# Gem Stones

By W. Timothy Adams[1]

The value of gem stones and mineral specimens produced in the United States during 1977 was estimated to be $8.9 million, the same as that of 1976. Production in the domestic commercial mining industry decreased, with the shutdown of many turquoise mines and the sapphire mine in Montana. Amateur collectors accounted for much of the activity in many States. Commercial operators sold mainly to wholesale or retail outlets and also to jewelry manufacturers.

## DOMESTIC PRODUCTION

Mines and collectors in 39 States produced gem materials estimated at $1,000 or more in value for each State. Nine States supplied 90% of the total value, as follows: Arizona, $4.5 million; Maine, $1 million; Nevada, $1 million; Oregon, $520,000; California, $230,000; Wyoming, $200,000; New Mexico, $170,000; Texas, $160,000; and Washington, $160,000.

Park authorities at the Crater of Diamonds Park in Arkansas reported 91,849 people visited the park and found 371 diamonds. The largest was a 4-carat, 25 point canary yellow stone, but no value was placed on the stone. A campground for visitors with 60 class A campsites with utility hookups is scheduled for completion this year.[2]

A 2,400-pound boulder of Wyoming jade was displayed in the lobby of the First National Bank Building in Denver, Colo. The material came from a 1-mile-wide, 4-mile-long jade strain discovered in southwestern Wyoming. Much of the jade carved in Hong Kong is supplied from Wyoming and imported into this country as finely carved Oriental jewelry.[3]

The second largest ruby ever found in the Cowee Valley near Franklin, N.C., was discovered at the Gregory Ruby Mine, a dig-for-fee mine. The stone weighed 456 carats and is conservatively valued at $20,000. It is 3-inches in diameter, 1 inch thick, 85% ruby, and the value could exceed $100,000 if a star is formed when the stone is cut.[4]

The Maine Tourmaline Necklace was donated to the State of Maine by the Maine Retail Jewelers' Association on May 25, 1977. Two years in the making, the necklace is made of Maine native gold and 24 pink and green Maine tourmalines with the center drop stone weighing 24.58 carats. The necklace will be available for the First Lady of Maine to wear at official functions.[5]

Peridot was produced by about 200 individuals of the San Carlos Apache Tribe at Peridot, Ariz. Twenty tons of crude materials valued at $17,000 was reported for 1977. Of this, it is estimated that 7% remains as salable material after processing into faceted and tumble-polished gem stones. The major portions of the finished stones are in the lower priced tumble-polished category. A report was completed on the olivine resources on Peridot Mesa at the request of the San Carlos Apache Tribe.[6]

The production of turquoise of all grades and quantities reported was 44 tons and was principally from Arizona, Nevada, and Colorado. About 10% of the turquoise produced was gem-grade material, which sold for $10 to $100 per carat and averaged about $200 per pound. Lower grade turquoise suitable for stabilizing treatment sold for about $35 per pound of rough material. The value for all types and grades of turquoise in 1977 was estimated at $4.5 million. The market for turquoise seems to be decreasing somewhat in the face of high prices and suspicion as to whether the material offered is a synthetic made of other material and colored to look like turquoise.

## CONSUMPTION

Domestic gem stone output went to amateur and commercial 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 $1,044.7 million, 48% more than that of 1976.

## PRICES

Typical costs to retail jewelers in December 1977 for representative better quality gem stones as reported by colored-stone dealers in various U.S. cities were as follows:[7]

