# Gem Stones

By Robert G. Clarke [1]

The production value of gem stones and mineral specimens in the United States during 1973 was estimated to be $2.7 million, essentially equal to the value of production in 1972. Amateur collectors provided most of the material. A few small companies operated deposits for turquoise, opal, jade, emerald, and sapphire. These small companies sold mostly to wholesale or retail outlets and sometimes to jewelry manufacturers.

## DOMESTIC PRODUCTION

Gem stone production was estimated to be $1,000 or more for each of 38 States. The following States accounted for 76% of the total production, in thousands: Oregon, $700; California, $220; Arizona, $170; Texas, $163; Washington, $160; Montana, $150; Wyoming, $142; Nevada, $140; Colorado, $131; and Idaho, $110.

The Yogo mine near Utica, Mont. was reopened by a new firm controlled by Sapphire International Corp.[2] The operation was described as employing 40 miners on two shifts, and daily ore production was 100 to 150 tons yielding 3,000 to 5,000 carats per day of a mix of good gem stones, imperfect stones, and chips. The aboveground washing plant operated about 6 months of the year, depending on the weather. Underground operations continued year-round. The sapphires from Yogo Gulch are a consistent corn-flower blue and are brilliant under artificial light.

Pala Properties, International, continued to work the Stewart Lithia mine and the Tourmaline Queen mine in the Pala district, San Diego County, Calif.[3] Good pockets of tourmaline matrix exhibiting deep rose coloring with green caps were uncovered in the Tourmaline Queen. Large tourmaline crystals, 2 inches in diameter and 4¾ inches long, were accompanied by quartz crystals 4 inches in diameter and 6½ inches long. The company also worked the White Queen mine where morganite was produced on an intermittent schedule and also planned to reopen the Pala Chief, Esmeralda, and the Himalaya mines.

Benitoite, one of the rarest gem stones, was produced from an open-cut mine in San Benito County, Calif.[4] The locality is near the headwaters of the San Benito River, about 25 miles north of Coalinga. Benitoite has a fire and dispersion very close to that of diamond; however, it has a hardness of 6.5 or less on the Mohs' scale.

Seashell and rock collectors at Miami Beach, Fla., found a large new source of material for their hobby.[5] A dredging project to deepen the shipping channel at the Port of Miami yielded about 400,000 tons of mixed material that contained a high percentage of coral and clam shells. The dredgings were put in numerous piles at the southern end of Miami Beach. An abundance of the coral and of the clam shells were infilled with yellow calcite crystals caused by fossilization. A mollusk paleontologist at the Rosenstiel School of Marine and Atmospheric Science, University of Miami, estimated the fossils to have a range in age from 100,000 to 1 million years.

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[1] Physical Scientist, Division of Nonmetallic Minerals—Mineral Supply.

[2] The Mining Record of Denver, Colorado. Yogo Mine in Montana is Reopened. V. 84, No. 34. Aug. 22, 1973, p. 2.

[3] California Geology. Mining Activity in California, July 1972–July 1973. V. 26, No. 12, December 1973, p. 294.

[4] Schiffman, W. Mine Produces Rarest of Gems. San Jose Mercury-News, July 22, 1973, p. 12.

[5] Gems and Minerals. Good News for Florida Rockhounds. No. 430, July 1973, pp. 40–41.

Touchstones were collected from gravel beds of the Coosa River system near Wetumpka, Ala., in Elmore County.[6] Touchstone, which has been used since ancient times by jewelers and goldsmiths, can give a precision of about 1 part in 100 in estimating the gold content of a gold-silver or gold-copper alloy. The stones from the Coosa River are also called tarbaby agates. The touchstone from the Coosa River is a deep velvet black variety of jasper and can be polished to a strikingly beautiful gem stone.

Two gem-quality diamonds, 2 to 2½ carats in weight, were reportedly found at the Crater of Diamonds State Park at Murfreesboro, Ark. Mr. J. Cannon, Superintendent of the Park, commented that the stones were of beautiful gem quality. Finders are keepers at the Park, and hence the value of the stones was unknown until the finders report appraisals.

Descriptions of field trips, events, and mineral and gem stone finds were reported regularly in the following publications: Gems and Minerals, Lapidary Journal, Mineralogical Record, and Rocks and Minerals.

**Domestic Gem Stone Producers.**—The Department of the Interior has received many inquiries regarding producers of gem stones. In response to these inquiries, the Bureau of Mines started an annual canvass in 1973. Quantity and value data were withheld to maintain confidentiality of the producers who responded to the canvass. The following lists producers by principal gem stone reported:

*Emerald.*—Big Crabtree mine, Mitchell County, N.C., operated by PBH Emerald Co., P.O. Box 163, Little Switzerland, N.C. 28749.

*Jade.*—Stewart mine, Kobuk Village, Alaska, operated by Stewart Jewel Jade Co., 531 4th Ave., Anchorage, Alaska 99501.

