Gem Stones

By W. F. Foshag,[1] George Switzer,[1] and Robert D. Thomson

GENERAL

DOMESTIC PRODUCTION

AS IN THE PAST, the United States continues to be an unimportant factor in world gem production. A wide variety of gems is produced but in small quantity. Gem mining is, and probably will continue to be, a minor industry.

Most gem-stone production in the United States results from the interest of thousands of amateur lapidaries, who pursue their hobby with great vigor and spend their vacations and weekends searching for materials suitable for cutting and polishing. Much of what they collect passes into the hands of numerous small mineral and lapidary supply dealers or roadside curio shops and changes hands through sale or exchange. The many varieties of quartz, such as agate, jasper, and petrified wood, are the chief materials produced in this way.

There are no large gem-mining companies in the United States. A few small companies operate certain deposits from time to time, such as turquoise, tourmaline, and jade, but they employ only a few miners. Since such a small percentage of the total gem production is mined on a commercial scale, no reliable statistics of the value of the domestic output of gems can be compiled. The value may approximate $400,000 to $500,000.

The many forms of quartz—chiefly the crypto-crystalline varieties—were produced in greatest quantity and value in 1951. Other gems produced, but in very much smaller quantity, were jade, kunzite, and turquoise, and a number of others in almost insignificant quantity. Of the producing States, California, Oregon, Texas, Washington, and Wyoming were the leaders.

Agate.—As far as could be ascertained, there was no appreciable change in agate production (including all varities of chalcedony) from that of 1950.

The Alpine-Big Bend area in Texas was one of the leading producers. A single locality near Alpine was reported to have yielded approximately 6,000 pounds of agate during the year, with an average value of 25 cents per pound.

Production from New Mexico was reported as essentially unchanged from the previous year.

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[1] Smithsonian Institution, consulting mineralogist to Bureau of Mines.

Large quantities of agate also were found in California, Oregon, and Washington, with smaller quantities in Arizona, Montana, and Wyoming. Small quantities of all forms of chalcedonic quartz, such as agate, jasper, petrified wood, and chert, were collected in nearly every State. A small quantity of chrysoprase was said to have been recovered at Porterville, Calif.

Kunzite.—Renewed mining activity in the Pala district, San Diego County, Calif., in the years 1949–51 yielded important quantities of kunzite. In the Vandenberg mine pockets were struck in July and October 1951 which yielded about 150 pounds of kunzite, of which about 10 percent was fine gem quality. The larger of these two pockets contained material of exceptionally good color. The value of this find was estimated at about $16,000.

Jade.—The available supply of Wyoming nephrite jade continued to diminish. Material of good color was reportedly selling for $30 to $60 per pound. A new find was reported in Shirley Basin, north of Medicine Bow, yielding some material of good medium-green color, selling at $5 to $10 per pound.

In California some jade (nephrite) was found along the coast near Monterey, and some jadeite jade was collected at Clear Creek, San Benito County. No production was reported from the Porterville locality. Reports published in 1951 described the jade deposits in Marin, Monterey, and San Benito Counties, Calif.[2]

No production of nephrite jade was reported for the year from the Kobuk area, northwestern Alaska.

Turquoise.—Turquoise production continued to decline in the Southwest. There was no large-scale activity in any turquoise localities, although undoubtedly small quantities were produced from various mines in Nevada, Arizona, and Colorado.

Other Gem Stones.—No diamonds were produced from the Arkansas diamond mines in 1951.

The Barton Mines Corp., North Creek, N. Y., reported a 1951 production of 60 pounds of gem-quality garnet, valued at $85.

No sapphire was produced in Montana from the Yogo Gulch area. The Yogo Sapphire Mining Corp. was negotiating to buy all the properties of the British-owned New Mine Sapphire Syndicate and planned to open the mines if negotiations were successful.

No variscite was produced from the Fairfield, Utah, locality during 1951 because of litigation. A small quantity was obtained by collectors at Grantsville and Lucin, Utah, and a new variscite deposit was reported near Snowville, Box Elder County, Utah.