| Gem stone | Carat weight | Price range per carat | Median prices per carat | |
|---|---|---|---|---|
| | | | Early December | Early November |
| Amethyst | 10 | $17.50- $36 | $30 | $30 |
| Aquamarine | 5 | 110- 500 | 150 | 150 |
| Cat's eye | 5 | 1,000- 2,400 | 1,600 | 1,600 |
| Citrine | 10 | 8- 30 | 16 | 16 |
| Emerald: | | | | |
| Medium to better | 1 | 1,500-16,000 | 5,000 | 5,000 |
| Commercial | 1 | 250- 7,000 | 1,500 | 1,500 |
| Garnet, green | 1 | 700- 1,400 | 1,026 | 1,026 |
| Opal, black | 3 | 500- 1,200 | 766 | 766 |
| Opal, white | 5 | 120- 220 | 150 | 150 |
| Peridot | 5 | 76- 120 | 90 | 90 |
| Ruby: | | | | |
| Medium to better | 1 | 700- 9,000 | 2,000 | 2,000 |
| Commercial | 1 | 250- 3,500 | 700 | 700 |
| Sapphire: | | | | |
| Medium to better | 1 | 450- 3,600 | 1,000 | 1,000 |
| Commercial | 1 | 100- 1,600 | 326 | 326 |
| Star sapphire: | | | | |
| Sky-blue | | 160- 1,600 | 600 | 600 |
| Grey | | 46- 330 | 190 | 190 |
| Tanzanite | 5 | 500- 600 | 550 | 550 |
| Topaz | 5 | 220- 440 | 360 | 360 |
| Tourmaline, green | 5 | 60- 130 | 90 | 90 |
| Tourmaline, pink | 5 | 50- 160 | 125 | 125 |

Typical costs to retail jewelers in December 1977 for representative diamonds as reported by diamond dealers in various U.S. cities were as follows:[8]

| Carat weight | Description, color[1] | Clarity[2] (GIA terms) | Price range per carat | Medium price per carat | |
|---|---|---|---|---|---|
| | | | | Early December | Early November |
| 0.04-0.08 | G-1 | $VS_1$ | $630-$1,088 | $824 | $744 |
| .04- .08 | G-1 | $SI_1$ | 550- 832 | 730 | 634 |
| .09- .16 | G-1 | $VS_1$ | 660- 1,198 | 940 | 850 |
| .09- .16 | G-1 | $SI_1$ | 604- 954 | 800 | 708 |
| .17- .22 | G-1 | $VS_1$ | 816- 1,246 | 1,050 | 1,000 |
| .17- .22 | G-1 | $SI_1$ | 680- 1,016 | 902 | 864 |
| .23- .28 | G-1 | $VS_1$ | 848- 1,418 | 1,206 | 1,150 |
| .23- .28 | G-1 | $SI_1$ | 794- 1,292 | 1,000 | 952 |
| .29- .35 | G-1 | $VS_1$ | 1,132- 1,618 | 1,312 | 1,304 |
| .29- .35 | G-1 | $SI_1$ | 906- 1,546 | 1,100 | 1,028 |
| .46- .55 | G-1 | $VS_1$ | 1,486- 2,536 | 2,090 | 1,940 |
| .46- .55 | G-1 | $SI_1$ | 1,100- 2,000 | 1,680 | 1,528 |
| .69- .79 | G-1 | $VS_1$ | 1,738- 3,826 | 2,852 | 2,616 |
| .69- .79 | G-1 | $SI_1$ | 1,338- 2,650 | 2,234 | 2,104 |
| .95-1.15 | G-1 | $VS_1$ | 2,420- 6,244 | 4,410 | 4,410 |
| .95-1.15 | G-1 | $SI_1$ | 1,984- 5,632 | 3,410 | 3,232 |
| 1.00 | D | FL | 17,000-21,000 | 20,000 | 16,000 |

[1]Gemological Institute of America color grades: D—colorless; G-1—traces of color.
[2]Clarity: FL—no blemishes; $VS_1$—very slightly included; $SI_1$—slightly included.

## FOREIGN TRADE

Exports of all gem materials amounted to $356.6 million, and reexports to $245.7 million. Diamond accounted for 94% of the value of exports and 95% of the reexports. Exports of diamond totaled 316,160 carats valued at $336.0 million. Of this total, diamond cut but unset, suitable for gem stones not over 0.5 carat, was 63,968 carats valued at $26.4 million; and cut, but unset, over 0.5 carat was 246,351 carats valued at $308.3 million.

Reexports of diamond amounted to 1,240,469 carats, valued at $232.9 million, in categories as follows: Rough or uncut, suitable for gem stones, not classified by weight, 1,113,988 carats valued at $146.0 million; cut but unset, not over 0.5 carat, 49,679 carats valued at $15.5 million; cut but unset, over 0.5 carat, 76,802 carats, valued at $71.4 million.