*Opal.*—Royal Peacock mine, Humboldt County, Nev., operated by Harry W. Wilson, Denio, Nev. 89404.

Spencer Opal mine, Clark County, Idaho, operated by Mark L. Stetler, 1862 Ranier Street, Idaho Falls, Idaho 83401. Mostly operated on a daily fee digging basis for amateurs.

*Sapphire.*—Chaussee Sapphire mine, Granite County, Mont., operated by Chaussee Sapphire Corp., P.O. Box 706, Philipsburg, Mont. 59858.

Sapphire Village mine (Yogo Gulch), Judith Basin County, Mont., operated by Sapphire International Corp., Utica, Mont. 59452.

*Turquoise.*—Blue Eye mine, Lander County, Nev. operated by Elmer F. Schroeder, Roderick Corp., Box 6, Crescent Valley, Nev. 89821.

Blue Jay mine, Esmeralda County, Nev., operated by M. C. Winfield, P.O. Box 813, Tonopah, Nev. 89049.

June #1 mine, Lander County, Nev., operated by W. H. Coplen, Box 301, Sells, Ariz. 85634.

Pinto Valley Turquoise Operation, Gila County, Ariz., operated by L. W. Hardy Co., Inc., 3809 E. Hwy. 66, Kingman, Ariz. 86401.

Tina Gem mine, Lander County, Nev., operated by R. G. Bonner, Box 948, Fallon, Nev. 89406.

*Variscite.*—Brown Claims, Esmeralda County, Nev., operated by C. R. Barbe, Box 187, Mina, Nev. 89422.

## CONSUMPTION

Domestic gem stone output generally went to rock, mineral, and gem stone collections, objects of art, and jewelry. Apparent consumption of gem stones (domestic production plus imports, minus exports and reexports) was $423 million, equal to that of 1972.

## PRICES

Prices of all gem stones increased during 1973. Price ranges in February 1973 for first-quality, cut and polished, unmounted gem diamond were as follows: 0.25 carat, $100 to $425; 0.5 carat, $300 to $1,000; 1 carat, $700 to $3,800; 2 carats, $2,300 to $12,000; and 3 carats, $4,100 to $25,000. The median price for each range in Feb-

[6] Mayo, R. Tarbaby Agate. Rocks and Minerals, v. 48, No. 1, January 1973, pp. 63–64.

ruary was 0.25 carat, $225; 0.5 carat, $550; 1 carat, $1,750; 2 carats, $4,750; and 3 carats, $9,500. A similar determination of price ranges in June 1973 was 0.25 carat, $100 to $450; 0.5 carat, $300 to $1,195; 1 carat, $800 to $5,000; 2 carats, $2,200 to $20,000; and 3 carats, $4,500 to $35,000. The median price for each range in June was 0.25 carat, $250; 0.5 carat, $595; 1 carat, $2,000; 2 carats, $4,950; 3 carats $11,950. Price data were not ascertained in the latter part of 1973 because of instability and conflict in international political affairs.

## FOREIGN TRADE

Exports of all gem materials amounted to $333.1 million, and reexports to $186.8 million. Diamond comprised 94% of the value of exports and 93% of the value of reexports. U.S. exports of diamond in 1973, on which work was done prior to shipment, amounted to 259,119 carats valued at $314.2 million. Of this, diamond cut but unset, suitable for gem stones, not over 0.5 carat, was 44,714 carats valued at $16.7 million; and cut but unset, over 0.5 carat, was 214,405 carats valued at $297.5 million.

Reexports of diamond, on which no work was done, amounted to 1,467,234 carats valued at $173.9 million in categories as follows: Rough or uncut, suitable for gem stones, not classified by weight, 1,389,340 carats valued at $128.3 million; cut but unset, not over 0.5 carat, 35,579 carats valued at $9.0 million; cut but unset, over 0.5 carat, 42,315 carats valued at $36.6 million.

The six leading recipients of diamond exports accounted for 92% of the carats and 93% of the value and were as follows: Hong Kong, 69,071 carats valued at $97.2 million; Switzerland, 59,126 carats valued at $52.3 million; Japan, 53,592 carats valued at $51.7 million; the Netherlands, 30,037 carats valued at $53.9 million; Belgium, 19,878 carats valued at $30.8 million; and Israel, 7,395 carats valued at $6.3 million. The six leading recipients of diamond reexports accounted for 94% of the carats and 92% of the value and were as follows: Israel, 636,497 carats valued at $70.2 million; Belgium, 403,108 carats valued at $30.7 million; the Netherlands, 194,101 carats valued at $30.4 million; Switzerland, 124,715 carats valued at $19.3 million; Japan, 15,874 carats valued at $5.8 million; and Hong Kong, 9,075 carats valued at $2.8 million.