A number of good-size pieces (single pieces up to several hundred carats) of pale-blue topaz were recovered by collectors in Mason County, Tex. The Thomas Mountains, Utah, topaz locality was visited by many collectors, but no important production resulted.

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[2] Chesterman, Charles W., Nephrite in Marin County, Calif.: California Div. of Mines Spec. Rept. 10-B, 1951, 11 pp.
Crippen, Richard A., Jr., Nephrite Jade and Associated Rocks of the Cape San Martin Region, Monterey County, Calif.: California Div. of Mines Spec. Rept. 10-A, 1951, 14 pp.
Yoder, H. S. and Chesterman, C. W., Jadeite of San Benito County, Calif.: California Div. of Mines Spec. Rept. 10-C, 1951, 8 pp.

Small quantities of tourmaline and morganite were produced in San Diego County, Calif., and some tourmaline and aquamarine in the various New England pegmatite localities, chiefly in Maine and New Hampshire.

Rose-quartz production from South Dakota was small. Some of the rock-crystal quartz from Arkansas undoubtedly went into the gem trade.

The total value of these miscellaneous gems probably was not more than a few hundred dollars.

CONSUMPTION AND USES

Business conditions in the jewelry industry remained essentially the same as in 1950. In general, sales were slow, particularly in the early months of the year, and even the traditional Christmas rush did not come up to the expectations of most retailers. Continuation of the Korean War eliminated any immediate chance of a reduction in the 20-percent excise tax on jewelry. This, plus continually rising living costs, caused a slump in the jewelry industry.

Again in 1951, the United States was the principal world market for diamonds. There was no significant change in the volume of diamonds sold by jewelers. Diamond jewelry sales represented about one-quarter of total jewelry sales of the typical dealer in 1951. Most jewelers had no trouble in obtaining an adequate supply of diamonds, although fine-quality stones in the larger sizes were said to be in short supply.

Fashion in Jewels.—During 1951 women continued to wear a large quantity of jewelry of conspicuous sizes. There was a steady rise in the production and use of baguette diamonds, as well as other fancy cuts, such as the pear and marquise. Large, emerald-cut diamonds were the most coveted solitaires, but because of their high price few could afford them.

Paris jewelry went to no extremes and made no radical departure in style. Leaf forms from many trees and shrubs inspired the designers. The scale continued large, but forms were light and airy.

Paris continued to set trends for the world of fashion in 1951, but three Italian cities—Rome, Florence, and Milan—also emerged as sources of inspiration. Since the Italian jewelry designers sometimes come from the ranks of painters, sculptors, and even architects, great diversity of artistic creation may be expected from this source.

IMPORTS [3]

Imports of gem stones, exclusive of industrial diamonds, in 1951, as reported by the United States Department of Commerce, totaled $129.3 million, compared with $118.5 million in 1950, an increase of about 9 percent. Diamonds were the more important, totaling $110.6 million (86 percent) of the total value of imports, with "cut but unset" representing 56 percent of the diamond imports.

[3] Figures on imports and exports compiled by M. B. Price and E. D. Page, of the Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 1.—Precious and semiprecious stones (exclusive of industrial diamonds) imported for consumption in the United States, 1950–51

[U. S. Department of Commerce]

Commodity	1950		1951	
	Carats	Value	Carats	Value
Diamonds:				
Rough or uncut (suitable for cutting into gem stones), duty-free	[1] 673, 699	[1] $43, 655, 706	697, 981	$48, 704, 819
Cut but unset, suitable for jewelry, dutiable	[1] 492, 741	[1] 58, 531, 035	480, 516	61, 858, 003
Emeralds:				
Rough or uncut, duty-free	12, 142	7, 991	2, 706	2, 698
Cut but not set, dutiable	9, 706	237, 446	20, 148	264, 527
Pearls and parts, not strung or set, dutiable:				
Natural	----------	410, 970	----------	449, 379
Cultured or cultivated	----------	3, 192, 334	----------	2, 747, 653
Other precious and semiprecious stones:				
Rough or uncut, duty-free	----------	[1] 304, 167	----------	160, 609
Cut but not set, dutiable	----------	2, 429, 992	----------	2, 686, 137
Imitation, except opaque, dutiable:				
Not cut or faceted	----------	19, 088	----------	87, 162
Cut or faceted:				
Synthetic	----------	811, 372	----------	888, 629
Other	----------	[1] 8, 753, 307	----------	11, 307, 401
Imitation, opaque, including imitation pearls, dutiable	----------	14, 854	----------	26, 394
Marcasites, dutiable:				
Real	----------	136, 768	----------	88, 395
Imitation	----------	3, 019	----------	3, 836
Total	----------	[1] 118, 508, 049	----------	129, 275, 642

[1] Revised figure.

