Gem Stones

By W. Timothy Adams[1]

The production value of gem stones and mineral specimens in the United States during 1976 was estimated to be $8.9 million, an increase of 2% over that of 1975. Most of the value was contributed by the few companies that operated deposits for emerald, jade, opal, sapphire, and turquoise. Amateur collectors were important even though their total contribution was surpassed by the commercial operators. The commercial operators sold mainly to wholesale or retail outlets and occasionally to jewelry manufacturers.

DOMESTIC PRODUCTION

Mines and collectors in 39 States produced gem materials estimated at $1,000 or more for each State. Ten States supplied 90% of the total value as follows: Arizona, $4.0 million; Nevada, $1.3 million; Maine, $1.1 million; Oregon, $525,000; California, $231,000; New Mexico, $210,000; Montana, $170,000; Texas, $168,000; Washington, $168,000; and Wyoming, $147,000.

Park authorities at the Crater of Diamonds Park in Arkansas reported the finding of 398 diamonds, of which 1 was 3 carats and 3 were 2 carats each. No value was placed on the stones.[2]

A report was published on the evaluation of diamond-containing weathered kimberlite pipes in Colorado and Wyoming.[3]

A 200-carat emerald crystal was found at the Big Crabtree emerald mine near Little Switzerland, N.C. The stone appeared to be of fine quality and could yield a stone of 40 carats if cut. It would be larger than the Carolina emerald of 14 carats. Peridot was mined by about 200 individuals of the San Carlos Apache Tribe at Peridot, Ariz., and no estimate of quantity and value of the peridot was available.

The production of turquoise of all grades and quantities reported was 221 tons, valued at $3.9 million and was principally from Arizona, Nevada, and Colorado. The great interest in Native American style jewelry continued throughout 1976. Many articles appeared in various publications describing the qualities of genuine turquoise and Native American jewelry.[4]

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[1]Physical scientist, Division of Nonmetallic Minerals.

[2]Arkansas Department of Parks and Tourism, Parks Division.

[3]McCallum, M. E. and C. D. Mabarak. Diamond in State-Line Kimberlite Diatremes, Albany County, Wyo.; Larimer County, Colo., Geol. Survey of Wyo., RI 12, September 1976, 36 pp.

[4]Hass, L. N. Turquoise — Blue Heaven in a Stone, Part I. Gems and Miner., No. 458, December 1975, pp. 8-9, 62-63, 76-77.

———. Part II. Gems and Miner., No. 459, January 1976, pp. 42, 62-64.

———. Part III. Gems and Miner., No. 460, February 1976, pp. 33-36.

Rowe, R. C. Turquoise — Genuine or False. Gems and Miner., No. 459, January 1976, pp. 35-37.

Hemrich, G. I. Turquoise Substitutes. Gems and Miner., No. 470, December 1976, pp. 17-20, 22.

Mine	Location	Operator
Emerald: Big Crabtree mine	Mitchell County, N.C	PBH Emerald Co. Box 163 Little Switzerland, N.C. 28749
Jade: Stewart Jewel Jade mine	Kobuk Village, Alaska	Stewart Jewel Jade Co. 531 4th Ave. Anchorage, Alaska 99501
Opal:		
Royal Peacock mine	Humboldt County, Nev	Harry W. Wilson Denio, Nev. 89404
Spencer Opal mine (dig-for-fee mine).	Clark County, Idaho	Mark L. Stetler 1862 Ranier St. Idaho Falls, Idaho 83401
Sapphire:		
Chaussee Sapphire mine (sold unscreened material to tourists in summer and assisted in screening).	Granite County, Mont	Chaussee Sapphire Corp. Box 706 Philipsburg, Mont. 59858
Sapphire Village mine (Yogo Gulch).	Judith Basin County, Mont.	Sapphire International Corp. Box 30 Utica, Mont. 59452
Turquoise:		
Aurora mine	Lander County, Nev	Carico Lake Mining Co. Box 3426 Albuquerque, N. Mex. 87110
Black Spider mine	____do	Grillos Mining Co. 2221 10th St. Lubbock, Tex. 79401
Blue Eagle mine	Mineral County, Nev	E. Loving and D. Lester Box 155 Mina, Nev. 89422
Blue Jim mine	Lander County, Nev	James Elquist Box 255 Battle Mountain, Nev. 89820
Blue Spider mine	____do	John Lee & Co. 5101 North 40th St., Apt. 119 Phoenix, Ariz. 85018
Boundary mine	Mineral County, Nev	D. Brannon and R. H. Herrington Box 377 Mina, Nev. 89422
Duval Corp. mine	Mohave County, Ariz	L. W. Hardy Co., Inc. 3809 East Highway 66 Kingman, Ariz. 86401
Morenci mine	Greenlee County, Ariz	W. O. Brown 230 West 66 Ave. Gallup, N. Mex. 87301
Pinto Valley mine	Gila County, Ariz	L. W. Hardy Co., Inc. 3809 East Highway 66 Kingman, Ariz. 86401
Red Mountain mine	Lander County, Nev	J. M. Johnson 102 West 9th Pl. Mesa, Ariz. 85201 Turquoise Nugget (colessee) Box 1118 Flagstaff, Ariz. 86001
Royal Blue mine	Esmeralda County, Nev	R. C. Wilcox Box 1311 Tonopah, Nev. 89040
Shoshone and Ackerman mines	Churchill County, Nev	Lombardo Turquoise Co., Inc. 1300 East Main St. Austin, Nev. 89310
Turquoise Chief mine	Lake County, Colo	N. F. Reed Albuquerque, N. Mex. 87110
Villa Grove mine	Saguache County, Colo	G. Musick Box 174 Villa Grove, Colo. 81155

