GEM STONES

By Gordon T. Austin[1]

Production value of natural gem materials in the United States during 1988 increased about 103% to $43.5 million. The materials produced included faceting rough, lapidary rough, carving material, specimen material, natural and cultured freshwater pearls, mother of pearl, and coral.

The combined production value of synthetic and simulant gem materials was reported to be $16.3 million, about a 7% increase over that of 1987. Synthetic gems are manmade and have the same optical, physical, and chemical properties and the same appearance as the natural gem that they represent. Synthetic gem materials produced in the United States include alexandrite, coral, diamond, emerald, garnet, lapis lazuli, quartz, ruby, sapphire, spinel, and turquoise. Simulants are manmade gem materials that have an appearance similar to that of a natural gem material but have different optical, physical, and chemical properties. The gem simulants produced in the United States include coral, cubic zirconia, lapis lazuli, malachite, and turquoise. Additionally, certain colors of synthetic sapphire and spinel, used to represent other gem stones, would be classed as simulants. Cubic zirconia is the major simulant and is produced in both colored and colorless varieties.

The gem materials were sold to wholesale and retail outlets, in gem and mineral shops, at gem and mineral shows, to cutting factories, and to jewelry manufacturers.

DOMESTIC DATA COVERAGE

Estimates of U.S. production were developed by the Bureau of Mines from the "Gems and Gem Stones Survey," a voluntary survey of U.S. operations, and from Bureau estimates of unreported production. Of the approximately 300 operations to which a survey request was sent, 82% responded, accounting for about 95% of the total production, 92% of the natural production, and 100% of the synthetic and simulant production.

The 300 operations surveyed in 1988 were an increase of about 14% compared with the number of operations surveyed in 1987. The response rate was essentially unchanged. Production by nonresponding operations, by professional collectors, and by amateur or hobbyist collectors was estimated by the Bureau. These estimates were based on information from published data, conversations with gem and mineral dealers, analyses of gem and mineral shows and sales statistics, and from information informally supplied by collectors. In the formal voluntary survey and the informal surveys, the Bureau is totally dependent upon the cooperation of the producers, brokers, dealers, and collectors. Individuals and companies have been very cooperative and forthcoming with information. The Bureau is very appreciative of this cooperation.

DOMESTIC PRODUCTION

Each of the 50 States produced at least $1,000 worth of gem materials. Ten States accounted for 95% of the total value of natural gem material produced. The States, in order of declining value of production, with their 1987 standing shown in parenthesis, were Tennessee (1), California (2), Arizona (3), Arkansas (4), Montana (5), Oregon (10), North Carolina (7), Idaho (8), Missouri (9), and Utah (19). Certain States were known for the production of a single gem material, i.e., Tennessee for freshwater pearls and Arkansas for quartz, whereas other States produced a wide variety of gem materials. Arizona is best known for the widest variety of gem materials. Production included agate, amethyst, antlerite, azurite, chrysocolla, fire agate, garnets, jade, malachite, onyx, peridot, petrified wood, precious opal, shattuchite, smithsonite, and turquoise. California, Idaho, Montana, and North Carolina also produced a wide variety of gem materials. North Carolina was the only State to have produced all four of the major gems: diamond, emerald, ruby, and sapphire.

The average production value of natural gem materials for the past 10 years was $12.5 million per year, with a high of $43.5 million in 1988 and a low of $6.9 million in 1980. The value of production for the past 10 years must be separated into two trends. The first trend was the period between 1979 and 1985, during which time approximately 24 producers were surveyed. Production averaged $7.5 million per year and was generally level. The second trend, 1986 to the present, production averaged $24.2 million and was the result of an increase of 1,150% in the number of producers surveyed.

The reported production value of synthetic and simulant gem materials was $16.3 million in 1988. The reported value of production increased 7%, however, the quantity of materials produced was significantly greater. A shift in the types of materials produced, primarily a change from colored cubic zirconia to colorless cubic zirconia, resulted in the production of lower value material. Thirteen firms, five in California, four in Arizona, and one each in Massachusetts, Michigan, New Jersey, and Ohio, produced synthetic and simulant gem material. The six States, in order of declining value of production, were Massachusetts, California, New Jersey, Michigan, Ohio, and Arizona.

Dia Em Resources Ltd. and LKA International Inc. completed the evaluation of their Rist and Ellis Emerald Mines at Hiddenite, NC. Using the beryllometer designed and built by LKA to assist in sorting emeralds from waste materials, approximately 3,000 carats of emerald was recovered. Analysis of all of the data collected indicated that the property did not have the

degree of commercial viability required by LKA to continue to the next phase of the project. LKA plans to dispose of the property in 1989. It announced plans to also sell the two largest emerald crystals ever found in the United States, the 1,438-carat Stephenson and the 1,686.3-carat LKA crystal.

A 0.25-carat diamond was recovered during testing of a bulk ore sample from a North Carolina placer gold mine. The stone, positively identified by a mineralogist, was of industrial grade. The diamond was the seventh largest found in North Carolina, the largest being 4.33 carats. A company geologist stated that the find was interesting, but would not change the company's approach to the project.

The Dow Chemical Co. sold its 6-year-old diamond exploration project in the Upper Peninsula of Michigan to Crystal Exploration Inc. of Denver, CO, a subsidiary of Restech International Ltd. of Sydney, Australia. Dow discovered seven kimberlite pipes, and core drilling yielded a scattering of sand-grain-size diamonds. The diamonds were too few and too small for commercial production. A Dow spokesperson stated that more exploration and mining expertise was needed and that Dow was not a hard-rock mining company. Dow retained an option to take part in the exploration and development and to share in any profits.

Amselco Exploration Inc., a subsidiary of British Petroleum Co. of Canada, and Exmin Corp., a subsidiary of the Belgian company Sibeka (Société d'Entreprises et d'Investissements S.A.), continued exploration for diamonds on leased lands in Michigan and Wisconsin. Exmin continued diamond exploration efforts in Minnesota.

Three firms continued their diamond exploration project in the State Line District on the Colorado-Wyoming border.

