THE MINERAL INDUSTRY

ITS

STATISTICS, TECHNOLOGY AND TRADE

DURING

1921

FOUNDED BY RICHARD P. ROTHWELL

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PRECIOUS STONES

By George F. Kunz

The year 1921 has been a remarkable one for the precious-stone industry as compared with the preceding years. It has been marked by the shutting-down of the larger diamond mines and of nearly all the smaller sources. In ruby mining, fewer stones have been found, and this is also true of the semi-precious stones. Many of the lesser gems, such as the amethyst, agate, carnelian and amber, have been cut to a considerable extent by the Chinese, and to an even greater extent in the Rhine provinces, many young apprentices having been employed, and great quantities of material sent all over the world.

In the pursuance of their conservative policy, the directors of the great De Beers combination stringently curtailed production in the course of 1921, finally bringing it practically to a standstill. Nevertheless, the sales of diamonds for the year ending June 30, 1921, amounted to the respectable figure of £2,300,581; however, the latter half of 1921 did not make as good a showing. This action of the large producers necessarily forced the owners of the smaller mines to follow their example, more especially as they had no great reserves like the largest company, and in Southwest Africa similar measures were taken. When, however, the turn of the tide comes, everything is in readiness to take full advantage of it.

When we consider the unusual prosperity enjoyed by the precious-stone industry in 1919 and in the first half of 1920, the reaction evidenced in the present period of depression seems to be only a natural one, and the prospects for the future may be pronounced satisfactory. Undoubtedly the increased incomes resulting from the tremendous stimulation of many branches of business during the World War, and for some time thereafter, created a strong and widespread demand for precious stones, more particularly for diamonds. As the number of buyers grew, prices rapidly mounted, especially as the situation was very wisely handled by the great London Diamond Syndicate, which practically controlled the whole diamond output.

However, coincidentally with the falling-off in the number of purchasers, came the marketing, in one way or another, of a considerable quantity of old diamonds owned by exiled Russian aristocrats and also by noble families of many other European countries where the old order of things had been overthrown. This has created a temporary compe-

tition with the mine products even though the actual production has been very greatly decreased. Still, this marketing of old diamonds will very soon cease, and with the hoped-for return of economic stability throughout the world, the precious-stone industry will resume an upward movement.

Besides the sale of jewels by the impoverished nobility of certain European countries, another unfavorable competition with the marketing of new diamonds from the mines arose from the generous and thoroughly justifiable policy of some leading gem dealers in the United States to take back from many of their customers diamonds which had been bought in the recent era of greatest prosperity. This has often been done under similar circumstances in the past, and aside from the accommodation afforded to individuals, it greatly serves to stabilize the market in a temporary period of depression.

United States Imports

For the United States, and therefore to a considerable extent for the whole world, the record of precious-stone imports into this country constitutes a barometer recording the varying prosperity of this branch of industry. As a fair instance of the striking differences from one year to another, we give the figures of these imports for the ten-year period 1911–1920:

1911	$42,315,830	1917	$40,906,667
1912	42,552,720	1918	24,272,000
1913	46,560,608	1919	105,273,543
1914	19,764,987	1920	75,855,591
1915	26,521,330		
1916	51,590,080		$475,613,356

This gives an average per year of $47,561,133. The imports for 1921 amounted to $38,127,649, and although this total falls far below that of the record years 1919 and 1920, it is larger than the average for the eight years 1911–1918, which was $36,800,000. This serves to emphasize the essential stability of the diamond market, in spite of notable fluctuations.

IMPORTS OF DIAMONDS AND OTHER PRECIOUS STONES INTO THE UNITED STATES

	1918.	1919.	1920.	1921.
Diamonds, glaziers' and engravers', unset and miners', free	$718,397	$984,381	$1,527,753	$435,872
Diamonds, uncut, dutiable	12,605,526	20,315,758	10,527,363	2,257,299
Diamonds, cut but not set, dutiable	7,761,810	64,222,947	45,444,999	26,338,455
Pearls and parts of, not strung or set, dutiable	722,981	11,541,000	7,377,772	4,538,803
Other precious stones and bort, dutiable	604,550	1,623,522	3,717,741	733,919
Other precious and semi-precious stones, cut, but not set, dutiable	968,094	5,006,032	5,031,639	2,587,404
Imitation precious stones, dutiable	890,642	1,579,903	2,228,325	1,235,897
	$24,272,000	$105,273,543	$75,855,591	$38,127,649

IMPORTS OF CUT DIAMONDS AND PEARLS ACCORDING TO THE SOURCE

	Diamonds, cut, but not set, dut.			Pearls, and parts of, not strung, not set, dut.		
	1919.	1920.	1921.	1919.	1920.	1921.
Imported from:						
Belgium			$12,024,417			
France	$2,033,268	$2,506,090	638,443	$5,982,654	$3,861,617	$3,543,425
Netherlands	53,561,019	31,024,241	11,497,228			
United Kingdom	6,664,911	3,003,534	1,873,039	5,347,460	3,235,320	802,949
British India				81,003	79,452	48,637
Other countries (a)	1,963,749	8,911,134	305,328	129,883	201,383	143,792
Totals	$64,222,947	$45,444,999	$26,338,455	$11,541,000	$7,377,772	$4,538,803

(a) Includes cut diamonds from Belgium before 1921.

Prima facie, there does not seem any reason to identify the cut diamonds entered at New York from "other countries" with the so-called "Russian" diamonds sold by exiles or looters. In 1919 and 1920 no reports are made for Belgium, but the $8,911,134 for other countries in 1920 (nearly five times as much as in 1919) evidently refers to the newly awakened Antwerp industry, for while this in 1921 is $12,024,417, "other countries" have then fallen off to only $305,328.

From 1867 to 1917, the total value of imports of "diamonds and other precious stones" was $771,544,558. As in many of the earlier years no distinction was made between diamonds and other precious stones a small allowance has to be made for the latter, but it can safely be assumed that the diamonds were worth close to $750,000,000. Since 1917 we have nearly $200,000,000 additional for diamond imports. This gives us a total not far short of a billion dollars, and the cost of acquisition to the present owners, embracing as it must the duties, the sales tax, the cost of cutting the uncut diamonds, the setting, and the profits of the eventual sellers, may be set at twice as much or more.

DIAMONDS

Many conditions conspired to make diamond mining different from what it has ever been before, and resulted in an extensive closing-down of the principal mines. Much discussion has been indulged in as to the precise causes which determined the large purchases of diamonds made just before and during the war by Germans and Russians, and it has been shrewdly surmised that the ulterior aim was to stabilize the financial status of these countries and of individual buyers, for diamonds offered a permanent security for investments against the inevitable breakdown of the currency. When this finally occurred, the greater part of the accumulated diamonds were thrown upon the market in 1921 by the

German and the Russian owners, and nothing has more clearly proved that the stones were not bought to be cut and set into jewels than the fact that in many instances a number of packages still bearing the original, unbroken seal, and each containing diamonds worth £100,000 each, were among the goods thus offered for resale at a lower than purchase price.

Thus the Diamond Syndicate has had manifold difficulties to contend with in its efforts to maintain diamond prices. The writer of the present article in an address at Chicago, before the Economic Section of the American Association for the Advancement of Science on Dec. 27, 1920, drew attention to the superior excellence of diamonds and precious stones as the only stable portable investments for war or revolution, and was able to give many historical proofs of the truth of this contention.

The depression in the diamond industry was strikingly shown in the heavy decrease of sales in 1921 as compared with 1920, according to the reports of the Department of Mines and Industries of the Union of South Africa. As shown in the table below there was a drop of more than £8,000,000. The value per carat also declined, although not quite so sharply. Moreover, the Customs statistics show exports of only 316,702 carats, worth £1,355,487 in 1921, while in 1920, 2,039,544 carats were exported at a value of £11,597,451. As during the 5-year period 1916–1920 the weight of the diamonds produced exceeded the weight of the diamonds sold by 1,254,328 carats, the export returns for 1921 prove that we must add 213,404 carats to this total to figure the quantity of the 6 years' output still held by the Diamond Syndicate. This gives 1,467,733 carats.[1]

The total sales since 1913 are given as follows, a part of the diamonds sold having been mined in previous years.