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 $705 million, 51% more than that of 1975.

PRICES

Typical costs to a retail jeweler in December 1976 for representative better quality gem stones as reported by 15 typical importers were as follows:[5]

[5]Jewelers' Circular — Keystone. JC-K's Colored Stone Price Index. V. 147, No. 5, February 1977, p. 84.

Gem stone	Carat weight	Median price per carat	Price range per carat
Amethyst	10	$15	$11-$17.50
Aquamarine	8	120	75-260
Cat's eye	5	1,100	750-1,100
Citrine	10	8	5-10
Emerald	1	2,875	1,500-5,000
Garnet, green	1	475	400-600
Man's sky blue star	10	300	190-450
Opal, black	3	438	300-500
Opal, white, fiery	5	62	60-70
Peridot	10	50	45-60
Ruby	2	1,875	1,250-3,500
Sapphire	2	725	400-1,200
Tanzanite	5	300	150-250
Tourmaline, green	10	55	55-100
Tourmaline, pink	10	100	75-125

NOTES.—Ten-carat cat's eyes and 15-carat peridot, both of which were on the 1974 list, became unavailable during 1975, but the median price per carat of the smaller stones held at the levels of the larger stones.

No survey was made of diamond prices; price trends indicated higher prices for cut diamond 1 carat and smaller, but no change in larger cut diamond.

FOREIGN TRADE

Exports of all gem materials amounted to $326.7 million, and reexports to $155.5 million. Diamond accounted for 94% of the value of exports and 92% of the reexports. Exports of diamond totaled 312,853 carats valued at $306.1 million. Of this total, diamond cut but unset, suitable for gem stones not over 0.5 carat, was 53,375 carats valued at $21.1 million; and cut, but unset, over 0.5 carat was 258,738 carats valued at $284.9 million.

Reexports of diamond amounted to 1,198,805 carats, valued at $142.7 million, in categories as follows: Rough or uncut, suitable for gem stones, not classified by weight, 1,025,183 carats valued at $88.9 million; cut but unset, not over 0.5 carat, 45,127 carats valued at $9.2 million; cut but unset, over 0.5 carat, 128,450 carats, valued at $44.6 million.

The 10 leading recipients of diamond exports accounted for 89% of the carats and 98% of the value and were as follows: Hong Kong, 98,102 carats valued at $132.5 million; the Netherlands, 39,033 carats valued at $39.7 million; Switzerland, 32,480 carats valued at $37.2 million; Japan, 46,924 carats valued at $33.5 million; Belgium, 25,827 carats valued at $25.8 million; France, 6,288 carats valued at $14.5 million; West Germany, 5,416 carats valued at $7.1 million; the United Kingdom, 4,671 carats valued at $4.7 million; Israel, 9,670 carats valued at $3.2 million; and Canada, 8,952 carats valued at $2.3 million.