The Diamond Mining Task Force, appointed in 1986 by the Arkansas Governor to assist the State Parks, Recreation, and Travel Commission in determining if commercial diamond mining would be allowed at the Crater of Diamonds State Park, recommended preliminary tests of the Park to determine the size of the reserve. Whether the area will be tested is up to the State Parks, Recreation, and Travel Commission. The recommended tests included drilling 10 angled core holes, about 2.5 inches in diameter and 850 feet long. The recommendations set a $350,000 price tag on the testing and stated that funding should come from private sources. Sunshine Mining Co., which started a joint venture called Arkansas Diamond Development Co., proposed to conduct an estimated $3 million in geological testing without any written guarantee that they will receive a commercial contract to mine diamonds. At yearend, studies were under way and no decisions had been made concerning the mining project.

Recent mining on private land at Opal Butte in Morrow County, OR, approximately 35 miles south of Heppner, produced a wide variety of very fine-quality opals. The varieties produced included hyalite, rainbow, contra luz, hydrophane, crystal opal, fire opal, blue opal, and dendritic opal. The opal occurs in rhyolite geodes in a decomposed perlite.[2]

A number of mines in southern Oregon started producing gem labordorite feldspar in 1988. The material comes in a wide range of colors, including yellow (the most common), pink, peach, salmon, red-orange, red-green, blue-green, and bicolored red and green. The best red faceting-grade material cuts some of the finest gem feldspar available. The mines also produce sunstone, a feldspar with schiller that is caused by millions of microscopic copper platelets on the cleavage planes of the feldspar. Sunstone is the State gem stone of Oregon.

American Pearl Farms of Tennessee completed its second significant harvest of cultured freshwater pearls. American currently has five pearl farms under operation and acquired additional water acreage for a sixth farm to be established during 1989. The new farm is planned to be nine times larger than the existing farms.

During December 1988, the largest and heaviest faceted gem stone ever cut was completed by a U.S. cutter. The 36,853-carat champagne colored topaz was cut from a 46-pound crystal mined in Brazil. The stone was cut in a diamond shape that was 13.75 inches long, 6.13 inches thick, and 4.75 inches wide. This was the third consecutive year in which record-size gem stones were cut in the United States. The unnamed stone was displayed for the first time at the Tucson Gem and Mineral Show in Tucson, AZ. The stone was offered for sale at $3 a carat, a total asking price of $110,600.

CONSUMPTION

Domestic gem materials production was consumed in commercial and amateur manufacture of jewelry, in gem and mineral collections, and in the production of objects of art. The value of U.S. apparent consumption was estimated to be a record high $3,703 million, an increase of about 7%. The average annual estimated consumption for the past 10 years was $2,506 million, with a high of $3,703 million in 1988 and a low of $1,238 million in 1979. The trend of estimated consumption for the past 10 years was one of continued growth with about 199% increase or an annual compounded growth rate of about 13%.

The U.S. estimated apparent consumption of diamonds increased about 25% in quantity and value to 8.3 million carats and $3.1 billion, respectively. The average annual apparent consumption of diamonds for the past 10 years was 4.6 million carats, with a high of 8.3 million carats in 1988 and a low of 1.2 million carats in 1981. The trend for apparent consumption, quantity and value, for the past 10 years was

one of significant increase. Apparent consumption of diamonds increased about 153% in quantity and 216% in value over that period.

The estimated apparent consumption of colored stones, led by emerald, ruby, and sapphire, was valued at $353.8 million, an increase of 18%. The annual average consumption of colored stones for the past 7 years was valued at $316.3 million, with a high of $361.0 million in 1984 and a low of $252.4 million in 1982. The trend for apparent consumption of colored stones for the past 7 years was one of fluctuating increases and decreases, but the general tread was one of increased consumption.

The estimated apparent consumption of pearls—natural, cultured, and imitations—was $168.9 million, an increase of about 5%. This was the first increase after 3 years of decreases from the 7-year high in 1984. The value was about 82% greater than the 7-year low in 1982, but was about 7% less than the 7-year average of $181.8 million per year.

Estimated apparent consumption of synthetic and imitation gem materials decreased about 5% to $105.9 million. Average apparent consumption of synthetic and imitation gem materials for the past 7 years was $65.2 million, with a high of $109.1 million in 1987 and a low of $29.9 million in 1979. The trend for apparent consumption for the past 7 years was one of generally strong growth. Apparent consumption increased about 251% over the 7 years or averaged an annual compounded rate of growth of about 23% a year during the period.

It was estimated by the American Diamond Industry Association that U.S. jewelers sold 19.8 million pieces of diamond jewelry worth a total of $11.3 billion during 1988.

PRICES

The average U.S. wholesale asking price of the top 25 grades (D–H color and IF through VS_2 clarity) of a 1-carat diamond fluctuated between $6,200 and $7,000 and was $7,000 at yearend. The average value per carat of all grades, sizes, and types of gem-quality diamonds consumed in the United States, based on 1988 estimated apparent consumption, was $373, unchanged from that of 1987. The average value of diamonds consumed in the United States for the past 10 years, based on the estimated annual apparent consumption, was $490 per carat, with a high of $1,128 per carat in 1981 and a low of $298 per carat in 1979. The trend for the average annual value of diamonds consumed for the past 10 years was one of rapid increase from the 10-year low in 1979 to the 10-year high in 1981 followed by a general decline until an apparent stabilization in 1987.

The average yearend wholesale purchase price of a fine-quality 1-carat ruby, paid by retail jewelers on a per stone or memo basis, was $3,500, an increase of 17%. The average value of all rubies imported into the United States increased 19% to $30.06 per carat. The average annual value of all rubies imported into the United States for the past 7 years was $24.31 per carat, with a high of $34.04 per carat in 1982 and a low of $16.42 per carat in 1984. The trend for the value of ruby imports for the past 7 years was one of rapid decline, 52% for the period from 1982 to 1984. This was followed by a steady, moderate increase of 16% annual recovery.

The average yearend wholesale purchase price of a fine-quality 1-carat sapphire, paid by retail jewelers on a per stone or memo basis, was $1,400, an increase of 33%. The average value of all sapphires imported into the United States decreased 17% to $23.22 per carat. The average annual value of all sapphires imported into the United States for the past 7 years was $20.66 per carat, with a high of $27.97 per carat in 1987 and a low of $18.50 per carat in 1984. The trend for the value of sapphires imports for the past 7 years was one of fluctuating increases and decreases with the 1988 value ending the 7-year period about 5% below the beginning value in 1982.