	Carats.	Value.	Value per Carat.
1913	5,537,820	£12,088,983	43s. 8d.
1914	3,363,568	6,758,544	40s. 2d.
1915	551,951	1,459,597	52s. 11d.
1916	2,291,956	5,227,777	45s. 7d.
1917	2,416,209	6,170,906	51s. 1d.
1918	2,641,932	7,232,744	54s. 9d.
1919	2,648,931	13,379,662	101s. 0d.—
1920	1,765,554	10,163,941	115s. 2d.
1921	530,107	2,161,796	81s. 7d.

Diamond-cutting and Trade

The pioneer in building up a considerable diamond-cutting industry in England, Sir Bernard Oppenheimer, Bart., died at his country residence, Sefton Park, near Slough, on June 13, 1921, at the age of fifty-four years.

[1] *So. Afr. Min. Eng. Jour.*, Mar. 25, 1922.

He owed his great reputation and his title to his important efforts to help win the World War. In conjunction with a few partners he built an immense factory at Letchworth for the manufacture of war munitions, and by 1916 its output was not less than 16,000 shells per diem. A similar energy, though enlisted in a less important cause, marked his building up of a diamond-cutting industry in which maimed or otherwise disabled veterans could receive training in this delicate and well-remunerated vocation. As illustrating the relative success of this enterprise, we may note that while the value of the cut diamonds imported from the United Kingdom into the United States for the year 1921, was $1,873,039 as compared with $3,003,534 for 1920, the percentage which this represented of the total diamond imports was 7.11 in 1921 against 6.61 in 1920. This seems to show that the English experiment is at least moderately successful.

France has followed the example of Great Britain in starting a diamond-cutting establishment where disabled soldiers will receive training in this work. It is situated in Versailles and was initiated at the instance of Joseph Asscher, senior member of the great diamond-cutting firm of Asscher Bros. in Amsterdam. For his activity in behalf of the French veterans he has been awarded a decoration of the Legion of Honor.

As to the activity of the French Diamond Commission, the President of the Chambre Syndicale des Diamants, Perles, Pierres Précieuses et des Lapidaires, made the following statement at the meeting of Jan. 11, 1922:

> The activities of the Commission shall be as follows:
>
> *Importations.*—As in the past, authorizations by the President, control of the arrival at the custom house by the commissioners.
>
> *Exportations.*—Control by the Commission and at the Chambre Syndicale, in presence of a customs representative; the sealed note of the exporter, provided also with the sealed note of the Commission, is addressed to the nearest post office.
>
> It should either be accompanied by an agent of the Post Office, or controlled by means of a memorandum stamped at the Post Office, if there shall be an agreement between the Postmaster General and the Minister of Finance.
>
> The control of exportation shall be available for the service of indirect contributions (business returns).
>
> The Commission should give its opinion in case of litigation.

Concerning the diamonds sold by Russians in the Antwerp market in 1921, the following details transmitted to the U. S. Department of Commerce by James T. Kirby, clerk in the American Consulate at Antwerp, under date of July 26, 1921, are of importance:

"For a period of about two months the supply of diamonds from

Russia had apparently ceased, when suddenly a lot of several thousand carats was again negotiated on the market. A considerable portion of this lot must, of course, be recut. Besides these Russian stocks, the importance of which has been somewhat overestimated, the market seems to have been further unfavorably influenced by contraband and smuggling, which had been on the increase since the signing of the armistice.

"It is thought by some merchants that the Government could intervene to advantage by placing on stones presented for recutting a real duty, say 20 per cent. Such a measure, however, besides being very difficult of application, would be inoperative unless adopted by all countries. The measure taken in one country only would result in favoring cutting establishments in neighboring countries. Antwerp would then remain exposed to the disagreeable duty of smuggling so long as the situation did not improve in Russia and Poland, where persons in need of funds sell their jewels at low prices. At present, therefore, it is difficult to give a carat a value which would be approximately exact.

"The London Syndicate recently began to buy Russian diamonds, which has done much toward eliminating the bad influence of this dumping."

Diamond Mining and Production

Congo.—In the Congo, the diamond resources have been actively developed in recent years, as is shown by the following statistics of production:

DIAMOND OUTPUT OF THE BELGIAN CONGO

	Carats.		Carats.
1915	48,995	1919	275,000
1916	53,940	1920	315,000
1917	100,000	1921	174,000
1918	164,420		

A considerable number of what are known as "industrial diamonds," chiefly for use in diamond drills, are brought to Antwerp from the Congo, and toward the end of 1921 two of the principal London dealers in this class of diamonds agreed with the Congo Diamond Regie at Antwerp to buy all of the next three consignments of these diamonds from the Congo up to a maximum of 70,000 carats each time.

Southwest Africa.—Operating under the terms presented by the conference of the four large South African diamond producers, held toward the close of 1919, the Consolidated Mines of Southwest Africa, the new organization which has taken over the properties of the old German companies in Southwest Africa, was assigned the following quotas of output for the four quarters of 1920 at the given base prices

per carat.[1] In order to show the number of carats, we have divided the quotas by the base price in each case.

	Quota.	Base Price.			Equivalent in Carats.
		£.	s.	d.	
First quarter	£619,580	5	12	4	110,344
Second quarter	630,000	7	4	7	87,200
Third quarter	540,330	8	4	4	65,770
Fourth quarter	275,583	8	9	5	32,517
	£2,065,493				295,831

The cost of operation varied considerably. For 1920 it was about £1 4s. per carat; but it was lower than it would have been but for the fact that the scale of operating was above normal requirements. The Government pays 70 per cent. of these working costs, as a partial offset to its heavy tax on the value of the diamonds exported.

The Anglo-American Corporation of South Africa, Ltd., which has acquired a very large interest in the Consolidated Diamond Mines of Southwest Africa, Ltd., has deposited with the Guaranty Trust Co. of New York a certain number of its £1 shares, and the Trust Co. is issuing "American shares" of no par value, each of which represents five of the £1 shares. The Anglo-American Corporation has also considerable holdings in several gold-mining companies, and in the Transvaal Coal Corporation, Ltd. Its interest in the Consolidated Diamond Mines of Southwest Africa is principally constituted by its holdings of the company's 8-per cent. debentures, secured by a mortgage on the mining property, which, as has already been stated in these reports, consists of the diamantiferous area formerly owned by the German companies of Southwest Africa. The Anglo-American Corporation paid two 5-per cent. dividends on its shares in 1920, and one such dividend in 1921, but although the earnings permitted another 5-per cent. dividend in 1921, it was thought wiser, in view of the temporary depression of the diamond market, to conserve the company's resources.

The diamond output is sold through the London Diamond Syndicate subject to the arrangement that the share of the various interests shall be as follows: 21 per cent. for the Consolidated of Southwest Africa, 51 per cent. for the De Beers mines; 18 per cent. for the Premier mine, and 10 per cent. for the New Jagersfontein mine. Quite recently it has been stated that the Anglo-American Corporation has bought some 8,000,000 francs' worth of Congo diamonds, which will also be disposed of

[1] *Eng. Min. Jour.*, Oct. 29, 1921.

by the London Syndicate. This would tend to remove any competition of Antwerp with London in the diamond trade.

Union of South Africa.—While usually the largest diamond producer in South Africa is Cape Province, in 1921 more diamonds were recovered in the Transvaal. Of a total of 424,486 carats worth £1,254,151, the Pretoria district furnished 358,505 carats valued at £852,949, this representing practically the output of the Premier mine. Kimberley, Cape Province, furnished 179,752 carats, and Barkley West 53,725 carats. From the Orange Free State, the great alluvial diamond field, came 143,686 carats. The depression has been most accentuated in Cape Province, where are the De Beers mines, although operations were on a reduced scale in the Transvaal also. The somewhat better results realized here are due in great part to the different way in which the mining is carried on, for in the Premier mine the diamonds are rather quarried than mined, so that the expensive white labor is less necessary than it is at Kimberley, where the work is largely performed at fairly great depths. On the other hand, the region least affected by labor conditions has been the Orange Free State, where individual prospectors secure the stones from the alluvial diggings.[1]

The alluvial diamond output of Cape and Transvaal provinces for 1921 was as follows:

	Carats.	Value.
Cape Province	59,811¾	£420,297 11s. 3d.
Transvaal Province	79,636	£422,508 1s. 6d.