The eight leading recipients of diamond reexports accounted for 96% of the carats and 97% of the value and were as follows: Belgium, 432,030 carats valued at $41.1 million; Israel, 403,017 carats valued at $34.3 million; the Netherlands, 213,537 carats valued at $25.2 million; the United Kingdom, 32,830 carats valued at $11.7 million; Switzerland, 7,832 carats valued at $8.9 million; France, 20,884 carats valued at $6.9 million; Japan, 26,764 carats valued at $5.6 million; and Hong Kong, 10,797 carats valued at $4.5 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 $0.6 million. Natural precious and semiprecious stones, unset, were valued at $18.0 million; and synthetic or reconstructed stones, unset, were valued at $2.0 million. Reexports of all other gem materials amounted to $12.8 million in categories as follows: Pearls, $0.8 million; natural precious and semiprecious stones, unset, $11.8 million; synthetic or reconstructed stones, unset, $0.1 million.

Imports of gem materials increased about 39% in value over those of 1975. Diamond accounted for 86% of the total value of gem material imports.

Although rough and uncut diamond imports were reported from 24 countries, over 99% of the value was from 9 countries as follows: The Republic of South Africa, 1,194,128 carats, $257.2 million; the United Kingdom, 494,884 carats, $113.8 million; Sierra Leone, 331,554 carats, $42.9 million; the Netherlands, 50,393 carats, $20.5 million; Israel, 38,573 carats, $8.2 million; Belgium-Luxembourg, 37,885 carats, $6.7 million; Venezuela, 260,066 carats, $6.0 million; Liberia, 2,790 carats, $2.9 million; and the Central African Republic, 36,006 carats, $2.2 million.

Cut but unset diamond, not over 1/2 carat, was imported from 38 countries; however, the imports of this category from 10 countries amounted to 99% of total carats and value as follows: Israel, 1,100,253 carats, $178.7 million; Belgium, 1,011,991 carats, $157.1 million; India, 498,996 carats, $64.7 million; the Netherlands, 68,419 carats, $9.6 million; the U.S.S.R., 35,794 carats, $8.1 million; the Republic of South Africa, 13,747 carats, $3.7 million; Switzerland, 12,673 carats, $1.7 million; the United Kingdom, 11,243 carats, $1.6 million; France, 9,276 carats, $1.9 million; and Hong Kong, 8,981 carats, $1.3 million. Cut but unset diamond, over 1/2 carat was imported from 30 countries; the imports from 9 countries amounted to 99% of the total carats and 98% of the value as follows: Belgium, 156,083 carats, $66.8 million; Israel, 102,563 carats, $32.5 million; the Republic of South Africa, 8,178 carats, $6.0 million; the Netherlands, 9,717 carats, $3.3 million; the U.S.S.R., 6,660 carats, $2.5 million; the United Kingdom, 2,661 carats, $2.0 million; Switzerland, 1,142 carats, $1.1 million; India, 3,389 carats, $0.8 million; and Hong Kong, 860 carats, $0.7 million.

Imports of emeralds increased 45% in quantity and 37% in value. Emerald was imported from 33 countries; the imports from 9 countries amounted to 96% of the carats and 94% of the value as follows: Colombia, 57,252 carats, $21.6 million; India, 578,780 carats, $9.7 million; Switzerland, 28,457 carats, $6.9 million; Brazil, 207,620 carats, $3.8 million; Israel, 76,805 carats, $2.7 million; the United Kingdom, 76,069 carats, $2.5 million; Hong Kong, 49,730 carats, $2.1 million; West Germany, 34,817 carats, $1.7 million; and France, 3,745 carats, $1.1 million. Ruby and sapphire were imported from 34 countries; the imports from 7 countries amounted to 91% of the value as follows: Thailand, $15.6 million; Sri Lanka, $2.3 million; India, $2.0 million; Switzerland, $2.0 million; Hong Kong, $1.8 million; West Germany, $0.7 million; and Canada, $0.4 million. Natural pearls and parts from 11 countries increased 12% in value of imports; 5 countries accounted for 91% of the value as follows: India, $371,000; Japan, $104,000; France, $85,000; Burma, $82,000; and Hong Kong, $48,000. Cultured pearls increased 52% in value of imports which were received from 20 countries of which Japan, at $10.6 million, accounted for 95% of the value. Imports of imitation pearls increased 32% in value; Japan, at $569,000, accounted for 84% of the value. Coral, cut but unset, and cameos suitable for use in jewelry increased slightly in value of imports, which were received from 20 countries; 3 countries accounted for 94% of the value as follows: Italy, $3.4 million; Taiwan, $1.5 million; and Japan, $1.2 million.

