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Introduction

This annual statistical number of the JOURNAL is laid out on the same plan as its predecessors, but as has always been the case it comprises some new features that are important, as to which we can fittingly repeat the substance of our preface last year. Besides a comprehensive treatment of many of the minor minerals and metals, there is presented again a valuable series of metallurgical articles, reviewing the progress of 1911 in the various departments of metallurgy. Also there are numerous articles upon

statistical information. Our thanks are due also to the producers of copper, lead, spelter and other substances, who have communicated to us the amount of their output in 1911 and have thereby enabled close approximations to the actual production in 1911 to be made by Jan. 4, our date of going to press.

The production of the more important minerals and metals is summarized in the table on this page. The details appear in subsequent pages. It will be found that in some cases our contributors give figures that do not agree with our own. The explanation of such differences will generally be that the articles of outside contributors were necessarily written and put into type before our own statistics were available. The necessity of handling the great mass of material in this huge number in a few days leaves no time for leisurely comparison and revision to effect a careful coordination of all the data. We feel sure that no one, in the light of this explanation, will be misled by any discrepancies that may be discovered. This number of 102 pages, if made up in the form of ordinary technical treatise, would constitute a book of upward of 360 pages.

The reader of these pages will obtain the idea that 1911 was fairly prosperous in the mining industry and will, perhaps, find it difficult to understand the pessimism that prevailed. Many of the important substances show increased production. In many cases the outputs were the largest on record, that having occurred in the cases of copper, lead and spelter. On the other hand there were decreases in the production of coal, petroleum and iron, but they were not large. Consumption was generally large; there were some increases and some decreases. The reasons for such variations in the returns are not yet easy to understand. Prices ranged a little lower in 1911 than in 1910, our index number for the metals having been 112 in 1911 against 115 in 1910 and 115 in 1909.

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PRODUCTION OF METALS IN THE UNITED STATES

Metal	Unit	1910	1911
Copper (a).....	Lb.	1,086,249,983	1,101,291,290
Ferromanganese.....	L. tons	224,431	175,595
Gold (b).....	£	96,269,100	96,233,528
Iron.....	L. tons	27,074,114	23,647,451
Lead (c).....	S. tons	392,704	402,281
Nickel (e).....	Lb.	25,359,544	26,716,843
Quicksilver.....	flasks	22,418	21,500
Silver (b).....	Tr. oz.	57,137,900	57,796,117
Zinc (d).....	S. tons	277,065	292,700

(a) Production from ore originating in the United States. (b) The statistics for 1910 are the final and those for 1911 are the preliminary statistics reported by the director of the Mint. (c) Production of refined lead from ore and scrap originating in the United States; antimonial lead is included. (d) Total production of smelters, except those treating dross and junk exclusively; includes spelter derived from imported ore. (e) Imports for first 11 months of each year. This nickel is smelted in the United States for the production of metal, oxide and salts.

PRODUCTION OF MINERAL AND CHEMICAL SUBSTANCES

Substance	Unit	1910	1911
Ammonium sulphate.....	S. tons	116,000	127,000
Arsenic.....	Lb.	2,652,000	6,162,000
Coal, anthracite.....	S. tons	82,670,235	86,896,065
Coal, bituminous.....	S. tons	411,126,408	396,296,823
Coke (b).....	S. tons	36,056,059	29,338,214
Copper sulphate.....	Lb.	26,356,788	33,454,000
Iron ore.....	L. tons	53,267,397	41,815,471
Petroleum.....	Bbl.	210,588,308	209,931,884
Tungsten ore.....	S. tons	2,130	(a) 1,125
Zinc oxide.....	S. tons	78,000	65,000

(a) Preliminary estimate of U. S. Geological Survey. (b) All coal and coke statistics are the estimates of Coal Age.

mining developments by leaders of the industry, many of those that are unsigned being fully as responsible as those that are. No one can turn over the following pages without a recognition of the impressive list of contributors and the authoritative nature of their summaries. To all of these contributors, who have collaborated in this number, we tender our thanks, and also to the many persons who have assisted in the collection of

METAL MARKETS

New York, Jan. 3—The metal markets have been rather quiet over the end of the year, with no developments of especial importance.

MONTHLY INDEX NUMBERS					
Month	1910	1911	Month	1910	1911
January....	127	110	July.....	112	112
February...	124	115	August....	113	117
March.....	118	112	September..	114	111
April.....	118	114	October....	111	112
May.....	113	118	November..	117	111
June.....	107	115	December..	115	110

Year 1909, 115; 1910, 115; 1911, 112. Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Nov. 1911..	\$13,941,093	\$ 3,458,321	Exp. \$10,482,772
" 1910..	1,376,011	4,318,500	Imp. 2,937,489
Year 1911..	36,188,397	52,737,854	Imp. 16,549,457
" 1910..	57,444,422	54,245,886	Exp. 3,198,536
Silver:			
Nov. 1911..	5,052,238	3,338,956	Exp. 1,713,282
" 1910..	5,265,595	4,827,254	Exp. 438,341
Year 1911..	59,667,286	40,439,844	Exp. 19,227,442
" 1910..	51,299,913	41,479,718	Exp. 9,820,195

Exports from the port of New York, week ended Dec. 30: Gold, \$217,076; silver, \$1,328,153, chiefly to London. Imports: Gold, \$787,605; silver, \$121,600, principally from Mexico and South America.

Gold—Prices of gold on the open market in London were at the normal level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Some gold was taken for India and a little for Egypt; but most of the supplies went to the Bank of England.

Iridium—The price remains unchanged, at \$64 per oz. for pure metal.

Platinum—The market is rather quiet, as is usual at the end of the year. Prices are unchanged. Dealers ask \$46 per oz. for refined platinum and \$48.50 per oz. for hard metal.

SILVER AND STERLING EXCHANGE						
Dec.-Jan.	28	29	30	1	2	3
New York....	54%	54%	54%	....	54%	54%
London....	25%	25%	25%	25%	25%	25%
Sterling Ex.	4.8560	4.8600	4.8620	....	4.8620	4.8635

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—The market is steady and shows a slight improvement since the holiday suspension of business. There are no new features in the situation.

Aluminum—Little business is reported at the close of the year, though dealers look for an improvement this month. Prices are unchanged. Quotations are 18½@19c. per lb. for No. 1 ingots, New York delivery.

Copper, Tin, Lead and Zinc

NEW YORK							
Dec.-Jan.	Copper		Tin	Lead		Zinc	
	Lake Cts. per lb.	Electrolytic Cts. per lb.	Cts. per lb.	New York Cts. per lb.	St. Louis Cts. per lb.	New York Cts. per lb.	St. Louis Cts. per lb.
28	14½@14½	13.95@14.10	45	4.45	4.32@4.35	6.20@6.35	6.05@6.20
29	14½@14½	13.95@14.10	44½	4.45	4.32@4.35	6.25@6.35	6.10@6.20
30	14½@14½	13.95@14.10	44½	4.45	4.32@4.35	6.25@6.35	6.10@6.20
1	.....	.....	.....	.....	.....	.....	.....
2	14½@14½	14.00@14.10	44½	4.45	4.32@4.35	6.25@6.40	6.10@6.25
3	14½@14½	14.00@14.10	42	4.45	4.32@4.35	6.25@6.40	6.10@6.25

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON							
Dec.-Jan.	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'd	Spot	3 Mos		
28	63%	64½	67%	206	191½	15%	26%
29	63	63%	67%	205	190	15%	26%
30	.....	.....	.....	.....	.....	.....	.....
1	.....	.....	.....	.....	.....	.....	.....
2	63½	64½	67%	201	188½	15%	26%
3	63½	64%	67%	191	184½	15%	26%

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21½c.

Copper—The holidays have had the usual retarding influence upon business. Transactions have been in relatively small volume, but in view of the heavy sales of previous weeks producers have been able to look on complacently. There has been some realizing of speculative copper, influenced by the erratic London quotations, but as a whole, the market shows a firm front in anticipation of the December statistics. The close is steady at 14½ to 14¾c. for Lake copper, and 14 to 14.10c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 13¾ to 14c. as the average for the week.

The standard market has been subject

to various dips during the few days on which business was done in London, the close being somewhat lower at £63 11s. 3d. for spot, and £64 7s. 6d. for three months.

European visible stocks on Jan. 1 are reported as follows: In England, 42,100; France, 5250; Rotterdam, 5300; Hamburg, 8100; afloat from Chile, 1580; afloat from Australia, 8350; total, 70,680 long tons, an increase of 710 tons over the Dec. 15 report.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 15¼c. base, carload lots at mill.

Tin—Contrary to all expectations, the London market opened the new year with a considerable decline. It was understood among the trade that the London Syndicate was practically in control of such tin as has to be delivered under contract in January, and the decline came therefore as a great surprise. As December statistics were favorable, no reason for the weakness can be discovered.

A fair business took place among dealers in this market during the last week of the old year at prices somewhat below the importation point. Holders, however, do not seem willing to follow to the full extent the decline of the London market, and are now asking a premium of about ½c. per lb. for spot and January tin. The market closes in London at £191 for spot, and £184 15s. for three months, and in New York at 42c. for January.

Visible stocks of tin on Dec. 30 were: London, 10,998; Holland, 2764; United States, excluding Pacific ports, 2868; total, 16,630 long tons, an increase of 116 tons over Nov. 30.

Lead—The market is unchanged at 4.45c. New York, and 4.32½@4.35c. St. Louis.

The London market is rather easier, the close being cabled at £15 12s. 6d. for Spanish, and £15 15s. for English lead.

Spelter—Business has been dull in consequence of the holidays. Consumers persist in buying from hand-to-mouth, even though future deliveries are offered at a considerable discount from the prices at which near-by spelter is being sold. This condition produces a wide spread in quotations. The close is quoted at 6.10@6.25c. St. Louis, and 6.25@6.40c. New York.

The London market has remained steady throughout the week at £26 15s. for good ordinaries, and £27 for specials.

Antimony—Business has been fair, and prices are unchanged. Cookson's is quoted at 7¾@7¾c. per lb., and Hallett's at 7¾@7¾c., while 6¾@7c. is named for Chinese, Hungarian and other outside brands.

Gold, Silver and Platinum in 1911

By Frederick Hobart

The gold production of the world in 1911 again exceeded that of any previous year, though the increase over 1910 was small, only 0.9 per cent., according to the preliminary figures so far collected. This was entirely due to the increase of over \$15,750,000 in the Transvaal. There were fair gains also in Rhodesia, in Canada and in West Africa. The United States production was about stationary. The important decreases were in Australia, the causes of which are explained elsewhere; in Russia, where unusual drought interfered with operations in the Siberian placers during the first half of the year; in Mexico, where revolutionary disturbances affected mining and mine labor; and in India, where two of the important Kolar mines are still in a zone of lean ore. These decreases, however, were not sufficient to overcome the large gain in the Transvaal and the other increases.

In Table I herewith, the approximate returns for 1911 are given in comparison with the corrected figures for 1910. The total for 1911 is \$473,383,543, showing an increase over the previous year of \$4,017,933, or 0.9 per cent. In this table the statements for the United States are the preliminary estimates compiled by the director of the Mint. For nearly all

I. GOLD PRODUCTION OF THE WORLD

	1910	1911
Transvaal	\$155,730,260	\$170,487,900
United States	96,269,100	96,233,528
Australia	65,634,340	61,072,409
Russia	43,168,389	40,600,000
Mexico	24,073,100	19,500,000
Rhodesia	12,607,791	13,045,100
India	12,089,400	10,505,506
Canada	10,224,910	10,646,000
China	10,102,300	10,000,000
Japan, East Indies, etc.	10,522,437	10,600,000
West Africa	3,674,087	5,268,100
Madagascar	2,149,721	1,900,000
France	1,114,700	1,275,000
Central and So. America	14,886,234	15,000,000
Other countries	7,118,841	7,250,000
Total	\$469,365,610	\$473,383,543

the important producers reports are for 11 months of the year, the month of December being estimated. Our estimates have been made on a conservative basis, so that revisions later may slightly increase the total; but the difference will not be great.

Table II shows the course of the world's production for 20 years past. While we cannot here discuss the full effect of increased gold output on prices and prosperity, it is clearly evident that the gain has been at least contemporaneous with the extraordinary increase in production and commerce of the last two decades; and that it must at least be considered one of the important causes contributing to that development. The

table shows that the production last year was more than three times that of 1892; twice that of 1897, and nearly 60 per cent. greater than in 1902, or 10 years ago. The chief factors in the last decade have been the new developments in the Transvaal, in Alaska and the Yukon, in the Lena country and the Transbaikal in Siberia; and the advances in gold metallurgy.

II. GOLD PRODUCTION OF THE WORLD FOR 20 YEARS

1892	\$146,292,600	1902	\$298,812,493
1893	158,437,551	1903	329,475,401
1894	182,509,283	1904	349,088,293
1895	198,995,741	1905	378,411,054
1896	211,242,081	1906	405,551,022
1897	237,833,984	1907	411,294,458
1898	287,327,833	1908	443,434,527
1899	311,505,947	1909	459,927,482
1900	258,829,703	1910	469,365,110
1901	260,877,429	1911	473,383,543

In 1911, as in 1910, there were no great or important new districts open. For the future the prospect is rather uncertain. The Transvaal has, perhaps, reached almost its highest development, though it will continue a large producer. It is possible that important mining fields may be opened in the Congo; and South America is, in large part, an unexplored country. From these countries and perhaps from Manchuria and Mongolia the future gains are to be expected.

AMERICAN PRODUCTION

Table III shows the gold production of the United States, the figures being furnished by the Director of the United States Mint. The year showed no important changes. California took the first place, its small decrease being exceeded by the larger loss in Colorado,

III. UNITED STATES GOLD PRODUCTION

	1910	1911
Alabama	\$32,900	\$18,335
Alaska	16,271,800	16,002,976
Arizona	3,413,200	2,954,790
California	20,441,400	20,310,987
Colorado	20,526,500	19,153,860
Georgia	24,000	30,532
Idaho	1,035,000	1,169,261
Illinois	.....	5,788
Michigan	.....	20
Maryland	.....	20
Montana	3,720,400	3,169,840
Nevada	18,783,700	18,968,578
New Mexico	477,200	639,897
N. Carolina	64,500	76,693
Oklahoma	.....	30,698
Oregon	681,400	599,235
Pennsylvania	5,900	7,814
So. Carolina	37,800	13,437
S. Dakota	5,380,200	7,430,367
Tennessee	2,800	14,140
Texas	400	1,178
Utah	4,312,700	4,709,747
Virginia	900	4,300
Washington	806,000	504,537
Wyoming	4,100	18,791
Porto Rico	1,000	2,191
Philippines	154,400	130,501
Miscellaneous	.....	265,013
Total	\$96,269,100	\$96,233,528

which held the first rank in 1910. Of the other important producers Nevada and Alaska showed only small changes,

but South Dakota reports a very considerable gain. Utah and Idaho also gained in production, but Montana and Arizona decreased. The larger states are treated fully on other pages.

The total gold production showed a decrease in 1911 of only \$35,572; that is, it was practically the same in both years.

Table IV gives the silver production of the United States for two years past, in fine ounces. For these figures we are indebted to the courtesy of the Director of the United States Mint. The miscellaneous line includes silver reported which it was not possible, at this early date, to apportion exactly to the several states. It will be seen that in 1911 Utah, with an increase of 2,233,733 oz., attained the first rank as a producer, passing Montana and Nevada, which held

IV. UNITED STATES SILVER PRODUCTION

	1910	1911
Alabama	300	174
Alaska	153,900	275,691
Arizona	2,655,700	1,594,428
California	1,791,600	2,727,336
Colorado	8,523,000	7,530,940
Georgia	300	174
Idaho	7,027,000	7,507,802
Illinois	2,100	4,648
Michigan	262,200	507,234
Maryland	.....	87
Missouri	32,200	56,228
Montana	12,282,900	11,116,778
Nevada	12,366,000	10,651,571
N. Mexico	779,000	1,142,335
N. Carolina	8,300	2,227
Oklahoma	.....	168,245
Oregon	43,800	69,116
Pennsylvania	700	13,262
S. Carolina	.....	14
S. Dakota	120,600	206,188
Tennessee	69,800	126,683
Texas	364,400	442,480
Utah	10,445,900	12,679,633
Virginia	200	45
Washington	204,900	142,196
Wyoming	1,300	1,009
Porto Rico	.....	51
Philippines	1,800	3,383
Miscellaneous	.....	826,102
Total	57,137,900	57,796,117

second and third ranks, as they were first and second in 1910. Utah, Idaho and California were the only states making notable gains in 1911; Colorado, Nevada and Montana showing decreases.

The total production of silver in 1911 increased by 658,277 oz. over that of 1910. As in previous years nearly all this silver was produced in connection with other metals, chiefly lead, copper and gold.

The production of silver in the world cannot fairly be reported at this date. In all probability, it did not differ greatly from that of 1910; and was, therefore, about 222,000,000 oz. A decrease in Mexico, due to disturbed political conditions, was almost made up by considerable increases in Canada and Australia.

THE SILVER MARKET

The silver market was affected chiefly, as usual, by the conditions in the East; last year also by the great speculation carried on by Indian and Chinese capitalists. This speculation forced the price up in the latter part of the year to a point considerably above the nearly uniform level of the earlier months.