TECHNOLOGY

The emphasis in gem-stone research was on diamonds. The Diamond Research Laboratory of Johannesburg, Union of South Africa, sponsored and supported by Industrial Distributors (1946), Ltd., investigated many problems in mining and utilization of diamonds.

Articles published recently dealt with the investigation of the Slipper diamond, a 7.25-carat octahedron with a small included octahedron [4] and the luminescence of polished cleavage plates of diamond; [5] description of the unusual twinned tetrahedral diamonds from the Belgian Congo; [6] a fractographic study of the cleavage face of a 34½-carat diamond from the Premier mine, South Africa, which had a cleavage pattern partly characteristic of type I and partly of type II diamond; [7] description of the effects of treating diamonds in a cyclotron; [8] and measurement of the thermo conductivity of diamond, sapphire, and quartz.[9]

An excellent summary of the chief scientific and industrial development regarding diamonds that took place during 1951 was prepared by

[4] Kohn, J. A., Observations on the Slipper Diamond: Gems and Gemology, vol. 6, No. 11, Fall 1950, pp. 347–348.
[5] Raman, C. V., The Luminiscence of Diamond–II: Curr. Sci. (India), vol. 20, No. 1, January 1951, pp. 1–7.
[6] Polinard, E., Sur une forme titraedrique du diamant: Bull. soc. geol. Belg., vol. 74, No. 3, 1950, pp. 59–63.
[7] Custers, J. F. H., Laminations in Type II Diamonds: Research, vol. 4, No. 3, March 1951, pp. 131–136.
[8] Ehrmann, M., Bombarded Diamonds: Gems and Gemology, vol. 6, No. 10, summer 1950, p. 295.
Pough, F. H. and Schulke, A. A., The Recognition of Surface Irradiated Diamonds: Gems and Gemology, vol. 7, No. 1, Spring 1951, pp. 3–11.
[9] Berman, R., Simon, F. E., and Wilks, J., Thermal Conductivity of Dielectric Crystals; the "Umklapp" Process: Nature, vol. 168, No. 4268, Aug. 18, 1951, pp. 277–280.

P. Grodzinski and his associates and distributed by the Industrial Diamond Information Bureau, 32–34 Holborn Viaduct, London, E. C. 1.

In the field of colored gem stones, taaffeite, a pale mauve gem resembling spinel but chemically a beryllium magnesium-aluminum oxide, was described.[10]

DIAMONDS[11]

The year 1951 was another record-breaking year in the diamond industry. The value of diamonds sold through the Central Selling Organization, on behalf of South African and other producers, amounted to £65 million. Sale of diamonds produced in Brazil, British Guiana, and Venezuela raised the overall total to approximately £68 million, an increase of about 30 percent over 1950. A 15-percent increase in diamond prices in March 1951 brought sterling prices to full parity with dollar prices, which were in effect before the devaluation of sterling in 1949. The increased sales for 1951, however, are only partly attributable to this cause, also being influenced by increased production of rough diamonds through increased mining activity and better milling practices.

A sharp increase in sales of industrial diamonds featured the 1951 market. Sales by the Central Selling Organization were divided as follows:

Gem diamonds	£46,780,632
Industrial diamonds	18,277,333
	65,057,965

A new record also was set for world production of diamonds in 1951, with a total of 16,800,000 carats, compared with 15,250,000 carats in 1950.

Cutting.—The strong demand for gem diamonds continued unabated during 1951.

In spite of this high level of activity, the cutting industry continued to be plagued with unemployment, indicating a surplus of workers in the industry.