Exports of all other gem materials amounted to $19.0 million. Of this total, pearls, natural and cultured, not set or strung, were valued at $0.5 million. Natural precious and semiprecious stones, unset, were valued at $16.2 million; and synthetic or reconstructed stones, unset, were valued at $2.3 million. Reexports of all other gem materials amounted to $12.9 million. Reexports of pearls amounted to $0.8 million; of natural precious and semiprecious stones, unset, to $11.6 million; and of synthetic or reconstructed stones, unset, to $0.5 million.

Imports of gem material from 85 countries and territories increased 31% in value compared with that of 1972. Diamond accounted for 86% of the total value of gem material imports.

Most of the rough and uncut diamond imports were from seven countries, which accounted for 98% of this category as follows: the United Kingdom, 978,553 carats, $225.8 million; Sierra Leone, 747,000 carats, $78.9 million; Republic of South Africa, 426,881 carats, $83.7 million; Venezuela, 296,271 carats, $9.8 million; Central African Republic, 190,833 carats, $7.7 million; Belgium-Luxembourg, 68,056 carats, $16.8 million; and the Netherlands, 55,255 carats, $22.2 million. Of the imports of diamond, cut and unset, not over 0.5 carat, 89% was supplied by the following eight countries: Belgium-Luxembourg, 1,016,871 carats, $131.4 million; Israel, 774,090 carats, $106.6 million; India, 211,061 carats, $22.8 million; the U.S.S.R., 27,435 carats, $5.2 million; France, 23,485 carats, $2.4 million; the United Kingdom, 18,511 carats, $1.9 million; the Netherlands 15,158 carats, $1.7 million; the Republic of South Africa, 13,656 carats, $3.9 million. For diamond, cut and unset, over 0.5 carat, 99% came from the following seven countries: Belgium-Luxembourg, 142,001 carats, $45.8 million; Israel, 77,944 carats, $21.6 million; the Republic of South Africa, 10,070 carats, $8.9 million; the Netherlands, 2,832 carats, $2.4 million; India, 2,148 carats, $0.3 million; the U.S.S.R., 1,882 carats, $0.7

million; and the United Kingdom, 1,683 carats, $0.5 million.

Imports of emeralds increased 31% in quantity and 47% in value. Of 28 countries supplying natural emeralds to the United States, 10 countries accounted for 97% of the quantity as follows: India, 412,179 carats, $6.7 million; Brazil, 148,399 carats, $1.2 million; Colombia, 47,524 carats, $15.2 million; Hong Kong, 34,196 carats, $1.0 million; Switzerland, 27,840 carats, $2.9 million; the United Kingdom, 22,651 carats, $2.3 million; Israel, 13,771 carats, $0.6 million; the Netherlands, 9,652 carats, $0.1 million; West Germany, 9,419 carats, $0.2 million; and Belgium-Luxembourg, 3,478 carats, $0.2 million.

Imports of rubies and sapphires increased 47% and came from 30 countries. Eight countries accounted for 90% of the value of rubies and sapphires as follows: Thailand, $11.7 million; Hong Kong, $2.5 million; India, $1.4 million; Switzerland, $0.7 million; the United Kingdom, $0.6 million; France, $0.3 million, and Israel, $0.2 million.

Natural pearls and parts imported from India were valued at $260,000. Other leading suppliers of natural pearls and the value of imports were as follows: Italy, $33,100; Japan, $28,600; Hong Kong, $18,500; Switzerland, $10,500; Burma, $8,300; and Taiwan, $5,300. Imports of cultured pearls from Japan were valued at $8.4 million. Cultured pearls, also imported from Hong Kong were valued at $231,000; from Burma, $348,000; from Switzerland, $101,000; from France, $38,000; from Thailand, $22,000; from Italy, $19,000; from West Germany, $8,000; and from India, $8,000.

The imports of imitation pearls decreased two-thirds. Imports from Japan valued at $1.1 million comprised 85% of the total. Other countries from which imitation pearls were imported included: Spain, $78,000; Taiwan, $27,000; Australia, $7,000; Hong Kong, $5,000; the Republic of Korea, $4,000; and West Germany, $1,000. Smaller values also came from France, Switzerland, and Portugal.

Of 17 countries supplying imitation gem stones to the United States, 6 countries accounted for 78% by value, as follows: Austria, $4.0 million; West Germany, $2.8 million; Czechoslovakia, $0.8 million; Switzerland, $0.5 million; Japan, $0.3 million; and Denmark, $0.1 million.

Synthetic materials, gem-stone quality, cut but not set, and others, decreased about 3% in value. From West Germany, the value of synthetics was $4.8 million; from Switzerland, $1.2 million; from Japan, $1.0 million; from France, $0.8 million; from Taiwan, $0.7 million; from Israel, $0.5 million; from Hong Kong, $0.4 million; from Belgium-Luxembourg, $0.3 million; and from Austria, $0.2 million. These nine countries accounted for 98% of synthetic gem imports.

