X-rays by generating a low concentration of yellow color centers that do not produce a visually observable effect on color. Otherwise, the spectral and visible responses to X-rays are distinct for natural and synthetic emeralds. The change in color experienced by synthetic samples is usually reversed by exposure to daylight, although a few samples will require heat treatment to restore their original color. Dr. Schmetzer concludes with the warning that this test should be used only with the client's permission and knowledge of the risk involved. *CMS*

LETTERS

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Kashmir, and Montana)—often do not achieve good results with basaltic sapphires. Thus, studies into the response of the Fe^{2+}/Fe^{3+} IVCT absorption to different methods of heat treatment promise to be of great importance to the jewelry industry.

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