The average yearend wholesale purchase price of a fine-quality 1-carat emerald, paid by retail jewelers on a per stone or memo basis, was $2,600, an increase of 8%. The average value of all emeralds imported into the United States increased 15% to $78.79 per carat. The average annual value of all emeralds imported into the United States for the past 10 years was $54.99 per carat, with a high of $78.79 per carat in 1988 and a low of $35.06 per carat in 1984. The trend for the value of emerald imports for the past 10 years was one of fluctuating increases and decreases from 1979 through 1984 followed by a steady moderate growth resulting in the 1988 average value being about 71% greater than 1979.

FOREIGN TRADE

Export value of all gem materials increased 36% to $1,010 million, the first time ever that exports have exceeded a billion dollars. The quantity of diamonds exported was essentially unchanged at 590,412 carats, however, the value of exports increased about 38% to $908.9 million. The average annual quantity of diamonds exported for the past 10 years was 369,264 carats, with a high of 590,412 in 1988 and a low of 184,871 in 1982. The trend for the quantity of diamonds exported for the past 10 years was one of moderate decline, 13%, during the first 4 years, followed by significant growth, 219%, from the low in the period from 1982 to 1988. The average annual value of diamond exports for the past 10 years was $521.6 million, with a high of $908.9 million in 1988 and a low of $292.8 million in 1982. The trend for the value of diamond exports for the past 10 years was one of significant decline, 113%, over 4 years, followed by 3 years of moderate growth, 32%, leading to 3

TABLE 1

PRICES OF U.S. CUT DIAMONDS, BY SIZE AND QUALITY

Carat weight	Description, color[1]	Clarity[2] (GIA terms)	Price range per carat[3] Jan. 1988–Jan. 1989	Average[4] July 1988
0.25	G	VS1	$1,100–$1,300	$1,300
.25	G	VS2	950– 1,100	1,100
.25	G	SI1	800– 880	880
.25	H	VS1	950– 1,100	1,100
.25	H	VS2	900– 1,000	1,000
.25	H	SI1	780– 860	860
.50	G	VS1	2,300– 2,500	2,500
.50	G	VS2	2,100– 2,300	2,300
.50	G	SI1	1,800– 1,900	1,900
.50	H	VS1	2,200– 2,300	2,300
.50	H	VS2	2,000– 2,100	2,100
.50	H	SI1	1,700– 1,800	1,800
.75	G	VS1	2,600– 3,000	2,900
.75	G	VS2	2,500– 2,700	2,700
.75	G	SI1	2,200– 2,300	2,300
.75	H	VS1	2,400– 2,600	2,600
.75	H	VS2	2,200– 2,300	2,300
.75	H	SI1	2,000– 2,100	2,100
1.00	G	VS1	4,200– 4,600	4,600
1.00	G	VS2	3,700– 4,100	4,100
1.00	G	SI1	3,200– 3,500	3,500
1.00	H	VS1	3,700– 4,100	4,100
1.00	H	VS2	3,300– 3,600	3,600
1.00	H	SI1	3,900– 3,200	3,200

[1] Gemological Institute of America (GIA) color grades: D—colorless; E—rare white; H–I—traces of color.
[2] Clarity: IF—no blemishes; VVS1—very, very slightly included; VS—very slightly included; VS2—very slightly included, but more visible; SI1—slightly included.
[3] Jeweler's Circular-Keystone. V. 159, No. 2, Feb. 1989.
[4] Jeweler's Circular-Keystone. V. 154, No. 2, Aug. 1988.

TABLE 2

PRICES OF U.S. CUT COLORED GEM STONES, BY SIZE[1]

Gem stone	Carat weight	Price range per carat in 1988[2]	Average price per carat[2]	
			Jan. 1988	Jan. 1989
Amethyst	1	$6– $10	$8	$8
Aquamarine	1	100– 250	175	175
Emerald	1	1,800–3,000	2,400	2,600
Garnet, tsavorite	1	700–1,200	950	650
Ruby	1	2,500–3,500	3,000	3,500
Sapphire	1	600–1,500	1,050	1,400
Tanzanite	1	275– 450	354	300
Topaz	1	6– 9	7.50	9
Tourmaline, red	1	60– 125	92.50	92.50

[1] Fine quality.
[2] Jewelers' Circular-Keystone. V. 159, No. 2, Feb. 1989, p. 399. These figures represent a sampling of net prices that wholesale colored stone dealers in various U.S. cities charged their cash customers during.

years of significant growth, 136%, which resulted in a record-high year in 1988.

Exports of other precious and semiprecious stones, cut but unset, increased about 51% to $68.5 million. The average annual export value for the past 7 years for cut but unset natural gem stones, other than diamonds and pearls, was $38.8 million, with a high of $68.5 million in 1988 and a low of $27.7 million in 1984. The 7-year trend for the export value of these gem materials was one of fluctuating increases and decreases, but resulted in a significant overall increase of 131% for the period. Exports of the same types of gem materials, except as uncut and unset, increased 15% to $24.2 million. The average annual value of exports for the past 7 years was $16.9 million, with a high of $24.2 million in 1988 and a low of $12.2 million in 1985. The 7-year trend for the value of exports was one of 4 years of moderate, 29% decline, followed by 3 years of significant, 98% growth, which resulted in an overall growth of 58% for the period.

Exports of synthetic gem material, cut and uncut but not set, increased slightly to $6.0 million. The average annual value of exports for the past 7 years was $5.2 million, with a high of $7.7 million in 1982 followed by a low of $3.7 million in 1983. The 7-year trend for the value of exports was one of extreme decline, 52%, from 1982 to 1983; followed by a steady, moderate growth, 62%, over the next 5 years.

Exports of natural, cultured, and imitation pearls, not set or strung, increased about 22% to $2.2 million.

Reexports of gem material increased 10% to $407.9 million. The quantity of diamonds reexported decreased about 21% to 1.5 million carats, the third lowest amount in the past 10 years. However, the value of diamonds exported increased about 4% to $319.0 million. The average annual quantity of diamonds reexported for the past 10 years was 1.9 million carats, with a high of 3.0 million carats in 1981 and a low

of 1.0 million in 1979. The 10-year trend for the quantity of diamonds reexported was highly mixed. The period started with an extreme increase, 207%, through 1981, followed by a moderate decline, 37%, through 1984, followed by 3 years of essentially level reexports, leading to the most recent decline in 1988. The average annual value of reexported diamonds for the past 10 years was $295.4 million, with a high of $412.8 million in 1981 and a low of $186.0 million in 1985. The 10-year trend for the value of reexports was one of extreme increase, 58%, for 1979–82, moderate decline, 55%, for the next 4 years, followed by 3 years of significant increase, 72%, which resulted in the average annual value ending the period 22% greater than it started.