Imports of other precious and semiprecious stones, rough and uncut, increased 30% in value and came from 46 countries of which 7 countries accounted for 78% of the value as follows: Brazil, $2.5 million; Australia, $2.0 million; Colombia, $1.1 million; Hong Kong, $0.3 million; India, $0.2 million; the Republic of South Africa, $0.2 million; and Zambia, $0.2 million. Other precious and semiprecious stones, cut but unset increased 26% in value and were imported from 59 countries, of which 7 countries accounted for 87% of the value as follows: Hong Kong, $15.4 million; Brazil, $5.3 million; West Germany, $3.5 million; Australia, $2.9 million; Taiwan, $1.5 million; Iran, $1.0 million; and India, $1.0 million. Synthetic gem stones, cut but unset, increased 26% in value and came from 17 countries of which 6 countries accounted for 96% of the value as follows: West Germany, $5,639 million; France, $1,226 million; Switzerland, $1,191 million; Japan, $1,099 million; Taiwan, $0.272 million; and Hong Kong, $0.259 million. Imitation gem stones increased 9% in value and came from 18 countries, of which 5 countries accounted for 98% of the value as follows: Austria, $4,959 million; West Germany, $2,618 million; Czechoslovakia, $0.961 million; Japan, $0.252 million; and Hong Kong, $0.106 million.

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

(Thousand carats and thousand dollars)

Stones	1975		1976	
	Quantity	Value	Quantity	Value
Diamonds:				
Rough or uncut	2,341	347,882	2,464	462,657
Cut but unset	2,236	374,237	3,087	549,182
Emeralds: Cut but unset	806	40,348	1,165	55,286
Coral, cut but unset, and cameos suitable for use in jewelry	NA	6,475	NA	6,497
Rubies and sapphires: Cut but unset	NA	19,069	NA	27,165
Marcasites	NA	23	NA	20
Pearls:				
Natural	NA	673	NA	755
Cultured	NA	7,261	NA	11,062
Imitation	NA	515	NA	680
Other precious and semiprecious stones:				
Rough and uncut	NA	6,380	NA	8,266
Cut but unset	NA	28,718	NA	35,278
Other n.s.p.f	NA	1,935	NA	2,565
Synthetic:				
Cut but unset number	13,682	8,008	18,705	10,115
Other	NA	610	NA	766
Imitation gem stones	NA	8,296	NA	9,072
Total	NA	850,430	NA	1,179,366

NA Not available.

WORLD REVIEW

Australia.—Turquoise was discovered in Australia in 1967. The deposits are located in the remote central region of the Northern Territory approximately 265 miles northeast of the railhead at Alice Springs. The turquoise occurs in a series of Cambrian siltstone-mudstone beds that form part of the Sandover Beds of the Georgina Basin. A range of phosphate types is produced from the mine. Microscopic and X-ray diffusion examination have shown the typical high-grade material to be composed of very-fine-grained, close-packed nodules of turquoise. The turquoise has been formed by the chemical combination of phosphates and alumina in the phosphate-rich beds and copper leached from the overlying copper-rich tuffaceous siltstones. Mining is by open-cut methods. Specimens up to three-quarters ton have been recovered. Proven reserves are considerable, and continuity of supply is offered. A wide range of material is available for gem cutters and the carving trade. The area is not open to collectors and hobbyists.[6]

New markets for Australian opals are being opened both at home and in Japan. Stones from Cooper Pedy and Andamooka are being used in a variety of styles in watch bracelets and pendants. A new manufacturing process is reported to insure high durability of the stone.[7]

Botswana.—A new tax regime instituted by the Government of Botswana established an effective partnership between the Government and the De Beers Group. The Orapa mine produced 2,360,945 carats of diamond from 3,428,985 tons of ore in 1976. Construction work is in progress at Orapa to increase the capacity of the mine from 2.3 million carats to 4.5 million carats per year. The new Letlhakine mine, 24 miles southeast of Orapa was commissioned, and production began at the rate of 320,000 carats per year. The mine treated diamondiferous gravels surrounding the pipe. Design work was in progress for the second stage of development to treat the kimberlite. Prospecting continued at a kimberlite pipe discovered in Jwaneng in the south of the country. The pipe is overlain by 150 feet of overburden and represents a considerable technical achievement. A drilling program has established that the pipe is large and contains diamond in economic quantities.[8]

Burma.—The Mogok ruby that made Burma one of the gem capitals of the world has also been the cause of the country's plunder by smugglers and black marketeers. The gem industry was nationalized in 1969, and 18 kinds of precious stones including rubies, sapphires, and jade were brought under official control. Officials admit that thieves are still active despite strong security at the mines.[9]

[6]Cumming, J. Australian Turquoise. Lapidary J., v. 30, No. 7, October 1976, pp. 1634-1636.