Table V shows the exports of silver from London to the East from Jan. 1 to Dec. 21 for two years past. Table VII gives the average prices of silver in New York and London, by months.

The exports of silver from the United States direct to China in the 10 months ended Oct. 31 were valued at \$4,218,735

V. SHIPMENTS OF SILVER TO THE EAST

	1910	1911	Changes
India.....	£6,858,000	£8,702,500	I. £1,844,500
China.....	1,424,000	990,300	D. 433,700
Total.....	£8,282,000	£9,692,800	I. £1,410,800

in 1910, and \$7,081,056 in 1911; an increase of \$2,826,321. These exports in 1911 were approximately 13,360,000 oz. The largest item of silver exports from the United States in the 10 months was \$42,097,655—approximately 79,450,000 oz.—to Great Britain. London still remains the great market for silver, especially for the East.

VI. MONTHLY AVERAGE PRICES OF SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January.....	51.750	52.375	53.795	23.843	24.154	24.865
February.....	51.472	51.534	52.222	23.706	23.794	24.081
March.....	50.468	51.454	52.745	23.227	23.690	24.324
April.....	51.428	53.221	53.325	23.708	24.483	24.595
May.....	52.905	53.870	53.308	24.343	24.797	24.583
June.....	52.538	53.462	53.043	24.166	24.651	24.486
July.....	51.043	54.150	52.630	23.519	25.034	24.286
August.....	51.125	52.912	52.171	23.588	24.428	24.082
September.....	51.440	53.295	52.440	23.743	24.567	24.209
October.....	50.923	55.490	53.340	23.502	25.596	24.594
November.....	50.703	55.635	55.719	23.351	25.680	25.649
December.....	52.226	54.428	54.905	24.030	25.160	25.349
Total.....	51.502	53.486	53.304	23.706	24.670	24.592

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Coined silver in the United States, Dec. 1, as estimated by the Treasury Department: Silver dollars, \$565,168,367; subsidiary silver, \$164,080,387; total, \$729,248,754. Of the silver dollars \$490,453,000 are held in the Treasury against silver certificates outstanding.

THE COMMERCIAL MOVEMENT OF GOLD

Space will not permit us here to go into details of the movement of gold in 1911. It is sufficient to say that the great production of the year was absorbed largely in the channels of commerce without any of the commotion which has marked some recent years. At one period political complications in Europe caused a demand for gold from Germany, but this quickly passed over. France and England, as usual, imported

more gold than they exported. The United States also imported \$16,550,000 more gold than it exported; this, with its own production, making an increase in the stock of gold in the country of \$112,800,000—less the amount used in the arts. It is rather remarkable that the gold holdings of the great European banks at the close of 1911 show practically no change from those at the end of 1910. If the proportion of the gold produced which was used in the arts was the same as in previous years, about 25 to 30 per cent., there must have been some \$340,000,000 of the yellow metal added to the world's circulating medium; but it does not appear in the public records. It is in private hands or in circulation.

Foreign commerce of the United States, 11 months ended Nov. 30, as valued by the Bureau of Statistics of the Department of Commerce and Labor:

Merchandise	1910	1911
Exports.....	\$1,637,256,221	\$1,867,605,414
Imports.....	1,426,194,277	1,392,550,517
Excess, exports.....	\$211,061,944	\$475,054,897
Add excess of exports, silver.....		19,227,442
Total.....		\$494,282,339
Deduct excess of imports, gold.....		16,549,457
Net export balance.....		\$477,732,882

Gold held by United States Treasury, Dec. 1, was: Reserve for redemption of treasury notes, \$150,000,000; held against gold certificates, \$1,002,579,669; in current balances, \$28,364,250; total, \$1,180,943,919. The gold in banks and circulation is estimated at \$616,777,641; making a total of \$1,797,721,560 in the United States.

Platinum in 1911

During 1911 the production of platinum continued to be chiefly from the Ural placers in Russia. The Russian output, which was estimated at 300,000 oz. in 1910, was a little less—about 280,000 oz.—in 1911, on account of the working out of some of the older placers, and to a short supply of labor in the early part of the year. Later short crops in Eastern Russia sent many laborers back to the mines, and a number of *starateli*—prospectors and tributors—in the placers increased.

From Colombia, the next producer, the output continued small and irregular. The operation of two dredges in the Choco district is reported to be successful, but does not seem to have resulted in any large increase in the production, which may be estimated at about 10,000 oz. for the year.

In the United States about 350 oz. is produced yearly, chiefly parted from placer gold obtained in northern California and Oregon. The Rambler mine, in Wyoming, from which some production was promised, was not in operation during the year. There was only a small quantity saved in British Columbia. The only

other producer is Australia, but there also the quantity is small.

The imports of platinum into the United States in the 11 months ended Nov. 30, were 112,948 oz. in 1910, and 110,937 oz. in 1911; a decrease of 1111 oz. Of the imports in 1911 there were 51,310 oz. crude metal, and 59,627 oz. in refined and manufactured form.

THE MARKETS

The course of the platinum market in 1911 is shown in the accompanying table, in which are given the prices at New York, at Ekaterinburg and St. Petersburg, in Russia. Ekaterinburg is the primary

AVERAGE PRICES OF PLATINUM.
IN DOLLARS PER OUNCE TROY.

	New York, Refined Platinum.	Russia, Crude Metal—83 Per Cent. Platinum.	
		St. Petersburg.	Ekaterin- burg.
January.....	\$39.06	\$31.57	\$31.90
February.....	39.31	31.96	31.85
March.....	41.00	32.43	32.25
April.....	41.35	34.69	34.27
May.....	42.81	34.55	35.25
June.....	42.88	34.71	35.06
July.....	42.95	35.47	34.71
August.....	44.38	36.78	35.44
September.....	45.31	37.02	37.23
October.....	46.25	37.39	37.60
November.....	46.13	37.98	37.89
December.....	46.00	37.78	37.60
Average for the year	\$43.12	\$35.21	\$35.09
Av. for 1910	32.70	26.96	26.37

market where purchases are made from the small miners; metal from the large estates is shipped direct to St. Petersburg, which is the wholesale market. The final collection and distribution of Russian platinum remains in the hands of two or three large companies in Paris and St. Petersburg, which entirely control the trade.

The record for the year is of a steady and almost unchecked advance through the year. The lowest monthly average of refined platinum in New York was \$39.06 per oz. in January; the highest was \$46.25, in October. From that point the decline to December was only 25c. per oz. The average for 1911 was \$10.42 above that of the previous year. The strong point in the market was the large demand for the jewelry trade, fashion having established the use of platinum in jewelry quite firmly, at least for the present. This, combined with the limited production, resulted in the firmness of the market.

The Russian prices, which have been reduced to American weights and currency in the table, are for crude metal, 83 per cent. platinum; the New York prices are for refined metal. Hard metal, which contains from 7 to 10 per cent. iridium, is usually quoted about \$2.50 per oz. higher than refined platinum. Iridium ranged in 1911 between \$60 and \$65 per oz. for pure metal.

Precious Stones in 1911

By George F. Kunz*

It seems remarkable that in the face of a universal financial depression the price of diamonds and pearls should have advanced considerably since 1906, and this after only one year's shutdown of the great group of diamond mines and with no attempt to regulate the price of pearls. The imports of precious stones have remained constant, for, although the imports in 1908 were less than in 1906, a banner year, this was partly the result of overbuying, and the effect of the small importation in 1908 was the selling down of the old stocks, which in turn led to the greater imports of 1909, 1910 and 1911.

That the sale of precious stones does not always fluctuate with financial conditions was never more apparent than this year, which was marked by a financial slump in September, by threatening war clouds between Germany and France, Russia and Japan, by the revolution in China, and, finally, by the war between Italy and Turkey. But it will invariably happen that when people are assured of the permanent worth of an investment they will not hesitate to buy even when the financial situation appears to be less favorable than usual, or else they buy because they will buy under all circumstances.

STEADY ADVANCE IN DIAMOND PRICES

However, the upward trend of prices, especially that of the diamond output, has steadily continued, in spite of occasional setbacks; this is clearly apparent when we compare the average prices of the uncut, rough diamonds for five-year periods for the last 20 years: 1891 to 1895, average price per carat, 26s. 9.45d.; 1896 to 1900, 29s. 1.15d. per carat, increase in price, 8.6%; 1901 to 1905, 47s. 3.36d. per carat, increase, 62.5%; 1906 to 1910, 55s. 7.93d. per carat, increase, 17.7%. The diamond syndicate advances on the price of rough diamonds when sold to the diamond cutters have been as follows: June, 1906, 4%; May, 1907, 3; June, 1909, 5; June, 1910, 2%.

GREATER COST OF DE BEERS DIAMONDS

That the advances in diamonds are justifiable may be seen after a study of the report of the De Beers Consolidated Mines for the year ended June 30, 1911. The amount of production was £4,938,086, the total revenue being £5,928,830. Deducting from this £2,930,213 for mining expenses, depreciation, interest on de-

bentures, etc., there remained a balance of £2,998,616. From this £310,137 was paid to the Union of South Africa for taxes on profits for the year ended June 30, 1910, and £265,458 was set aside to cover the taxes on profits to June 30, 1911. This shows the increased cost of mining at greater depth. Preferred dividends to the amount of £800,000 and deferred dividends amounting to £1,000,000 were paid and provided for. After subtracting these items there remained a balance of £623,019 on the year's operations. On January 1, 1911, the balance of the first mortgage debentures of the company, bearing interest at 5%, to the amount of £1,216,120 were redeemed, as were also £27,080 of Bultfontein obligations at 4½%. The reserve fund was increased from £968,905 to £1,374,766 during the year, and the company was relieved of a contingent liability of £630,000 for the Klerksdrop-Fourteen-Streams Ry. Co. by the Union government's settlement of that company's debentures.

The following average results were attained in the different mines of the De Beers group during the year ended June 30, 1911:

	Carats per load	Value per carat	Value per load
De Beers & Kimberley	.28	51s 6.29d	14s 5.12 d
Wesselton	.27	37s 9.6 d	10s 2.47 d
Bultfontein	.38	35s 0.52d	13s 3.79 d
Dutoitspan	.21	73s 6.5 d	15s 5.325d

At the same time even with the advances in the price there was a decrease of £476,800 in income as compared with 1910, due to the decreased production, although the price rose steadily. This decrease represents fully one-half the amount of the value of the German Southwest Africa deposits, and with the increased demand all over the world, a larger diamond yield would not glut the market and continued advances are not improbable, clearly proving that the bourses do not always dictate the prices of commodities which have an international status.

The value of the precious stones, cut and uncut, brought into the port of New York in 1911, the figures for December being estimated, is about \$40,854,088, as against \$40,566,489 for 1910, thus showing a slight increase in the imports of these articles. As the conditions prevailing during the year were distinctly unfavorable, it is evident that under normal conditions there would have been a considerable increase over the figures of

the previous year. As it is, only in the record year of 1906 were more precious stones imported into New York than in 1911, the difference between these two years being \$2,719,400 only.

The total importations into the United States for 10 months of 1911 are, from official figures, \$36,413,685, and the amount for the whole year may safely be put at about \$42,500,000. This would be about \$1,000,000 less than in 1909, \$1,750,000 less than in 1906, and a small increase over the figures for 1910. It is noteworthy that in no triennial period were so many precious stones imported into our country as in the years 1909, 1910 and 1911, during which time precious stones worth nearly \$128,500,000 were brought in. The nearest approximation of these figures was in 1905, 1906 and 1907, when the imports totaled \$114,306,458.

DE BEERS PRODUCTION TO DATE 67,000,000 CARATS

We can gain some idea of the enormous production of diamonds in the South African fields from the fact that the De Beers group of mines has furnished diamonds weighing at least 67,000,000 carats and worth more than £100,000,000, or \$500,000,000. If to this immense sum we add the value of the diamonds extracted from the Premier mine, from a number of smaller independent mines and from those in German Southwest Africa, we would probably have a total of nearly, if not quite, \$600,000,000. The great and consistent demand for diamonds is strikingly shown by the rising prices, notwithstanding this enormous production. Before these reach the final customer, when all the costs of cutting and handling are added, the value will amount to about \$1,200,000,000.

When we consider that in 1906 the German-African mines had not yet been developed, and that there has been an average annual yield of about \$4,500,000 from this source during the last three years, in addition to the South African supply, it is not surprising that the diamond mines of New South Wales should receive the encouragement they do. However, there is as yet considerable doubt as to the likelihood of their ever equaling the African mines in richness, or their ever becoming dividend-payers. There has not been any important development of the Arkansas deposits, which, in their present condition, are awaiting the placing of extensive

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machinery for working them. Some small diamonds have been found in the Belgian Congo at a point 1500 miles north of the Kimberley mines, and there is only a nominal supply from British Guiana. The East Indian yield is less than £2000, less than a day's African output, and the Brazilian not over £50,000 or about a week's output.

The diamond, the pearl, the emerald and the sapphire are now enjoying public favor to the full. There has been a material advance in the price of these gems from the figures of four years ago, when I predicted that the sapphire in particular, which had not been the subject of fashion's favor, was soon likely to become so.

The Fergus County, Mont., mines, were more productive than ever before; however, in general, and larger blue stones are included, colored stones are not so well favored as they were formerly.

Cameos, which have not been in vogue for over 20 years, are being revived to some extent, although not enough to enable the dealers to sell out their old stocks. Coral is now in great favor. Many necklaces are imported at a wide range of prices, the cost varying from 5c. to \$2000. Pearls are higher in value, this being due both to the decreasing fisheries and to the universally accepted edict that the pearl is one of the richest and at the same time one of the most modest of jewels; therefore the price has steadily advanced since 1895, notwithstanding the depressions of 1907 and 1910. One of the principal discoveries of gems was that by Schaller of turquoise in minute triclinic crystals in Campbell County, Virginia.

A series of combinations is now sold of vari-colored square, round or oblong stones, or caliber-cut stones, such as the emerald and the sapphire, demantoid, peridot, sapphire, kunzite, aquamarine, etc. In this way marked contrasts are produced, but the effect is often quite harmonious when a number of these stones are skillfully grouped together by the jeweler.

Two-thirds of all fine jewels are now mounted in platinum. Whether it is due to this demand or not, platinum, which sold at \$18 per oz. in 1881, and at \$24 in 1891, brings in 1911 over \$50 per oz. when combined with 5 or 10% of iridium.

An American Radium Industry

Extensive experiments with the treatment of uranium ores to produce radium and radio-active compounds, were carried on during 1911 by a private American syndicate, at Pittsburgh. Satisfactory results are reported, but no definite plans are announced.

The Arkansas Diamond Field

By JOHN T. FULLER*

Five years have now elapsed since the finding of the first diamond on these fields. During this period one "pipe" has been proved to contain diamonds in payable quantity, the "washings" to date having shown 28 carats per 100 loads of 16 cu. ft. A second "pipe" has been proved to contain diamonds but whether or not in payable quantities has yet to be determined, while a third "pipe" is still in the anticipatory state.

The year 1911 saw but little development and practically no work on the mines, as all the companies in the field were hampered by lack of capital.

The Arkansas Diamond Co. which owns the greater part of the "pipe" in sections 21 and 28—T. 98.—R. 25W., is making, quiet but determined efforts to raise the capital necessary to equip and develop its mine. It does not seem possible that a property of such great promise can remain unproductive for an indefinite time.

The Mauney tract, and a portion of the Ozark company's holdings lie on this same "pipe." The most important event of the year was the finding of an 8½-carat white stone on the Mauney tract. This is the largest stone found to date on these fields. A white stone weighing 3½ carats was also found on the "pipe" in section 14 owned by the American Diamond Mining Co.; the stone is the largest yet found on its property.

It is impossible to forecast the year 1912, as everything depends on what success the various companies may have in raising the required capital.

Antimony in 1911

Antimony in the United States continues to be distinctly a minor metal. There is no antimony ore smelted in this country, and it is believed the entire ore production, only used for experimental purposes, will not exceed 50 tons. The American Smelting & Refining Co., the United States Metals Refining Co., and the Balbach Smelting & Refining Co. are producers of antimonial lead, all of which finds a ready market, without the necessity of separating the metals. There is also a small production in secondary alloys by the scrap smelters.

About 70% of all metallic antimony imported, on which, incidentally, there is a duty of 1½c. per lb., is the well known Cookson's brand, and the largest users of it say that it is distinctly economical to use only the purest metal, both from the standpoint of dressing, and of exact knowledge of the composition of the resultant alloys. There is also a consid-

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erable importation of needle antimony from China, of which the production so far has not been interfered with by the revolution. This needle antimony is exclusively an Oriental product, depending

AVERAGE PRICES OF ANTIMONY
(IN CENTS PER POUND)

	1910			1911		
	Cookson's	U. S.	Ordinaries	Cookson's	U. S.	Ordinaries
January...	8.5007	9887	7.7388	8.25	7.74	7.5
February...	8.4697	9697	7.5788	8.38	8.02	7.65
March.....	8.3597	9387	7.3139	9.56	9.13	9.60
April.....	8.4387	9387	7.4389	9.54	9.13	8.92
May.....	8.4387	9387	7.4389	9.50	8.97	7.99
June.....	8.2417	9387	7.4388	8.75	.....	7.42
July.....	8.1757	9387	7.4008	8.50	.....	7.35
August....	8.2787	9387	7.3288	8.44	7.94	7.36
September..	8.3137	9387	7.3138	8.31	7.84	7.26
October....	8.2637	9007	7.4008	8.14	7.71	6.96
November..	7.9227	6567	7.1887	7.97	7.61	6.92
December..	7.6257	4387	7.0637	7.78	7.50	6.82
Year.....	8.2527	7.8767	7.3868	8.59	8.16	7.54

for its production apparently on pure ores and cheap labor.