The reexports of natural gem materials, cut but not set, other than diamonds and pearls, increased about 37% to $55.1 million, a record high for the 7-year period for which data were available. The average annual value of reexports for the past 7 years was $37.1 million, with a high of $55.1 million in 1988 and a low of $22.9 million in 1985. The 7-year trend for the value of reexports was one of alternating decreases and increases with the increases prevailing and resulting in a 70% rise in value during the period. The reexports of natural gem materials, not cut or set, other than diamonds and pearls, increased about 1,600% to $22.2 million. The extremely large increase was most likely the result of reexporting uncut colored stones to worldwide cutting centers for cutting and reexport to the United States as finished gems. The average annual value of reexports for the past 7 years was $12.2 million, with a high of $22.2 million in 1988 and a low of $1.3 million in 1987. The 7-year trend for the value of reexports was one of extreme increases and decreases, with the value at the end of the period increasing by 192%. Reexports of natural, cultured, and imitation pearls and synthetic gem materials was $11.3 million and $0.3 million, respectively.

The value of all gem materials imported increased about 24% to $5,063 million. The value of imported gem diamonds accounted for about 85% of the total. The value of imported gem diamonds increased 26% to a record high $4,306 million. The increase in the value of cut diamonds imported accounted for 81% of the total dollar increase. The average annual value of imports for the past 10 years was $2,330 million, with a high of $4,306 million in 1988 and a low of $1,859 million in 1979. The 10-year trend for the value of diamond imports was one of generally steady continuous growth with an increase of 132% for the period. During the period, the value of imported uncut diamonds increased 72%, while the value of imported cut stones increased 869%.

TABLE 3

U.S. EXPORTS AND REEXPORTS OF DIAMOND (EXCLUSIVE OF INDUSTRIAL DIAMOND), BY COUNTRY

Country	1987		1988	
	Quantity (carats)	Value[1] (millions)	Quantity (carats)	Value[1] (millions)
Exports:				
Belgium	162,009	$122.9	163,246	$142.4
Canada	24,943	17.8	24,104	18.4
France	1,943	4.3	7,946	11.4
Germany, Federal Republic of	3,842	4.0	3,736	4.7
Hong Kong	100,365	148.2	92,067	208.1
Israel	172,634	110.8	169,433	137.9
Japan	62,404	144.1	74,566	196.2
Singapore	5,686	7.0	5,135	9.2
Switzerland	30,161	76.3	23,929	141.9
Thailand	14,028	9.3	16,082	12.2
United Kingdom	4,151	8.2	3,641	20.6
Other	5,221	7.5	6,527	5.9
Total	**587,387**	**660.4**	**590,412**	**908.9**
Reexports:				
Belgium	1,184,952	101.1	833,081	104.4
Canada	5,424	.8	5,855	1.2
China	2,062	.1	14,009	.3
Germany, Federal Republic of	24,840	2.6	31,236	2.6
Hong Kong	82,491	27.2	34,682	19.6
India	84,893	2.9	139,684	5.0
Israel	199,579	70.3	137,820	65.9
Japan	95,919	7.2	114,904	10.2
Netherlands	47,313	3.2	89,000	9.4
Switzerland	39,765	57.7	34,234	77.5
United Kingdom	101,300	18.4	26,929	12.6
Other	74,333	16.2	83,026	10.3
Total	**1,942,871**	**307.7**	**1,544,460**	**319.0**

[1] Customs value.

Source: Bureau of the Census.

The value of imports for all other gem materials, led by emerald, ruby, and sapphire, increased 14% to $757.6 million. Emerald imports increased about 23% to $174.6 million. The average annual value of emerald imports for the past 10 years was $139.5 million, with a high of $174.6 million in 1988 and a low of $105.1 million in 1979. The 10-year trend for the value of emerald imports was one of fluctuating increases and decreases resulting in a 66% increase for the period.

The value of ruby imports increased 21% to $72.0 million, the fifth highest value in the past 10 years. The 10-year average annual value of imports was $70.6 million, with a high of $93.8 million in 1981 and a low of $30.0 million in 1979. The 10-year trend of import values was one of extreme fluctuations. The period ended with values having increased 140%, but were still 23% below the high for the period. The value of sapphire imports increased 10% to $81.5 million, the fifth highest value in the past 10 years. The 10-year average annual value of sapphire imports was $71.1 million, with a high of $95.1 million in 1986 and a low of $24.2 million in 1979. The 10-year trend for the value of imports was one of extremely fluctuating increases and decreases. The period ended with the value 237% greater than at the beginning, but still 14% below the high for the period.

The value of imported gem materials, other than diamond, emerald, ruby, and sapphire, increased 10% to $429.5 million. The average annual value of imports was $315.8 million, with a high of $429.5 million in 1988 and a low of $153.3 million in 1979. The 10-year trend for the value of imports was one of fluctuating increases and decreases resulting in an overall increase of 180% for the period.