**Table 1.—U.S. imports for consumption of precious and semiprecious gem stones**

(Thousand carats and thousand dollars)

| Stones | 1972 | | 1973 | |
|---|---|---|---|---|
| | Quantity | Value | Quantity | Value |
| Diamonds: | | | | |
| Rough or uncut | 3,096 | 338,624 | [1] 2,821 | [1] 460,198 |
| Cut but unset | 2,410 | 288,055 | 2,360 | 360,892 |
| Emeralds: Cut but unset | 573 | 22,176 | 749 | 32,600 |
| Rubies and sapphires: Cut but unset | NA | 13,172 | NA | 19,336 |
| Marcasites | NA | 96 | NA | 28 |
| Pearls: | | | | |
| Natural | NA | 571 | NA | 368 |
| Cultured | NA | 7,615 | NA | 9,232 |
| Imitation | NA | 3,707 | NA | 1,257 |
| Other precious and semiprecious stones: | | | | |
| Rough and uncut | NA | 6,210 | NA | 5,859 |
| Cut but unset | NA | 17,238 | NA | 25,043 |
| Other n.s.p.f. | NA | 1,107 | NA | 1,532 |
| Synthetic: | | | | |
| Cut but unset | 16,957 | 10,571 | 16,365 | 10,066 |
| Other | NA | 165 | NA | 341 |
| Imitation gem stones | NA | 6,829 | NA | 10,906 |
| Total | NA | 716,136 | NA | 937,658 |

NA Not available.
[1] Adjusted by the Bureau of Mines.

## Table 2.—U.S. imports for consumption of diamond (exclusive of industrial diamond), by country

(Thousand carats and thousand dollars)

| Country | 1971 | | | | 1972 | | | | 1973 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rough or uncut | | Cut but unset | | Rough or uncut | | Cut but unset | | Rough or uncut | | Cut but unset | |
| | Quantity | Value | Quantity | Value | Quantity | Value | Quantity | Value | Quantity | Value | Quantity | Value |
| Belgium-Luxembourg | 88 | 9,092 | 1,036 | 113,626 | 64 | 10,706 | 1,211 | 147,392 | 68 | 16,836 | 1,159 | 177,222 |
| Brazil | 3 | 129 | 2 | 232 | (1) | 26 | 3 | 321 | (1) | 6 | 2 | 409 |
| Canada | -- | -- | 1 | 69 | -- | -- | 1 | 82 | 1 | 276 | 1 | 91 |
| Central African Republic | 208 | 6,785 | -- | -- | 207 | 6,587 | -- | -- | 191 | 7,668 | -- | -- |
| France | 21 | 634 | 31 | 2,514 | 33 | 1,564 | 23 | 1,895 | 6 | 169 | 24 | 2,441 |
| Germany, West | 1 | 121 | 2 | 210 | (1) | 31 | 3 | 324 | 1 | 301 | 1 | 94 |
| Guyana | 1 | 49 | (1) | 19 | 2 | 96 | (1) | 6 | (1) | 37 | (1) | 3 |
| India | -- | -- | 80 | 6,429 | -- | -- | 186 | 16,507 | (1) | 21 | 213 | 23,099 |
| Israel | 47 | 3,425 | 671 | 69,569 | 38 | 5,120 | 852 | 98,316 | 34 | 7,838 | 852 | 128,204 |
| Japan | (1) | 33 | 2 | 203 | -- | -- | 1 | 129 | 1 | 36 | 2 | 286 |
| Liberia | 17 | 3,797 | (1) | 66 | 3 | 1,611 | (1) | 67 | 7 | 5,192 | (1) | 406 |
| Netherlands | 31 | 6,190 | 20 | 2,440 | 37 | 10,948 | 15 | 2,266 | 55 | 22,209 | 18 | 4,143 |
| Sierra Leone | 281 | 14,331 | 4 | 527 | 164 | 15,593 | 3 | 324 | [2] 747 | [2] 78,919 | (1) | 40 |
| South Africa, Republic of | 904 | 83,389 | 25 | 6,388 | 953 | 100,059 | 27 | 8,286 | 427 | 83,707 | 24 | 12,833 |
| Switzerland | 16 | 3,149 | 11 | 1,156 | 47 | 2,269 | 8 | 1,188 | 1 | 181 | 5 | 1,429 |
| U.S.S.R. | -- | -- | 24 | 3,324 | -- | -- | 35 | 5,802 | -- | -- | 30 | 5,931 |
| United Kingdom | 947 | 118,913 | 12 | 1,366 | 1,302 | 178,659 | 32 | 3,586 | 979 | 225,802 | 20 | 2,415 |
| Venezuela | 177 | 4,283 | -- | -- | 244 | 5,118 | -- | -- | 296 | 9,839 | (1) | 12 |
| Other | (1) | 255 | 4 | 529 | 2 | 237 | 10 | 1,564 | 7 | 1,161 | 9 | 1,834 |
| Total | 2,742 | 254,575 | 1,925 | 208,667 | 3,096 | 338,624 | 2,410 | 288,055 | [2] 2,821 | [2] 460,198 | 2,360 | 360,892 |

[1] Less than ½ unit.
[2] Adjusted by the Bureau of Mines.