The 11 leading recipients of diamond exports accounted for 97% of both the carats and the value and were as follows: Hong Kong, 107,902 carats valued at $131.6 million; Belgium, 32,664 carats valued at $45.2 million; Switzerland, 25,452 carats valued at $41.8 million; Japan, 33,190 carats valued at $35.8 million; the Netherlands, 24,327 carats valued at $32.1 million; France, 6,011 carats valued at $18.8 million; the United Kingdom, 9,809 carats valued at $7.2 million; Israel, 18,360 carats valued at $7.0 million; Canada, 11,789 carats valued at $5.8 million; India, 31,758 carats valued at $0.4 million; and Austria, 4,381 carats valued at $0.3 million.

The nine leading recipients of diamond reexports accounted for 99% of the carats and 98% of the value and were as follows: Israel, 466,101 carats valued at $73.6 million; Belgium, 395,545 carats valued at $69.0 million; the Netherlands, 185,544 carats valued at $30.6 million; Switzerland, 9,111 carats valued at $13.3 million; the United Kingdom, 40,444 carats valued at $12.2 million; France, 14,288 carats valued at $10.6 million; Japan, 15,981 carats valued at $8.9 million; Hong Kong, 12,408 carats valued at $7.9 million; and India, 84,874 carats valued at $2.0 million.

Exports of all other gem materials amounted to $20.6 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 $18.2 million; and synthetic or reconstructed stones, unset, were valued at $1.9 million. Reexports of all other gem materials amounted to $12.8 million in categories as follows: Pearls, $1.1 million; natural precious and semiprecious stones, unset, $11.6 million; synthetic or reconstructed stones, unset, $0.1 million.

Imports of gem materials increased 39% in value over those of 1976. Diamond accounted for 88% of the total value of gem material imports.

Although rough and uncut diamond imports were reported from 28 countries, 99% of the value was from 7 countries as follows: The Republic of South Africa, 1,096,493 carats, $315.8 million; the United Kingdom, 1,280,769 carats, $238.6 million; Sierra Leone, 185,869 carats, $40.5 million; the Netherlands, 29,152 carats, $12.5 million; Israel, 56,567 carats, $11.2 million; Belgium, 22,348 carats, $7.6 million; and Venezuela, 154,814 carats, $5.4 million.

Cut but unset diamond, not over 1/2 carat, was imported from 33 countries; however, the imports of this category from 7 countries amounted to 98% of total carats and value as follows: Israel, 1,145,413 carats, $256.2 million; Belgium, 1,106,815 carats, $223.3 million; India, 765,432 carats, $129.3 million; the U.S.S.R., 35,207 carats, $9.8 million; the Netherlands, 46,784 carats, $9.0 million; the Republic of South Africa, 20,707 carats, $7.6 million; and the United Kingdom, 26,520 carats, $4.2 million. Cut but unset diamond, over 1/2 carat, was imported from 28 countries; the imports from 8 countries amounted to 99% of both the total carats and value as follows: Belgium, 150,059 carats, $84.5 million; Israel, 115,087 carats, $48.1 million; the Republic of South Africa, 12,900 carats, $9.3 million; the U.S.S.R., 9,239 carats, $4.2 million; the Netherlands, 7,608 carats, $3.5 million; the United Kingdom, 4,479 carats, $2.8 million; Switzerland, 766 carats, $1.6 million; and India, 3,905 carats, $1.2 million.

Emerald imports increased 34% in quantity and 16% in value. Emerald was imported from 34 countries; the imports from 10 countries amounted to 98% of the carats and 95% of the value as follows: Colombia, 73,948 carats, $25.1 million; India, 968,937 carats, $12.5 million; Switzerland, 26,198 carats, $7.3 million; Israel, 68,644 carats,