WORLD REVIEW

De Beers Consolidated Mines Ltd.'s

TABLE 4

U.S. IMPORTS FOR CONSUMPTION OF DIAMOND, BY KIND, WEIGHT, AND COUNTRY

Kind, range, and country of origin	1987		1988	
	Quantity (carats)	Value[1] (millions)	Quantity (carats)	Value[1] (millions)
Rough or uncut, natural:[2]				
Belgium	323,742	$82.0	305,142	$111.8
Brazil	44,287	5.4	349,461	10.7
Israel	28,029	7.3	38,734	8.2
Netherlands	2,930	2.9	57,791	7.9
South Africa, Republic of	37,870	28.7	48,515	44.9
Switzerland	5,185	12.6	14,307	8.2
United Kingdom	797,759	208.3	619,461	317.5
Venezuela	7,901	.7	684	.1
Other	121,657	72.1	210,203	79.3
Total	**1,369,360**	**420.0**	**1,644,298**	**588.6**
Cut but unset, not over 0.5 carat:				
Belgium	1,307,990	468.2	1,035,452	406.7
Brazil	33,352	8.7	34,554	13.7
Canada	21,750	8.8	9,156	4.1
Hong Kong	241,251	41.8	285,268	63.1
India	3,198,504	670.8	3,758,747	886.1
Israel	1,511,724	629.8	1,109,474	532.8
Netherlands	51,959	13.6	27,588	26.8
South Africa, Republic of	14,461	11.8	5,532	5.1
Switzerland	73,268	40.3	76,169	36.8
United Kingdom	18,321	15.8	23,406	22.9
Other	144,708	33.3	160,707	37.9
Total	**6,617,288**	**1,942.9**	**6,526,053**	**2,036.0**
Cut but unset, over 0.5 carat:				
Belgium	384,789	380.1	709,527	578.9
Hong Kong	12,361	21.3	59,949	40.1
India	110,019	28.0	386,422	111.3
Israel	468,132	406.1	906,752	675.2
Netherlands	8,403	11.6	7,859	12.9
South Africa, Republic of	27,654	41.3	22,762	40.6
Switzerland	37,583	81.7	24,281	95.1
United Kingdom	29,155	42.6	17,546	45.3
Other	56,345	47.5	92,028	81.8
Total	**1,134,441**	**1,060.2**	**2,227,126**	**1,681.2**

[1] Customs value.
[2] Includes some natural advanced diamond.

sales of uncut diamonds through the Central Selling Organization in 1988 were reported to be a record $4.17 billion compared with $3.07 billion in 1987, an increase of approximately 36%. Sales of colored gem stones also remained very strong.

Emerald was mined in Australia, Brazil, Colombia, India, Mozambique, Pakistan, the Republic of South Africa, the U.S.S.R., Zambia, and Zimbabwe. Sapphire was produced in Australia, Colombia, Kenya, Malawi, Nigeria, Sri Lanka, Tanzania, Thailand, and the United States. Aquamarine was produced in Afghanistan, Brazil, China, India, Nigeria, Pakistan, the Republic of South Africa, Tanzania, the United States, and Zambia. Ruby was produced in Afghanistan, Burma, India, Kenya, Sri Lanka, Tanzania, Thailand, and the United States.

Angola

Endiama, the Government-owned and operated diamond mining company, signed an agreement with Lazare-Kaplan International (LKI) of New York that allows LKI to export to the United States $20 million per year of Angolan rough diamonds. Endiama is marketing diamonds through a total of five rough dealers: LKI, Industrial Diamond Corp. of London, and three Antwerp firms, George Evens, Arslanian Freres, and IDH Diamonds.

The leaders of the Angolan UNITA movement announced the discovery of huge deposits of diamonds in the areas of Cuado and Cubango. The spokesperson stated that the deposits were in the firm control of UNITA and that they plan to develop the deposits as soon as possible.

Australia

Freeport Bow River Properties Inc., the operating company of the Freeport-McMoRan Australia Ltd. and Gem Exploration and Minerals Ltd. joint venture, started production from the Bow River alluvial diamond project. Diamond output was about 480,000

TABLE 5

U.S. IMPORTS FOR CONSUMPTION OF NATURAL PRECIOUS AND SEMIPRECIOUS GEM STONES, OTHER THAN DIAMOND, BY KIND AND COUNTRY

Kind and country	1987		1988	
	Quantity (carats)	Value[1] (millions)	Quantity (carats)	Value[1] (millions)
Emerald:				
Belgium	30,190	$3.9	11,963	$5.6
Brazil	112,194	7.0	80,199	6.4
Colombia	195,403	44.6	243,521	63.8
France	8,401	1.9	13,817	3.2
Germany, Federal Republic of	38,034	3.9	34,376	2.4
Hong Kong	170,853	15.2	135,384	14.7
India	1,231,033	17.0	1,205,636	20.4
Israel	60,942	19.4	89,399	24.7
Japan	5,637	.6	20,102	1.0
South Africa, Republic of	5	(2)	4	(2)
Switzerland	58,789	18.3	65,021	20.6
Taiwan	3,697	(2)	256	(2)
Thailand	104,058	3.0	216,501	3.8
United Kingdom	7,652	2.2	8,026	2.9
Other	48,032	4.6	91,701	5.1
Total	**2,074,920**	**141.6**	**2,215,906**	**174.6**
Ruby:				
Belgium	12,078	.7	8,926	1.3
Brazil	3,102	(2)	4,945	.2
Colombia	3,198	(2)	258	(2)
France	6,219	1.6	5,885	3.4
Germany, Federal Republic of	18,267	.8	26,530	1.0
Hong Kong	42,687	3.6	47,152	4.6
India	302,323	.9	318,575	1.1
Israel	7,043	.6	38,593	1.6
Japan	335,381	.5	11,572	.8
Switzerland	41,492	14.1	40,183	11.6
Thailand	1,536,723	31.4	1,822,557	40.5
United Kingdom	11,523	2.9	8,443	3.6
Other	37,781	2.3	61,703	2.3
Total	**2,357,817**	**58.7**	**2,395,322**	**72.0**
Sapphire:				
Australia	—	—	2,883	.2
Austria	1,000	(2)	603	(2)
Belgium	21,356	1.2	20,024	.9
Brazil	2,580	(2)	9,528	.2
Canada	6,905	.7	16,177	.9
Colombia	2,234	(2)	1,398	(2)
France	7,048	1.1	46,296	2.3
Germany, Federal Republic of	12,067	1.6	26,750	1.0

See footnotes at end of table.