Marcasites, cut but not set, and suitable for jewelry were imported from four countries: Israel, $23,125; Switzerland, $3,644; Hong Kong, $850; and the United Kingdom, $450.

Precious and semiprecious stones, rough and uncut, amounted to $5.9 million in value of imports. Seven countries accounted for 92% of the value as follows: Colombia, $2.4 million; Brazil, $1.3 million; Australia, $0.8 million; the United Kingdom, $0.3 million; the Republic of South Africa, $0.3 million; Mozambique, $0.2 million; and Hong Kong, $0.1 million.

Precious and semiprecious stones, cut but not set, amounted to $25.0 million. Eleven countries accounted for 94% of the value as follows: Hong Kong, $9.4 million; Australia, $3.4 million; Brazil, $3.1 million; West Germany, $1.9 million; Iran, $1.4 million; Taiwan, $1.4 million; Japan, $1.0 million; Sri Lanka, $0.5 million; Mexico, $0.5 million; India, $0.5 million; and Switzerland, $0.5 million.

Coral and cameos, cut but not set, were imported from Italy, $1.2 million; from Japan, $0.5 million; and from Taiwan, $0.3 million. Minor quantities of coral and cameos were also imported from the United Kingdom, France, West Germany, Switzerland, Israel, Singapore, the Philippine Republic, Hong Kong, the People's Republic of China, Australia, and Egypt.

## WORLD REVIEW

**Angola.**—Companhia de Diamantes de Angola (DIAMANG), the only diamond producer, reported an increase in export value in 1972 of 4% to $63.4 million owing to an increase in the percentage of gem stones produced.[7] The quantity of diamond exported in 1972 decreased 6% to 2.2 million carats. All diamond exports go to metropolitan Portugal. The Consorcio de Diamantes de Angloa, the consortium of DIAMANG and De Beers interests that inherited all but 50,000 square kilometers of DIAMANG's former concession area, continued active exploration. A number of promising kimberlite deposits were found, but no plans were made for immediate exploitation.

**Australia.**—Large deposits of high-quality nephrite jade were discovered near Cowell, a town in the east coast of Eyre Peninsula, about 125 miles northwest of Adelaide, South Australia.[8] A newly formed company, Jade Australia Proprietary Ltd., Adelaide, was reported to have extensive proven reserves.

According to Australian sources, its 300 sapphire mines produce sapphires valued at $15 million and account for 80% of the world volume of sapphire and 50% of the world sapphire value.[9]

**Botswana.**—Development of a second large diamond mine is expected.[10] The Government of Botswana and De Beers Botswana Mining Co., discussed development of the DK 1 kimberlite pipe 25 miles southeast of the existing Orapa mine, which currently produces 2.4 million carats worth about $30 million per year. The mine at DK 1 could be operating within 18 months after agreements are reached.

**Burma.**—Burma's Ninth Annual Gem, Jade, and Pearl Emporium was held February 19–24, 1973. Jade sold amounted to $4,307,000; gems, to $281,000; and pearls, to $1,247,000. The total amounted to $5,835,000, a record high. The increase was due primarily to rising world prices of jade rather than an increase in the quantity of jade, or gems, or pearls. Attendance was by 12 countries, 151 firms, and 219 persons. Hong Kong buyers took 119 lots of jade out of the 156 lots sold. The People's Republic of China delegation bought 27 lots of jade, and Japanese buyers bought 9 lots. One bidder from the United States bought one lot of jade. Neither gems nor pearls were bought by U.S. bidders. Motivated by the success of the Ninth Emporium, the Government held a special emporium in August 1973 for jade and pearls, omitting gem stones. At the special emporium, jade sales amounted to $5.3 million. Hong Kong dealers monopolized the buying of jade, accounting for 72 lots of the 81 sold. Burmese authorities assert that reserves of jadeite are adequate

[7] U.S. Bureau of Mines. Angola. Mineral Trade Notes, v. 70, No. 8, August 1973, pp. 8–9.

[8] Stone, J. Massive Jade Discovery in South Australia. Calif. Min. J., v. 42, No. 11, July 1973, p. 24.

[9] Jewelers' Circular-Keystone. Briefly. Australia Becomes a Major Source of Sapphires. V. 64, No. 3, December 1973, p. 97.

[10] Engineering and Mining Journal. In Africa. Botswana. V. 174, No. 12, December 1973, p. 127.

and that prospects are good for locating additional deposits.

**Canada.**—Pacific Jade Industries, operators of all nephrite jade mines near Ogden Mountain, British Columbia, reported 1972 jade sales of nearly $200,000, over half of which was sold to the People's Republic of China.[11] Exports to other countries included West Germany, Hong Kong, Singapore, and Japan. The most precious jade is generally apple-green in color, translucent, free of flaws, and free of color variations. Variations in color can be almost white or black and all shades of green in between. The value of jade sold ranged from $1 to $30 per pound, averaging about $3.30 per pound. In addition to selling crude jade, Pacific Industries also marketed finished pieces ranging from inkstands and paper weights to works of art.