$3.6 million; Hong Kong, 68,717 carats, $3.1 million; the United Kingdom, 57,877 carats, $2.9 million; Brazil, 212,974 carats, $2.4 million; the Federal Republic of Germany, 30,318 carats, $1.9 million; France, 5,368 carats, $1.4 million; and Belgium, 12,706 carats, $0.8 million. Imports of ruby and sapphire were imported from 32 countries; the imports from 10 countries amounted to 96% of the value as follows: Thailand, $22.5 million; Switzerland, $2.0 million; Sri Lanka, $1.9 million; Hong Kong, $1.6 million; India, $1.6 million; Belgium, $0.5 million; Burma, $0.5 million; Israel, $0.5 million; the United Kingdom, $0.5 million; and Canada, $0.4 million. Natural pearls and parts from 12 countries decreased 28% in value of imports; 5 countries accounted for 92% of the value as follows: India, $369,000; Burma, $36,000; Japan, $35,000; Italy, $33,000; and Hong Kong, $27,000. Imports of cultured pearls increased 65% in value, and were received from 17 countries; Japan, at $17.6 million, accounted for 96% of the value. Imports of imitation pearls increased 39% in value; Japan, at $748,000, accounted for 79% of the value. Coral, cut but unset, and cameos suitable for use in jewelry decreased 32% in value of imports, which were received from 15 countries; 3 countries accounted for 95% of the value as follows: Italy, $1.8 million; Taiwan, $1.8 million; and Japan, $0.6 million.

Imports of other precious and semiprecious stones, rough and uncut, increased 26% in value and came from 43 countries, 7 of which accounted for 80% of the value as follows: Brazil, $3.9 million; Australia, $1.5 million; Colombia, $0.8 million; Kenya, $0.7 million; Switzerland, $0.7 million; Zaire, $0.4 million; and Israel, $0.3 million. Other precious and semiprecious stones, cut but unset, increased 1% in value and were imported from 65 countries, of which 5 countries accounted for 84% of the value as follows: Hong Kong, $17.8 million; Brazil, $4.2 million; the Federal Republic of Germany, $3.9 million; Australia, $2.7 million; and Taiwan, $1.2 million. Synthetic gem stones, cut but unset, increased 3% in value and came from 17 countries, 6 of which accounted for 94% of the value as follows: The Federal Republic of Germany, $6.4 million; Japan, $1.1 million; Switzerland, $1.1 million; France, $0.7 million; Austria, $0.3 million; and Israel, $0.2 million. Imitation gem stones increased 19% in value and came from 22 countries, of which 5 countries accounted for 94% of the value as follows: Austria, $6.0 million; the Federal Republic of Germany, $2.8 million; Czechoslovakia, $0.7 million; Japan, $0.3 million; and the United Kingdom $0.3 million.

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

(Thousand carats and thousand dollars)

| Stones | | 1976 | | 1977 | |
|---|---|---|---|---|---|
| | | Quantity | Value | Quantity | Value |
| Diamonds: | | | | | |
| Rough or uncut | | 2,464 | 462,657 | 2,909 | 638,205 |
| Cut but unset | | 3,087 | 549,182 | 3,502 | 806,332 |
| Emeralds: Cut but unset | | 1,165 | 55,286 | 1,563 | 64,375 |
| Coral, cut but unset, and cameos suitable for use in jewelry | | NA | 6,497 | NA | 4,410 |
| Rubies and sapphires: Cut but unset | | NA | 27,165 | NA | 33,544 |
| Marcasites | | NA | 20 | NA | 58 |
| Pearls: | | | | | |
| Natural | | NA | 755 | NA | 544 |
| Cultured | | NA | 11,062 | NA | 18,260 |
| Imitation | | NA | 680 | NA | 942 |
| Other precious and semiprecious stones: | | | | | |
| Rough and uncut | | NA | 8,266 | NA | 10,448 |
| Cut but unset | | NA | 35,278 | NA | 35,617 |
| Other n.s.p.f | | NA | 2,565 | NA | 3,273 |
| Synthetic: | | | | | |
| Cut but unset | number | 18,705 | 10,115 | 15,753 | 10,391 |
| Other | | NA | 766 | NA | 864 |
| Imitation gem stones | | NA | 9,072 | NA | 10,841 |
| Total | | NA | 1,179,366 | NA | 1,638,104 |

NA Not available.