This gives a value per carat of £7 0.54s. for the Cape Province stones, and of £5 6.11s. for the Transvaal stones.[2]

PRODUCTION OF DIAMONDS IN SOUTH AFRICA

Year.	Production from Mines.			Alluvial Diamonds.		
	Carats.	Estimated Value.	Value per Carat.	Carats.	Estimated Value.	Value per Carat.
1913	4,944,946	£10,254,203	41s. 6d.	206,049	£1,120,227	108s. 9d.
1914	2,653,089	4,906,342	37s. 0d.	143,924	576,729	80s. 2d.
1915	2,131	3,887	36s. 6d.	97,678	392,196	80s. 4d.
1916	2,170,348	4,769,479	43s. 11d.	167,620	948,571	113s. 2d.
1917	2,710,041	6,659,721	49s. 2d.	182,992	1,041,776	113s. 10d.
1918	2,385,361	6,137,283	51s. 5d.	143,438	964,574	134s. 6d.
1919	2,366,744	8,960,614	75s. 9d.	209,589	2,740,548	261s. 6d.
1920	2,312,436	12,289,602	106s. 3d.	221,460	2,441,440	220s. 6d.
1921	424,486	1,254,151	59s. 2d.	283,134	.....	.....

The depression of the diamond industry, which must continue until the great stock of diamonds thrown on the market by the Russian Government, and the accumulations of South African diamonds held by the London Syndicate, have been absorbed by the buyers, has induced

[1] *So. Afr. Min. Eng. Jour.*, Mar. 25, 1922.
[2] Communicated by Mr. E. Gibbs, of the Detective Service of South Africa.

the closing-down of most of the diamond mines in South Africa. However, the Premier company has continued operations, though on a reduced scale, work being confined to five 8-hr. shifts per week, some 5000 loads of blue ground being worked on each shift in the No. 3 gear.

In addition to this information, we are indebted to Dr. Percy A. Wagner[1] for the following description of an improvement in the treatment of the blue ground that has recently been introduced at the Premier mine:

"Dressing operations at this mine have been greatly simplified within the past two years by doing away with the jigs formerly employed for re-treating the concentrate made by the working gears. The concentrate is conveyed by means of a belt to three tube-mills run at such a speed as to ensure that crushing is performed by attrition without impact. These discharge into revolving screens with round holes 1/16 in. in diameter, everything below this diameter being rejected. The oversize is elevated to trommels with square holes of 5/8 in. and 1/2 in., and round holes of 3/8 in. and 1/4 in. These give six products, each of which goes to a greased Frue vanner. The concentrate collected on them is automatically scraped off and freed of the adhering grease in electrically heated melters fixed to the vanner frames. The product thus obtained represents 1/250,000 part by weight of the blue ground sent to the washing plant."

DIAMOND OUTPUT OF PREMIER MINE

Year Ended Oct. 31.	No. of Loads Washed.	No. of Carats Found.	Value of Diamonds.	Yield per Load in Carats.	Value per Carat.	Value per Load.	Cost of Production per Load.	Profit per Load.
			£		s. d.	s. d.	s. d.	s. d.
1903	76,931	99,208¼	137,435	1.290	27 8.50	35 6.70	4 7.20	30 11.50
1904	939,265	749,653½	866,030	0.798	23 1.20	18 5.30	2 7.62	15 9.68
1905	1,388,071	845,652	994,687	0.609	23 6.29	14 3.98	3 3.44	11 0.55
1906	2,988,471	899,746	1,277,740	0.301	28 4.82	8 6.61	3 5.71	5 0.90
1907	6,538,669	1,889,986¾	1,702,631	0.290	18 0.20	5 2.49	2 4.14	2 10.35
1908	8,058,844	2,078,825½	1,536,720	0.258	14 9.40	3 9.75	1 10.24	1 11.51
1909	7,517,793	1,872,136½	1,172,379	0.249	12 6.29	3 1.43	1 11.42	1 2.01
1910	9,331,882	2,145,832¾	1,496,641	0.230	13 11.39	3 2.49	2 0.56	1 1.93
1911	8,325,272	1,774,206	1,433,971	0.213	16 1.97	3 5.34	2 2.02	1 3.32
1912	9,707,098	1,992,474	2,004,943	0.205	20 1.50	4 1.57	2 4.79	1 8.78
1913	10,434,680	2,107,983	2,336,828	0.202	22 2.05	4 5.74	2 6.67	1 11.07
1914	7,683,943	1,417,755	1,259,643	0.185	17 9.23	3 3.34	2 5.89	9.45
1915	Mining operations suspended.							
1916	1,572,521	419,947	475,856	0.267	22 7.95	6 0.63	2 7.62	3 5.01
1917	4,928,629	906,341	1,198,923	0.184	26 5.48	4 10.38	2 2.68	2 7.60
1918	4,805,851	851,573	1,203,904	0.177	28 3.29	5 0.12	2 2.89	2 9.73
1919	4,529,261	814,577	1,961,259	0.180	48 1.84	8 7.92	2 10.68	5 9.24
1920	4,660,498	820,564	2,098,483	0.176	51 1.77	9 0.06	3 2.59	5 9.47
1921	1,954,230	411,981	439,626	0.211	21 4.11	4 5.99	3 4.43	1 1.56

This gives the following totals for the 18 years:

Number of loads washed	95,441,909
Carats of diamonds found	22,098,442
Value of diamonds	£23,597,698

The Nineteenth Annual Report of the Premier (Transvaal) Diamond Mining Co., Ltd., very naturally shows a reaction. The credit for diamond account was £439,636, and the balance carried to Expenditure

[1] Communicated under date of Aug. 27, 1921.

and Revenue Account No. 2 was £110,384. After subtracting £20,000 for general equipment, this left £90,354 of realized profits, the 60-per cent. share of the Government being £54,212, and the 40-per cent. share of the stockholders £36,142, With the help of the previous year's balance of £40,964 and of sundry revenue totaling £100,188, the company was able to pay two dividends of 3s. 6d. on the preference shares, and carry £77,921 over to balance sheet. The two dividends (less 7½ per cent. Government tax) amount to £92,000. No dividend was paid on the deferred shares.

This left £464,731 as undistributed balance carried to next year, £354,381 of this being suspense profit account for diamonds unsold June 30, 1921. The general reserve fund then stood at £700,000, while the special reserve fund for the stabiliment of the diamond trade had been increased to £2,476,900 invested in the shares of other diamond companies and kindred interests.

The higher average weight of the diamonds from the Premier mine this year, namely 0.211 carat against 0.176 carat in the previous year, is attributed to the fact that much of the blue ground whence they were derived came from the levels near the surface of the mine, which, for various reasons, had not been worked out before, especially in the vicinity of the rim rock. On the other hand the average value of the diamonds per carat showed a very marked decrease, for in 1919–1920 this was £2 11s. 1.77d., whereas in 1920–1921 it fell to £1 1s. 4.11d., considerably less than half as much.

Of the prevailing depression in the industry, the preliminary report says:

> Your Directors in their report last year mentioned that there was then a lull in the demand for diamonds. Since that date the world generally has been passing through a period of severe depression, which has been felt most acutely in the diamond industry. For many months there was a complete cessation of sales by the Syndicate of diamonds purchased by them from the four large producers, and up to now no sales of any importance have taken place.
>
> In consequence of the stagnation in the diamond market and of representations by the Diamond Syndicate, meetings of the four large producers and the Diamond Syndicate were held at Cape Town in March and May of the present year, when matters were discussed and a satisfying arrangement as to the future deliveries was come to.
>
> The severe and continued depression compelled your Directors to take steps to curtail operations and to economize wherever possible, which unfortunately necessitated the retrenchment of large numbers of employees, both European and native. All mining work was stopped and expenditure in every department was greatly reduced.
>
> A slight improvement in the diamond market has been noticeable recently, but it is still necessary to exercise patience and economy, for the depression through which the ndustry is passing makes the present a difficult period.