[7]Mining Journal Conferences. New Uses for Opal. V. 287, No. 7375, Dec. 24, 1976, p. 510.

[8]De Beers Consolidated Mines Ltd. 1976 Annual Report, 59 pp.

[9]Maung, C. T. The Curse of the Burmese Ruby. Wash. Post, Apr. 18, 1976, p. H-3.

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

(Thousand carats and thousand dollars)

Country	1974				1975				1976			
	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
Angola	(1)	15										
Belgium-Luxembourg	43	14,804	953	162,926	31	8,250	849	153,276	38	6,651	1,168	223,858
Bolivia					4	609						
Brazil	1	535	4	642	5	982	3	491	5	99		
Canada	(1)	(1)	(1)	52			1	156	1	79	4	690
Central African Republic	132	6,766			134	5,298			(1)	6	(1)	90
France	31	5,668	20	2,150	7	231	18	2,195	36	2,204		
Germany, West	1	72	2	207			1	281	6	643	9	1,957
Hong Kong	(1)	65	5	772			5	847	(1)	(1)	4	1,214
India			221	26,709			300	37,211	1	825	10	1,962
Israel	37	8,052	774	128,856	33	5,523	902	147,114	39	8,239	502	65,432
Japan	1	77	4	854	1	77	2	428	1	51	1,203	211,146
Liberia	6	8,683	(1)	5	4	4,981			3	2,871	6	1,001
Netherlands	51	19,193	32	4,948	36	13,643	58	9,860	50	20,524	78	12,849
Portugal	1	408	(1)	1	5	570	2	473				
Sierra Leone	453	57,577	1	82	272	32,696	(1)	83	331	42,861	1	129
South Africa, Republic of	389	68,948	23	9,786	927	189,885	21	7,777	1,194	257,249	22	9,674
Switzerland	2	251	8	1,587	(1)	42	4	1,087	1	29	14	2,796
U.S.S.R			15	3,609			43	9,215			43	10,607
United Kingdom	911	211,799	19	3,209	451	69,959	17	2,576	495	113,756	14	3,630
Venezuela	383	8,215	(1)	20	389	8,204	(1)	5	260	5,987	(1)	79
Western Africa, n.e.c	1	883			36	6,568			(1)	172		
Zaire	2	200	(1)	18	3	152						
Other	5	467	2	929	3	212	10	1,162	8	411	9	2,068
Total	2,450	412,678	2,083	347,362	2,341	347,882	2,236	374,237	2,464	462,657	3,087	549,182

[1]Less than 1/2 unit.

Significant quantities of Burmese jadeite ends up in Thailand through various smuggling routes. The price of fine apple and emerald green jadeite is such that a market has been created for the once-neglected yellow, red, and apricot colors. Much of the yellow and red material being offered is not jadeite but dyed quartz. The fraud may be detected by concoidal fractures on a chipped edge rather than the fibrous fracture displayed by jadeite.[10]

Colombia.—Two years ago small emeralds of little commercial value were discovered in alluvial sands near the small town of Yacopi. The discovery coincided with the closing of Muzo, the major emerald mine in Colombia. The increasing production from the Yacopi area gives evidence to the belief that soon something of real value will be discovered there. A major find at Yacopi would give Colombia a new source of foreign exchange.[11]

Guatemala.—Rough Maya jade will be made available to wholesale gem distributors and rockhounds. The jadeite is of excellent carving quality. The colors range from a pearly white and a richer green to a dark green that appears black when polished. The quality of the jade has been evaluated, and it compares favorably with Wyoming jade. Larger rough-cut boulders have been exported to Hong Kong for statue carving.[12]

Lesotho.—The Letseng-la-Terai mine began producing at a rate of 4,000 tons of ore per day. Systematic mining began in May with the object of exposing hard kimberlite at depth and stockpiling the overlying soft weathered kimberlite. At yearend, 500,000 tons of the weathered kimberlite had been stockpiled. The profitability of the mine depends on the production of a comparatively small quantity of large, high-quality stones.[13]