**Central African Republic.**—Cominco, Ltd., a Canadian company and Diamond Distributors, Inc., of New York formed a new company, Société Centraficaine d' Exploitation Diamantifere, to conduct diamond mining and exploration in the Central African Republic.[12] Cominco, which has the majority interest, will manage the new company and provide technical direction; Diamond Distributors, Inc., will be responsible for marketing. In the Central African Republic, 60% of the amount of diamond recovered is from the Upper Sangha (Carnot, Berberati, and Nola regions); the remainder is from the northern (Bamingui-Bangoran) and eastern (Haute-Kotte) areas.[13] About 45,000 workers were employed in 1973 to gather diamond from alluvial deposits.

**Colombia.**—The Government-owned emerald mines at Muzo, Coscuez, and Peña Blanca were closed in July 1973 and the operations landfilled to conserve the unmined emeralds. The emerald mine areas were placed under Colombian Army control. Negotiations were underway between the Ministry of Mines and private operators to arrange the reopening of the mines. The amount of security to be exercised by the Army to protect the operations was an important item. The export of emeralds accounted for more than half of the value of mineral exports from Colombia up to the time of the mine closures.

**Israel.**—The growth in the imports and exports of gem stones, particularly diamond, has been explosive. The main reasons have been the continual turmoil in exchange rates, and worldwide inflation. People are actively seeking a reliable item of value and a hedge against inflation. Gem stones, most of all diamond, fill the need. The following tabulation indicates the growth pattern: [14]

| Year | Net imports of rough gem diamond | | Net exports of polished diamond | |
|---|---|---|---|---|
| | Carats | Value | Carats | Value |
| 1970 | 3,624,027 | $154,361,873 | 1,501,265 | $202,040,738 |
| 1971 | 5,292,715 | 224,065,256 | 1,874,685 | 265,269,576 |
| 1972 | 6,176,605 | 316,059,884 | 2,296,829 | 385,691,783 |
| 1973 | 6,587,698 | 448,020,973 | 2,445,092 | 556,754,004 |

The value of diamond exports to the United States increased 78% from $74 million in 1971 to $132 million in 1973; however, the share of the exports to the United States decreased from 28% in 1971 to 24% in 1973. After the United States, Japan, Hong Kong, the Netherlands, Switzerland, Belgium, and West Germany, in that order, were the major recipients of diamond exports for 1971 through 1973. In September 1973, diamond enterprises numbered 649 and the employees numbered 9,857.

**Lesotho.**—As part of a continuing effort by the Lesotho National Development Corp. (LNDC) to revive commercial interest in diamond mining, De Beers Consolidated Mines, Ltd., was granted permission to conduct a 6-month evaluation of the Letseng-la-Terai diamond pipe in the Mokhotlong District.[15] This site was abandoned by Rio Tinto Zinc Corp. in 1972,

[11] Fish, R. H. East and West Meet at B. C. Jade Mine. Northern Miner, v. 59, No. 37, Nov. 29, 1973, p. 44.

[12] Northern Miner (Toronto). Cominco to Mine Diamonds in Central African Republic. V. 59, No. 37, Nov. 29, 1973, p. 32.

[13] Translations on Africa. Central African Republic. 1972 Mining Statistics Show Diamond Production Recovering. JPRS July 23, 1973. No. 1340. p. 1.

[14] Israel, State of. Annual Report for the Year 1973. Ministry of Commerce & Industry, Diamond Department, February 1974, 27 pp.

[15] U.S. Bureau of Mines. Diamond: Lesotho. Mineral Trade Notes, v. 70, No. 9, September 1973, p. 5.

and Newmont Mining Corp. cancelled a similar effort earlier this year at Kao in the Butha Buthe District. However, subsequent evaluations made of the stones in those areas have shown the diamond to be of higher value than originally appraised.

**Sierra Leone.**—Diamond exports continued to be the main source of revenue for Sierra Leone for 1972 and 1973. World prices which began rising in 1972 were still rising in 1973. The National Diamond Mining Corp. (DIMINCO) increased its work force to recover as much diamond as possible from its alluvial deposits. Diamond production was not tied to long-term price contracts as were other minerals, therefore revenue to the Government of Sierra Leone increased as diamond prices increased.

**Sri Lanka.**—The State Gem Corp., a Government-owned company, introduced an incentive program to encourage marketing of privately held gem materials. The incentive program was so successful that receipts to the Government increased more than twentyfold for the period January–July 1973 compared with those of the similar period in 1972. Many lovely gem stones are produced in Sri Lanka, but worldwide high prices applied at the source by the State Gem Corp. discouraged buyers from the United States.[16]

**South Africa, Republic of.**—The Central Selling Organization reported 1973 diamond sales of $1,290 million, an increase

[16] Pough, F. H. Ceylon: Island of Gems. Jewelers' Circular-Keystone, v. 144, No. 5, February 1974, pp. 77–79.