The statistics of working and production in the De Beers group of mines for the years 1917 to 1921 are as follows:

DE BEERS AND KIMBERLEY MINES

	Loads of Blue Ground Hoisted.	Loads of Blue Ground Washed.	Carats of Diamonds Found.	Selling Value per Carat.
1916–1917	None	None	41	Not Stated
1917–1918	None	None	315¾	Not Stated
1918–1919	None	None	241¾	Not Stated
1919–1920	None	None	242	Not Stated
1920–1921	None	None	955	Not Stated
WESSELTON MINE				
1916–1917	1,814,393	1,669,104	445,665¾	53s. 9.27d.
1917–1918	2,065,620	1,805,436	487,828½	54s. 9.76d.
1918–1919	1,035,311	1,657,146	403,039¾	69s. 11.79d.
1919–1920	1,927,178	1,646,895	401,531½	119s. 1.25d.
1920–1921	845,295	832,442	217,761	136s. 0.54d.
BULTFONTEIN MINE				
1916–1917	2,092,267	1,761,756	675,401¾	46s. 11.00d.
1917–1918	2,328,615	1,859,531	646,927½	49s. 9.62d.
1918–1919	1,262,942	1,629,198	507,858¾	63s. 5.38d.
1919–1920	2,021,026	2,251,257	663,419¾	102s. 10.29d.
1920–1921	934,537	670,907	233,924½	109s. 4.26d.
DUTOITSPAN MINE				
1916–1917	135,650	1,927,335	377,571¼	106s. 11.93d.
1917–1918	2,200,000	2,178,132	422,657¾	108s. 6.22d.
1918–1919	1,389,883	1,066,465	180,983	139s. 9.77d.
1919–1920	1,796,573	1,892,558	305,587	221s. 2.36d.
1920–1921	861,651	830,424	132,497	248s. 4.68d.
GRAND TOTALS FOR ALL MINES				
1913–1914	7,166,829	6,641,398	1,903,621¼	
1914–1915	738,472	693,822	188,136	
1915–1916	104,583	1,857,983	591,369¼	
1916–1917	4,042,310	5,358,195	1,498,679¾	
1917–1918	6,595,078	5,843,099	1,557,729½	
1918–1919	3,688,136	4,352,809	1,092,123½	
1919–1920	5,744,777	5,790,710	1,370,780¼	
1920–1921	2,641,483	2,333,773	585,137	
1913–1921	30,721,668	32,671,789	8,787,576¼	

The Thirty-third Annual Report of the De Beers Consolidated Mines, for the year ended June 30, 1921, reflects unmistakably the reaction in the diamond industry which had already set in during 1920. Still, the showing is more favorable than had been expected. On June 30, 1920, the undistributed balance amounted to £592,075, of which £354,244 represented the value of diamonds unsold at that date. The receipts from diamond sales during the year reached the quite respectable figure of £2,300,581; interests and profits on investments, and other revenue, amounted to £639,448, and there was a transfer of £1,010,232

from the general fund. These items, added to the balance above noted, give £4,542,336 on the credit side. From this came £1,976,043 for mining expenditure, £143,425 for expenditure on farms and landed property, and on the Kimberley-Alexandersfontein Railway, £164,470 for interest on debentures and on capital of leased companies, and £84,-186 transferred to sinking fund towards repayment of debentures; and also charges as follows: donations, £66,105; grants to employees leaving the company's service in consequence of trade depression, £112,731; other charges, £164,537; in all, £343,373. These deductions having been made, there remained £1,830,829, available in part for distribution to shareholders, after setting aside £6593 for Union of South Africa income tax, and £119,505 transferred to stabiliment reserve. The preferred shareholders received £740,000 after deduction of tax (that is to say £800,000 less £60,000, or 40 per cent.), and the deferred shareholders £500,000, free of tax, or 20 per cent.

The net results of the mining operations of the year ending June 30, 1921, made but little change in the number of loads of blue ground remaining on the floors of the several mines, as is shown in the subjoined table, which also gives the average number of carats of diamonds in a hundred loads and the value per load.

	Carats per 100 Loads.	Value per Load.	Loads of Blue Ground on the Floor at Close of Year.
DE BEERS MINE			
1916–1917	.....	.....	48,396
1917–1918	.....	.....	48,396
1918–1919	.....	.....	48,396
1919–1920	.....	.....	48,396
1920–1921	.....	.....	48,396
WESSELTON MINE			
1916–1917	27	14s. 6.22d.	2,752,386
1917–1918	27	14s. 9.59d.	3,012,570
1918–1919	24	16s. 9.55d.	2,390,735
1919–1920	24	28s. 7.02d.	2,671,018
1920–1921	26	35s. 4.46d.	2,683,871
BULTFONTEIN MINE			
1916–1917	38	17s. 9.94d.	2,665,777
1917–1918	35	17s. 5.16d.	3,134,861
1918–1919	31	19s. 8.03d.	2,768,605
1919–1920	29	29s. 9.94d.	2,538,374
1920–1921	35	38s. 3.29d.	2,802,004
DUTOITSPAN MINE			
1916–1917	19	20s. 3.94d.	2,411,618
1917–1918	19	20s. 9.22d.	2,434,329
1918–1919	17	23s. 9.22d.	2,757,747
1919–1920	16	35s. 4.70d.	2,661,762
1920–1921	16	39s. 8.91d.	2,682,410

The cost of production per load of blue ground, the value per load, and the profit per load in the three mines of the De Beers group which were worked in 1919, 1920 and 1921, were as follows, according to the company's report:

1919.			
Wesselton	6s. 7.19d.	16s. 9.55d.	10s. 2.36d.
Bultfontein	5s. 6.39d.	19s. 8.03d.	14s. 1.64d.
Dutoitspan	4s. 9.39d.	23s. 9.22d.	18s. 11.83d.
1920.			
Wesselton	8s. 4.97d.	28s. 7.02d.	20s. 2.05d.
Bultfontein	7s. 3.99d.	29s. 9.94d.	22s. 5.95d.
Dutoitspan	6s. 8.48d.	35s. 4.70d.	28s. 8.22d.
1921.			
Wesselton	11s. 9.54d.	35s. 4.46d.	23s. 6.92d.
Bultfontein	11s. 0.51d.	38s. 3.29d.	27s. 2.74d.
Dutoitspan	9s. 7.90d.	39s. 8.91d.	30s. 1.01d.

It will be observed that despite increased cost of production, the higher prices realized give in each case a larger profit per load.

The stock of blue ground on the floors June 30, 1921, compares with the stock in 1920 as follows:

Mine.	1920. Number of Loads.	1921. Number of Loads.
De Beers	48,396	48,396
Wesselton	2,671,018	2,683,871
Bultfontein	2,538,374	3,022,659
Dutoitspan	2,661,762	3,173,226

Thus there was an increase in 1920–21 of 1,008,602 loads, showing that just so much more had been hoisted than had been washed during the year.

As to the falling-off in the sales, the Chairman stated at the general meeting, held in Kimberley Dec. 9, 1921, that while during the year ending Dec. 31, 1920, the company sold £4,628,882 worth of diamonds, the returns for the ten months from Jan. 1, 1921 to Oct. 31, 1921, showed that the total deliveries of diamonds for that period only amounted to £618,930, while the expenditures of the company for these ten months totaled £2,019,249, leaving a deficit of £1,400,313. Of course this has entailed a considerable reduction of the working force, but to obviate hardship as far as possible, and to aid those who were discharged in their search for work elsewhere, a sum of £100 was offered to each employee over 18 years of age on resignation, and £50 to those under that age. A large number of men are said to have availed themselves of this offer.

As an illustration of the reduction of the number of employees, there

were employed on June 30, 1920, 3020 whites and 13,781 natives, while on Oct. 26, 1921, the company carried on its pay sheets 1636 whites and 2451 Kafirs. To over 100 old employees who are past work, there have been allotted fortnightly grants amounting in the aggregate to £13,680 per annum.