As seen by the accompanying table of prices, the market was dull and lifeless through the year. The international antimony syndicate put prices to an artificial level for a little while, but the so called collapse of the syndicate in September was merely the tardy recognition by a pricked bubble that it had already ceased to exist.

There continues to be a crop of suggestions for a simple metallurgy of antimony, which would be good, if they would only work. Pending the arrival of some workable improved process, the old-fashioned method of smelting sulphides to a regulus, and its sale as such, or reduction by iron or similar agents, and the reduction of oxides previously volatilized and collected, continues to be standard practice. The anti-phosphorus bill, which will increase antimony consumption, is still unsettled by Congress.

ANTIMONY OXIDE

The use of antimony oxide as a substitute for the oxide of tin in the ceramic and enamel industries, has been favored by the high price of tin during 1911. The Harshaw, Fuller & Goodwin Co. was, until recently, the sole manufacturer, but owing to increased demand, a larger plant became necessary, and the Enamel Co. of America, interested in the product, bought up and enlarged the Elyria plant of the Harshaw-Fuller company. The Enamel Co. of America has appointed as its joint selling agents the Roessler & Hasslacher Chemical Co. and the Harshaw, Fuller & Goodwin Co. It is understood that this plant operates chiefly on Chinese regulus. The imports of antimony oxide are small. The price of this product in 1911 was about 7¼@8c. per pound.

The Copper Industry in 1911

The history of 1911 is told concisely in the accompanying statistics and in the following special articles, wherefore no great elaboration is necessary in this introduction. The statistics of smelters' production are based uniformly upon the fine-copper content of blister copper, plus the production of the Michigan smelteries, and the small amount of copper scrap and precipitate that is put directly into anodes. The comparison between refiners'

SMELTERS' PRODUCTION (In Pounds)

Source	1910	1911
North American ore	1,284,339,246	1,288,243,875
Foreign ore (a)	41,976,733	34,883,713
Scrap (b)	10,962,099	18,603,084
Totals	1,337,278,078	1,341,730,672
To foreign refiners	33,855,800	32,467,440
To American refiners	1,303,422,278	1,309,263,232
Blister copper imported (c)	146,185,104	148,000,000
Total crude copper	1,449,607,382	1,457,263,232

(a) Exclusive of Canadian and Mexican ore (b) Inclusive only of scrap treated by primary smelters. (c) Exclusive of blister copper imported from Canada and Mexico.

PRODUCTION OF COPPER IN THE UNITED STATES (In Pounds)

State	1910	1911
Alaska	5,008,171	16,200,000
Arizona	299,606,971	316,933,756
California	45,793,894	37,085,315
Colorado	10,127,012	8,400,000
Idaho	6,216,461	1,830,666
Michigan	221,400,864	217,270,000
Montana	286,242,403	273,438,879
Nevada	63,877,500	65,800,000
New Mexico	3,632,351	2,288,288
Utah	125,042,381	140,293,198
East and South	18,195,450	19,147,761
Other states (a)	1,106,525	2,603,427
Totals	1,086,249,983	1,101,291,290

(a) Includes copper of which it is impossible to determine the origin.

PRODUCTION OF COPPER IN NORTH AMERICA (In Pounds)

Country	1910	1911
United States	1,086,249,983	1,101,291,290
Canada	52,492,282	55,945,498
Mexico	137,797,217	121,025,747
Cuba	7,799,764	9,981,340
Totals	1,284,339,246	1,288,243,875

In the above tables, the production credited to Alaska and to the United States is doubtless a little too low, and that credited to Canada correspondingly too high, it having been impossible at this time to trace back to Alaska the copper produced in the United States from some Canadian matte, which resulted from the smelting of Alaskan ore. Such copper is therefore credited temporarily to Canada.

and smelters' production throws light upon the matter of stocks of crude copper. In making this comparison, it is to be borne in mind that a small part of the smelters' production, possibly about 6,000,000 lb. in 1911, passed into bluestone rather than refined metal.

There is, moreover, a considerable production of blister copper at the refineries from their own byproducts, which may amount to as much as 20,000,000 lb. per annum. This is to be considered as a

working stock, continually locked up, and such production is excluded from our statistics.

Making all of the above allowances, it appears that the production of blister copper and its analogues was larger in 1911 than the production of refined copper. It is probable also that a surplus of ore accumulated at the smelteries or in transit thereto.

Upon the basis of the smelters' statistics we have distributed the production according to states and countries of origin, all of the smelters having courteously cooperated in this by an itemization

REFINERY STATISTICS

Month	United States Product'n	Deliveries Domestic	Deliveries for Export
Year 1910	1,462,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,228	52,407,650	62,129,699
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,930,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII (c)	115,000,000	65,000,000	67,000,000
Year, 1911	1,424,041,641	708,624,141	742,663,517

VISIBLE STOCKS

	United States	Europe	Total
I, 1911	122,030,195	236,629,120	358,649,373
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912 (c)	94,784,178	158,323,200	253,107,378

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe. (c) Estimated.

of the production so far as possible. As in previous years, this preliminary distribution is only approximate. It can never be precise; and no closer indication of the mine production than what is based on the smeltery figures can ever be made, other statisticians to the contrary notwithstanding. This consideration does not affect the total. It means simply that some copper credited to one state may really belong to another.

In 1911 the mine production was doubtless larger than the smeltery production in certain states, particularly Alaska, Arizona and New Mexico, where import-

ant new mines began to produce. Attention may be drawn to the smallness of the total credited to New Mexico. The explanation of this is that but very little of the Chino copper had been turned out as blister copper up to the end of the year, although the smelters had been receiving the concentrates for several weeks. For the same reason the amount of blister copper reported as actually produced from Miami and Ray is less than the copper in concentrates reported by those companies.

REVIEW BY STATES

Alaska—The large increase in the production of this territory was due to the inauguration of shipments from Copper River. The mine production was probably larger than our figure, A. H. Brooks, of the U. S. Geological Survey, having estimated 22,900,000 lb. Such an amount, however, had not passed through the smelting works up to the end of the year.

The shipment of copper ore from Alaska to the United States in December, 1911, was 9935 long tons, containing 5,258,956 lb. of copper, against 1,274,655 lb. in November. Of course the December ore had not been smelted previous to the close of the year. However, the figure that we credit to Alaska for 1911 is undoubtedly low for the reason stated in the foot-note to the previous table.

Arizona—The situation in this state is reviewed by Doctor Douglas in a subsequent article. We need say only that its increased production is ascribable chiefly to Miami and Ray. The latter company has reported to us its monthly production as follows: April, 704,261 lb.; May, 1,006,922; June, 1,167,463; July, 1,689,124; August, 1,833,083; September, 1,876,904; October, 2,069,287; November, 2,517,000; December (estimated), 2,660,000; total, 15,524,044.

California—The decrease in the production of this state was due especially to smoke troubles, causing the Balaklala works to be closed during the year, and reducing the Mammoth output.

Idaho—The Snowstorm mine was closed during part of the year, wherefore the reduced output of this state.

Michigan—The small reduction in output reflects the curtailment by the principal producer.

Montana—East Butte made an increased output but Anaconda curtailed, wherefore the less total for this state. Anaconda is now to produce at full rate.

Nevada—Nevada Consolidated contributed the total credited to this state. Mason Valley and perhaps Giroux will become producers in 1912.

New Mexico—Chino will make a large output in 1912. In 1911 but little of its concentrate was smelted.

Utah—Utah Copper Co., Utah Consolidated and South Utah were the chief producers. The output of Utah Copper Co. alone was 99,000,000 lb. This company ceased curtailment in September, since when it has been producing at full capacity. A further increase may be expected in the latter part of 1912.

East and South—The production of Vermont and Virginia became insignificant in 1911. The smeltery at Norfolk was idle. Tennessee made an increased output.

OTHER NORTH AMERICAN COUNTRIES

Canada—The output of this country was diminished by the closing of the Granby mine and smeltery during part of the year, owing to the colliery strike. Smelting was resumed in December. The deficiency of Granby output was partly made good by resumption of mining by the Britannia company, which shipped its ore to Tacoma. The Tacoma Steel Co. shipped ore from Texada Island. Production in the Sudbury district, Ontario, was about as usual.

Cuba—The Cuba Copper Co. is the principal producer.

Mexico—Curtailment by certain of the large producers and the revolutionary disturbances explain the decrease in the output of this country.

World's Production of Copper

Statistics of the world's production of copper are likely to differ on account of variations in the systems of computation adopted by individual statisticians. In our own statistics we adopt

WORLD'S PRODUCTION OF COPPER

Country	1910 (In Metric Tons)	1911
United States	492,712	499,542
Mexico	62,504	54,897
Canada	23,810	25,377
Cuba	3,538	4,528
Australasia	40,962	42,500
Chile	(b) 44,374	(b) 37,456
Peru	(f) 26,000	(c) 28,506
Japan	46,700	(e) 46,000
Russia	(a) 22,700	(d) 26,000
Germany	(a) 25,100	(d) 25,700
Africa	(a) 15,400	(d) 18,500
Spain and Portugal	(a) 51,100	(e) 52,000
Other countries	(a) 28,100	(e) 29,000
Totals	883,000	890,000

(a) As reported by the Metallgesellschaft, Frankfurt am Main. (b) Exports of Chile bars, plus contents of ore imported from Chile into the United States. (c) Based chiefly upon imports of pig copper and ore into the United States. (d) Partially estimated. (e) Wholly estimated, no precise data being available. (f) As reported by Aron Hirsch & Sohn.

the production of anodes and pig copper as the base and refer the metallurgical

production of the several countries back to the country of origin. Thus, Cuba produces no pig copper, but figures as a copper producer through Cuban ore smelted in the United States. Some copper doubtless escapes enumeration by this system, wherefore our statistics are more likely to be low than high.

The statistics that we have used for Chile in the above table are much larger than is commonly credited to that country. We have included the copper derived from the large amount of Chilean ore that is smelted in the United States

The New York Copper Market in 1911

The apprehensions entertained for the copper market at the outset of the year and the hopefulness which prevails as the year is drawing to a close form a contrast, which, retrospectively, it is difficult to reconcile. And yet the explanation is to be found in factors so simple that it seems strange they did not receive recognition earlier in the year. A deluge of copper; an increase of stocks to unwieldy proportions; the necessity of enlarging operations at the low-grade copper mines in order to keep up the dividends; these were the arguments advanced by those who could see no remedy other than a fall in prices, which would automatically check production. But the

due to accumulations of furnace material, which had served as a working stock, and which were first of all consumed before the refineries allowed their tanks to stand idle. Nothing would disturb the trade at large in its preconceived views. The market backed and filled for 10 months of the year within a range of not more than \$10 per ton, due largely to a persistent policy of hand-to-mouth buying, prompted by the expectation of a much lower level of prices.

In January, the market was dull. Sales took place at between 12.40 and 12.50c. early in the month. Competitive selling brought prices down to 12½c. by the be-

PRICE OF COPPER

	NEW YORK				London, Standard	
	Electrolytic		Lake		1910.	1911.
	1910.	1911.	1910.	1911.		
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.368
July	12.215	12.463	12.570	12.720	54.194	56.670
August	12.490	12.405	12.715	12.634	55.733	59.264
September	12.379	12.201	12.668	12.508	55.207	55.253
October	12.553	12.189	12.788	12.370	56.722	55.176
November	12.742	12.616	12.914	12.769	57.634	57.253
December	12.581	13.552	12.863	13.768	56.769	62.063
Year	12.738	12.376	13.039	12.634	57.054	55.973

New York, cents per pound, London, pounds sterling per long ton of standard copper.

ELECTROLYTIC COPPER REFINERIES OF THE UNITED STATES

Works	Location	1910 Capacity, Pounds	1911 Capacity, Pounds
Nichols Copper Co.	Laurel Hill, N. Y.	†330,000,000	†330,000,000
Raritan Copper Works	Perth Amboy, N. J.	*310,000,000	*320,000,000
Baltimore Copper Smelting and Rolling Company	Canton, Md.	*264,000,000	†288,000,000
American Smelting and Refining Co.	Perth Amboy, N. J.	*180,000,000	†180,000,000
U. S. Metals Refining Co.	Chrome, N. J.	*180,000,000	*180,000,000
Balbach Smelting and Refining Co.	Newark, N. J.	*41,000,000	*48,000,000
Anaconda Copper Mining Co.	Great Falls, Mont.	*65,000,000	*65,000,000
Tacoma Smelting Co.	Tacoma, Wash.	†28,000,000	†28,000,000
Calumet & Hecla Mining Co.	Buffalo, N. Y.	*50,000,000	*55,000,000
Total		1,448,000,000	1,494,000,000

*Official figures furnished by the respective companies. †Estimated from previous records.

reality proved otherwise. Producers exercised a commendable restraint; instead of forcing the output of their mines, it was, in most cases, decided that a curtailment would serve the industry best. The low level of the market stimulated consumption throughout the world. Copper replaced other metals for the most varied uses. The growth of consumption for miscellaneous purposes was so gradual as to evade observation from the standpoint of its effect upon prices. Stocks of pig copper which had accumulated at the refineries were gradually worked off. Upon their disappearance, the figures of production published by the Copper Producers' Association showed a shrinkage. This reduction in the output of the refineries was expected much earlier than was actually the case, the delay being

ginning of February, when there was a recovery, due to heavy purchases for foreign account, which resulted in an advance to 12.25@12.30c. The better tendency was short-lived. Prices sagged slowly, but the market showed resistance whenever it sank to the neighborhood of 12c. This was the situation up to May, when unfavorable statistics caused a break through 12c., and about the middle of that month the lowest point of the year was reached with 11.80@11.90c. The Standard Oil decision, handed down about that time, produced a change of sentiment. Europe took the lead with heavy purchases, and followed by a more liberal demand for home trade, quotations climbed steadily until 12.50@12.60c. was realized toward the end of June. Not long thereafter, the Morocco diffi-

culty began to cloud Europe's political horizon, and an urgent liquidation started in all speculative markets. However, the unsettlement of the stock exchanges had a relatively slight effect upon the price of copper, notwithstanding the fear of a serious contraction in the absorbing power of Europe and correspondingly smaller exports. Early in October, the quotation stood at 12.05@12.10c., the low point. Conservatism reigned supreme. Consumers on both sides of the Atlantic had allowed their stocks to run down to a minimum. Buying on a large scale could no longer be put off. Another shock caused by the filing of the suit against the Steel Corporation brought about a temporary setback toward the end of October, but aside from this short interim, the movement had started, which took the market out of the rut in which it had stuck practically since the panic of 1907. Favorable statistics in Novem-

The London Copper Market

SPECIAL CORRESPONDENCE

The year opened with optimism which was reflected in an initial improvement of 5s. per ton, the value of cash standard rising to £56 6s. 3d. per ton, and three months to £57 2s. 6d. Statistics showed a substantial decrease in the European visible supply. The improvement, however, was quickly lost, mainly under the influence of American statistics which disclosed an unwelcome increase in the output of the refineries during December, coinciding with a decrease in consumption, and the immense quantities shipped from America to Europe. A decline continued for 12 days, when there followed a gradual improvement, due mainly to the absorption of large quantities for consumption in both hemispheres. With trade requirements covered, prices again relapsed until the close, when selling pressure subsided under generally improved conditions; and the month closed with values £54 17s. 6d. and £55 13s. 9d. respectively.

The upward trend of prices which marked the closing days of January was manifest in the early part of February. European statistics were satisfactory, selling pressure had ceased, trade requirements were large, and speculative interest was encouraged. Later the market was disquieted by rumors of adverse American statistics for January, whereby buyers were intimidated and short selling was encouraged; the result being a decline of £1 10s. per ton. Further decline was arrested by persistent renewal of trade demand; prices advanced sharply to £55 and £55 15s. Thereafter fluctuations were within narrow limits, but tending downward toward the close, influenced partly by liquidation by tired holders and partly by apprehension as to the effect of a decision of the Railroad Commissioners in the United States on the freight-rate question. Closing prices were £54 15s. per ton for prompt standard, and £55 8s. 9d. for three months.

March opened with a fractional decline in prices. Statistics disclosed a decrease of 422 tons in the European visible supply, which was insufficient to counteract the downward trend. Throughout the month fluctuations were within narrow limits, the market being supported by trade demand rather than by interest displayed by speculators. Dullness supervened and was relieved only by a temporary manifestation of activity on Mar. 15, when a general covering of "bear" commitments coincided with some important sales of refined copper to consumers. The month closed with a market devoid of animation; cash standard being quoted £54 8s. 9d., and three months £55 per ton.