Means to eliminate the disparity in cutting costs, wages, and working hours in the various cutting centers was widely considered, but no uniform wage basis could be determined. Neither the efforts of the Netherlands and Belgian cutters and manufacturers to arrive at some satisfactory arrangement, nor the efforts of the Universal Alliance of Diamond Workers to work out an agreement with the German diamond workers' organization on time, tariffs, and apprenticeships, were successful.

Belgium continued to be the largest cutting center, followed by Germany, Netherlands, Israel, and the United States. Smaller cutting centers were in England, South Africa, France, India, Brazil, and Puerto Rico.

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[10] Anderson, B. W., A Rare New Gem Stone: Gemologist, vol. 20, No. 237, April 1951, pp. 75–77.

[11] Foshag, W. F. and Switzer, G., The Diamond Industry in 1951: Jewelers' Circular-Keystone, vol. 122, No. 10, July 1952, pp. 88, 90, 116–117, and 118; No. 11, August 1952, pp. 130, 132, and 168–169; and No. 12, September 1952, pp. 126, 128, and 149.

TABLE 2.—Diamonds (exclusive of industrial diamonds) imported for consumption in the United States, 1950–51, by countries

[U. S. Department of Commerce]

Country	Rough or uncut			Cut but unset		
	Carats	Value		Carats	Value	
		Total	Average		Total	Average
1950						
Argentina				109	$11,847	$108.69
Australia				12	6,500	541.67
Belgian Congo	[1] 200	[1] $10,000	[1] $50.00			
Belgium-Luxembourg	[1] 336	[1] 43,454	[1] 129.33	257,942	29,115,318	112.88
Brazil	[1] 28,096	[1] 777,164	[1] 27.66	2,125	190,562	89.68
British Guiana	[1] 375	[1] 22,378	[1] 59.67	1	148	148.00
British West Africa, n. e. s	[1] 9,955	[1] 317,412	[1] 31.88			
Canada	([2])	([2])	([2])	657	98,343	149.68
China				90	12,738	141.53
Cuba				261	34,893	133.69
Denmark				104	7,118	68.44
France				4,497	517,574	115.09
French Equatorial Africa	215	14,009	65.16			
French Morocco				156	14,779	94.74
Germany	3	41	13.67	7,317	603,797	82.52
Hong Kong				321	64,126	199.77
Hungary				5	120	24.00
India				8	1,277	159.63
Iran				16	1,551	96.94
Israel and Palestine	98	5,938	60.59	[1] 86,262	[1] 6,840,496	[1] 79.30
Italy				5	900	180.00
Kuwait				2	542	271.00
Lebanon				217	37,770	174.06
Netherlands	480	13,932	29.03	44,978	4,845.140	107.72
Philippines				30	8,500	283.33
Portuguese Asia				39	11,329	290.49
Southern-Southeastern Asia, n. e. s				75	4,621	61.61
Switzerland	[1] 151	[1] 7,324	[1] 48.50	3,251	740,125	227.66
Thailand				418	81,596	195.21
Union of South Africa	[1] 588,551	[1]41,149,102	[1] 69.92	74,476	14,313,316	192.19
U. S. S. R				3,919	190,000	48.48
United Kingdom	[1] 5,117	[1] 350,706	[1] 68.54	5,448	776,009	142.44
Venezuela	[1] 40,122	[1] 944,246	[1] 23.53			
Total 1950	[1] 673,699	[1] 3,655,706	[1] 64.80	[1] 492,741	[1]58,531,035	118.79
1951						
Australia	765	97,086	126.91	12	1,200	100.00
Bahrein	50	20,878	417.56			
Belgian Congo	2,645	215,173	81.35			
Blegium-Luxembourg	4,582	409,071	89.28	251,617	31,317,834	124.47
Brazil	7,749	523,453	67.55	452	79,078	174.95
British Guiana	1,563	55,513	35.52	6	646	107.67
British Malaya				161	26,700	165.84
Canada	6,112	174,167	28.50	7	1,751	250.14
Ceylon				9	121	13.44
Czechoslovakia				10	1,150	115.00
Denmark				17	2,348	138.12
France	286	13,990	48.92	3,208	425,507	132.64
Germany				9,691	789,720	81.49
India				2	260	130.00
Iran				30	3,600	120.00
Israel and Palestine	207	1,656	8.00	104,194	9,128,630	87.61
Italy				62	12,372	199.55
Japan				50	5,670	113.40
Kuwait				1	800	800.00
Liberia	180	10,000	55.56			
Mexico				6	1,871	311.83
Netherlands	19,329	1,481,908	76.67	35,940	4,398,388	122.38
Southern British Africa				154	27,853	180.86
Switzerland	85,110	5,533,669	65.02	7,229	1,259,918	174.29
Union of South Africa	66,930	1,856,217	27.73	64,537	13,835,217	214.38
United Kingdom	475,927	37,557,682	78.91	3,120	536,944	172.10
Uruguay				1	425	425.00
Venezuela	26,546	754,356	28.42			
Total 1951	697,981	48,704,819	69.78	480,516	61,858,003	128.73