India.—The Indian diamond industry, which is export-oriented and cottage based, has grown twelvefold in the past decade and now provides employment to approximately 150,000 workers, mostly skilled artisans. The United States has emerged as one of the principal buyers of Indian diamond accounting for more than 27% of India's exports. India's share in the world diamond trade is about 7% to 8% in terms of value and 1.2% to 1.5% in terms of caratage. A combination of skills developed over the years and low production costs have enabled India to specialize in the polished small diamonds known as "makeables." The bulk of India's raw material requirments, namely, rough diamonds, is supplied by the Diamond Trading Company (DTC), London. The outlook for the industry is encouraging.[14]

Iran.—Iranian production of turquoise from March 21, 1975 to March 20, 1976, was reported as 68.2 short tons. Proven reserves were reported as 11,000 short tons and resources as 22,000 short tons.[15]

Pakistan.—The Government of Pakistan decided to set up an organization to buy uncut emeralds, diamonds, and other precious stones from the mines at Swat in the North West Frontier Province and export them in finished form. The mines have been sealed by the police and mining operations suspended for the present. Of the 800 carats of emerald produced per month, a large proportion was said to be smuggled out of the country.[16]

South Africa, Republic of.—The Central Selling Organization reported diamond sales in 1976 of $1,555 million, 46% greater than in 1975. During 1976, sales exceeded production, and the excess was provided from stocks. The Central Selling Organization increased the price of diamond twice in 1976, by 3% in January and 6% in September. The demand for the smaller sizes and the lower qualities of larger diamonds was very strong in 1976. Toward the end of the year, there was improvement in demand for better quality large stones. No breakdown of gem stones or industrial diamond sales was given.[17]

South-West Africa, Territory of.—The Consolidated Diamond Mines of South-West Africa (Proprietary) Ltd. reported an increase in ore treated in 1976 to 14,167,067 short tons, from 13,498,048 tons in 1975. The average stone size increased from 0.73 carat per stone to 0.95 carat per stone in 1976. Overburden stripped increased from 46,389,670 short tons in 1975 to 54,996,027 tons in 1976. Diamond production decreased to 1,693,994 carats in 1976 from 1,747,739 carats in 1975.

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[10]Greenspan, J. The Latest Ripoff: Yellow-Red Burma Jade. Lapidary J., v. 29, No. 11, February 1976, p. 2084.
[11]World Mining. Colombian Miners Seek Emeralds at Yacopi as Famed Muzo Mine Closed. V. 29, No. 4, April 1976, pp. 88-89.
[12]Swezey, W. R. Ancient Maya Jade Deposits Rediscovered. Lapidary J., v. 30, No. 3, pp. 742-746.
[13]De Beers Consolidated Mines Ltd. 1976 Annual Report, 59 pp.
[14]U.S. Embassy, New Delhi, India. State Department Airgram A-87, Dec. 23, 1976, 8 pp.
[15]U.S. Embassy, Tehran, Iran. State Department Airgram A-225, Dec. 29, 1976, Enclosure 1: 1 pp.
[16]Mining Journal. Production Smuggling in Swat. V. 286, No. 7337, Mar. 5, 1976, p. 183.
[17]De Beers Consolidated Mines Ltd. 1976 Annual Report, 59 pp.

Further refinements made to the dewatering systems and stability improvements to the sea wall enabled operations to advance 150 feet further seaward of the high water mark. Fewer minor breakdowns were experienced with the bucketwheel excavator during the year, but three major component failures decreased overall availability.

Thailand.—Many of Thailand's precious and semiprecious stone mines are nearing depletion, resulting in a marked increase in importation of blue sapphires from Australia. Smuggling of gem stones from Burma and Cambodia also increased.[18]

U.S.S.R.—Soviet geologists are reported to have made diamond finds in ancient Timan paleozoic deposits west of the Urals.[19]

The Frankfurt diamond bourse has gone into receivership. German promoters attempted to make Frankfurt a world diamond market using cutters from Idar-Oberstein to challenge the dominance of Israel, Antwerp, New York, and Bombay. Breaking into a trade that is divided between De Beers and the many Israeli and Belgian craftsmen was too big a task for the Germans even with Soviet help.

It is reported that the U.S.S.R. has opened an export office in Antwerp under the name of RUSSALMAZ MV. It is also reported that the U.S.S.R. is selling the bulk of its finished goods to the Diamond Trading Co. marketing network since attempts to compete directly had failed.[20]

[18]U.S. Embassy, Bangkok, Thailand. State Department Airgram A-140, June 16, 1976, 8 pp.
[19]Mining Journal. Industry in Action: Exploration. V. 287, No. 7352, July 16, 1976, p. 51.
[20]McInnes, N. A Soviet Investment. Barron's, v. 56, No. 1, Jan. 5, 1976, p. 4.