April opened with a fractional advance in prices, but this was followed by a gradual and persistent decline, due partly to lack of speculative enterprise; to the forced sale of old purchases as they fell due, and to the hesitation of American consumers. In Europe the volume of business with manufacturers was moderate and seldom extending far forward. American statistics for the preceding month were regarded as unfavorable. On the other hand, European statistics for first half of April disclosed a reduction of 2664 tons in the visible supply, which tended to check the decline. The Amalgamated Copper Co.—after long abstention—entered the market at the reduced price of £56 10s. for Europe. London closing prices were £54 and £54 12s. 6d. for spot and three months.

In May some buoyancy on the Stock Exchange, and a reduction of 1535 tons in the visible supply combined to infuse some speculative interest into the market, and resulted in an advance; but it was of short duration. The improvement brought out fair orders, but manufacturers were reluctant to cover orders unless at substantial concessions. The American Producers' statistics were regarded unfavorably. Standard copper gradually fell till May 17, when a recovery set in, prompted by the fortnightly European statistics. Speculative business revived and trade demand followed to some extent. There was some revival of gossip in regard to a possible consolidation of the leading interests in America. Thereafter the trend of prices was upward; and the month closed with spot warrants £55 3s. 9d., three months £55 16s. 3d., and with European trade brisk.

In June the market opened at a fractional decline which, however, was recovered. The expansion in European consumption and evidence of increasing consumption in America were followed by enhanced prices. There was general suspension of business in the United Kingdom on June 22 and 23 in connection with the Coronation, but the strength of the market was in no way impaired. The absorbing power in the market did not allow prices to dip much, and the month closed with cash standard £57, and three months £57 11s. 3d. per ton.

In July, business opened with a decline of 5s. per ton, mainly induced by international complications coinciding with crop scares in the United States. Later support was forthcoming. A small decrease in the European visible supply, a calmer aspect in the political world, and better reports from Wall Street, combined to induce a rally in prices. Again, demand was more readily satisfied by disappointed speculative holders than by the leading producers whose accumulation of stock was an element of weak-

AVERAGE MONTHLY PRICES OF COPPER MANUFACTURES (IN CENTS PER POUND)

	1910		1911	
	Copper Wire	Sheet Copper	Copper Wire	Sheet Copper
Jan.	15.35	18.50	14.06	18.50
Feb.	15.25	18.75	13.50	18.50
Mar.	14.75	19.50	13.25	18.50
Apr.	14.75	19.50	13.75	18.50
May.	14.10	18.50	13.75	18.50
June.	14.19	18.50	13.75	18.50
July.	14.00	18.50	13.90	18.50
Aug.	14.00	18.50	13.81	18.50
Sept.	14.00	18.50	13.75	18.50
Oct.	14.00	18.50	13.50	18.50
Nov.	14.25	18.50	13.75	18.63
Dec.	14.25	18.50	14.94	19.13
Year.	14.41	18.69	13.81	18.56

ber and December helped to accelerate the pace, and by the end of the year prices had advanced to 14c., under the influence of an enormous volume of orders.

While European buyers have regained sufficient confidence in the future to anticipate their requirements a few months ahead, the domestic consumers have followed the market only reluctantly. A buying power is therefore in reserve, which, whenever it makes itself felt, may tax the resources of producers, some of whom have hardly a working stock of refined copper left on their hands. Whatever tension may be created ought, however, to be temporary only, since the output from the new porphyry mines of Arizona is gradually coming into the market, while the Anaconda company has announced that it will increase its production in January, and other producers are likely to do the same thing.

During 1911 there was a reduction of about 100,000,000 lb. in the world's visible supply of copper. In 1912 a new production of about 150,000,000 lb. is anticipated, besides which there will be whatever the older producers choose to add.

ness in the market. Manufacturers were consequently cautious in entering the market. Even the mid-monthly statistics, showing a decrease of 2273 tons in the European visible supply, failed to dispel the prevailing apathy. The lowest prices recorded in London were on July 20, when good quantities were taken over. With improved demand and a brighter general outlook values improved somewhat, and the month closed with cash standard at £56 5s. per ton, and £56 17s. 6d. for three months.

August opened with a fractional decline in prices, and buyers were not encouraged by statistics, the American statistics showing a decrease of 8739 tons during July. The favorable impression which was created by these figures as well as by the continued activity in the consuming industries was counter-balanced by the political outlook, weakness in the security markets, and by the paralysis of trade in the United Kingdom brought about by serious labor troubles. Throughout the month the consuming industries were well employed, but sellers were always found ready to supply the metal at current values, which moved within narrow limits.

September opened with a fractional advance in prices, and the market remained fairly steady for a week or more. The peace of Europe was gravely threatened by international dispute, and the stock

markets sustained great and persistent depression. Declining values caused heavy losses, wherein copper-mining securities participated largely. There are, however, little pressure on the part of dealers and speculators to sell, nor would the leading producers make any concessions in price. The lowest recorded price was on Sept. 22, when it became evident that there were few speculative holdings to be liquidated and numerous short sales to be covered. With some improvement in American finance the copper market quickly responded to a revival in demand, and improved by 15s.

October opened with a fractional decline in prices. Statistics showed a decrease of 837 tons in the European visible supply during second half of September, and the consuming industries were everywhere well employed; but these favorable factors were counter-balanced by the tardy reappearance of the Amalgamated group of American producers as sellers of the refined metal at prices which were not sufficiently low to tempt the trade. Prices drifted gradually downward. Thereafter, surrounding conditions improved, and the confidence thus imparted resulted in a great expansion of business and an improvement in prices. Demand being temporarily satisfied, prices relapsed somewhat. Trade requirements, however, were sufficient to arrest any serious decline, the

electrical industries being particularly active, as also the manufacture of sulphate. Closing prices were £55 7s. 6d. for cash standard, and £56 2s. 6d. for three months.

In November the market opened with an advance, due in some measure to the statistics. There was evidence of notable expansion in trade generally, and values consequently advanced almost uninterruptedly throughout the month, with comparatively little speculative aid. Nov. 22 the price of standard copper suddenly rose more than £1 per ton; a succeeding reaction was only temporary. Meantime American producers had sold largely in both hemispheres, but the volume of trade showed no sign of diminution, and the close of the month found the market very firm, cash standard being quoted £59 2s. 6d. with £59 16s. 3d. for three months.

December gave little promise of improved markets at the outset. Standard copper drifted gradually downward. At the lower level there was a sharp recovery of about 10s. per ton, due partly to some of the leading producers having raised their prices after making large sales to consumers, but more particularly to the hasty covering of short sales. In the latter part of the month there was feverish activity and a quick advance, spot standard going at the close to £63 per ton.

The Mines of Butte in 1911

By B. B. Thayer *

The properties of the North Butte, East Butte, Butte & Superior, Tuolumne and Anaconda Copper Mining Co., together with the zinc properties owned by W. A. Clark, were operated continuously in 1911, and while the business depression which existed throughout the United States during that period was felt in a certain degree in the Butte district, it was not felt to the same extent as at other points in this country, for while the mines were operated under somewhat curtailed conditions, advantage was taken of the lull by all of the operating companies to make extraordinary repairs in their different working shafts, and the amount of development work was normal, so that the decrease in the number of men employed was not proportionate to the decrease in output. Notwithstanding the conditions mentioned above, it is generally understood that the year 1911 was one of lower costs in the Butte district, several factors having entered into this question, the most prominent being the benefits derived from

the consolidation of certain properties now forming the property of the Anaconda Copper Mining Co., and also the more general use of electric power by all companies.

Early in the year 1911, the copper-producing mines owned by W. A. Clark were purchased by the Anaconda Copper Mining Co., and have since that time been operated under its direction.

The different companies that have operated in the Butte district since its beginning have always been noted as having been the pioneers in the investigation and adoption of new processes and methods, and the year 1911 will stand as one in which experimentation promising excellent results was most active.

There has been developed on the Missouri River and its tributary streams a large amount of electric power, and the hydro-electric plants are capable of still greater development. All of this power is available at Butte, and, in fact, in all

President, Anaconda Copper Mining Company, 42 Broadway, New York.

of the mining districts in Montana. A large amount of this power is being used in Butte for a variety of operations, and the Anaconda company is much pleased with the success which it has thus far attained in applying compressed air, generated by electric power, to its hoisting operations, in place of steam.

The zinc output of the camp, while large, would have been much greater had the producing companies been thoroughly satisfied with their methods of concentration. They have been trying out different processes and seem to have arrived at a satisfactory solution, and it has been rumored that both the Butte & Superior and W. A. Clark intend to erect concentrating plants in the near future.

It is the opinion of the engineers in charge of the different mines in Butte, both copper and zinc, that there has never been a time in the history of the Butte camp when the mines have looked so well, or when developments were more satisfactory than during the year 1911.

The Lake Superior District in 1911

By Carl L. C. Fichtel *

The year 1911 was rather eventful for the Lake Superior district, inasmuch as it received much publicity through the report of J. R. Finlay of New York, who was appointed by the State of Michigan to place a valuation on the various properties for taxation purposes; and through the contentions and affidavits of the minority interests of the Ahmeek and Osceola companies in the suits against the proposed consolidation of the Calumet & Hecla and its subsidiary companies. Mr. Finlay's estimated life of the district was comparatively short, but as his report was for taxation purposes only, it dwelt upon the apparent conditions and did not take into consideration the possibilities of the unexplored and undeveloped territory. Diamond drilling along the eastern side of the known trend of mineralization has shown that the sandstone contact is farther east than it was originally supposed to lie, and in the Arcadian drilling a trap formation was reached underlying the sandstone. These results have aroused interest in this region and may be the forerunner of developments of the utmost importance. The Michigan legislature passed a law making the position of mine inspector an elective office and Governor Osborn appointed a commission to look into the Employers' Liability Act and report at the next session.

Most of the producing companies operated under about the same conditions as in 1910, although advantage was taken of the condition of the metal market to make any needed repairs or alterations towards greater efficiency in the handling of the product. Owing to the continued low price of copper nearly all of the dividend-paying companies had to reduce the dividend rate, while some of the smaller companies curtailed on development work so that there was a slight falling off from 1910 figures in the amount of labor employed.

KEWEENAW COUNTY

Development work was carried on at the Keweenaw Copper Co. in sinking and drifting on the Kearsarge lode up to about Dec. 1, when operations were suspended; some copper was opened but the ground was of an inconsistent nature. The Calumet & Hecla company opened a shaft on the Kearsarge lode at the Cliff property and did some drifting at the 300-ft. level where the ground was rather encouraging. Ojibway did a large amount of development work in its two shafts, opening 19 stopes for production.

Towards the end of the year rock shipments were made to the Tamarack mill, starting with about 150 tons daily and gradually increasing the amount, the rock coming from the various openings. At this writing no official returns have been given out on the copper contents of the rock.

The Gratiot property suspended operations, after an extended mill test. Mohawk operated under about normal conditions and a betterment was noted in the shafts at the south end of the property. Shafts Nos. 3 and 4 of the Ahmeek were established in the lode and a large amount of development work done in these shafts, so that when conditions warrant, a decided increase can be made in the rock tonnage. At the stamp mill the two remaining heads were put in commission. This company entered the list of dividend payers, paying its initial dividend of \$2 on Nov. 1, 1911. At No. 2 shaft of the Allouez a new structural-steel shaft house and engine house are in the course of erection and will be completed early in 1912. The two shafts were put in shape to handle a large rock tonnage.

HOUGHTON COUNTY

Wolverine continued its exploratory work on the Osceola lode and in driving a crosscut from the drift at the 28th level between shafts Nos. 3 and 4 eastward to open the territory in that direction. About normal production was maintained at the old workings and the physical conditions of the property are first class. Centennial's underground conditions were improved in the northern extension of the drifts towards the Wolverine ground. No. 1 shaft was used for the hoisting of all the rock and No. 2 for men and timber. The Mayflower and Old Colony carried on systematic drill operations and succeeded in extracting some good drill cores of a lode supposed to be the same as that opened by the Calumet & Hecla on the St. Louis tract both by drilling and shaft sinking.

Early in the year the Calumet & Hecla directors announced a plan of consolidation with other companies in which it held stock control, which met with bitter opposition by some of the minority holders of the Ahmeek and Osceola companies with the result that the plan was abandoned in the autumn with five suits pending. On the conglomerate lode, all the shafts, with the exception of No.

11 which was shut down for a few months owing to the destruction of the shaft house by fire, were worked at about normal capacity. The shafts on the Osceola lode were opened extensively and put in shape to handle a large tonnage, looking towards an ultimate tonnage of about 2000 tons per shaft per day. At some of these shafts enlarged engines were installed and alterations were made to No. 16 shaft house and a 24x48-inch. Blake crusher installed. No. 21 shaft on the Kearsarge lode was operated throughout the year.

NEW INSTALLATIONS

Plans were about completed for the enlarging of the company's electric plant and the installing of a 7500-k.w. exhaust-steam turbine to be operated by the exhaust from the mill steam stamps, and for the erection of a new regrinding mill of twice the capacity of the present mill, half of the mill to be used for the treating of tailings from the Hecla mill and the second portion to retreat the old tailing piles. John Knox, Jr., in charge of the underground work was promoted to the position of general superintendent of the Calumet & Hecla and its subsidiaries.

Fire broke out in No. 5 shaft of the Tamarack and the shaft was closed for some months during the summer, but little damage was done. Towards the end of the year all development work was curtailed and attention given to breaking developed ground, resulting in the reduction of the operating force. Nos. 5 and 6 shafts of the Osceola were put in shape to handle a large tonnage, but operations were not resumed awaiting a more opportune time in metal conditions. The North and South Kearsarge branches were operated normally and alterations to the mill were started, changing it to a system along the lines of the Calumet & Hecla mills. Laurium continued development work throughout the year and succeeded in opening a large amount of ground on the Kearsarge lode.

Operations at the LaSalle property were suspended towards the end of the year. Developments at the Tecumseh tract were encouraging and No. 1 shaft was equipped to handle a large tonnage, but conditions did not warrant continuance. New Arcadian and New Baltic carried on exploratory work throughout the year, Arcadian getting some good drill cores and the New Baltic opening a series of two beds of a formation believed to be the northern extension of the Baltic lode, at a depth of 360 ft.

*Electric department, Calumet & Hecla Mining Co., Calumet, Mich.

Oneco opened the shaft on the Oneco lode to about 1000 ft. to develop this formation at depth, and a rich drill core was taken at 1200 ft. The Franklin erected on the site of its No. 1 Pewabic shaft a steel shaft house, which had been formerly used on the conglomerate workings, and about completed the erection of a new hoisting plant, which is an innovation, inasmuch that the descending skip will be used to compress air to be used to help bring the loaded skip to the surface. The shaft was widened and put in shape to accommodate a 10-ton skip. Developments on the Pewabic lode at depth were satisfactory.

The Quincy operated about normally throughout the year. Its new No. 9 shaft was put down to a depth of about 1400 ft. with indifferent results, although drifts from the lower workings of No. 8 towards this ground showed an improvement over that opened in the shaft. Hancock put down its large vertical shaft to about 3100 ft. and at that point a copper-bearing formation was cut, showing a large amount of copper. A large amount of opening was done on the Hancock lodes and a mill test covering a period of six months was made at the Allouez-Centennial mill showing an average yield of 18.21 lb. copper to the ton.

The Isle Royale Co. resumed development work in its southern shafts, Nos. 4, 5 and 6 and the property was put on a paying basis. Exploratory work was

suspended on the Baltic lode, nothing of a consistent nature being developed. The Houghton Copper Co. put down its shaft on the Superior-Baltic lode to a depth of about 650 ft. and opened the lode by means of crosscuts the results being most satisfactory.

The Superior company continued the use of the Atlantic mill for the stamping of its rock. Both shafts were opened and at No. 1 the drifts were extended to the boundary to allow the working of the ground from the far ends. No. 1 shaft was equipped with a hoisting plant bought from the Tamarack company. The Copper Range Consolidated acquired control of the Atlantic property through a stock exchange. Conditions at the three properties comprising the original group were about normal, with possibly a slight betterment in the lower levels of the Tri-Mountain. The company completed plans for the installation of a low-pressure turbine generating set at the Baltic mill and the contract will probably be closed early in 1912. The Winona and King Philip properties consolidated during the year and the first head of the stamp mill was put into service, handling about 450 tons of rock daily. After the mill had been in commission a short time it was decided to replace the Chilean mill with a conical tube mill for grinding the coarser sands.

Development work has been carried on throughout the year by the various

companies which were successful in their previous drilling. South Lake and Indiana started shaft sinking to open the formations and the North Lake cleared a shaft site. Algomah developed the largest body of copper ore other than native, that has ever been exposed in the district, although sinking below 104 ft. has exposed some native copper, which may indicate that the ore will lead in to the characteristic formation of the district. The new Lake shaft was completed below the eighth level and the permanent hoisting equipment is about ready to go into commission. The property will undoubtedly enter the producing list in the near future.

Adventure encountered the first of the series of lodes which the new No. 5 vertical shaft was put down to intersect; some drifting was done on this formation but the results were not satisfactory. At a depth of about 1525 ft. a crosscut was started from the shaft to cut the other two formations. The Mass company opened the Butler lode through shaft C and the Evergreen lode through its B shaft; results for the year were satisfactory. Victoria carried its new shaft down several hundred feet and succeeded in opening a good run of ground at the 19th and 22nd levels of its producing shaft. Calumet & Hecla carried on operations at the White Pine property in shaft sinking and drifting.