Under date of Aug. 27, 1921, Dr. Percy A. Wagner writes that the De Beers Consolidated Mines are erecting a huge direct-treatment plant to deal with the combined outputs of the Wesselton and Dutoitspan mines. The famous Kimberley mine has been definitely abandoned. The pumps have been pulled up, and water is rising in the mine at the rate of about 1 ft. in 24 hr.

The total value of the diamonds produced in the De Beers mines from their organization in 1888 down to June 30, 1917, was $506,545,448. To this must be added for the four years 1918–1921 the sum of $93,626,788, making in all $600,081,236 up to June 30, 1921.

Of the smaller mines we learn from Dr. Percy A. Wagner that the Blaauwbosch is still being worked as an open mine to the depth of 230 ft., this being a record for such a small mine. It is believed that this depth represents the limit here, and it is considered doubtful whether underground work would pay. In August it was reported that operations were to be resumed at the Monteleo mine. In the case of the Frank Smith mine, which was closed down after a six months' trial, the yield proved less than had been expected, but the quality of the diamonds was so good that the owners think the mine can be worked at a profit when the diamond market improves.

Regarding the Postmasburg occurrences, to the west of Kimberley, Dr. Wagner states that only the West End pipe has so far in any way fulfilled expectations. It has been proved to have an area of 150 claims and the yellow ground carries an average of about 20 carats to the 100 loads, the diamonds being of good quality. A large treatment plant is being erected, and as soon as this is completed washing operations will be begun. The Postmas Diamonds, Ltd., suspended operations during the early part of 1921, after a short period of working; the very unsatisfactory yield obtained was attributed to the bad design and working of the plant. One of the pipes opened up by this company has an area of 240 claims, and has been definitely proved to be diamantiferous. Whether it is payable or not remains to be seen. Two other pipes—the Smuts and the Bowden—have been located within a mile of the above-noted one. As to their areas or diamond content no definite information is available, but the general indications are considered so favorable that a company under the name of the Diamond Fields of Africa Exploring

Co., Ltd., has been floated in London. All the pipes of this area are in dolomite, and hence the material is very strongly impregnated with calcium carbonate.

While in most of the South African diamond mines but little development work was carried on in 1921, the area of the Crown Diamond mine, formerly known as the Lace Diamond mine, has formed an exception to this general rule, for exploratory tunnels have been opened there to test the productivity of the western end of the mine. A mass of mixed material, largely "hardibank," has always constituted an obstacle to mining here, although the fact that blue ground exists around it has been proved by an exploratory tunnel driven through this mass at the 160-ft. level. Various test results from ground thus obtained were as follows: 1090 loads of blue ground furnished an average of 11.78 carats of diamonds per 100 loads; 458 loads showed an average of 16.7 carats per 100 loads; and 541 loads gave an average of 20.01 carats to each 100 loads. A drill-hole bored near the mouth of the exploratory tunnel passed out of "hardibank" into blue ground at 34 ft. This shows that the "hardibank" does not extend downwards, but rests upon blue ground. After the drill-hole had traversed blue ground to the depth of 202 ft., basalt was encountered. A similar result was given by exploratory drives put in at the 440 level in 1919, basalt being met with at the walls of the pipe, and in the exploratory drives at the 160-ft. level, a large mass of this rock was encountered which must have been thrown up from below, for only one sheet of this amygdaloidal basalt is known to exist in the mine.[1]

Concerning the alluvial fields Dr. Wagner notes[2] that the workers in these fields have suffered exceptionally from the slump in diamonds, and that the greatest poverty and distress prevailed in the diggings, more especially in the Bloemhof area, where things were so bad that the Government Inspector of white labor advocated the closing of the diggings, on the ground that they were causing mental and moral degeneracy in a large number of those connected with them. Nevertheless a new area has been proclaimed, known as Coetzee's Farm, adjoining Zwartlaagte near Bloemhof, and from 600 to 700 diggers have been attracted thither, but the finds have fallen much below expectations. The long-delayed proclamation of the farm Mosesberg, which has been the subject of much litigation, was eagerly awaited, for there were known to be extensive areas of rich gravel on this property, and 15,000 prospectors and miners were developing and mining in May, 1921. The farm is situated on the Vaal River above Smith's Drift.

The most interesting event of 1921 in the alluvial fields was the dis-

[1] *So. Afr. Min. Eng. Jour.*, Feb. 25, 1922.
[2] Communicated in letter from Pretoria, dated Aug. 27, 1921.

covery in an abandoned claim at Gong Gong of a diamond weighing 381 carats, the largest ever found in the digging. Mr. Wagner tells us that the circumstances under which the find was made well illustrate the romance and vicissitudes of the alluvial diggings. Three men were trekking with a wagon and donkeys to Mosesberg, believing that the proclamation of the farm was imminent. In the neighborhood of Barkley West their donkeys strayed and were lost, with the result that the diggers were absolutely stranded. Eventually they decided to try their luck on this part of the river, and armed with picks and shovels they began operations at Gong Gong, on a claim which the former owner had abandoned in disgust. Within eighteen inches of the old working surface they unexpectedly turned up a big diamond. It was a large cleavage block, and proved to be of rather poor quality, but nevertheless, because of its size, it realized the sum of £2300, or nearly $9000, unheard-of wealth in the diggings at this time.

Brazil.—It has been reported that United States capitalists are negotiating for the purchase of three diamond mines in Brazil. The comparative activity of the Brazilian diamond field is shown by the fact that in 1920 diamonds worth $656,064 were exported, principally to England and the United States. In 1921, the exports were valued at $643,280. The diamonds came from the States of Bahia and Minas Geraes, the former contributing something over 50 per cent., mainly gathered by smaller mine owners. Minas Geraes has three chief producing companies, namely, the Boa Vista Diamond Mine Co. of Diamantina, which is controlled by Brazilian capital, although some 20 per cent. of the stock is owned in England; Cascalio & Co., of Diamantina, controlled by English capital, and the Sopa mine of Diamantina, which was formerly owned by a French company, but is now controlled by Brazilian capital. The estimates of total production are a little uncertain, because many subterfuges are used to avoid payment of the export taxes, but the product is said to be worth about 1000 contos of reis per month, or about $136,000.

Brazil is the great source for the carbonados, or amorphous black diamonds which are so successfully utilized for drilling; these come principally from the State of Bahia. The exports for the three years have been as follows: 1919, 2423 contos ($329,528); 1920, 3017 contos ($410,312); 1921, 2616 contos ($355,776).

Apart from diamonds, Brazil produces almost all the known semi-precious stones, the most important being aquamarines, rock-crystal, amethyst and tourmaline. This industry is in the hands of small groups of individual miners who work on a profit-sharing basis, the sales being made to local traders.

British Guiana.—While the diamond output of British Guiana is not very large, it can scarcely be called a negligible quantity, for in the 20 years from 1901 to 1920, diamonds weighing in the aggregate 216,581 carats were produced, the best returns being for the year 1920, when 39,362 carats of diamonds were found. This means nearly four times the average for the previous 19 years, and was in great measure due to the discovery of rich deposits on the Kurupung River, in the neighborhood of the older diamond fields. In these new deposits has been found a diamond weighing 29⅜ carats the largest, so far recovered in British Guiana.

Venezuela.—Diamonds have been found recently in Venezuela, in gravel of the Caroni River. The local fancy is that they originated in the mountain chain called Roraima, near the headwaters of the Caroni. As these diamonds were found in the placer deposits and mixed with the gravel, our informant, Mr. Edward H. Emerson, believes that they must occur in the same formation as the gold quartz. Only two rocks have been recognized, one being a greenish schist of which the residual gold deposits have been formed, the other being a coarse diorite, which decomposed into a coarse sand. This diorite contains fine gold, in places, but gives no such concentrated placers as the more easily decomposed schist; still our informant does not venture to say whether the diamonds originally occurred in the schist or in the diorite, and he admits that there may be some other rock farther up the river from which they may have come.[1]

Pearls

Arabia.—The Arabian fisheries are guaranteed by the British Government, inasmuch as no one but the native Arabian is permitted to fish for pearls. This control was attempted some years ago. Some French officers endeavored to undertake the fishing, but the British Government interfered, and the matter remains entirely in the possession of the Arabians, who have carried it on from time immemorial.