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

(Thousand carats and thousand dollars)

| Country | 1975 | | | | 1976 | | | | 1977 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | 31 | 8,250 | 849 | 153,276 | 38 | 6,651 | 1,168 | 223,858 | 22 | 7,592 | 1,257 | 307,766 |
| Bolivia | -- | -- | -- | -- | 5 | 99 | -- | -- | -- | -- | -- | -- |
| Brazil | 5 | 982 | 3 | 491 | 1 | 79 | 4 | 690 | (1) | 91 | 4 | 860 |
| Canada | -- | -- | 1 | 156 | (1) | 6 | (1) | 90 | (1) | 49 | 1 | 704 |
| Central African Empire | 134 | 5,298 | -- | -- | 36 | 2,204 | -- | -- | 51 | 3,539 | -- | -- |
| France | 7 | 231 | 18 | 2,195 | 6 | 643 | 9 | 1,957 | 8 | 683 | 9 | 1,577 |
| Germany, Federal Republic of | -- | -- | 1 | 281 | (1) | (1) | 4 | 1,214 | (1) | 8 | 4 | 906 |
| Ghana | 2 | 58 | -- | -- | (1) | 16 | -- | -- | 8 | 64 | -- | -- |
| Hong Kong | -- | -- | 5 | 847 | 1 | 825 | 10 | 1,962 | 1 | 98 | 9 | 1,741 |
| India | -- | -- | 300 | 37,211 | -- | -- | 502 | 65,432 | (1) | 1 | 769 | 130,501 |
| Ireland | -- | -- | (1) | 64 | -- | -- | -- | -- | 1 | 413 | 2 | 305 |
| Israel | 33 | 5,523 | 902 | 147,114 | 39 | 8,239 | 1,203 | 211,146 | 57 | 11,177 | 1,260 | 304,263 |
| Italy | -- | -- | 1 | 219 | 1 | 82 | 2 | 292 | -- | -- | 2 | 641 |
| Japan | 1 | 77 | 2 | 428 | 1 | 51 | 6 | 1,001 | (1) | 27 | 1 | 286 |
| Liberia | 4 | 4,981 | -- | -- | 3 | 2,871 | -- | -- | 1 | 228 | -- | -- |
| Mauritania | -- | -- | -- | -- | -- | -- | (1) | 47 | 5 | 45 | (1) | 23 |
| Netherlands | 36 | 13,643 | 58 | 9,860 | 50 | 20,524 | 78 | 12,849 | 29 | 12,465 | 54 | 12,489 |
| Portugal | 5 | 570 | 2 | 473 | -- | -- | -- | -- | -- | -- | -- | -- |
| Sierra Leone | 272 | 32,696 | (1) | 83 | 331 | 42,861 | 1 | 129 | 186 | 40,467 | 4 | 881 |
| South Africa, Republic of | 927 | 189,885 | 21 | 7,777 | 1,194 | 257,249 | 22 | 9,674 | 1,096 | 315,790 | 33 | 16,905 |
| Switzerland | (1) | 42 | 4 | 1,087 | 1 | 29 | 14 | 2,796 | 6 | 811 | 8 | 3,003 |
| Tunisia | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 3 | 548 |
| U.S.S.R | -- | -- | 43 | 9,215 | -- | -- | 43 | 10,607 | -- | -- | 44 | 14,089 |
| United Kingdom | 451 | 69,959 | 17 | 2,576 | 495 | 113,756 | 14 | 3,630 | 1,281 | 238,608 | 32 | 7,073 |
| Venezuela | 389 | 8,204 | (1) | 5 | 260 | 5,987 | (1) | 79 | 155 | 5,381 | -- | -- |
| Western Africa, n.e.c | 36 | 6,568 | -- | -- | (1) | 172 | -- | -- | (1) | 23 | -- | -- |
| Other | r8 | r915 | r9 | r879 | r2 | r313 | r7 | r1,729 | 2 | 645 | 6 | 1,771 |
| Total | 2,341 | 347,882 | 2,236 | 374,237 | 2,464 | 462,657 | 3,087 | 549,182 | 2,909 | 638,205 | 3,502 | 806,332 |

rRevised.
1Less than 1/2 unit.