Copper in Arizona in 1911

By James Douglas *

The last year was one of activity in building new and remodeling old works in Arizona. The porphyry mines progressed beyond the development stage, and two of them, the Miami and the Ray Consolidated, commenced to produce, while the increased quantity of concentrates, and the decreasing quantity of lump ore in the older districts, necessitated the addition of reverberatories to the cupola plants.

INCREASE IN REVERBERATORY SMELTING

In the case of the Arizona Copper Co. a decision was reached to abandon the old and to erect new smelting works exclusively on the reverberatory system. It is understood that the new works will be designed, not so much for increased production, as for greater economy in smelting. Along these lines the Copper Queen, which now receives from 300 to 400 tons of concentrates daily from the Moctezuma Copper Co., and which makes between 100 and 200 tons of flue dust

daily, will put two reverberatories into operation in March or April. The Calumet & Arizona Co. is remodeling the old works at Douglas, increasing the capacity and adding roasting and reverberatory furnaces. At the United Verde, Mr. Clark is planning new works in a more central situation to the ore production of the district.

PRODUCTION EXCEEDED THAT OF 1910

However, production in the older camps was well maintained, while the new mines probably brought the production of the state to a somewhat higher figure than the maximum of any previous year. The Copper Queen produced slightly less copper than in 1910. Its production for the year will probably approximate 75,000,000 lb. No startling developments were made underground, but new discoveries more than kept pace with extraction. The total production of the Douglas smeltery is estimated at 111,-

000,000 lb., of which about 26,000,000 lb. was contributed by the Moctezuma Copper Co. The combination of the Calumet & Arizona with the Superior & Pittsburg cannot but prove beneficial to both companies, and it is already reflected in a notable increase in the output of copper. The combined companies will probably make a production of about 50,000,000 lb. The only other notable producer in the district was the Shattuck-Arizona, with an output of copper in its ores—which were smelted at the Copper Queen smeltery, at Douglas—of between four and five million pounds. The Courtland camp, in the Dragoon Mountains, which, three years ago, promised to be a prominent producer, did not realize expectations. Its copper output has probably been 2,000,000 pounds.

IMPORTANT DISCOVERIES OF SECONDARY ORE

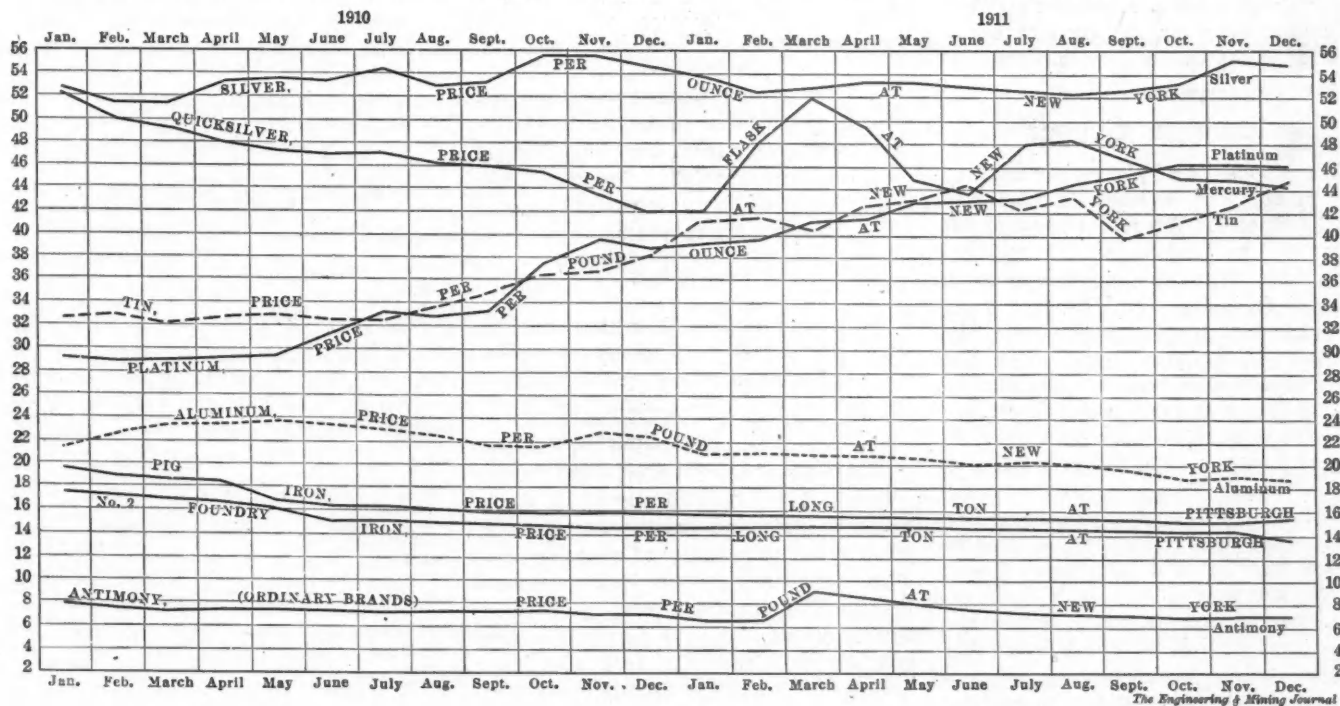
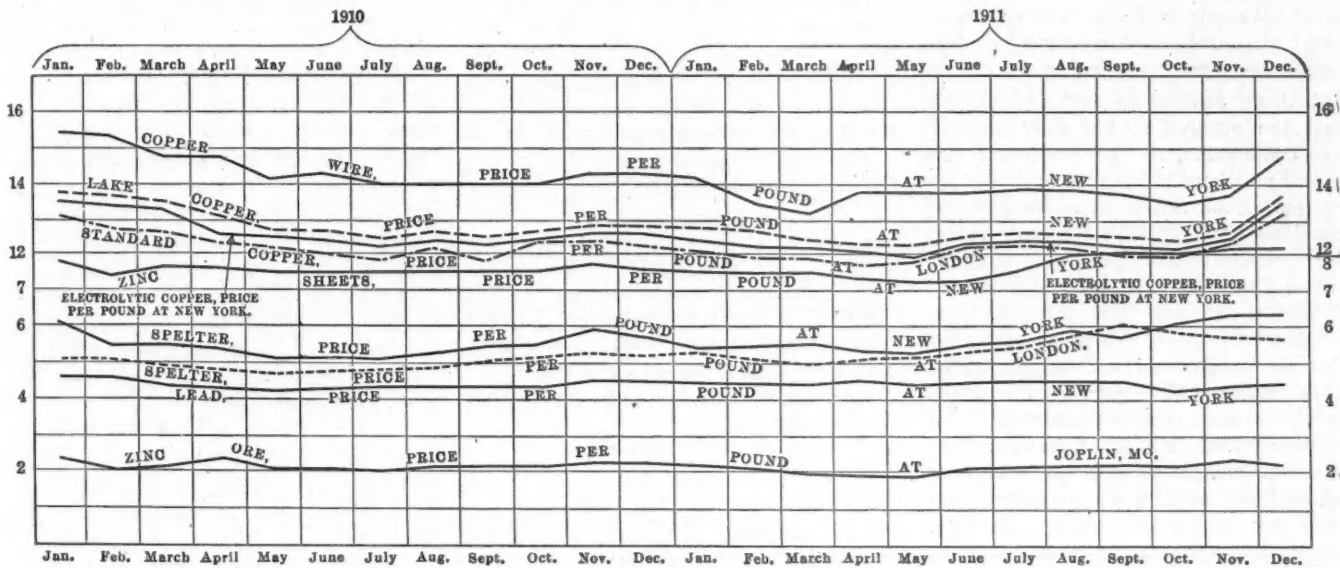
In the Clifton district the most promising development was the discovery of

*99 John St., New York.

profitable secondary ores at considerably greater depth than was theretofore assigned as the limit in depth of the altered zone. These deeper ores occur along certain fault planes in the Humbolt mine of the Arizona Copper Co., and the West Yankee of the Detroit Copper Co., and encourage the hope that the district may possess resources heretofore unsuspected. The production of the district, including the Shannon, and

exclusively from the ores of the Old Dominion and the United Globe mines, there being less custom ore in the Globe market than formerly. A notable feature of development during the last two years was the depth to which secondary enrichment extended along the main Old Dominion fissure and the size of the orebodies at a depth of even 1600 ft. from surface. At the Old Dominion, as elsewhere, the increased quantity of concen-

ducer, and began shipping actively in April, and will probably show a production from the sections of the mill which are as yet in operation of probably over 12,000,000 lb. It is currently estimated that its production will reach about 3,000,000 lb. per month, but that consummation will not be reached until the current year has partially expired. Its neighbors, the Live Oak and the Inspiration, confined energies to underground de-



METAL PRICES IN 1910 AND 1911

small quantities of ore from outside companies, will probably, when the annual statistics are completed, amount to about 70,000,000 pounds.

In the Globe district the Old Dominion smeltery turned out about five million pounds more of copper than in 1910. The total output will probably foot up to 25,000,000 lb. or over. This was almost

trates and the decreased quantity of lump ore points to modifications in the company's smelting methods.

The Imperial Copper Co. mines were idle. Little copper was mined in the northern part of the territory.

PORPHYRY MINES

In regard to the so called porphyry mines, the Miami took the lead as a pro-

development and to planning large concentrating works. The Ray Consolidated is reported to be treating 7000 tons per day, securing 18% concentrates. It expects to treat ultimately 13,000 tons per day. The Hayden plant of the American Smelting & Refining Co. on the Gila River will have two reverberatory furnaces and two basic converters in operation in April, 1912.

SOUTHWEST COPPER PRODUCTION

Outside of Arizona the development on the Chino deposits of Santa Rita is the only important one worthy of recording. At Chino, 1500 tons per day are being put through the concentrator, making 20% concentrates. It is expected that four sections will be in operation by the middle of 1912, and ultimately to treat 8000 tons per day. The mines in the Burro Mountains, including the Chemung, the Burro Mountain, and the Savannah, were rather sluggishly explored, and no steps were taken toward producing.

Mexico's production suffered slightly from the revolution, but very slightly, both combatants, the government forces as well as the revolutionary leaders, having treated the American operations and American property with the most exemplary consideration. The output from the Greene-Cananea will probably exceed 50,000,000 lb., but from this, the estimated production of the Miami company must be deducted. The Greene-Cananea showed great skill in successfully smelting the Miama concentrates directly in the converters. It is an interesting feature of recent operations in the Southwest that probably none of the so called porphyry companies will smelt their own copper, but will confine themselves to making high-grade concentrates and turning these over for reduction to one or another of the smelting establishments.

Katanga Copper

The shipments of pig copper and copper in ore from Katanga in 1911 were 3000 long tons. The recent annual meetings of the proprietary and operating companies have been chiefly devoted to excuses for disappointed hopes. A correspondent communicates the following: On Dec. 4, 1911, the annual meeting of the Union Minière was held at Brussels. At this meeting the annual report was submitted, and it was stated that the company owned 10 of the principal copper mines, containing 10,000,000 tons of copper ore. Three years ago it was predicted that these mines would produce 30,000 tons in 1911 of copper. Inasmuch, however, as the mines have not yet passed beyond the experimental stage, some years will have to elapse before they can become regular producers. The ores are principally fines and this explains the large consumption of coke. The coke is being imported from Rhodesia, and costs about \$26 per ton. It is claimed that some coal mines have been discovered in Rhodesia, near the border line of Belgium-Congo, and that this coal would be a great advantage for the Katanga mine. The cost of producing copper in September was 1420 francs per ton, to which has to be added £9 freight to Antwerp, making a total price of about £65, c.i.f. Antwerp. This indicates

a loss at present prices for this metal.

The ores are not as fabulously rich as was once stated. The ores treated since September average 12 to 13%. It is claimed that in view of the improvements that have been introduced by the new management, the cost of production will be reduced to about £34, plus £9 freight to Antwerp, say about £43, c.i.f. Antwerp. This would indicate that after the improvements have been introduced, the Union Minière is going to operate at a profit, but so far it has not reached that point. There does not seem to be an appreciable amount of precious metals in the ore. Of the 200,000 shares outstanding, 184,000 shares are still in the hands of the original subscribers, and only 16,000 shares are in circulation.

Sulphur

The Consorzio's annual report to producers contains the following statistics covering its first five financial years:—

The small quantity sold during the

Year. Aug. 1—July 31.	Production. Tons.	Sales. Tons	Shipments. Tons	Stocks at end of year. Tons.
1906—7	427,719	161,318	322,000	529,896
1907—8	407,277	441,055	384,000	546,399
1908—9	396,295	300,552	349,000	593,461
1909—10	396,737	409,645	397,000	586,627
1910—11	391,978	816,818	445,500	523,141

first year is explained by the circumstance that the law of 1906 conceded to the respective owners the free disposal of the sulphur produced previously; the heavy sales of last year comprise quantities sold for future years.

PRODUCTION

The above figures show that the production has been constantly declining. The causes of this are: The exhaustion of old deposits, not compensated by the opening of new ones; diminished labor, owing to the increased emigration during late years; and the difficulty of the small mines in obtaining credit. For the last two reasons the number of mines has decreased rapidly. During the last year of the Anglo-Sicilian Sulphur Co., there were working 720, and during the first year of the Consorzio there were 637, during the second year 603, the third 541, and the fourth and fifth 476. It was at first estimated that production during the next financial year would not exceed that of last year; since then, the Trabonella mine, which of late, has produced about 20,000 tons of sulphur per annum, has shut down, owing to an explosion, and, it is believed, will produce nothing for a year or longer.

The great increase last year was primarily owing to larger consumption for the vines, due to the high prices that have

continued to rule for wine in consequence of last year's small vintages. The vintages having this year again been under the average in the principal countries, prices of wine are keeping up, and the consumption of sulphur for the vines will probably be brisk next spring. Consumption for industrial purposes has also shown progress as evidence by larger shipments to Sweden and Russia.

MARKET

Under the circumstances here set forth, the Consorzio has increased prices a little, especially at Catania, where the local industry annually consumes about 180,000 tons of sulphur. Prices of refined and ground sulphur are dearer than last year, also on account of dearer coal, higher salaries, and increased cost of bagging.

In the United States, the production of sulphur is almost entirely confined to Calcasieu parish, in Louisiana, although Arizona, Nevada, Utah and Wyoming produce small quantities.

British Imports of Tin Ores in 1911

Reported by *The Mining Journal*
IN TONS OF 2240 LB.

Source	11 Months 1911	11 Months 1910
AFRICA		
Cape of Good Hope.....	6	68
Natal.....	.....	1
Nigeria.....	.....	457
Portuguese East Africa.....	10	79
Southern Nigeria.....	1,077	371
Transvaal.....	2,119	2,784
Swaziland.....	1,088	328
Rhodesia.....	.....	1
AMERICA		
Canada.....	7	4
United States.....	228	63
Mexico.....	14	.....
Argentina.....	18	9
Bolivia.....	14,913	14,339
Chile.....	4,034	3,072
Peru.....	769	486
ASIA		
British India.....	.....	9
Burmah.....	.....	.....
Japan.....	55	110
Straits Settlements.....	6	10
AUSTRALIA		
South Australia.....	.....	.....
Tasmania.....	.....	1
Victoria.....	.....	15
New South Wales.....	14	.....
EUROPE		
Austria-Hungary.....	2	.....
Belgium.....	51	24
Denmark.....	.....	2
France.....	805	723
Germany.....	773	278
Italy.....	65	128
Netherlands.....	101	93
Portugal.....	31	16
Russia.....	167	153
Spain.....	145	148
Sweden.....	6	.....
Totals.....	26,504	23,774

The Production of Lead in 1911

The production of lead in the United States in 1911 is given in the accompanying tables, which are compiled from returns made by all of the refiners. It is to be remarked that these figures represent the refinery production of lead in

PRODUCTION OF REFINED LEAD IN THE UNITED STATES

(IN TONS OF 2000 LB.)

Class	1910	1911
Desilverized.....	217,490	213,548
Antimonial.....	9,098	8,822
Southeast Missouri (a).....	145,387	153,915
Southwest Missouri.....	20,729	25,996
Total domestic.....	392,704	402,281
Foreign, desilverized.....	90,473	89,758
Foreign, antimonial.....	4,892	4,738
Total foreign.....	95,365	94,496
Grand total.....	488,069	496,777

(a) Includes the total production of works in southern Illinois.

final marketable form. It appears that there was a small decrease in the output of what we class as desilverized, which was offset by the increased production of the Kansas, Missouri and Illinois refiners. Certain of the latter now desilverize a portion of their lead, but adhering to the old industrial classification we include

The production of lead in Colorado appears to have increased; also that of Idaho outside of the Cœur d'Alene; and probably there was a small increase in Utah.