Victor Rosenstein of Bahrein, Arabia, is the largest buyer, purchasing nearly all the pearls found there. Among these there was one the size of a good-sized marble, for which he paid £6000.

China.—In the borderland between Kiang-Sou and Che-Kiang in China there are many lakes wherein the pearl oyster has taken up its abode. The fishing rights are held by the owners of these lakes, but they rent out the privilege of exploitation. Of the fishermen who secure this right some pay for fishing during an entire year, while others, who have another regular vocation, pay a small amount for a single day's fishing.

[1] Communicated by Mr. Edward H. Emerson, in letter of Mar. 20, 1922.

There are said to be from 700 to 800 boats used in the exploitation. Such pearls as are found are sold to dealers who take them to Shanghai, where they sell them at a large profit.

Madagascar.—The President of the French Republic has issued a decree, on the recommendation of the Minister of the Colonies, authorizing the granting of concessions for the fishing for pearl oysters, nacreous shells, and sponges in the territorial waters of Madagascar. All persons who, before the promulgation of the decree, had acquired rights of fishing, have the privilege of changing these rights into concessions, if they make the demand within six months. The customary fishing rights of the natives are to be regulated by the Governor General of the Island. Concessionaires who wish to establish a culture station are to submit the project to the Governor General. All the concessions are to be personal and temporary, although some modification in the terms may be accorded on due application. Each concession has a duration of ten years, but it may be renewed where sufficient justification is proven; they are also revocable in case the exploitation is interrupted for one year, or the rental is not paid, and for a few other reasons. The use of dredges, or other means of dredging, is only authorized for depths exceeding 20 meters, and the Governor General can prohibit the use of such machines on the whole or any part of the concession, when this becomes necessary for the replenishing of the beds.[1]

Other Precious Stones

Australia.—The Australian sapphire fields have been passing through a sort of crisis recently in the recoil from the prosperity of 1919. To stabilize the market the Government entered into an agreement with a firm of gem dealers having offices in Bombay, Paris and London. This firm was to be sole agent for the sale of the sapphires, for a term of three years, each party having the right to terminate the contract on three months' notice. A ruling monthly price for the sapphires was to be announced each month, and the Government agreed to advance 75 per cent. of this price to the individual miners, the balance, less charges, to be paid them when the gems were sold. This agreement was later abrogated.

After February, 1921, when the arrangement concluded by the Australian Government was resumed, Anakie sapphires to the value of £20,000 were soon sold, the price commanded by first-grade parcel blues being £7 11s. per oz. This activity lasted for a while, though on a

[1] Receuil Mensuel des Procès-Verbaux des Séances de la Chambre Syndicales des Négociants en Diamants, Perles, Pierres Précieuses, et des Lapidaires, No. 57, March, 1922, pp. 951–954.

diminishing scale, until in September the agreement was terminated. The official returns of gem-stones from this field are thus given:

Parcel blues	£40,354	15s.	10d.
Fancy stones, locally cut	1,192	0	0
Mechanical stones, machine and corundum	4,976	17s.	4d.
Total	£46,523	14s.	2d.

This compares with an output of £64,050 in 1920, showing a decrease of £17,527 in value. But little prospecting was done in this region, a few miners, who went to try their luck at Tomahawk Creek having returned unsuccessful. Some attempts to develop the new find at Woodbine had no satisfactory result; the quality of the sapphire found here does not compare favorably with that of the Anakie field.[1]

Opal mining was almost abandoned in the Australian fields in 1921, the only official returns being 36 oz. worth £100.

In May, 1920, a deputation waited on the Minister for Mines in New South Wales, and inquired whether the Government contemplated improving the facilities for the marketing of the black opal in the Lightning Ridge district. The Minister replied that about 90 per cent. of the output was acquired on the field by some fifteen buyers, and was sold by them to a single buyer in London, who thus practically controlled the price. The Minister also stated that the Mines Department had no available funds for the purchase of precious stones, but that if the deputation would report the number of stones in the hands of the miners, he would collect information as to market conditions. It is considered doubtful whether the 200 or 300 opal miners now operating at Lightning Ridge would be able to remain in case the prices should be depressed.

Brazil.—A number of large aquamarine beryls were found in Brazil during 1921. Of these the largest came from the Marambya mine and weighed 331.3 grams; another from the same mine weighed 213.2 grams. One from the Verruga mine had a weight 237.7 grams. The Marambya mine furnished three other aquamarine crystals with respective weights of 48.3 grams, 39.7 grams, and 34.3 grams; a smaller one came from the Cerro mine and weighed 18.5 grams. Another Brazilian source, the Citubina mine, produced a lot of 108 aquamarine crystals with an aggregate weight of 984.5 grams.[2] Other precious-stone material from Brazil in 1921 comprised a great tourmaline crystal weighing 1623 grams, a topaz with a weight of 41,400 grams, a rich blue topaz of 11,407 grams, a wine-colored topaz of 24,499 grams, and a transparent beryl of 27,215 grams.

[1] *Queens. Govt. Min. Jour.*, Apr. 15, 1922.

[2] The greatest crystal of aquamarine ever found was at the Marambya mine, on Mar. 28, 1910. It weighed 110.5 kg. (243.1 lb.). It was described by George F. Kunz (New York Academy of Sciences, Apr. 3, 1911, and *Am. Jour. of Science*, 21, 463 (1911)).

India.—The report of the Burma Ruby Mines, Ltd., for the year ending Feb. 28, 1921, shows a marked reaction from the results of the preceding year, for the Income and Expense Account exhibits a loss for the 12 months of £5929 13s. 6d., while on Feb. 28, 1920, there was a surplus of £4359 3s. 10d. This leaves a net deficiency of £1570 9s. 6d. During the year 771,406 truck loads of ruby earth were washed, against 754,324 loads in the previous year, but the value of the stones recovered only amounted to £43,010 as compared with £76,153. However, the large total for 1919–1920 included the value of the great "Peace Ruby" of 42 carats, valued at £20,000. This is also reflected in the decreased amount of sales, namely £33,507 for 1921–1922 against £91,601 in 1919–1920. Still there continues to be a steady demand for the ordinary qualities in India and Burma, and fine stones always find a good market in London and Paris. As the new sluicing system which has been introduced was only in action for seven months, it was not possible to compute the cost of production per load for the entire year. The report states that the poor result of the year's mining is accounted for by the almost complete absence of important and valuable stones. Expenses remained practically the same as before.

Aventurine of great interest is noted in a communication made at a meeting of the London Mineralogical Society on Jan. 10, 1922. H. H. Thomas and E. G. Radley stated that the so-called "aventurine" from India is a quartz-schist, and owes its color to plates of green fuchsite arrayed parallel to the planes of foliation. The mica contains 1.77 per cent. of chromium oxide and a little vanadium. This beautiful material, very inexpensive, has found a great sale in the form of necklaces, enjoying the favor of the rich imperial jade.

Mexico.—A mineral which has not heretofore been found in the region of Guadalcázar, State of San Luis Potosí, and one which is rather rare in Mexico, is the bluish-green variety of beryl known as aquamarine. It occurs in hexagonal crystals, or crystalline masses, up to 1 cm. in length, but rarely has the crystallographic faces and angles. The mother rock of this beryl is a pegmatite, containing besides quartz a great quantity of microscopic crystals of topaz, and a number of other crystallizations so far not determined, but which may perhaps be combinations of rare earths. Dr. Wittich found this pegmatite in the contact zone of the granitic "Realejo" in the ravine of the stream Los Arcos. In the pegmatites, beryl is a mineral of frequent occurrence, and is probably a pneumatogenic product, for it generally contains great quantities of gases, even of helium.[1]

[1] E. Wittich and Dr. I. Kratsert, "Contribuciones a la Mineralogia Mexicana" Memorias y Revista de la Sociedad Científica "Antonio Alzate," Vol. 39, Nos. 9–12, pp. 659, 660, Mexico, Dec., 1921.