## WORLD REVIEW

**Angola.**—The Government of Angola increased its holdings in Compania de Diamantes de Angola (Diamang) from 200,000 shares to over 1.5 million shares. This gave the Government a 60.85% majority interest. Foreign companies with interests in Diamang will not be affected by the takeover.[9]

**Australia.**—Subject to obtaining the necessary government approval, Conzinc Riotinto of Australia (CRA) Exploration Pty. was attempting to increase its 35% interest in venture prospecting for diamonds in the Kimberley's, Western Australia.[10] Promising diamond finds in the Kimberley region of West Australia led to a confrontation between Western Australia's State Government and the Federal Government's Director of Aboriginal Affairs. Exploration permits issued by the State to CRA Exploration Pty., DeBeers Consolidated Ltd., and Broken Hill Pty. Ltd. were rejected by the Director under his authority over aboriginal lands. It is believed that diamondiferous kimberlite pipe has been discovered.[11]

**Botswana.**—Agreement has been reached between the Government of Botswana and DeBeers Consolidated Mines Ltd. on the basic final arrangements for the development and operation of the large diamond mine at Jwaneng. Development of the mine and infrastructure is expected to take about 4 years.[12]

**Central African Empire.**—Diamond output increased to 301,000 carats. In 1976, total diamond production was 286,000 carats, half of the 524,000 carats mined as recently as 1972. Exports totaled 269,000 carats valued at $14.4 million. Exports maintained their value, reflecting the emphasis on gem-quality stones. Part of the decline in production was due to legal difficulties between the leading alluvial diamond mining company, Société Centrafricaine d' Exploitation Diamantifere (SCED), and the Central African Empire Government. Questions relating to SCED status under the nation's investment and tax code led to a temporary suspension of mining.[13]

**Colombia.**—Colombia supplies 90% of the world's emeralds. Legal production is estimated at $25 million, which represents about 10% of the nation's total exports. Fewer than 1% of the emeralds found are judged to be of top quality.[14]

**Greenland.**—Fiscanex Ltd., Willowdale, Ontario, Canada, marketed ruby corundum as individual crystals or dots of crystals in a variety of rock matrix types. These stones have exceptionally good color and fluoresce strongly under longwave ultravioletlight but somewhat less under shortwave ultravioletlight. The firm anticipates entering the reconstituted ruby material market since the quality of the material is suitable for recrystallized laser applications.

**Israel.**—Exports of cut diamonds for the first 9 months of 1977 increased 42%. The diamonds were valued at $708 million with the expectation that exports will total more than $1,000 million in 1977.[15]

**Pakistan.**—Rich deposits of rubies occur in the Hunza area of northern Pakistan. In order to properly explore the occurrences, Pakistan Mineral Development Corp. took responsibility for the Hunza ruby project in 1974. The main marble formation having ruby mineralization was reported to have a stratigraphic thickness of 2,500 feet and was traced for an uninterrupted strike length of more than 12 miles. Average weight of individual ruby crystals being produced is slightly less than a carat. Crystals up to 2 carats are not uncommon. Color of the stones ranges from dull red or brownish, pink, purple to red, bright red, and dark pigeon-blood red.[16]

**South Africa, Republic of.**—Preliminary data on diamond production for 1977 showed an increase of 14%. The total for 1977 was 8,033,000 carats; 4,171,000 carats of industrial diamond and 3,862,000 carats of gem stones. The upward trend in sales has prompted DeBeers Consolidated Mines Ltd. to expand its exploration program and accelerate mine development at ongoing operations. The Finsch open pit in northern Cape Province is being expanded to increase production from 2.0 million to 3.0 million carats per year by 1979. The Langhoogle underground mine, Cape Province, is being reopened and is expected to supply 60,000 carats per year beginning in July 1978. The Koingnaas mine on the Cape Province coast was scheduled to begin production in July 1978 and produce 500,000 carats per year.[17] Expansion was also scheduled for the Kimberley District mines, however, the Dutoitspan and Bultfontein mines were temporarily closed by flooding. Mine personnel were transferred to the two other mines in the district. Production is expected to be

maintained at the 1976 level of over 1 million carats.[18]