The New York Lead Market in 1911

Conditions in this market have not changed from those of previous years. In view of the fact that the largest producer and seller of this metal tries to maintain the market as steady as possible, no wide fluctuations have occurred. The largest consumers obtain their requirements on basis of average prices, so that they are forced to enter the market only at times when an unexpected expansion in business compels them to increase their consumption of lead to such an extent that the regular supplies which they receive under contract are not sufficient. Production of the metal has remained on about the same level as during last year, and as no new mines of consequence have been discovered in this country, any increased smelting and re-

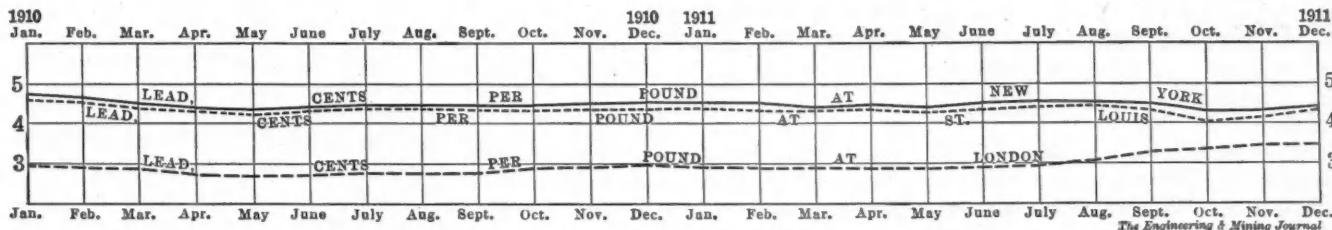
end of July and all through the month of August there was no difference between the quotations of the largest and outside sellers.

PRICES OF LEAD

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January.....	4.700	4.483	4.582	4.334	13.650	13.009
February....	4.613	4.440	4.445	4.266	13.328	13.043
March.....	4.459	4.394	4.307	4.238	13.063	13.122
April.....	4.376	4.412	4.225	4.262	12.641	12.889
May.....	4.315	4.373	4.164	4.223	12.550	12.984
June.....	4.343	4.435	4.207	4.292	12.688	13.260
July.....	4.404	4.499	4.291	4.397	12.531	13.530
August.....	4.400	4.500	4.290	4.406	12.513	14.260
September..	4.400	4.485	4.289	4.356	12.582	14.744
October.....	4.400	4.265	4.271	4.139	13.091	15.332
November...	4.442	4.298	4.314	4.181	13.217	15.821
December...	4.500	4.450	4.363	4.332	13.197	15.648
Year.....	4.446	4.420	4.312	4.286	12.920	13.970

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

The market eased up somewhat during the month of September. At the beginning of October the leading interest suddenly reduced its price by \$3 per ton which was quickly followed by an additional cut of \$2 per ton, and the outsiders promptly followed suit. At this lower level, which was maintained until the



LEAD PRICES IN 1911, PLOTTED FROM MONTHLY AVERAGES

under desilverized only the production of Omaha, Chicago, Pittsburg, New Jersey and the Pacific Coast.

It is impossible at this early date to report the production of crude lead or trace it to the mines of origin.

U. S. IMPORTS AND EXPORTS OF LEAD

(IN TONS OF 2000 LB.)

Imports	1910	1911 (b)
In ore.....	47,192	17,183
In base bullion.....	57,741	64,164
Refined.....	3,490	2,203
Totals.....	108,423	83,550
Exports:		
In ore (a).....	11,253	16,208
In bullion (a).....	58,852	71,815
Totals.....	67,105	88,023

(a) All of foreign origin. (b) 11 months.

The production of lead by the mines may have increased in 1911 more than the refinery statistics show, a rather large supply of lead ore having been accumulated at the Tooele smeltery, in Utah.

The refinery statistics indicate that the output of lead in Missouri experienced another large increase in 1911, while that of the Cœur d'Alene was probably about the same as in the previous year.

fining capacity would not in itself mean an increased supply of lead.

From the first of the year until the beginning of October no change was made in the quotations of the largest producer, which were 4.42½c., East St. Louis, and 4.50c., New York, for desilverized lead. Only at such times when lead produced in Missouri accumulated and was offered very freely were these quotations shaded by outside sellers; so at the end of March and the beginning of April lead was offered in St. Louis down to 4.22½c. and could, therefore, be sold in the New York market at about 4.37½ cents.

When the usual spring business did not develop, a disappointment was felt in the trade, and the lead which had been held for the expected improvement was pressed for sale, so that at the beginning of June outside quotations were lowered to 4.20c. and 4.35c., St. Louis and New York respectively. The belated spring business, however, came during June, and this demand quickly took care of the supplies that were pressing on and demoralizing the market. From the

middle of November, a very heavy demand developed and large purchases were made. In consequence thereof, prices were advanced to the extent of 10c. twice in quick succession during the latter part of November, thus establishing a price of 4.37½c., East St. Louis, and 4.45c., New York. Business continued satisfactory, and the year closed on that basis.

The London Lead Market

SPECIAL CORRESPONDENCE

In January there was active business during the first 10 days, the market being rather bare of offers. Then followed a period of comparative slackness due to heavy arrivals. Opening at £13 per ton for soft foreign, the price improved to £13 5s., and finished at £12 15s. @ £13 according to time of delivery. English brands rule about 5s. per ton higher than Spanish lead.

February opened with a dull market and prices unchanged, incoming supplies being sufficient to meet all demand.

Gradually a stronger tone prevailed in view of improved trade requirements. The market strengthened further toward the close of the month by reason of reduced supplies. Final quotations were £13 5s. for foreign brands, and £13 7s. 6d. to £13 8s. 9d. for English.

March found an improved inquiry both for home trade and for export; prompt arrivals were insufficient to satisfy demand, and in many cases metal had to be supplied from the public warehouses. A fair volume of business was transacted on the whole, but a downward trend of prices was not arrested till quite at the end of the month.

In April an active business prevailed both for home and export almost to the close of the month and with little or no variation in prices; the low range of values being an encouragement to buyers in general. A fractional decline toward the end of the month was due to realization of some speculative purchases; and closing prices were £12 17s. 6d. for soft foreign.

May opened with some appearance of weakness due to pressure of second-hand parcels of foreign, for which £12 15s. was reported taken: but when buyers came forward it was found that no appreciable quantity was obtainable. A gradual improvement followed on good trade demand, and £13 was the ruling price for the greater part of the month, supplies being somewhat restricted by hindrances in shipment owing to strikes in Spain.

June opened with no alteration in quotations but with increasing evidence of short supply, so that the trade had to draw on American sources to redress the balance. The month saw a gradual but persistent improvement in values, closing @ £13 7s. 6d. to £13 8s. 9d. for foreign.

In July values were unaltered for a fortnight or more, the market being sufficiently supplied by incoming lots: and home consumers remained indifferent. Meanwhile continental demand had made inroads on stocks and by July 19 it was found that little was on offer in London and that advanced prices were asked. These were readily paid and a persistent advance was in progress for the rest of the month. Closing prices were £14 per ton for foreign brands.

In August the recent advance continued. In the second half after labor trouble had subsided manufacturers were keen to replenish their stocks. Closing prices were £14 7s. 6d. for foreign brands.

In September the continued dwindling of supplies was more seriously regarded on the continent than in the United Kingdom, but English consumers began to appreciate the situation. Prices advanced persistently. This brought out

some speculative parcels for sale, and dealers promptly lowered their bids. This episode, however, was of short duration, as demand was constant and supplies short and irregular. Closing values were £15 for foreign brands.

In October the underlying strength of the market was not generally appreciated till the latter half of the month, and business was mostly restricted to the supplying of immediate wants. Later demand increased and the trend of prices was upward for the rest of the month. Closing prices were £15 10s. for foreign lead.

In November the upward movement was early manifest, prompt supplies commanding £15 15s., and the demand for extended delivery also improved in view of a strike of wharf laborers in Australia. As the month advanced the undertone remained firm, and purchases extending into 1912 were freely made, particularly in view of political unrest in Mexico and possible curtailment of supplies thence. The above was at £15 15s. for Spanish lead.

December opened with no alteration in prices but with increased volume of business; large quantities changing hands at £15 17s. 6d. for delivery extending into 1910. The buying slackened after a few days and prices eased in consequence down to £15 10s. for foreign, and £15 17s. 6d. for British lead.

Mining in the Coeur d' Alene

SPECIAL CORRESPONDENCE

The mining industry of the Coeur d'Alene during 1911 enjoyed a period of quiet prosperity. The output of the district was slightly greater than for 1910. The lead production will probably total 235,000,000 lb. None of the 1910 producers dropped out and an increased production was made from the Hercules Mining Co. and a slightly increased production from the Federal Mining & Smelting Co. This, together with the production from the Stewart Mining Co. makes a greater yield than for 1910. The zinc production was materially increased. The Federal Mining & Smelting Co., from the Macquisten-tube installation, at the Morning plant, produced over a million pounds of zinc and the Success Mining Co. operated several months during 1911, with a heavy output. Dividend disbursements in 1911 are impossible to get with accuracy, but they were not far from \$2,400,000 for the mines of the district. Industrial conditions were satisfactory and at no time were there less than 2200 miners at work.

ZINC NOW SAVED

Much development was made in the concentrator practice of the district. The new Hercules Mining Co. concentrator was put in commission at

the town of Wallace and the Federal Mining & Smelting Co. made extensive improvements and extensions to its concentrator at the Morning mine, at Mullan. These improvements were along the line of finer grinding in ball mills and the use of Macquisten tubes for recovering zinc which heretofore went to waste in the fine tailings. The picking of clean shipping ore from the mill feed was extended and an elaborate picking plant was erected by the Federal Mining & Smelting Co. at the mouth of the Arizona tunnel, of their Wardner mine. The disastrous fires and snow slides, which caused such appalling loss of life and destruction of property, during 1910, were in 1911 fortunately entirely absent. Much careful prospecting was done by development companies with more or less success, but no new producer of importance came into the field. Few, if any, new companies were floated in the district and while the trading in the stocks of the mines, both productive and prospective, was light, there seems to have been plenty of money available for legitimate development schemes. The steady grind of production went right along and fortunately there were no calamities or remarkable occurrences, either of litigation or physical catastrophe to chronicle.

White Lead in 1911

The consumption of all paints in 1911 was appreciably below that of 1910, the reduction being estimated at about 25%. This is attributed chiefly to the high cost of linseed oil, the price of which averaged higher than for any year since the era of high values following the Civil War. While the difference between this average and that of the last 10 years would not represent a material addition to the cost of painting an ordinary house, the effect of practically doubling what had come to be regarded as a normal price for oil, was to make property owners defer painting to such an extent as to cause the deficiency in consumption already noted. This effect extended to the ready-made paints in the same degree, by reason of the advance in prices which manufacturers were compelled to make. With a prospect for lower prices of oil, as a result of a larger crop of flaxseed, both here and in the foreign producing countries, notably in the Argentine, the outlook for 1912 is regarded as more encouraging.

LEAD CARBONATE

In addition to the retarding influence of the high cost of oil, the white-lead industry has had to meet a growing competition in the lower grades of paint made from lithopone, a chemical product con-

taining zinc and barium. This pigment seems to possess some advantages in the manufacture of cheap paints over mechanical combinations of white lead, zinc and barytes or gypsum. It cannot be used in combination with lead, because the presence of the zinc sulphide causes the lead to turn black, and it does not appear to be a serious competitor of white lead except in the cheapest grade of paints.

The steadiness of pig lead which was practically unchanged in price from late in November, 1910, until the early part of October, 1911, was reflected in white lead which was without change from the list in force from the close of 1910 until the last of October, 1911, when a reduction of $\frac{1}{4}$ c. was made in the price of dry lead, following a decline of the same fraction in pig lead. This brought the price down to 5c., at which contracts with paint manufacturers and other large con-

sumers were made, covering a good share of their requirements for 1912. The advances of pig lead covering 20c. of the previous decline of 25c. per cwt., which occurred within a month after white lead had been reduced, made these contracts favorable for the buyers, and correspondingly disastrous to the sellers, who had had no opportunity to accumulate any considerable stock of lower-cost metal.

The reduction in the price of dry white lead left the margin between the pigment dry and in oil wider than has prevailed for many years, and with an accumulation of stocks in the hands of some of the corrodors the temptation to break prices in the hope of getting a portion of the stock into the hands of distributors proved irresistible and following some special inducements by one of the smaller Western companies came a break of $\frac{1}{2}$ c. in the card price by another company which was speedily followed by all cor-

rodors. This made the closing price $6\frac{3}{4}$ c. for lead in oil in packages of 100 lb. and upward, with a differential on the smaller sizes, with dry lead at 5c. to large buyers.

LEAD OXIDE

Red lead was irregular in price during 1911; the bulk of the business was at $6\frac{1}{2}$ c. for large packages and some at $6\frac{3}{4}$ c. There was even more irregularity in the price of litharge, on which there is a keener competition than on red lead. Large consumers were paying $5\frac{3}{4}$ c. during the early part of 1911 but during the later months they were able to buy as low as $5\frac{1}{4}$ c. and at the close that appeared to be the quotable price to carload buyers, and large packages in less than carload lots were not quoted above $5\frac{1}{2}$ c. As a whole the oxide business is not on a profitable basis to the manufacturer.

Southeastern Missouri in 1911

By H. A. Wheeler *

The southeastern Missouri lead district produced about 138,500 tons of pig lead in 1911 (the December output is estimated), which had a value at St. Louis of approximately \$12,000,000. This magnificent production maintains the prestige of this district as the world's greatest lead producer. The output in 1911 only lacks about 1% of being up to the record-breaking output of 1910.

St. Francois County has been preëminently the leader as well as the center of this district since the discovery of the deeper or disseminated lead about 40 years ago at Bonne Terre. In 1911 St. Francois County contributed about 97% of the output, which is furnished by the mining camps about Bone Terre, Desloge, Flat River, Leadwood and Doe Run.

FURTHER PROSPECTING NECESSARY

As the disseminated deposits in St. Francois and Madison Counties are always associated with the old shallow diggings, and as Washington County has been by far the largest and richest producer of lead from the latter source, it seems quite probable that it, and also Jefferson County are underlain by the disseminated deposits.

The large mills are drawing heavily on the reserves of St. Francois County, and it is going to require energetic prospecting to open up new orebodies to maintain the present heavy production than has been pursued since the panic of 1907. Important interests were beginning to prospect in Washington County just prior to the panic, but since then no further drilling has been attempted.

Some quiet investigations were made by Bostonians last year but it was directed towards property investments rather than development work.

DEBRIS TROUBLES EXPERIENCED

One or two labor agitators, whose actions suggest blackmail, have induced some of the farmers along Big River to bring an injunction suit to restrain the mills along the Big River and its tributaries, from operating, on the grounds of the slimes injuring the land and destroying the fish. As regards the slimes damaging the land, this can only happen during flood stages, when the current is so swift that the deposit is utterly insignificant, if not imaginary, and the farmers did not complain until the fire-eaters recently broke loose.

Madison County, at the southern end of the lead belt, made the smallest output in many years, as only one property was operated. The North American Lead property, at Fredericktown, formerly controlled by Columbus, Ohio, capitalists was taken over by the bondholders under a foreclosure sale and is now held by the Dominion Nickel Co. of Sudbury, Canada. As it changed in recent years from lead to a producer of copper, nickel and cobalt, with lead as a byproduct, it will probably be kept closed, to prevent disturbing the nickel market. The Catherine mine was examined under a lease and bond

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by prominent interests and preparations are being made to reopen this property, as also the adjoining Fleming land, on a royalty basis.

RAILROADING A PROFITABLE SIDE LINE

The St. Joe company had a successful year in 1911, and through its affiliation with and control of the output of the Doe Run Lead Co., its smeltery at Herculeaneum is the largest producer of pig lead in the country. While this old and successful company has been known to the trade for years as the largest and strongest independent producer of lead in the country, few are aware of its success in building up one of the snuggest and most profitable railroad enterprises that has thus far escaped the maws of the big railroad magnates. After struggling for years with bad roads, poor teams and wretched service at a continuous loss, it built, in 1880, a narrow gauge road from its mine at Bonne Terre to Summit, on the Iron Mountain Railroad in conjunction with its adjoining neighbor, the Desloge Lead Co. (since absorbed). This 13-mile road solved the problem of changing an annual deficit into a profit; the line was gradually extended north and south, until at present it is about 64 miles long, including branches. Traffic arrangements have been made with other railroads, and the passenger business has become an important factor.

The old or No. 2 mill at Bonne Terre was continuously operated throughout 1911 as also the No. 3 mill at Leadwood,

each of which has a capacity of 1500 tons per day. They were supplied by seven mines located at Bonne Terre (3), Flat River, Gumbo, Huntington and Leadwood. The smeltery at Herculaneum is now equipped with four Dwight-Lloyd sintering furnaces for roasting the concentrates, which have replaced the Savelsberg pot-roasting system. A MacDougal furnace has been erected for roasting matte, which replaces a Pierce turret roaster.

No increase has been made in the land holdings of the St. Joe company, which total about 20,000 acres, of which only about 160 acres have been exhausted. The usual 6% dividends were paid in 1911 on the \$10,000,000 issued stock, which brings the total paid to \$7,958,357.

DOE RUN LEAD COMPANY

The year 1911 was the banner one in the history of the Doe Run Lead Co., as its lead production was about 32,000 tons. This was due to its new, or No. 3, mill at Rivermines being increased from 2000 to 3000 tons per day. The old, or No. 1 mill at Doe Run, of 1200 tons capacity, was operated on ore from the new or No. 12 shaft at Doe Run, and also from the No. 3 shaft at Flat River. The old No. 2 mill on the former Columbia property has not been operated since the erection of the No. 3 mill.