TABLE 5—Continued

U.S. IMPORTS FOR CONSUMPTION OF NATURAL PRECIOUS AND SEMIPRECIOUS GEM STONES, OTHER THAN DIAMOND, BY KIND AND COUNTRY

Kind and country	1987		1988	
	Quantity (carats)	Value[1] (millions)	Quantity (carats)	Value[1] (millions)
Hong Kong	63,684	$5.4	123,689	$5.8
India	84,973	.5	149,488	1.2
Israel	14,254	1.1	8,931	1.1
Japan	48,460	.4	22,662	.6
Korea, Republic of	9,793	(2)	6,438	(2)
Singapore	7	(2)	4,705	.2
Sri Lanka	55,241	3.1	39,259	2.4
Switzerland	46,786	11.3	32,446	10.2
Thailand	2,121,376	42.7	2,878,129	50.2
United Kingdom	110,112	3.9	10,102	2.9
Other	37,847	1.0	110,301	1.4
Total	**2,645,723**	**74.0**	**3,509,809**	**81.5**
Other:				
Rough, uncut:				
Australia		.8		.9
Brazil		20.7		29.7
Colombia		5.5		2.4
Hong Kong		1.4		.5
Nigeria		.2		.2
Pakistan	NA	1.2	NA	1.0
South Africa, Republic of		.3		4.8
Switzerland		.1		1.7
United Kingdom		(2)		.6
Zambia		.1		.9
Other		3.8		5.5
Total	**NA**	**34.1**	**NA**	**48.2**
Cut, set and unset:				
Australia		6.1		12.6
Brazil		17.2		18.6
Canada		.6		.4
China		2.7		2.3
Germany, Federal Republic of		13.7		15.8
Hong Kong		28.7		27.4
India	NA	5.7	NA	5.1
Japan		128.8		144.5
Switzerland		3.0		3.1
Taiwan		11.1		11.3
Thailand		11.7		14.2
United Kingdom		1.0		1.7
Other		21.2		17.7
Total	**NA**	**251.5**	**NA**	**274.7**

NA Not available.
[1] Customs value.
[2] Less than 1/10 unit.

Source: Bureau of the Census.

TABLE 6

VALUE OF U.S. IMPORTS OF SYNTHETIC AND IMITATION GEM STONES, INCLUDING PEARLS, BY COUNTRY

(Million dollars)[1]

Country	1987	1988
Synthetic, cut but unset:		
Austria	1.3	2.0
France	.8	.6
Germany, Federal Republic of	9.2	9.1
Japan	1.8	2.1
Korea, Republic of	11.6	8.1
Switzerland	4.6	6.0
Other	5.0	5.6
Total	**34.3**	**33.5**
Imitation:		
Austria	50.7	49.4
Czechoslovakia	2.1	2.7
Germany, Federal Republic of	7.1	6.7
Japan	3.7	4.6
Other	8.0	6.2
Total	**71.6**	**69.6**

[1] Customs value.

Source: Bureau of the Census.

carats. The diamond production was about 20% gem quality, 70% near-gem quality, and 10% bort.

Argyle Diamond Mines Pty. Ltd.'s annual diamond production from the AK-1 pipe increased by nearly 14% to a record 34,553,724 carats. Argyle's annual production accounted for about 37% of the world's production of natural diamonds. Additional deposits of alluvial diamonds in the lower reaches of the Smoke and Limestone Creeks that drain the AK-1 pipe add about 60 million carats to Argyle's resources. Mining of these alluvial diamonds is scheduled to begin in 1989, annual production is projected to be about 2 million carats. Argyle Diamond Sales Ltd. announced the sale of a brilliant-cut 1.51-carat purple-red diamond for an Australian record price of $1 million per carat. The diamond was cut in Perth.

TABLE 7

U.S. IMPORTS FOR CONSUMPTION OF PRECIOUS AND SEMIPRECIOUS GEM STONES

(Thousand carats and thousand dollars)

Stones	1987		1988	
	Quantity	Value[1]	Quantity	Value[1]
Diamonds:				
Rough or uncut	1,369	$420,004	1,644	$588,611
Cut but unset	7,752	3,003,090	8,753	3,717,151
Emeralds: Cut but unset	2,075	141,575	2,216	174,623
Coral: Cut but unset, and cameos suitable for use in jewelry	NA	3,060	NA	2,967
Rubies and sapphires: Cut but unset	5,004	133,396	5,905	153,552
Marcasites		766		1,229
Pearls:				
Natural	NA	3,879	NA	3,389
Cultured	NA	151,854	NA	171,693
Imitation	NA	6,259	NA	7,198
Other precious and semiprecious stones:				
Rough, uncut	NA	34,079	NA	48,186
Cut, set and unset	NA	78,215	NA	79,056
Other	NA	13,716	NA	19,795
Synthetic:				
Cut but unset	82,697	30,958	81,096	28,995
Other	NA	3,358	NA	4,485
Imitation gem stone	NA	65,311	NA	62,404
Total	**XX**	**4,089,520**	**XX**	**5,063,334**

NA Not available. XX Not applicable.
[1] Customs value.

Source: Bureau of the Census.

Gem Exploration Ltd. reported success in a sampling program for the Kununurra project in Western Australia. Four alluvial diamonds weighing 1.42 carats were recovered from ancient alluvial deposits of the Ord River. The stones discovered included both gem and industrial quality.

Capricorn Resources Australia NL launched Australia's first underwater diamond exploration project. Using crocodile- and shark-proof cages to protect the divers, underwater work was started in the Joseph Bonaparte Gulf off the north coast of Western Australia. The company believes that diamonds from the Argyle and Bow River areas have washed into the gulf. To date the divers have recovered four diamonds averaging 0.27 carat from samples taken from the seabed.

Max Resources NL was preparing to develop a diamond prospect at Nullagine, about 200 kilometers southwest of Port Hedland. Nullagine would become Australia's third diamond mine. Annual production is projected to be 138,000 carats, of which 60% will be gem quality.

The value of sapphires exported from Australia increased by about 23% to $24.6 million. Sapphires were mined in the Anakie District and Lava Plains in Queensland, and in the New England District of New South Wales. The production value of opals increased about 17% to $97 million. Most of the increase was due to increased production from the Sheepyard Field, which started production in 1987. Australia also produced agate, amethyst, aquamarine, chrysoprase, garnet, peridot, rhodonite, and zircon; the export value of these materials increased 28% to $8.7 million.[3] Australia also produces the Pool Emerald, a laboratory grown hydrothermal emerald that was recrystallized from emerald from the Emerald Pool Mine in Western Australia.

Belgium

The total value of diamond imports and exports was about $12.4 billion, a record for any diamond center. Antwerp was the largest trading center.

Botswana

Debswana, the operator of the diamond mining joint venture between De Beers and the Botswana Government, announced plans to build a new diamond processing plant at the Jwaneng Mine. The plant would recover diamonds too small to be recovered by old methods. Annual production should increase about 10% from the present production of about 7.6 million carats.