Demand for the smaller sized gem stones increased rapidly in 1977. The Central Selling Organization announced price increases of 15% and 17% during 1977 for a compound increase of nearly 35% for the year. Increased prices and demand provided Central Selling Organization sales of approximately $2.1 billion in 1977, a 33% increase over 1976.[19]

**South-West Africa, Territory of.**—A new diamond deposit was claimed in the Hunsberge area, east of the Restricted Diamond Area No. 1.[20]

**Zaire.**—Société Minière de Bakwanga (Miba), Zaire's principal producer of low-grade industrial diamond, is operated by the Zairian Government. Miba has an export quota of 13.5 million carats per year, which is set by Zaire—British Diamond Distributors, Ltd., an affiliate of the Central Selling Organization. Miba has suffered from supply problems along with a cash squeeze that prevented it from making normal reinvestments to upgrade and maintain capital equipment to overcome a substantial shortage of exports below that allowed by the quota.[21]

**Zambia.**—The Kafubu emerald mine is to be developed on a commercial scale. Recent geological surveys have shown that the emerald deposits south of Kalulushi may be more extensive and of much greater value than originally anticipated. The mine has been clandestinely operated by small workers.[22]

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

(Thousand carats)

| Country | 1975 | | | 1976 | | | 1977[p] | | |
|---|---|---|---|---|---|---|---|---|---|
| | Gem | Industrial | Total | Gem | Industrial | Total | Gem | Industrial | Total |
| Africa: | | | | | | | | | |
| Angola | 743 | 248 | 991 | 255 | 85 | 340 | 265 | 88 | 353 |
| Botswana | 359 | 2,038 | 2,397 | 358 | 2,026 | 2,384 | 404 | 2,287 | 2,691 |
| Central African Empire | 220 | 119 | 339 | 172 | 114 | 286 | 182 | 119 | 301 |
| Ghana | 233 | 2,095 | 2,328 | 228 | 2,055 | 2,283 | 230 | 2,070 | e2,300 |
| Guinea[e] | 25 | 55 | 80 | 25 | 55 | 80 | 25 | 55 | 80 |
| Ivory Coast | 84 | 125 | 209 | 24 | 36 | 60 | 26 | 39 | e65 |
| Lesotho | [2]1 | [2]2 | [2]3 | [2]1 | [2]4 | [2]5 | 6 | 22 | e28 |
| Liberia | [3]244 | [3]162 | [3]406 | [3]176 | [3]144 | [3]320 | 163 | 163 | 326 |
| Sierra Leone | 293 | 439 | 732 | 192 | 289 | 481 | 180 | 270 | e450 |
| South Africa, Republic of: | | | | | | | | | |
| Premier mine | 509 | 1,527 | 2,036 | 458 | 1,375 | 1,833 | 502 | 1,508 | 2,010 |
| Other De Beers properties[4] | 2,518 | 2,061 | 4,579 | 2,549 | 2,086 | 4,635 | 2,796 | 2,287 | 5,083 |
| Other | 408 | 272 | 680 | 333 | 222 | 555 | 564 | 376 | 940 |
| Total | 3,435 | 3,860 | 7,295 | 3,340 | 3,683 | 7,023 | 3,862 | 4,171 | 8,033 |
| South-West Africa, Territory of | 1,660 | r88 | r1,748 | 1,609 | 85 | 1,694 | 1,901 | 100 | 2,001 |
| Tanzania | 224 | 224 | 448 | 219 | 219 | 438 | 187 | 188 | e375 |
| Zaire | r395 | 12,415 | 12,810 | 591 | 11,230 | 11,821 | 561 | 10,652 | 11,213 |
| Other areas: | | | | | | | | | |
| Brazil | 131 | 131 | 262 | 38 | 38 | 76 | 100 | 100 | e200 |
| Guyana | 8 | 13 | 21 | 6 | 8 | 14 | 7 | 10 | 17 |
| India | 17 | 3 | 20 | 17 | 3 | 20 | 19 | 3 | e22 |
| Indonesia[e] | r3 | r12 | 15 | 3 | 12 | 15 | 3 | 12 | 15 |
| U.S.S.R. | 1,950 | 7,750 | 9,700 | 2,000 | 7,900 | 9,900 | 2,100 | 8,200 | 10,300 |
| Venezuela | 239 | 821 | 1,060 | 190 | 643 | 833 | 160 | 540 | 700 |
| World total | r10,264 | r30,600 | r40,864 | 9,444 | 28,629 | 38,073 | 10,381 | 29,089 | 39,470 |