This large production was obtained from six mines, which are situated on spurs of the M. R. & B. T. R. R., as follows: Nos. 1 and 4 shafts at Flat River, No. 3 at Rivermines (formerly Central Station), No. 6 at Elvins, No. 8 at Mitchell, No. 9 at Columbia (Red Onion) and No. 12 at Doe Run. The No. 12 shaft is equipped with electric-driven machinery, driven by a 300-kw. generator, which is direct connected with a low-pressure turbine. The latter is supplied with the exhaust from two noncondensing corliss engines that drive the No. 1 or Doe Run mill.

The electric-power station at Rivermines supplies current for operating the six shafts and the 3000-ton mill in the Flat River district. It is equipped with four Snow twin-tandem 4-cycle gas engines of 800-hp. that furnish 900,000 kw. per month. The plant was equipped with the Loomis-Pettibone draught gas producers, which require frequent blowing out to remove the clinkers. Recently two 500-hp. independent Westinghouse continuous gas producers were installed which eliminate the shutdowns and have thus far proved satisfactory, after 115 days continuous operation. The No. 3 mill was increased from a daily capacity of 200 tons to 300 by adding two Hancock jigs and four sets of rolls, with the necessary auxiliaries.

The plant at Doe Run was originally equipped with a small smeltery, but when the St. Joe company built the large smeltery at Herculaneum, the output of both properties have been smelted there. The concentrates were roasted at Doe Run until last year in a battery of Freiberg roasting furnaces, but these have been abandoned and salvage, as the concentrates are now sold to the St. Joe company. The company continued to pay 6% dividends on its capital of \$6,578,200 (\$10,000,000 authorized) during 1911 and the total dividends paid to date aggregate \$2,941,858.

DESLOGE CONSOLIDATED LEAD CO.

The Desloge property made the largest output in its history and had a successful year. The mill was enlarged to a daily capacity of 1500 tons, and typifies the steady growth of this company, as it was built as a 500-ton unit about 17 years ago. Although four Flintshire or small reverberatory furnaces have always been operated, and notwithstanding that a small water-jacket shaft furnace with three Freiberg roasters were subsequently added, most of the concentrates are smelted at either the large plant of the Federal Lead Co. at Alton, Ill., or the National Lead Co.'s smeltery at Collinsville, Ill., where the Scotch hearth and bag process are employed. The production was derived from three mines, or Nos. 3, 4 and 6 shafts and shipped over its own railroad to the mill, the latter being on Big River. Although No. 4 shaft is on Big River and the mine is working beneath it, the mine makes little water and is one of the driest in the district.

NATIONAL AND FEDERAL LEAD COS.

The National Lead Co., under its local operating company, the St. Louis Smelting & Refining Co., worked steadily throughout the year in its usual quiet, successful manner.

The important subsidiary of the Guggenheim Exploration Company known as the Federal Lead Co. had a very successful year and continued as the largest individual producer in the district, which position it has maintained since the completion of the Central mill. The latter is the largest in the district, as it has a capacity of 4000 tons per diem. A testing department has been added to the mill which is equipped with a complete series of concentration machinery that permits of the treatment of carload samples. This is at the service of all departments of the Guggenheim Exploration Co. and its numerous ramifications, which enables all tests to be made under its own auspices.

This company recently examined the Catherine mine at Fredericktown, in Mad-

ison County, under lease and bond, and has decided to reopen this property, which has 1540 acres. It has also leased the adjoining Flemming property, which is known to contain lead, and will operate it through the two shafts of the Catherine mine. As the Catherine property is equipped with a 300-ton mill, it should not take long to reënter the producing list. Like all the Madison County mines, the Catherine makes but little water and the deepest shaft is only 160 ft. The concentrates are shipped to its large smeltery at Alton, Ill., 80 miles north, where considerable custom work is also handled. This plant is on the Mississippi River and is favorably situated with reference to the cheap Illinois coal and the Eastern railroads.

POTOSI MINES CO.

This is the new company under Boston auspices which acquired a large acreage two years ago about Potosi, in Washington County, which has produced large amounts of shallow lead and "tiff" or barite. About 25,000 acres were secured, but little effort has thus far been made to develop this promising tract beyond shipping considerable tiff that is gophered on a royalty basis by the tiff diggers. In 1910 the Jake Day tract of 357 acres was purchased on Big River, in St. Francois County, that lies in the heart of the disseminated lead belt. This property is now under the management of A. E. Stilwell, as president, who is famous for building the Kansas City, Mexico & Orient R. R. from Kansas City to the west coast of Mexico without obtaining a dollar from Wall Street. Plans are under consideration for erecting a 500-ton mill and for securing a spur from the M. R. & B. T. R. R. The company is capitalized for \$5,000,000, of which \$600,000 is 8% cumulative preferred stock and \$4,400,000 is common.

MINE LA MOTTE CO.

The Mine la Motte property was the only producer last year in Madison County. It was operated under the Pittsburg management that has controlled it since its meteoric exploitation by Dougherty & Albers several years ago. It was under consideration by one of the large St. Francois County operators last year, but thus far no changes have occurred in the title. It has a large acreage, said to be in excess of 35,000, but much of it is timber, granite and sandstone land that does not contain the Bonne Terre or disseminated-lead-bearing limestone. It has a 500-ton mill that is supplied by five mines that are less than 150 ft. deep. It formerly operated its own smeltery, but in recent years the concentrates have been sold in the St. Louis market.

The Tin Industry in 1911

The tin-mining industry of the United States continued during 1911 to be insignificant. Little or nothing was done in connection with the deposits in the Black Hills. The Pahasa Mining Co. reported to us that it made no developments on its property during the year, and at present the stockholders have not yet decided what the future course of the company will be. In Texas, at the mines on Mt. Franklin, near El Paso, the mill and smelting furnace were operated intermittently from January to May, and about four tons of pig tin, 99.8 per cent. pure, were produced and shipped to market. The intermittent character of the operations was due to bad weather and other causes. The mine is now temporarily closed pending the consummation of new arrangements, presumably of a financial character. The engineers in charge of this property are optimistic with respect to the supply of tin existing there and their ability to treat the ore. The smelting furnace of the company was fired with crude oil and excellent results in smelting were obtained from the use of that fuel.

The experience in smelting with oil obtained at El Paso may be useful in the treatment of black tin from Alaska, if a considerable supply ever be obtained from that source. As to the latter, there seems now to be some real prospect, a shipment of 93 tons of concentrate having actually been made in October by the York Dredging Co. This company has installed a dredge (described in the JOURNAL of July 15 and Dec. 23, 1911) on Buck Creek, 14 miles north of York. Operations were begun on Sept. 10 and continued until Oct. 15. Its capacity is about 1000 cu.yd. per 24 hours. A recovery of 6 to 7 lb. of black tin per cubic yard is reported.

Estimating the world's production of tin in the usual way from the statements of imports, exports and stocks we get the following figures for the 12 months ended Nov. 31, 1911, in long tons: Straits, 53,670; Australia, 3825; Banka, 15,131; Bolivia, 22,064; China (exports only), 2600; England, 4500; South Africa, 2200; total, 103,990 tons. In a similar way deliveries were: United States, 40,485; London and Holland, 36,931; other Europe, 15,298; China and India (from the Straits), 3400; miscellaneous, 6350; total, 102,464 tons. This shows consumption as very close to production, and explains the comparative ease with which the metal was "cornered."

The production of tin in the Federated Malay States in 1911, estimating December, was 730,762 pikuls, or 43,486 long tons. This is classed as Straits tin. The output compares with 736,898 pikuls in 1910; 818,887 in 1909; 854,064 in 1908,

and 813,636 pikuls in 1907. The decrease last year and in 1910 was due to the diversion of Chinese labor to other fields.

For the 11 months ended Nov. 30 the imports of tin into the United States were 98,526,628 lb. in 1910, and 97,561,923 lb. in 1911; a decrease of 966,705 lb. According to the customs returns the imports in 1911 were 33,910,736 lb. from the Straits; 50,979,569 lb. from Great Britain; 4,574,850 lb. from Germany; 8,096,768 lb. from other countries. The receipts from Great Britain were largely of Straits tin, which goes to that country in transit. Those from Germany were largely of Bolivian tin, which is smelted and refined in that country.

The New York Tin Market

The market for tin was entirely dominated by the Syndicate—consisting of London and continental firms—which, through its successful operations during the preceding years, has become very powerful. In describing the fluctuations of prices of this metal, one is therefore compelled to simply give a description of the manipulations of the Syndicate, which

PRICE OF TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42.400
February	32.920	41.614	August	33.972	43.319
March	32.463	40.157	September	34.982	39.755
April	32.976	42.185	October	36.190	41.185
May	33.125	43.115	November	36.547	43.125
June	32.769	44.606	December	38.199	44.655
			'Av. Year..	34.123	42.281

Prices are in cents per pound.

were but little disturbed by the quantities of the metal not under their control. An attempt is being made by dealers and traders on the London Metal Exchange, not belonging to the Syndicate, to wrest from it the control of the market by inaugurating a new contract on the London Metal Exchange under which so called standard tin can be delivered; that is to say, tin produced by the Dutch Government, and in China and Germany from Chinese and Bolivian ores, all of which brands were hitherto barred from delivery under the old Metal Exchange contract. This new contract will come into force on Feb. 1, and it remains to be seen what effect it will have on the activity of the Syndicate. The Syndicate was assisted in its bull operations throughout the year by the favorable statistics of the metal, which disclosed the fact that actual production has hardly come up to consumption, so that existing stocks had constantly to be drawn upon.

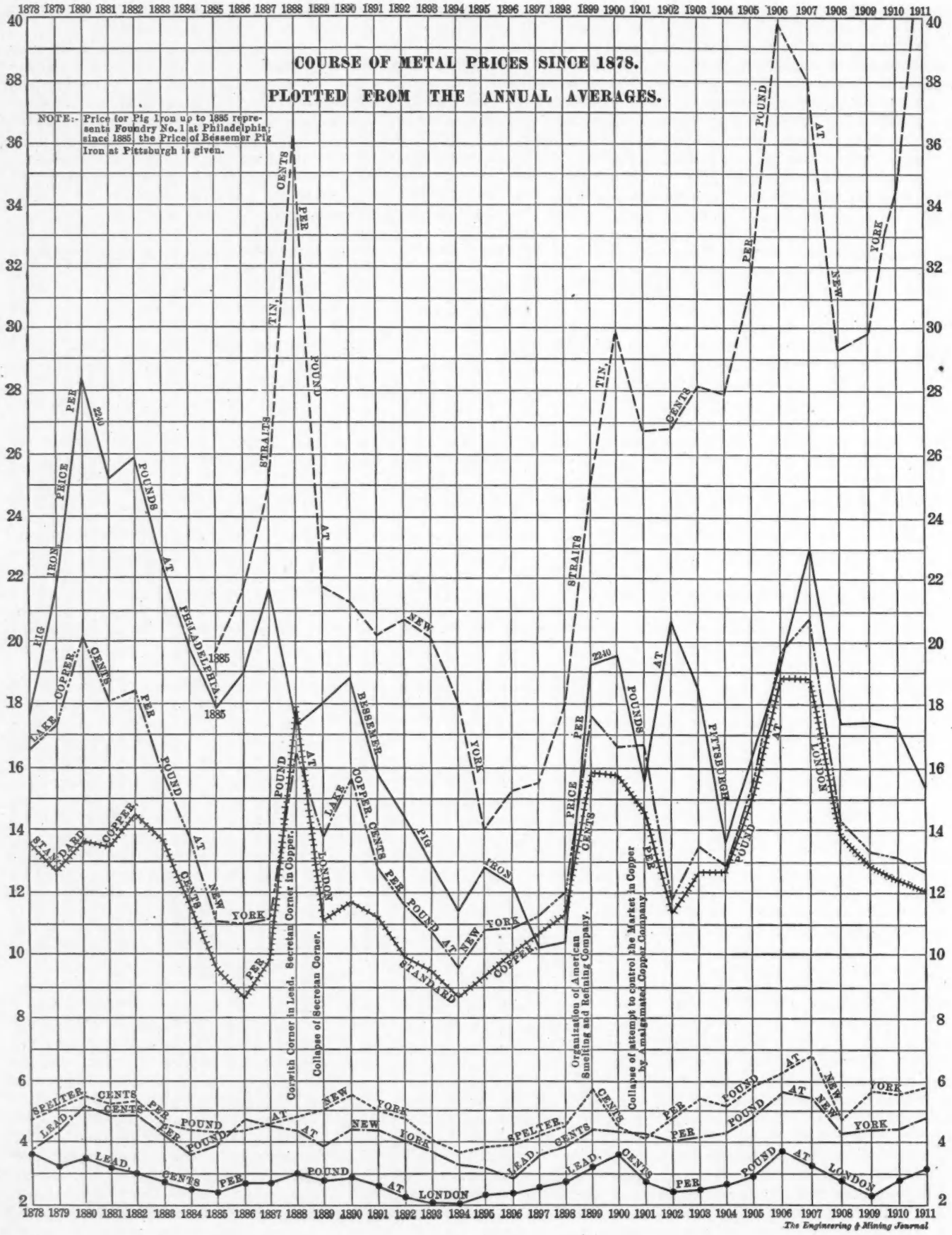
The New York market opened the beginning of the year strong at around 40c., advancing during the month of January

to about 43¼c. Fluctuations in February became very violent, due to some urgent liquidation on part of a member of the Syndicate, which brought down prices during the first 10 days of the month to about 38c. After this liquidation was completed, the market advanced just as rapidly as it had declined, reaching 44c. by the middle of the month and remaining fairly steady until the end of February.

March showed a continuous decline to about 39½c., advancing again to about 42c. by the middle of April. From this level it moved irregularly during the next few weeks, without, however, displaying any violent fluctuations until the middle of May. Then a buying movement on part of the Syndicate, especially in spot tin, advanced the market rapidly in London, which was naturally reflected in the domestic market. The market advanced quickly to about 46c. early in June.

The corner in spot tin, which advanced the price thereof about £44 over the three-months quotation, thereby disclosing a very unhealthy condition of things, induced sellers in this market to liquidate their holdings of near-by material at about 3c. below the price at which it could be imported. The squeeze of the shorts lasted until the middle of June, when spot tin suddenly declined about £41, while three-months tin scored a small advance, thus bringing both quotations closely together. Spot tin was selling in this market at about 42¾c., advancing gradually from this level to 43¾c. by the middle of July. Some outside selling then appeared, which broke the price temporarily. After this selling had subsided, the market became strong again, and reached 45c. toward the latter part of August. This meant a premium of about 4c. for spot tin, of which supplies in this market were small and closely held. This premium disappeared almost entirely at the beginning of September, and the market declined further in sympathy with London, where the unsettled political situation had a disturbing effect.

At the end of September the market was established at about 38½c., New York. The market became firm again during October, and reached 42c. the latter part of the month, advancing further the beginning of November. In London, a considerable backwardation for three-months tin developed, which was due to the new Metal Exchange contract, to go into effect on Feb. 1, 1912, under which almost any brand of tin can be delivered, subject to certain rules and regulations. Therefore, the trade did not consider this backwardation as a sign of intrinsic weakness of the market.



The Zinc Industry in 1911

The zinc industry of the United States in 1911 was profitable both to miners and smelters, to the former because the price for spelter, and consequently of ore, was materially above what is considered to be a normal average; and to the latter because the margin between the value of zinc in crude and finished form was larger than usual. The latter condition was due, of course, to the bountiful supply of ore; because of this same fact the joy of the producers of ore was not unalloyed. The smelters are, however, entitled to have an inning now and then.

PRODUCTION

The production of spelter in the United States in 1911 is reported in the following tables. We have not at this time attempted to collect the statistics of the dross smelters, respecting whom we draw the line at those who resmelt dross, scrap, etc., but not ore. Many of the ore smelters also treat dross and skimmings, the spelter obtained from which figures in their reports. All of the ore smelters have reported to us their production in 1911 up to Dec. 16, together with their own estimate of probable production in the last fortnight of the year, except the Edgar Zinc Co. In order to arrive at totals we have estimated the production of the Edgar Zinc Co. as 25,000 tons. All of the smelters with the exception of the Edgar Zinc Co. reported to us by telegraph their stock of spelter at the end of Dec. 31, 1911.

The U. S. Geological Survey reported the spelter statistics for the first half of the year. Using its figures we arrive at those for the second half by difference.

Five smelters reported to us a production of 9511 tons of bonded spelter in 1911 and exports of 9298 tons thereof up to Dec. 16, 1911. At the end of the year no bonded spelter was reported in stock.

SMELTING CAPACITY

In spite of the fears that that were entertained in the latter part of 1910 that there would be a deficiency in smelting capacity in 1911, there appears to have been actually an increase.

At the end of 1910 the smelters reported to us a total of 91,291 retorts, of which 9740 (Lanyon Zinc Co.) were about to be permanently dismantled, leaving 81,551 available, of which 3208 were in works that were idle.