[1] Revised figure.
[2] Revised to none.

In the United States employment in the diamond-cutting industry reached a low level in 1951. During the year less than 50 percent of the enrolled members of the Diamond Workers Protective Union had steady employment, and work in the non-union shops was seasonal. High labor costs in the United States permitted only cutting of the larger and finer grade stones.

Imports.—Imports of gem-grade diamonds into the United States amounted to $110,563,000 in 1951 compared with $102,187,000 (revised) in 1950, an increase of slightly less than 1 percent. The United Kingdom furnished most of the rough or uncut and Belgium-Luxembourg most of the cut in 1951.

World Production.—Official figures on diamond production are not available for all countries, but the figures in the accompanying table are believed to be reasonably accurate. World production in 1951 (gems and industrials) is estimated to have been 16,800,000 metric carats, which compares with 15,250,000 carats for 1950, an increase of nearly 10 percent.

Belgian Congo was again the leading producer by weight, but only about 5 percent of the Belgian Congo production was of gem quality. South Africa, although producing much less by weight, lead in value owing to a higher percentage of gem stones.

TABLE 3.—World production of diamonds, 1948–51, by countries, in metric carats

[Including industrial diamonds]

Country	1948	1949	1950	1951
Africa:				
Angola	795,509	769,981	538,867	751,447
Belgian Congo	5,824,567	9,649,896	10,147,471	10,564,667
French Equatorial Africa	118,300	122,928	[4] 111,407	[2] 136,000
French West Africa	77,970	94,996	126,346	101,000
Gold Coast	[2] 850,000	[1] 972,976	[2] 950,000	[2] 1,600,000
Sierra Leone	465,518	494,119	655,474	475,759
Southwest Africa	200,691	280,134	488,422	478,075
Tanganyika	148,169	191,787	195,274	108,625
Union of South Africa:				
Lode	[2] 930,000	964,266	1,516,194	1,967,272
Alluvial	[2] 270,000	[3] 289,756	[3] 231,674	[3] 289,063
Brazil [2]	250,000	250,000	200,000	200,000
British Guiana	36,562	34,790	37,462	43,260
Venezuela	75,513	56,362	60,389	63,226
Other countries [2]	3,500	3,000	3,000	3,000
Grand total (round figures)	10,050,000	14,175,000	[4] 15,250,000	16,800,000

[1] Exports.
[2] Estimated.
[3] Includes an estimated 100,000 carats for State mines of Namaqualand.
[4] Revised.

Industrial Diamonds.—Details regarding imports, production, sales, and uses of industrial diamonds will be found in the Abrasive Materials chapter of this volume.

OTHER GEM STONES

The price of most gem stones other than diamonds continued to hold steady owing to a short supply of newly mined stones of fine quality.

Ceylon maintained its output of important quantities of a variety of gems, chiefly ruby, sapphire, chrysoberyl, spinel, garnet, zircon,

topaz, and tourmaline. The gems came from the alluvial gravels of the Ratnapura district. The gem mining was done by individuals or small companies, and no official production figures are available.