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

(Thousand carats)

Country	1974			1975			1976[p]		
	Gem	Industrial	Total	Gem	Industrial	Total	Gem	Industrial	Total
Africa:									
Angola	1,470	490	1,960	345	115	[e]460	495	165	[e]660
Botswana	408	2,310	2,718	360	2,037	2,397	354	2,007	2,361
Central African Republic	220	118	338	220	119	339	221	119	[e]340
Ghana	257	2,315	2,572	233	2,095	2,328	228	2,055	2,283
Guinea[e]	25	55	80	25	55	80	25	55	80
Ivory Coast	112	167	279	84	125	209	22	38	60
Lesotho[2]	2	9	11	1	2	3	1	2	[e]3
Liberia[3]	377	259	636	[4]241	[4]165	[4]406	250	150	[e]400
Sierra Leone[e]	670	1,000	1,670	600	900	1,500	600	900	1,500
South Africa, Republic of:									
Premier mine	605	1,817	2,422	509	1,527	2,036	458	1,375	1,833
Other De Beers properties[5]	2,397	1,961	4,358	2,518	2,061	4,579	2,549	2,086	4,635
Other	438	292	730	408	272	680	332	222	554
Total	3,440	4,070	7,510	3,435	3,860	7,295	3,339	3,683	7,022
South-West Africa, Territory of	1,491	79	1,570	1,660	87	1,747	1,609	85	1,694
Tanzania	249	249	498	224	224	448	225	225	[e]450
Zaire	[r]620	[r]12,991	13,611	395	12,415	12,810	591	11,230	11,821
Other areas:									
Brazil	127	127	254	135	135	[e]270	135	135	[e]270
Guyana	12	18	30	8	13	21	6	8	14
India	18	3	21	17	3	20	17	3	20
Indonesia[e]	12	3	15	12	3	15	12	3	15
U.S.S.R.	1,900	7,600	9,500	1,950	7,750	9,700	2,000	7,900	9,900
Venezuela	279	970	1,249	239	821	1,060	190	643	833
World total	[r]11,689	[r]32,833	44,522	10,184	30,924	41,108	10,320	29,406	39,726

[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 (1974-75), Liberia (1974), Venezuela (all years), and Zaire (1974-75) 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]Partial figure; January 1 through December 15 only.
[5]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

Ruby crystals were subjected to a static pressure greater than 1 megabar in a diamond-windowed pressure cell. The pressure was monitored continuously by observing the spectral shift of the sharp fluorescent Ri ruby line excited with a calcium-helium gas-diffusion laser beam. One megabar appears to be the highest pressure ever reported for a static experiment in which an interval calibration was employed. The accessibility of this pressure range, coupled with the high temperature already reached, makes it possible to experiment directly at the conditions of the earth's core.[21]

General Electric (GE) scientists successfully tested a new machine that can apply pressures greater than 8 million pounds per square inch. To achieve and maintain these pressures, GE created a pair of tungsten carbide pistons tipped with the company's manufactured industrial diamonds. The apparatus will be used to study changes that occur in materials under high pressures and temperatures.[22]

Two distinct suites of minerals included in natural diamond are described. It is indicated that they probably represent different physical and chemical conditions during diamond growth. Detailed mineralogical and chemical study of the minerals included in diamond during its growth can provide significant data regarding the chemistry and physics of the upper mantle, as well as providing insight into the genesis of diamond.[23]

A detailed analysis of the composition of gaseous inclusions in seven Arkansas diamonds ranging in size from 0.37 to 2.06 carats and containing other inclusions was made by mass spectrographic techniques. The released gases were found to be of variable compositon and similar to those reported earlier from diamonds of African origin. Based on the tentative assumption that the gases are genetically related to the host diamond, a theoretical gas-solid diamond growth model was presented, which can account for the observed compositional variations in the included gases.[24]

There are three significant features in the typical appearance of opal that provide clues to the mechanism responsible for the color display: (1) The color is associated with small grains, and throughout each grain the color is fairly uniform, (2) the color of the grains changes as the orientation of the stone is changed with respect to the light source and the observer, and (3) generally the colors are spectrally pure. Electron micrographs revealed regular geometric patterns of tiny holes across the entire surface of a grain. These arrays of holes are sufficiently regular to act as three-dimensional diffraction gratings that give rise to the stones' characteristic fire.[25]