**Table 3.—Diamond (natural): World production, by country [1]**

(Thousand carats)

| Country | 1971 | | | 1972 | | | 1973 p | | |
|---|---|---|---|---|---|---|---|---|---|
| | Gem | Industrial | Total | Gem | Industrial | Total | Gem | Industrial | Total |
| Africa: | | | | | | | | | |
| Angola | 1,810 | 603 | 2,413 | 1,616 | 539 | 2,155 | 1,594 | 531 | 2,125 |
| Botswana | 82 | 740 | 822 | 360 | 2,043 | 2,403 | 362 | 2,054 | 2,416 |
| Central African Republic | r 304 | r 164 | r 468 | 346 | 178 | 524 | 251 | 129 | 380 |
| Ghana | 256 | 2,306 | 2,562 | 266 | 2,393 | 2,659 | 232 | 2,085 | 2,317 |
| Guinea e | 22 | 52 | 74 | 25 | 55 | 80 | 25 | 55 | 80 |
| Ivory Coast | 130 | 196 | 326 | 134 | 200 | 334 | 120 | 180 | 300 |
| Lesotho [2] | 1 | 6 | 7 | 1 | 8 | 9 | 1 | 9 | e 10 |
| Liberia | [3] 532 | [3] 277 | [3] 809 | [3] 414 | [3] 350 | [3] 764 | 450 | 370 | e 820 |
| Sierra Leone | r 778 | r 1,168 | r 1,946 | 720 | 1,080 | 1,800 | [4] 670 | [4] 1,000 | e [4] 1,670 |
| South Africa, Republic of: | | | | | | | | | |
| Premier mine | 609 | 1,828 | 2,437 | 613 | 1,841 | 2,454 | 625 | 1,876 | 2,501 |
| Other de Beers Co. [5] | 2,162 | 1,769 | 3,931 | 2,289 | 1,872 | 4,161 | 2,368 | 1,938 | 4,306 |
| Other | 398 | 265 | 663 | 468 | 312 | 780 | 455 | 303 | 758 |
| Total | 3,169 | 3,862 | 7,031 | 3,370 | 4,025 | 7,395 | 3,448 | 4,117 | 7,565 |
| South West Africa, Territory of | 1,566 | 82 | 1,648 | 1,516 | 80 | 1,596 | 1,520 | 80 | 1,600 |
| Tanzania | 419 | 418 | 837 | [4] 326 | [4] 325 | [4] 651 | 290 | 290 | e 580 |
| Zaire | r 1,274 | r 11,469 | r 12,743 | 1,339 | 12,051 | 13,390 | 1,294 | 11,646 | 12,940 |
| Other areas: | | | | | | | | | |
| Brazil e | 150 | 150 | 300 | 155 | 155 | 310 | 160 | 160 | 320 |
| Guyana | 19 | 29 | 48 | 20 | 29 | 49 | 21 | 31 | e 52 |
| India | 16 | 3 | 19 | 17 | 3 | 20 | 18 | 3 | 21 |
| Indonesia e | 12 | 3 | 15 | 12 | 3 | 15 | 12 | 3 | 15 |
| U.S.S.R. e | 1,800 | 7,000 | 8,800 | 1,850 | 7,350 | 9,200 | 1,900 | 7,600 | 9,500 |
| Venezuela | 114 | 385 | 499 | 141 | 315 | 456 | 241 | 537 | 778 |
| World total | r 12,454 | r 28,913 | r 41,367 | 12,628 | 31,182 | 43,810 | 12,609 | 30,880 | 43,489 |

e Estimate. p Preliminary. r Revised.

[1] Total (gem plus industrial) diamond output for each country is actually reported except where indicated to be an estimate by footnote. In contrast, the detailed separate reporting of gem diamond and industrial diamond represents Bureau of Mines estimates in the case of all countries except Lesotho (1971 and 1972), Liberia (1971 and 1972), and Venezuela (1971 and 1972), where sources give both total output and detail. The estimated distribution of total output between gem and industrial diamond is conjectural in the case of a number of countries, based on unofficial information of varying reliability.

[2] Exports of diamond originating in Lesotho; excludes stones imported for cutting and subsequently reexported.

[3] Exports for year ending August 31 of that stated.

[4] Exports.

[5] All company output from the Republic of South Africa except for that from the Premier mine; also excludes company output from the Territory of South West Africa and from Botswana.

of 40% over those of 1972. No breakdown of quantity of gem stones or value of gem stones versus the quantity and value of industrial stones was given. De Beers suspended operations at some mines in favor of operations at other mines to adjust production to meet demand.[17] Consumer demand worldwide in 1973 was mostly for 1.0 carat stones and resulted in a surplus of small stones weighing less than ¼ carat. A marketing program was developed for use of smaller stones to accentuate other gem stones in jewelry settings.