Madagascar.—A valuable contribution to our knowledge of the gem minerals of Madagascar has recently been made by Prof. Alfred Lacroix, of the Muséum d'Histoire Naturelle.[1] The writer stated that although from its discovery the Island of Madagascar enjoyed the repute of possessing valuable gem deposits, a Frenchman who visited the Island as early as 1547 having declared that precious stones existed there, still it is only from 1891, thirty years ago, that we can really date their discovery. At that time M. A. Grandidier gave to the Muséum a fine crystal of rubellite and some small sapphires and zircons found there, as a general rule either from the eluvials (wind-drift) covering pegmatite veins, or else in the pegmatite itself, only very rarely in alluvial deposits. The most prized of these Madagascar gems are the beryls, which occur in a great variety of beautiful colors, yellow, blue, sea-green (aquamarine) and rose-pink. The latter contains a small amount of caesium and on those of a peach-bloom hue, or of a salmon-pink, the name "morganite" has been bestowed. Then there are tourmalines in great variety of coloration, the kunzite variety of spodumene, fine garnets, some topazes and a very few sapphires and rubies. To these should be added spinels, crysoberyls, zircons, cordierites, diopsides, amethyst and citrines. Especially characteristic are gem examples, such as have not been found elsewhere, of the following: kornerupine, danburyite, scapolite, and ferriferous orthoclase.

We are informed that the French Government has entrusted to Prof. Lacroix and M. Vielle-Koechlin the task of assembling a complete collection of the gems found in the great French colony of Madagascar.

The work of bringing together the very numerous specimens is nearing completion, and the collection will be exhibited at the French Colonial Exhibition in Marseilles to be held early in 1922. Prof. Lacroix is our greatest authority on Madagascar minerals, on which he has just issued a magnificent work, published at Government expense, and embodying the results of many years of research carried on by him in this great island.

Russia.—One of the reviving industries in Soviet Russia is the mining of Uralian precious stones. This is now to be carried on systematically and on a large scale, for the report drawn up by the Mining Department of Ekaterinburg assumes an output of 825 poods, or nearly 30,000 lb. Of course the term "precious stone" must be taken in a very wide sense as covering all decorative stones as well as gems suitable for jewels. Already, in the summer of 1921, the initial steps in this mining had been taken, indeed work in deepening the already existing shafts had been

[1] A. Lacroix, "Les Pierres de Madagascar," lecture given at the Muséum d'Histoire Naturelle, on Apr. 10, 1921. It is a résumé of a chapter from the second volume of the forthcoming work by the same writer, entitled, "Minéralogie de Madagascar."

started in October, 1920. Among other stones, aquamarines and tourmalines are mentioned. The material is to be cut and facetted in the great workshops at Ekaterinburg, which were established by two Italians at the command of Catherine II. The polishing equipment here is said to be sufficient to treat 21,000 carats at one time. All the stones taken out can be utilized in one way or another, if not for jewelry or decoration work, for rich vases and the like, then for mineralogical collections. For these Ekaterinburg is the only Russian source and the demand is said to be great. A party of Americans who traversed the Urals in 1921 are stated to have secured a number of specimens, but the steady and regular demand comes from the "Société Uralienne des Naturalistes," of which the writer was elected an Honorary Member in 1892.

The District Government has determined to keep the exploitation of the mines in its own hands, although numerous applications have been made by private persons and companies.

The writer visited the Urals in 1891, and found that the finest beryls, topaz, and amethysts were discovered in the Government of Perm, notably at Alabaska and Musuka, where many of the most wonderful crystals of these gem minerals were found, and these now grace the mineral cabinets of the world.

The amber which is found in coastal deposits in East Prussia, principally along the shores of the Samland Peninsula, is recovered partly by dredging operations and partly by excavation. Smaller quantities are obtained on the coast of the Baltic between Danzig and Pillau, and from Oranz to Memel. The amber is owned by the Public Amberworks in Königsberg, Prussia. Much of the material is worked up into ornamental forms in Danzig, both natural and molded amber being used. The articles include necklets, brooches, pendants, ear-rings, rings, paper-cutters, seals, penholders, cigar and cigarette holders, and many kinds of pipes. Besides these amber beads are exported to Africa, buttons to China and Japan, and rosaries to Mohammedan lands. Amber is also manufactured in combination with the precious metals. The amber guild of the Free and Hanseatic City of Danzig dates back to the fifteenth century, having originated in 1477, and the industry has constantly developed since then, so that at present its repute is world-wide. In order to protect their interests, the amber manufacturers of Danzig have organized a union bearing the name "Vereinigte Bernsteinwaren—Fabrikanten E. V. Danzig."

Southwest Africa.—In Southwest Africa, about two kilometers east of Usakos, a most important discovery of gem tourmalines has been made, in an intrusion of pegmatitic granite in schist. The tourmalines

occur in crystals up to 2 ft. in length, and bluish-green stones predominate, but the rare dark-blue variety known as indicolite is also reported. Dr. Percy A. Wagner has had a number of them cut and states that they are most brilliant and flawless, constituting very handsome gems.[1]

The discovery in 1910, by Dr. E. Reuning, of aquamarines and rose-quartz in pegmatite about three miles to the north of Rössing Station, and about a mile to the east of the Hanoas (Knife) Hills, has already been noted in a previous report.[2] It is stated that now, under the new control of the Southwest African region by the Union of South Africa, operations were resumed early in 1921, and when the district was visited in March by Dr. Percy A. Wagner, a white man and a number of natives were working there.[3] The most noted of the gem material found by Dr. Reuning was the golden-hued beryl on which the name heliodore was bestowed. Dr. Wagner notes that the heliodore of these pegmatites contains appreciable quantities of uranium oxide, and is distinctly radio-active. This he takes to indicate that the pegmatite solution from which the pegmatite crystallized was itself radio-active.

Besides the "heliodore," there are to be found in the pegmatites near Rössing Station other fine beryls, notably beautifully clear, transparent, flawless crystals of a light blue or pale bluish-green hue. At Swakopmund, there was shown to Mr. Wagner a very fine necklace of pale, sky-blue aquamarines cut in Paris. Then there are other beryls, clear transparent to translucent crystals of a fine yellowish-green color, which seem to correspond to the variety of beryl known as aquamarine chrysolite that is found in Siberia and Brazil. By daylight the color of these stones strongly resembles that of the heliodore when seen by artificial light.[4]

United States.—As to the precious-stone output of the United States, the diamond deposits near Murfreesboro, Ark., discovered in 1906, have produced quite a number of diamonds. The largest stone found here so far weighed 20.25 carats and was of good color, though having a number of flaws; it furnished, when cut, a marquise stone of 4.15 carats valued at $3000. Another diamond weighing 18.03 carats has also been found here. During the coming year this mine will be worked with improved machinery. However, by far the largest yield of precious stones has been afforded by the sapphire mines of Yogo Gulch, Fergus County, Mont.; the value of these sapphires represents fully one-half of the total output of precious stones. Possibly about one-fifth of the total can be

[1] Communicated by Dr. Percy A. Wagner, in letter dated Mar. 13, 1922.
[2] MINERAL INDUSTRY, 21, 728 (1912).
[3] "On Some Occurrences in the Namib Desert." Percy A. Wagner, *Trans. Geol. Soc. of So. Afr.*, 4, 86 (1921).
[4] "Some Mineral Occurrences in the Namib Desert." Percy A. Wagner, *Trans. Geol. Soc. of So. Afr.*, 24, 92 (1921).

credited to tourmalines, almost all from California, although a few came from Maine. Turquoise and turquoise-matrix from Arizona, New Mexico, California, and Nevada furnished about one-tenth of the total. The balance were quartzes, the so-called copper silicate, and moss agates, principally from California and the Coast States, and utilized chiefly for the tourist trade. At final retail prices, it may be estimated that $1,000,000 worth of precious stones of United States origin have been sold since the beginning of the World War. A good part of this price is of course due to the expense of cutting, and to the profits of the various hands through which the stones passed.