The Spencer mines in Idaho produced gem opal, which not only has the intense color of Australian doublets and triplets, but has an additional feature of displaying a star of brilliant colors. There are three types of stars to be found among the Idaho gems: A cat's eye stone that exhibits a single streak of dispersed colors across the triplet, a three-ray star, and a six-ray star. Stars such as these have not been reported for Australian opal.[26]

Two major techniques, flux and hydrothermal, have been used to grow emerald crystals, and various solvents have been employed. The lithium molybdate flux has proved to be commercially viable in the hands of Chatham and Gilson. Hydrothermal work, using two acid mineralizers, which gave satisfactory growth, did not prove to be commercially viable.[27]

Color changes were observed on gamma-ray irradiation of over 500 colorless, pink, blue, and green tourmalines. The only significant changes observed were the development or intensification of pink or the development of yellow superimposed on the preexisting color. Some of these colors are stable to heat, and some are not.[28]

The well-known brown color produced by the irradiation of topaz has been reexamined particularly with respect to the kinetics

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[21]Mao, H. K. and P. M. Bell. High Pressure Physics: The 1-Megabar Mark on the Ruby Ri Static Pressure Scale. Science, v. 191, No. 4229, Feb. 27, 1976, pp. 851-852.

[22]American Metal Market/Metalworking News. GE Machine Able to Generate 8 Million Pounds of Pressure. V. 83, No. 111, June 7, 1976, p. 27.

[23]Meyer, H. O. A. and H. M. Tsai. Mineral Inclusions in Diamond: Temperature and Pressure of Equilibrium. Science, v. 191, No. 4229, Feb. 27, 1976, pp. 849-851.

[24]American Mineralogist. Experimental Results and a Theoretical Interpretation of Gaseous Inclusions Found in Arkansas Natural Diamonds. V. 60, No. 5-6, May-June, 1975, pp. 413-418.

[25]Darragh, P. J., A. J. Gaskin, and J. V. Sanders. Opal. Sci. Am., v. 234, No. 4, April 1976, pp. 84-85, 88-95.

[26]Sanders, J. V. Star Opal From Idaho. Lapidary J. v. 29, No. 11, February 1976, pp. 1986, 1988, 1990, 1992, 2008, 2010.

Nassau, K. Synthetic Emerald: The Confusing History and the Current Technologies. Part I, Lapidary J., v. 30, No. 1, April 1976, pp. 196-202.

[27]Nassau, K. Synthetic Emerald: The Confusing History and the Current Technologies. Part II. Lapidary J., v. 30, No. 2, May 1976, pp. 468, 470, 472, 488, 490, 492.

[28]Nassau, K. Gamma Ray Irradiation Induced Changes in the Color of Tourmalines. Am. Mineralogist, v. 60, No. 7-8, July-August 1976, pp. 710-713.

of the color formation. The known color is produced at two different rates. Heating to 200 for a few hours removes essentially all the color of the specimens tested.[29]

A completely new comparison microscope assists the geologist and mineralogist in the accurate identification of minerals by color. The Lovibond-Nelson microcolorimeter is based on an optically linked pair of microscopes using a single light source. Accurately graded glass filters are calibrated to the Lovibond subtractive color system and give an optical match with a sample.[30]

An automatic cutting machine, The Piermatic, an English invention, cuts small diamond stones with efficiency and consistency of make. Machines are in use in Israel, New York, and Puerto Rico. Use of the machine is usually limited to stones of about 30 points.[31]

Modern technology in the form of aerial photographs offers major assistance to mineral collectors. Photograph prints available from film libraries show settlers' homesteads, derelict railways, ghost towns, or any kind of habitation or clearing. Fifty-year-old bush trails show plainly no matter how overgrown they have become. Careful study of photographs will often save many miles of wandering in search of prospective sites.[32]

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[29]Nassau, K. and B. E. Prescott. Blue and Brown Topaz Produced by Gamma Irradiation. Am. Mineralogist, v. 60, No. 7-8, July-August 1976 pp. 705-709.

[30]Mining Journal. Methods and Machines. Microcolorimeter for Mineral Identification. V. 286, No. 7342, May 7, 1976, p. 363.

[31]Jeweler's Circular-Keystone. Gemstones. Automatic Diamond Cutting in N.Y. V. 146, No. 7, June 1976, p. 46.

[32]Hutchinson, W. and J. Hutchinson. Genuine Treasure Maps. Lapidary J., v. 30, No. 3, June 1976, pp. 818-821.