[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 every country except Lesotho (1975-76), Liberia (1977), Venezuela (1975 and 1976), and Zaire (1975), 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 stone imported for cutting and subsequently reexported.

[3]Exports.

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

## TECHNOLOGY

Grading and demonstrating cut diamonds is said to be fast and accurate when using the Gem Proportionscope. When the diamond is placed in the optical field of the instrument, any deviation from ideal proportions is said to be clearly visible. Comparisons can be easily made for establishing the grade of a diamond's cut.[23]

Six isolated and totally enclosed inclusions were recovered from an Arkansas diamond by burning in air at 850°C. They are identified as (a) three euhedral crystals of chromian diopside, (b) a euhedral bicrystal of chromian diopside plus orthopyroxene with minor included matter, (c) anhedral olivine plus a small amount of attached unidentified glassy silicate rich in silicon and aluminum with minor iron, titanium, zinc, and potassium, (d) finely polycrystalline periclase plus minor magnetite. X-ray diffraction, and chemical and morphological data are given. The periclase may have existed in the diamond as magnesite; if so, the observed inclusions bear resemblance to equilibrium phases recently reported for silicate plus carbonate reactions under mantle-like conditions. Interpretation of pressure-temperature equilibrium conditions for the diamond inclusion system based on the silicate-carbonate reaction and the two-pyroxene geothermometer suggests $5x10^4$ kbars and 1,300°C, but the olivine plus vitreous-like phase inclusion may indicate a pressure well below $5x10^4$ kbars.[24]

When does a science come of age? When it grows so fast and in so many parts of the world that its members need abstracts. These data will be useful in two types of laboratories: (1) The research laboratory where the goal is new syntheses through flame, flux, and pressure; and (2) the testing laboratory, which is under constant challenge to identify manmade materials and treatments. More than 1,750 entries are arranged in the alphabetical order of mineral species. However, garnet-type synthetics such as yttium-aluminum garnet (YAG) and gadolinium-gallium garnet (GGG) are grouped together, as are double, triplets, and information about synthesis in general. Treatments such as irradiation, staining, coating, and heating are also covered. Each entry gives the color, type, manufacturer, identification data, and the name and date of the publication or patent describing it. The abstracted journals and monographs are worldwide and date from the 1880's.[25]

For many years it was said that opal could not be synthesized. However, synthetics are now available from several sources. When the synthetics first came on the market, gemologists had to develop methods of differentiating them from natural opals. One of the first indications was that synthetic opals were too perfect as compared with most natural opals, but better methods were necessary. A series of tests was devised and are presented to assist in the identification of synthetic opal.[26]

Faceting may be described as the technique of cutting a gem stone with a number of flat polished surfaces arranged in a given pattern and at predetermined angles. The main reason for faceting a stone is that this style of cutting takes advantage of the inherent brilliance of the material being cut. The amount of brilliance a gem shows depends on the quantity of light reflected from its surface and, even more important, the amount of internal reflection. Faceted gems are usually cut from transparent materials to take advantage of their property of reflecting light. Even though stones are faceted primarily for their brilliance, many of the more valuable stones are cut for their color. If color is the main feature, even if a stone has just a little potential brilliance, it will look better faceted. The potential brilliance of a gem is very important in determining the style of cut that will help the stone achieve its potential brilliance. There are two basic styles of cuts—the brilliant and the step (or emerald) cut. Brilliant cuts are preferred for stones having a high refractive index and a high dispersion; the step cut is effective for colored gems having a low to medium refractive index. The evaluation of equipment, materials, methodology, and techniques were discussed in a recent publication.[27]

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