Brazil

Brasaust Mineracal, the Brazilian subsidiary of the Australian companies Gem Exploration and Minerals and Titan Resources, completed the first phase of a bulk sampling program of the Estrela do Sul diamond project in Minas Gerais State. Of 20 samples totaling 574 cubic meters, 2 samples with a combined volume of 35.4 cubic meters yielded 8 diamonds weighing 3.75 carats. The best sample returned an equivalent grade of 11.8 carats per 100 cubic meters. A total of 1,290 cubic meters of material was collected from

the palaeo-conglomerate.

Canada

Monopros Ltd., a subsidiary of De Beers, announced the discovery of a kimberlite near Prince Albert, Saskatchewan. Monopros conducted a bulk sampling program, but has not revealed the results. Rumors circulated that Monopros had exposed a diamond pipe on its property and that overburden removal could reveal additional potential. Other major companies have established large land positions in the area.

China

It was reported the Mount Yimeng area in Shandong Province has an estimated 11.2 million carats of diamond reserves, the largest of any Province in China. Two Government-owned mines currently operate in the area producing a total of 30,000 carats per year. Five of the largest diamonds discovered in China have come from this area.

Construction was started in northeast China on the country's largest diamond mine. Located in Wafangdian, Liaoning Province, the mine will cost an estimated $19 million. It was forecasted that the mine will produce about 118,000 carats per year once production begins in 1989.

A Hong Kong-based jewelry firm established a new diamond-polishing factory in the city of Shunde, Guangdong Province. The cutting facility, which began with 10 cutters trained in Thailand, was expected to eventually increase its work force to a total of 300 workers.

Argyle Diamond Sales and the Australian Government set up a diamond cutting and polishing factory at Shunyi, near Beijing. When in full operation, the factory will employ approximately 1,000 Chinese workers processing near-gem material.

Colombia

The Colombian Ministry of Mines and Ecominas, the state mining company, is attempting to improve the image of the emerald industry. The industry has been racked by violence, smuggling, and ecologically damaging mining practices. In an effort to correct the damaging mining practices and to better determine production, Ecominas began to periodically monitor the operations of the 4 large concessionaires and the 14 smaller subcontractors. Marketing improvements, through the establishment of a national federation of emerald producers and traders (supported by the state) and the creation of an emerald exchange in Bogota, were implemented.

Guinea

A 181.77-carat diamond, recovered in November from the Aredor Mine, was purchased by a syndicate of buyers for $8.6 million. At $47,400 per carat, it was the highest per carat price ever paid for a rough diamond. A spokesperson for Bridge Oil Ltd., Australia, a partner in the mine, said the stone should polish out to a D-color, between 85 and 100 carats. There are only 16 white diamonds over 100 carats in the world. If the stone is D-color, flawless, and 100 carats it could sell for more than $18 million.

India

A 50-carat rare blue diamond crystal was found in the gravel of the Mahanadi River between Boudh and Sonepur. The area produced alluvial diamonds, most were yellow to brown in color, in sizes up to 10 carats.

Israel

Exports of diamonds were about $2.6 billion, an increase of 23% compared with that of 1987. Approximately 43% was exported to the United States and about 35% to the Far East.

Namibia

CDM Ltd. experienced a decrease in total diamond production because of a decrease in the grade of the materials processed. Technical problems with the No. 1 plant and No. 4 plant pretreatment facility did not allow for an offset of the lower grades with higher throughput. The No. 4 pretreatment facility was put into production only to find that modifications were needed because of the extreme variations of the materials being treated. The modifications were completed by yearend. CDM announced that construction of a new mine at Auchas on the Orange River would begin in early 1989.

A new diamond-sorting operation was opened in Windhoek. Namibia Ltd. operates the plant with about 80 Namibians that were trained by the Central Selling Organization personnel. Previously, the sorting was done in Kimberly, the Republic of South Africa.

An extremely rich alluvial diamond deposit was discovered near Luderitz by the Namibian West Coast Diamond Co. The deposit was about 120 meters off the coast in about 6 meters of water. In 7 hours, two divers recovered 931 diamonds weighing a total of 1,550 carats, indicating a extremely rich deposit.

Sierra Leone

The Diamond Corp. West Africa Ltd., a subsidiary of De Beers, reportedly closed its operations in Sierra Leone where it had been involved in buying and exporting diamonds for over 30 years. Meanwhile, the Government of Sierra Leone announced it had licensed 15 exporters to legally export diamonds. Each exporter was required to deposit $0.5 million monthly in the Central Bank of which $0.3 million can be used. The remaining $0.2 million must be used to help local imports with hard currency. Currently, it is believed that a majority of Sierra Leone diamonds enter the world markets through Liberia.

South Africa, Republic of

The reopening of the Koffiefontein Mine was delayed when heavy rains flooded the No. 2 shaft and damaged underground installations. Underground production finally began in

July with full production planned for the second quarter of 1989.

At the Buffels inland complex, Langhoogte Mine reserves were exhausted early in the year, and thereafter, new reserves at Nuttabooi were mined. Extensions to the security area to include Nuttabooi, and the new haul road were completed during the first quarter of the year.

Sri Lanka

Reports indicated a diamond rush was underway in Koslanda township in the highland tea growing area. The diamond finds were concentrated along the course of the Menik Ganga River near the Diyaluma Waterfall, a famous tourist attraction. In the past, the local villagers, in their search for sapphires, had dismissed the diamonds as barren stones, but experts report they are high-quality diamonds.

TECHNOLOGY

Cutters Choice, a division of Dyna-Systems of Boise, ID, began marketing a new lap for cutting and polishing gem stones. The new laps were made of glass instead of the traditional metal. Glass gives the laps a flatter surface, which is less scratch-prone and not as harsh in cutting although it cuts faster. In commercial-cutting factory tests, the laps stayed sharp longer than metal laps. The company markets 12 different glass laps.

The U.S.S.R. announced the development of automatic crystal growth equipment that can produce large, 30-centimeter by 8-centimeter, synthetic crystals of all precious stones except diamond and tourmaline. The growth of the large tubelike crystals require about 38 hours. The "Diacont" automatic crystal growth equipment was developed by the Institute for Crystallography, Moscow, in collaboration with the Central Research Institute for Physics, Budapest.