Australian opal production [12] for 1951 was valued at £65,474, an increase of £9,255 over that produced in 1950. Good-quality material was scarce. The Andamooka and Coober Pedy fields in South Australia were the main producing centers. The Hayricks mine in the Quilpie district was the only one operating in Queensland, and a few men worked intermittently at Lightning Ridge, New South Wales. The value of opal exports in 1951 amounted to £79,972, as compared with £40,040 in 1950. The United States was the largest buyer in both years.

Australian sapphire production [12] during 1951 was valued at £1,135, compared with £3,181 in 1950. Production, which amounted to 63 ounces, was chiefly from the areas of Rubyvale and Sapphire, Queensland. Three cutting plants were operated at the fields, and lapidaries in Brisbane and other cities cut Queensland sapphires for the local market and export. No export statistics are available.

Cultured-pearl production in Japan during 1951 amounted to 3,375 kilograms. Production had risen steadily from none in 1945 to 938 kilograms in 1948 and 2,625 kilograms in 1950. The 1951 export value of cultured pearls was $4,354,000. An interesting change took place in the export market after World War II. In 1938, 40 percent of the cultured-pearl exports went to the United States, while in 1951 the corresponding figure was 61 percent.

Production of emeralds in Colombia was reported by the Ministry of Development to be about 68,000 carats in 1951. This represents only the production of the Government-owned Muzo and Cosquez mines, which had been closed the last quarter of 1949 but were opened again during the latter part of 1951; production was, however, erratic. Production of the privately owned Chivor mine is not known. The Chivor Emerald Mines, Inc., the owner, went into bankruptcy in April 1951. Some production was continued by the workers, but all of the stones went into the black market. Despite this trouble, it was reported that a new vein was found at Chivor, and the emeralds produced were said to be the best quality ever taken from the mine.

Brazil continued to produce a large quantity of amethyst, aquamarine, citrine, topaz, and tourmaline and smaller quantities of chrysoberyl, andalusite, euclase, and other gems.

Gem-stone production in other well-known districts, such as Burma, Thailand, Mozambique, Madagascar, and India, apparently was small, and no official figures are available.

SYNTHETIC GEM STONES

Synthetic Emerald.—This synthetic gem, so far as known, is produced only by the Chatham Research Laboratories in San Francisco, Calif. Production in 1951 averaged 5,000 carats per month in crystals averaging 40 carats each. The total production of 60,000

[12] Australian Bureau of Mineral Resources, Geology and Geophysics, Australian Mineral Industry—1951: 1952, p. 165.

carats for the year was an increase of about 20 percent over 1950. Production was broken down as follows: 50 percent very low grade (opaque) but good color, 40 percent medium grade, and 10 percent fine gem quality. Retail prices of top-quality stones remained about the same at $90 to $120 per carat. Flawless stones over 2 carats in size were not produced.

Corundum and Spinel.—The year 1951 found conditions in the American synthetic gem industry at a very low ebb owing to recovery of the European industry after World War II, chiefly in Germany and France.

It was reported that one shop in the United States continued to cut synthetics on a large scale, by offering well-cut and well-sized stones at higher prices than the European goods but with the added advantage of good deliveries. Most of the material cut from American sources was for educational jewelry (for example, class rings), the most popular style being the buff-top flat back. Ruby-colored corundum predominated, the distribution being 70 percent ruby corundum and 30 percent blue spinel.

The sales of rough synthetic gem stones manufactured in the United States virtually vanished. European manufactured synthetic gem stones—principally from Germany—reached manufacturing jewelers directly rather than through the normal channels of gem-stone dealers. Thus, by obtaining their gem stones directly from Europe the manufacturing jewelers bypassed wholesalers and realized some price advantage.

There was some increase in the use of synthetic star rubies and sapphires in 1951 over 1950. Also, some synthetic stars of European manufacture were seen and at much lower prices than those made in the United States.

Synthetic Rutile (Titania).—During 1951 titania sales increased somewhat, with a greater number of manufacturing jewelers incorporating this stone in their designs. However, there had not been great popular acceptance of this material, and it had not become a serious threat to the diamond trade, as was at first feared by some.