Amethysts have recently been found and mined in Arizona to a notable extent on the claims near the Roosevelt dam, discovered by W. S. McDaniels. Orders for material to the amount of $2000 have been obtained from lapidaries and dealers in Los Angeles, the crystals having been taken from but 20 in. below the surface of the ground. This is the first amethyst deposit of commercial importance in Arizona.

Jade has never been more sought after nor held at a higher price than at the present time. It is also interesting to note that in addition to jade there has been used a compact idocrase, californite, described by the present writer, and which comes from California, as well as the compact pectolite found in Alaska, and the barenite which occurs in Rhode Island and in various parts of China. There was also noted this year a remarkable occurrence of compact garnet, resembling jade, discovered in Alaska by Commander Emmons and described by Henry S. Washington.

One of the results of the World War has been a revival of interest in what is denominated as "mourning jewelry," whether made of jet, or of black onyx, in combination with some white stone such as moonstone, for example. In this connection it is interesting to report the discovery of large deposits of jet in what is known as Coal Basin, at the foot of the Henry Mountains, Wayne County, Utah. About 14,000 linear feet of the outcrop of the stratum containing jet has been exposed, and the mineral has been found occurring promiscuously, here and there, all along the exposed stratum in the form of flattened-out trees, the tree-trunks, limbs, roots and bark having all been metamorphosed with jet. Geological conditions make it clear that these trees were at one time buried or covered to a depth of approximately 2000 ft., and there is no doubt that the pressure of this tremendous overburden flattened out trees probably a foot or more in diameter until their thickness was reduced to from 1 to 6 in., thus closing all the pores of the wood. The heat generated by this enormous and long-continued pressure produced a state of fossilization resulting in the present deposits of jet. This burying of the trees must have occurred ages ago, probably at the time of the

great uplift when the Henry mountain range punctured the great southern Utah desert, rearing up peaks thousands of feet high. In the course of further ages the water derived from the melting snow on the mountain slopes cut a deep chasm out of the earth's crust, which deepened and widened until at last an oblong basin was formed, thus exposing the stratum wherein the jet trees now lie for about 14,000 linear feet. A tough hard fireclay from 1 to 2 ft. thick now overlies the jet, the balance of the overburden being extremely soft, so that it can readily be sluiced off by water, when it is a simple matter to peel off the layer of clay. This operation is favored by the existence, at an elevation of about 600 ft., of a spring of water which can be piped down to the jet workings. In some cases nearly complete "jet trees" were found, the limbs, roots and bark being of this mineral. The bark was so well preserved that it is possible to determine that at least three different kinds of trees have been converted into jet. It is claimed that there is enough jet here to supply the world for centuries.[1]

The turquoise as used by the Zuñi Indians of New Mexico in early times is the theme of an attractive publication, issued by the Museum of the American Indian Heye Foundation.[2] This gives very reliable and satisfactory information on the matter, and also regarding the location of the deposits whence the material was drawn. The principal sources, both in early and modern times, have been the Cerillos mountains of New Mexico, about 20 miles south-southwest of Santa Fe. Still, a few other deposits were worked to a limited extent, such as some in the Burro and Little Hichita mountains in Grant County, and in the Jarilla hills in Otero County. It is considered unlikely that the Zuñi Indians extracted the turquoise themselves; they more probably secured it by trade with Rio Grande Pueblos. Later, when corporations obtained control, and Indian quarrying was practically abandoned, white traders were the sources of supply. In early times, owing to the difficulty of transporting the turquoise for long distances without the aid of animals, the material was much rarer than is the case today, although it must not be forgotten that Pepper found over 50,000 worked pieces of turquoise in his excavations at Pueblo Bonito. That it was used for ornamental and sacred purposes by the Zuñi who dwelt in the now-ruined pueblo of Hawikuh has been proved by the results of the excavations carried on there lately. The earliest notice of the use of turquoise in this region is that furnished by Fray Marcos de Niza, concerning his journey to Cibola in 1539.

[1] Communicated by Mr. J. C. Gustaveson, Ogden, Utah, in letter dated Apr. 12, 1922. The black and white jewelry which has been so much favored may consist of onyx with a tiny border made up of caliber-cut stones or intermingled with white diamonds in a platinum setting, or also crystal with onyx or jet.

[2] F. W. Hodge, "Turquoise Work of Hawikuh, New Mexico." Leaflets of the Museum of the American Indian, Heye Foundation, No. 2, New York, Mar. 22, 1921, 30 pp., 2 colored plates and text illustrations.

During the excavations conducted at Hawikuh by the Hendricks-Hodge expedition in 1917–1920 there were found various examples of turquoise beads and small pendants of the solid stones, as well as several hair-combs and ear-tablets, and a breast ornament, all incrusted with turquoise on bases of wood.

Regarding the Los Cerillos mines the present writer noted in 1890 that whatever work was carried on there was done in a very desultory way, either by local lapidaries, poor whites, or Indians. The method followed is to build large fires against the base of the rock until it becomes thoroughly heated, when cool water is thrown over it. The abrupt change of temperature induces large pieces of the rock to crack off; but much of the precious material is ruined in this way. From these broken-off pieces of rock the turquoise is picked out of the exposed seams with pieces of pointed iron, such as old barrow-teeth, or any other sharp-pointed instrument. Only occasionally was a blast put in.[1]

Technology

The intensity of X-ray reflection by the diamond has been investigated by Sir W. H. Bragg, who read a paper on the subject before the Physical Society of London, May 27, 1921. An interesting feature was that if the outer electrons of the carbon atom lay at any considerable distance from the center, they must be in motion over a wide range, or else for some other reason contribute little to the reflection. It also appeared that the properties of the carbon atom in diamond are based on a tetrahedral, not on a spherical form.[2]

In his Presidential address[3] before the Mineralogical Society of America, delivered Dec. 29, 1921, Prof. Charles Palache of Harvard University passed in review the chief results of the investigations made regarding the "diamond-pipes" of South Africa, noting the valuable information given in Dr. Wagner's book on the South African mines.[4] After admitting that in his view the exact mechanical process by which these vertical holes have been produced has so far not been elucidated, Prof. Palache turns to the question as to the determining causes for the differences in the characteristic qualities of diamonds from different "types" and for the very unequal distribution of diamond material in some of them, and their absence from others. In regard to the latter he said:

[1] George F. Kunz, "Gems and Precious Stones of North America," New York, 1890, pp. 56, 57
[2] *Chem. News*, June 17, 1921, p. 285.
[3] "Some Problems of Mineral Genesis in South Africa," Presidential Address, presented at the Second Annual Meeting of the Mineralogical Society of America, Amherst, Mass., Dec. 29, 1921. *Am. Mineralogist*, March, 1922.
[4] Percy A. Wagner, "The Diamond Fields of South Africa," Johannesburg, 1914.

"The explanation of the apparent total absence of diamonds in many pipes and of these local variations in character of the stones is probably to be found in the delicate equilibrium existing between the molten magma and the carbon in solution. Goldschmidt and Fersmann showed in their study of diamond crystals that the forms of growth and of solution were markedly different; that few crystals had escaped solution etching; and that a crystal might even have been growing on certain faces in the same magmatic solution that was dissolving material from other faces.[1] The control of the saturated condition of the solution is thus sensitive, but its nature is quite unknown. It may well be temperature or pressure, or the presence of other dissolved substances. The latter would be most likely to cause variation of color or other physical characters of the diamond crystals. And for the absence of diamond from so many pipes, at least two explanations may be suggested. Carbon may never have been present in the magma of a particular locality. It seems more likely that it is always present, but may be held in solution by peculiar chemical or physical conditions through the cooling period in which diamond can form and thus remains in solid solution in the rock. The ultimate source of the carbon is of course problematic. The sporadic distribution of diamond in the pipes might be explained by postulating local digestion in the magma of older, carbon-containing rocks. But it seems more probable that it is derived from the dissociation of cardon oxide gases in the magma, the carbon separating under favorable conditions as diamonds."

[1] A. von Fersmann and V. Goldschmid, "Der Diamant," Heidelberg, 1911, p. vii.