The Laboratory for Hydrothermal Growth at the Institute of Geology and Geophysics, Siberian Branch of the U.S.S.R. Academy of Sciences in Novosibirsk, produced a selection of unusual hydrothermally grown synthetic beryl crystals. Deposited over colorless beryl seeds, ionic dopants resulted in a number of different colors. Purple resulted from doping with a combination of chromium and manganese. Intense pink was caused by manganese alone. Blue was the product of copper, and rich slightly orangy red color was from traces of cobalt. It is known that at least one other color, a dark sapphire blue, was produced. It is not known how much of the material has been grown or if it will be commercially produced.[4]

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[1] Physical scientist, Branch of Industrial Minerals.

[2] Gems and Gemology. V. 24, No. 4, Winter 1988, pp. 229–236.

[3] Australian Bureau of Mineral Resources. Australian Mineral Industry Annual Review. Preliminary Summary 1988. Gemstones, Feb. 1989.

[4] Page 252 of work cited in footnote 2.

TABLE 8

DIAMOND: WORLD PRODUCTION, BY TYPE AND COUNTRY[1]

(Thousand carats)

Country	Natural															Synthetic[3]
	1984			1985			1986			1987[p]			1988[e]			
	Gem[2]	Industrial	Total	Gem[2]	Industrial	Total	Gem[2]	Industrial	Total	Gem[2]	Industrial	Total	Gem[2]	Industrial	Total	
Angola	652	250	902	464	250	714	240	10	[e]250	180	10	[e]190	950	50	1,000	—
Australia	3,415	2,277	5,692	4,242	2,828	7,070	13,145	16,066	29,211	13,650	16,683	30,333	17,517	17,517	[4]35,034	—
Botswana	5,810	7,104	12,914	6,318	6,317	12,635	9,610	3,500	13,110	9,367	3,840	13,207	10,801	4,428	[4]15,229	—
Brazil	200	550	750	233	217	450	310	315	625	309	213	522	310	300	610	—
Central African Republic	236	101	337	190	87	277	259	99	358	304	108	412	[4]284	[4]59	[4]343	—
China[e]	200	800	1,000	200	800	1,000	200	800	1,000	200	800	1,000	200	800	1,000	15,000
Czechoslovakia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5,000
France	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4,000
Ghana	35	311	346	60	r576	r636	r83	r438	521	r65	r400	465	49	303	352	—
Greece	—	—	—	—	—	—	—	—	—	—	—	—	([5])	—	([5])	1,000
Guinea	44	3	47	123	9	132	190	14	204	163	12	175	136	10	146	—
Guyana[e]	6	8	14	4	7	11	3	6	[3]9	4	7	11	1	3	[4]4	—
India	13	2	15	14	2	16	13	r3	16	r16	r3	19	16	3	19	—
Indonesia[e]	5	22	27	5	22	27	5	22	27	5	25	30	5	25	30	—
Ireland	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	90,000
Ivory Coast[e 6]	20	5	25	15	5	20	10	4	14	15	r6	r21	15	5	20	—
Japan	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	25,000
Liberia	108	132	240	66	72	138	63	189	252	60	190	[e]250	67	100	[4]167	—
Namibia	884	46	930	865	45	910	970	40	1,010	r987	r50	1,037	901	37	[4]938	—
Romania	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5,000
Sierra Leone[6]	240	105	345	243	106	349	215	100	315	r150	r75	225	100	75	175	—
South Africa, Republic of:																
Finsch Mine	1,714	3,184	4,898	1,770	3,184	4,954	1,821	3,208	5,029	1,455	2,701	4,156	1,372	2,548	3,920	—
Premier Mine	765	1,785	2,550	820	1,864	2,684	882	1,977	2,859	772	1,713	2,485	696	1,543	2,239	—
Other De Beers properties[7]	1,452	593	2,045	1,500	569	2,069	1,428	529	1,957	1,427	546	1,973	1,388	531	1,919	—
Other	585	65	650	460	35	495	342	41	383	409	30	439	283	21	304	—
Total	**4,516**	**5,627**	**10,143**	**4,550**	**5,652**	**10,202**	**4,473**	**5,755**	**10,228**	**4,063**	**4,990**	**9,053**	**3,739**	**4,643**	**8,382**	**25,000**
Swaziland	7	10	17	9	12	21	17	23	[e]40	17	23	[e]40	60	90	150	—
Sweden	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	25,000
Tanzania	193	84	277	165	71	236	133	57	190	r105	r45	r[e]150	105	45	150	—
U.S.S.R.[e]	4,300	6,400	10,700	4,400	6,400	10,800	4,400	6,400	10,800	r4,400	r6,400	r10,800	4,500	6,500	11,000	41,500
United States	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	W
Venezuela	40	232	272	35	180	215	45	189	234	50	200	[e]250	50	200	250	—
Yugoslavia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5,000
Zaire	5,169	13,290	18,459	4,032	16,127	20,159	4,661	18,643	23,304	r3,885	r15,540	19,425	3,800	15,200	19,000	—
Total	**26,093**	**37,359**	**63,452**	**r26,233**	**r39,785**	**r66,018**	**39,045**	**52,672**	**91,717**	**37,995**	**49,620**	**87,615**	**43,606**	**50,393**	**93,999**	**241,500**

[e] Estimated. [p] Preliminary. r Revised. W Withheld to avoid disclosing company propriety data.

[1] Table includes data available through May 31, 1989. Total diamond output (gem plus industrial) for each country actually is reported except where indicated by a footnote to be estimated. In contrast, the detailed separate production data for gem and industrial diamond are Bureau of Mines estimates in the case of every country except Australia (1984–87), Botswana (1987), Brazil (1987), Central African Republic (1984–88), Guinea (1984–87), and Liberia (1984–86), for which source publications give details on grade as well as totals. The estimated distribution of total output between gem and industrial diamond is conjectural, and for most countries, is based on the best available data at time of publication.

[2] Includes near-gem and cheap-gem qualities.

[3] Includes all synthetic diamond production.

[4] Reported figure.

[5] Less then 1/2 unit.

[6] Figures are estimates based on reported exports and do not include smuggled diamonds.

[7] Other De Beers Group output from the Republic of South Africa includes Kimberley Pool, Koffiefontein Mine, and the Namaqualand Mines.