**Zaire.**—On November 30, 1973, the Government of Zaire announced that companies formerly operated by a Belgian group, FORMINIERE, would be taken over 100%. Included in this group was the diamond mine of the Société Minière de Bakwanga (MIBA) located at Mbuji Mayi, East Kasai Region. The MIBA mine produces over 12 million carats of diamond annually, nearly all industrial diamond, and is a major foreign exchange earner for Zaire. MIBA employed about 4,000 workers in East Kasai in 1973.

## TECHNOLOGY

The Diamond Grading Laboratory, London, England, developed a method for positive identification of individual diamond gems.[18] The method utilizes the range of color in diamond, approximately 1,000 hues, and the characteristics of flaws and inclusions commonly found in all diamond. A full "fingerprint" dossier, including a color photograph, was recommended for all stones 1 carat and over, for an approximate cost of $75 each.

Another utilization of diamond characteristics was developed for identifying the source, or area in the world, from which a diamond came. The De Beers Diamond Research Center, Johannesburg, Republic of South Africa, compiled a set of 150,000 physical observations of diamond from various parts of the world for use in establishing the identifying traits.[19]

Geologists have believed that high pressures and temperatures were necessary for the growth of diamond. Laboratory efforts using high pressure and temperatures were proven successful, first by General Electric Co. research workers and subsequently by many others. However, a review of all available data disclosed that other conditions may foster the growth of diamond.[20] Information gained from patent literature and from laboratory experiments was used to present a new theory on the growth of both natural and synthetic diamond. According to the theory, the essential requirement is a set of conditions that will provide a source of individual carbon atoms that exist in excited states. This theory attempts to explain why diamond is not present in the lower regions of kimberlite pipes, and why some kimberlite pipes have no diamond present. Although high pressure and high temperature used by the earlier experimenters provided a set of conditions that presented carbon atoms in an excited state, the passage of an electric current in the presence of catalytic contaminants was needed to complete the transformation to diamond.

Nephrite jade has a hardness of 6½ on the Mohs' scale and jadeite jade has a hardness of 7. However, the hardness is not an indication of the toughness, or the resistance to breakage. In addition to the two jades, a number of minerals were measured for relative toughness even though no widely accepted scale exists.[21] For comparison, carbonado diamond was found to be the toughest mineral. Of all other natural minerals, nephrite jade measured highest in resistance to breakage, and jadeite was ranked next, a sequence which is the reverse of their accepted relative hardness. In fact, the two jades exceeded most commercially available ceramics. Only ultrahigh strength, hot-pressed oxides and nitrides used for cutting tools and turbine vanes exceeded the two jades in toughness.

The most attractive of current imitation diamonds is a well-made doublet

[17] Forbes. De Beers. V. 112, No. 2, July 15, 1973, pp. 62–64.

[18] Black, S. Diamond: Position Secure As Queen of the Gems. The Financial Times, London. No. 25,968, Feb. 7, 1973, pp. 18–19.

[19] De Beers Consolidated Mines Limited. 1973 Annual Report. P. 23.

[20] Wilson, W. D. On the Growth of Diamond, Part I–A–Modern Theory. Lapidary J., v. 27, No. 6, September 1973, pp. 982–984. On the Growth of Diamond, Part II–Growth of Diamond at Low Pressure. Lapidary J., v. 27, No. 7, October 1973, pp. 1096–1098.

[21] Bradt, R. C., J. V. Biggers, and R. C. Newnham. The Toughness of Jade. Am. Mineralogist, v. 58, Nos. 7–8, July–August 1973, pp. 727–732.

which combines the virtues of two synthetics.[22] A sapphire crown provides durability to the exposed area, and a strontium titanate pavillion provides fire and brilliance. The juncture may be at the girdle or it may be just below the girdle. The plastic cement used to join the crown and pavillion is resistant to almost anything likely to be encountered except steam cleaning.

All phases of faceting require equipment to be properly prepared and also require a skillful artisan. The proper procedure for dopping gems for facet cutting was described for a variety of minerals.[23]

The term "cameo" applies particularly to a stone, shell, glass or other hard substance upon which a design has been carved. A comparison was made of methods used to carve antique cameos and current methods are thoroughly illustrated by examples in color photography.[24]

Pierre Gilson, one of the leading producers of synthetic emeralds, submitted a 3.5–carat synthetic black opal to the Gemological Institute of America for examination.[25] The specimen was described as "absolutely beautiful." The representatives of Gilson claimed that stones as large as 20 carats may be available in the future.

[22] Pough, F. H. The Simulated Diamond Story. Jewelers' Circular-Keystone, v. 163, No. 10, July 1973, pp. 146, 162–170.
[23] Grieger, J. Faceting Know-How. Grieger J., v. 1, No. 2, May 1973, pp. 1, 11.
[24] Williams, J. D. Cameos. Miner. Digest, v. 2, 2d. Quarter, 1973, pp. 42–51.
[25] Jewelers' Circular-Keystone. Gilson's New Triumph. V. 144, No. 2, November 1973, p. 91.