At the end of 1911 the total number of retorts was 87,800, of which 4744 were in works then idle, one of which was in operation during a part of 1911, and another of which was being made ready for operation in January, 1912.

PRODUCTION OF ZINC

(IN TONS OF 2000 LB.)

By Ore Smelters		
States	1910	1911
Colorado	6,564	7,250
Illinois	79,570	88,665
Kansas and Missouri	112,182	103,407
Oklahoma	34,760	45,963
East	43,989	47,415
Totals	277,065	292,700
By dross and scrap smelters		
	11,350 (e)	12,000
TOTAL PRODUCTION OF ZINC		
Ore smelters	277,065	292,700
Dross smelters	11,350 (e)	12,000
	288,415	304,700

(e) Estimated.

SPELTER STATISTICS BY SEMESTERS

(IN TONS OF 2000 LB.)

Production, first half	140,196
Production, second half (a)	152,504
Total production (a)	292,700
Stocks, Jan. 1, 1911	23,000
Stock, June 30, 1911	17,788
Stock, Dec. 31, 1911	8,700

(a) Of ore smelters only, but including spelter derived from dross, etc., treated by them.

DELIVERIES INTO CONSUMPTION

	1910	1911
Stock, Jan. 1	11,500	23,000
Production	288,415	304,700
Imports	3,452 (a)	300
	303,367	328,000
Exports, domestic	3,989 (a)	5,700
Exports, foreign	4,468 (a)	11,100
Stock, Dec. 31	23,000	8,700
Deliveries	271,892	302,500

(a) December estimated. These statistics, reported by the Bureau of Statistics, do not agree with those reported to us by the smelters. In both cases we exclude spelter derived from imported ore, and subsequently exported in manufactured form under drawback privilege, such manufacture being properly a domestic consumption.

The works that went permanently out of use in 1911 were those at Pulaski, Va., and Bethlehem, Penn. New works that went into operation were those of the Bartlesville Zinc Co. (five furnaces, 3200 retorts) at Collinsville, Okla.; Tulsa Fuel & Manufacturing Co. (six furnaces, 3320 retorts) at Collinsville, Okla.; and Grasselli Chemical Co. (six furnaces, 3456 retorts) at Meadowbrook, W. Va.

Additions to smelting capacity were made by the Bartlesville Zinc Co., at Bartlesville, Okla., Lanyon-Starr Smelting Co., National Zinc Co. and United Zinc & Chemical Company.

At the end of 1911, among operating smelteries, 5120 retorts were under construction at Collinsville, Okla., 2880 at Palmerton, Penn., 1800 at Danville, Ill., and 876 at Lasalle, Ill., a total of 10,676 comprised in 23 furnaces. New works under construction were those of the Granby Mining & Smelting Co., at East St. Louis, Ill., and of the American Zinc, Lead & Smelting Co. and the Robert Lanyon Zinc & Acid Co., at Hillsboro, Ill., with an aggregate of 8480 re-

torts projected. It does not appear that there will be any deficiency in smelting capacity in 1912.

ORE SUPPLY

The production of blende in the Joplin district was about 250,000 tons; of calamine about 18,000 tons; a total of 268,000 tons, against 296,000 tons in 1910. Wisconsin produced about 75,000 tons of blende and calamine, chiefly the former, against a total of 63,000 tons in 1910. There was, consequently, a small deficiency in the output of these two districts, but it was much more than offset by the increased production west of the Rocky Mountains, especially at Leadville and Butte. The smelters received a large tonnage of Leadville calamine, which is relatively of low grade, and also of Butte blende, which is relatively of high grade. The Butte & Superior Copper Co., produced upward of 3000 tons, monthly, of concentrate assaying from 45 to 50 per cent. zinc; W. A. Clark produced a less amount from the Elm Orlu mine. The Butte production may be expected to increase further in 1912, inasmuch as the Butte & Superior company is erecting a new mill of capacity for about 200,000 tons of crude ore per annum, which ought to result in the production of about 50,000 tons of concentrate.

A new zinc production is expected to come before long from the Holston River district in Tennessee, where the American Zinc, Lead and Smelting Co. has become interested. This company claims to have developed 11,000,000 tons of ore and is now sinking a shaft to a depth of 1000 ft. for its extraction and is planning to erect a concentrating mill of 2500 tons daily capacity at Mascot. The chief production of zinc ore in this district in 1911 was made by the Grasselli Chemical Co., which erected a new mill there. Two other large enterprises for mine development are reported to be under consideration.

GERMANY

Germany's imports and exports during the first 10 months of 1911 were as follows (in metric tons):

IMPORTS		
	1910	1911
Spelter	32,241	40,547
Zinc sheets	190	405
Broken zinc	1,558	1,929
Zinc ores	207,944	221,253
Zinc dust	1,124	679
Sulphide of zinc	2,757	2,289
Zinc-white	3,823	4,208
EXPORTS		
	1910	1911
Spelter	65,440	61,935
Zinc sheets	18,601	31,174
Broken zinc	3,518	3,177
Zinc ores	45,090	41,035
Zinc dust	2,583	2,734
Sulphide of zinc	8,782	11,375
Zinc-white	18,290	17,161

The American Spelter Market in 1911

Among the commercial metals, spelter continues to be the only one whereof the market is not dominated by one paramount factor. The forces of supply and demand have free sway. Fluctuations, therefore, are apt to be frequent, indexing as it were changes in general sentiment and the vicissitudes of trade at large. The market is still gaged by the prices ruling in St. Louis, where quotations hovered around 5.35c. at the beginning of the year. After a temporary dip to 5.20@5.25c. toward the end of January, the demand improved in anticipation of a livelier spring business, which carried prices up to 5.50c. early in March. The ease in the ore market, and the consequently favorable smelting margins, caused smelters to realize freely. Under these offerings, recessions occurred, which brought about a gradual lowering in quotations to 5.15@5.20c. about the end of May and early June. As subsequent events have shown, this decline was hardly justified. The free selling of first hands was due to a desire to clinch not

the Atlantic until the market crossed 6c. during the closing days of October. Reports of large exports were current, but the statistics will probably show that the bulk of the quantities sent out of the country by Western smelters consisted of bonded spelter obtained from Mexican or British Columbia ore which had not been retained for domestic consumption since the Payne-Aldrich tariff became effective. Nevertheless, the foreign syndicate became frightened, and to keep out American spelter lowered its prices. This action had no effect on the home market, which proved its independence by a further advance during November and into the first days of December, when the market had climbed to 6¼@6½c. Coincidentally there prevailed an acute scarcity of spot spelter, for which premiums were realized by the few fortunate holders. By the middle of December, the tension was relieved. Spelter which had been held back from the market was offered for sale, and as the im-

The London Spelter Market

SPECIAL CORRESPONDENCE

In January the market opened firm, with rather improved consumptive demand, and ordinary brands ruling from £23 17s. 6d. @ £24 per ton. On Jan. 11 a small advance was established, and was in force until Jan. 23 when a restricted demand weakened the market, and "Producers" Syndicate made a drastic cut of 15s. in the price, whereby they were enabled to market their full output for the time being. The market was weakened also by the intermittent pressure of second-hand lots; and the closing price for ordinary brands was £23 5s. @ £23 7s. 6d. with Silesian "specials" about 10s.

In February the market opened with some appearance of strength owing to the complete absorption of all that had been offered by the Syndicate at the reduced price. Business, however was quiet in view of continued slackness in

ZINC SMELTING CAPACITY OF THE UNITED STATES AT THE END OF 1911

Name	Location	Furnaces	Retorts
American Zinc, Lead and Smelting Co.	Deering, Kan.	6	3,840
American Zinc, Lead and Smelting Co.	Caney, Kan.	6	3,648
Bartlesville Zinc Co.	Bartlesville, Okla.	9	5,184
Bartlesville Zinc Co.	Collinsville, Okla.	5	3,200
Chanute Zinc Co.	Chanute, Kan.	4	1,280
Beer, Sondheimer & Co.	Altoona, Kan.	6	3,840
L. Vogelstein & Co.	Gas City, Kan.	4	(a) 2,560
L. Vogelstein & Co.	La Harpe, Kan.	3	1,856
Collinsville Zinc Co.	Collinsville, Ill.	6	(b) 1,536
Edgar Zinc Co.	St. Louis, Mo.	9	2,000
Edgar Zinc Co.	Cherryvale, Kan.	24	4,800
Granby Mining and Smelting Co.	Neodesha, Kan.	6	3,840
Grasselli Chemical Co.	Clarksburg, W. Va.	10	5,760
Grasselli Chemical Co.	Meadowbrk, W. Va.	6	3,456
Hegeler Bros.	Danville, Ill.	2	1,800
Illinois Zinc Co.	Peru, Ill.	7	4,610
Lanyon-Starr Smelting Co.	Bartlesville, Okla.	7	3,456
Mathiesen & Hegeler	Lasalle, Ill.	5	4,380
Mineral Point Zinc Co.	Depue, Ill.	6	4,520
National Zinc Co.	Bartlesville, Okla.	7	4,256
Nevada Zinc Co.	Nevada, Mo.	3	(c) 648
New Jersey Zinc Co.	Palmerton, Penn.	12	2,892
Pittsburg Zinc Co.	Pittsburg, Kan.	2	448
Prime Western Spelter Co.	Gas City, Kan.	9	5,384
Sandoval Zinc Co.	Sandoval, Ill.	4	896
Tulsa Fuel and Manufacturing Co.	Collinsville, Okla.	6	3,320
United States Zinc Co.	Pueblo, Colo.	7	1,680
United Zinc and Chemical Co.	Springfield, Ill.	.	3,680
			87,800

(a) Inactive. (b) Inactive during latter part of year. (c) Not operating in 1911, but preparing for production in 1912.

PRICE OF SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January.....	6.101	5.452	5.951	5.302	23.350	23.887
February.....	5.569	5.518	5.419	5.368	23.188	23.276
March.....	5.637	5.563	5.487	5.413	23.031	23.016
April.....	5.439	5.399	5.289	5.249	22.469	23.743
May.....	5.191	5.348	5.041	5.198	22.100	24.375
June.....	5.128	5.520	4.978	5.370	22.064	24.612
July.....	5.152	5.695	5.002	5.545	22.406	25.006
August.....	5.279	5.953	5.129	5.803	22.800	26.801
September.....	5.514	5.869	5.364	5.719	23.165	27.750
October.....	5.628	6.102	5.478	5.951	23.900	27.256
November.....	5.976	6.380	5.826	6.229	24.083	26.795
December.....	5.624	6.301	5.474	6.151	24.019	26.849
Year.....	5.520	5.758	5.370	5.608	23.050	25.281

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

only a satisfactory current smelting profit, but also to dispose of stocks of spelter at the zinc works, as the metal could readily be replaced, at a profit, with ore. This opportunity continued to exist upon an increasingly attractive scale throughout the remainder of the year.

The market had reached a point where it practically became dependent upon the current production, when previously the accumulation at the zinc works had, in addition, found its way into consumption. Whatever favorable development might occur, it was bound to have a pronounced effect upon prices. The European market furnished the incentive. Excepting that business was brisker and the initiative in consequence more to the fore, the situation there turned out to be not unlike that prevailing in this country. Supplies had been reduced to a minimum and consumption had reached a maximum rate. Quotations in London began to climb until they reached the export parity. The domestic market, not having a surplus to spare, was driven ahead. The advance was almost uninterrupted on both sides of

mediate demand had been satisfied, the market experienced a sudden decline to about 6c., and closes uncertain at 6.10@6.20c., St. Louis.

Stocks of spelter in first hands are practically nominal at the end of the year. Stocks of ore at the zinc works are larger than they have ever been before. New works in Oklahoma and Illinois now about completed, or in the course of construction, will eventually help to bring about the disappearance of the disparity between spelter and ore prices. Smelting interests least of all desire a continuance of a situation which, though it means for them a temporary advantage, contains the element of serious consequences to their industry. To what extent a lower level of spelter prices will contribute toward the solution, the future will reveal.

the demand for galvanized iron. Toward the middle of the month dealers had to make concessions, and a sharp rally of about 5s. per ton was of short duration. Official syndicate prices remained unchanged, but speculative lots in dealers' hands had to go at reduced prices.

March opened with some appearance of firmness and a slight improvement in values up to £23 being paid for ordinary brands. Nearly all the month the quotation was uniform at £22 17s. 6d. @ £23. Business with consumers was very quiet till toward the end of the month, when second-hand lots were scarce, and buyers had to apply either to the English producers or to the Producers' Syndicate abroad. On March 31 the underlying firmness of the market found expression in a sudden advance of 7s. 6d. per ton.

In April the market remained at unchanged quotations for some days, but with an increasing volume of business which soon absorbed all second-hand parcels and obliged consumers to pay the prices asked by the Producers' Syndicate. On April 7th the London quotation for ordinary brands advanced to £23 12s. @ £23 12s. 6d. Demand continued unabated, and a further advance of 5s. per ton was established. The upward movement continued gradual until the end of the month, it being manifest that trade requirements were quite abreast of production if not surpassing it.

In May a gradual advance in values was uninterrupted. Consumers were quite ready to contract for large quantities, but producers remained cautious and there was but little second-hand metal on offer. As the month advanced galvanizers found increasing demand for their wares, and sheet zinc also found ready sale: but little spelter could be had for later delivery than June. The close was £24 10s. for ordinary brands, and £25 for specials.

In June business was restricted more by the unwillingness of holders to offer than by the reluctance of consumers to buy. Those who had allowed their stocks to run low had to pay advanced prices in order to replenish; for all the consuming industries were fully employed and the small quantities of spelter which were offered from time to time were eagerly bought up. Prices varied only slightly throughout the month, but always upward.

In July the Syndicate reentered the market, but only with moderate quantities which were readily absorbed: there being no surplus supplies available. The pressure for supplies was persistent from all quarters. As the month advanced this pressure became more acute, particularly when it was known that the situation in America was very similar. Closing values in London were £25 2s. 6d. for ordinary brands, and £26 for Silesian "specials."

In August demand continued unabated, and an initial advance of 7s. 6d. per ton found buyers quite ready to take the little which the associated producers offered thereat. Successive advances followed with a like result. A few speculative lots of spelter found ready buyers, often at fancy prices. Closing prices were £27 7s. 6d. for ordinary brands, and £28 10s. for specials.

September opened with an appearance of weakness in the market, due to some speculative resales, which, however, were soon absorbed. Business was rather restricted, there being no surplus stocks in producers' hands. The Syndicate price was early advanced a few shillings and

thereat only relatively small quantities were on offer. The London quotation for ordinary brands advanced to £27 15s., with £28 10s. for specials.

October opened with a firm but comparatively quiet market, and so remained for nearly a fortnight, one feature being the increasing American consumption. Ordinary brands were quoted £27 15s., and specials £28 10s. Thereafter came a reduction in prices for sheet zinc, due to decreased demand and consequent competition, and sellers of spelter—outside the Producers' Syndicate—pressed sales so far as to reduce the London quotation for ordinary brands to £27. The Syndicate abruptly reduced its selling prices by £1. Toward the close there was an improved consumptive demand with evidence of restricted supply: and prices improved, closing quotations being £26 13s. 9d. for ordinaries, and £27 10s. for specials.

In November values were almost stationary, the only variation being a little easing of the London quotation during the first fortnight under pressure of some supplies outside the Syndicate's control. British and Continental demand combined to absorb all that was in hand for sale on behalf of the Syndicate, whose prices were consequently advanced for further business. The London quotations remained at the end of the month the same as at the beginning, £26 15s. for ordinary brands, and £27 5s. for specials.

December found the consuming industries as busy as ever, many galvanizers being unable to accept orders for delivery earlier than February. Spelter outside the control of the Syndicate was readily absorbed and values were thus steadied.

Oklahoma Lead and Zinc Mining in 1911

BY GEORGE W. BIGHAM*

On account of the high state royalty tax, 0.5% on the gross production, and the low prices of lead and zinc ore, the mills of the Miami and Quapaw camps have been idle the greater part of 1911. The water question also is retarding the development of this section, as unwatering the mines is proving a much longer and expensive matter than was anticipated.

The Oklahoma Lead & Zinc Mining & Milling Co. was busy for 14 months continuously with a 12-in. centrifugal pump, and only lowered the water to the 205-ft. level. Chapman & Lennan are now sinking a 7x12-ft. pump shaft and will install a double 10-in. steam pump on the 300-ft. level. Prospecting on this ground showed lead and zinc from 204

to 310 ft., and three mills will be erected in the next six months.

The Carson-Dodson Mining Co. has two shafts down to the 240-ft. level with an air shaft cut on each. The "dirt" in this mine is extraordinarily rich. On Oct. 27 and 28, 84 tons of "dirt" were trammed to the mill of the Oklahoma Lead & Zinc Mining & Milling Co., and 60,000 lb. of lead and 34,000 lb. of blende recovered. This company will build a mill as soon as it gets its drifts properly opened for steady running.

The 30-Acre Mining Co. has 13 drift holes, all showing a 30-ft. face of ore at 170 ft. It has two shafts down to

MIAMI PRODUCTION IN 1911

Company	Zinc Concentrate	Lead Concentrate
Emma Gordon	3,307,464	742,115
Sullivan	3,158,256	1,147,010
Turkey Fat	3,084,020	891,640
New State	2,108,285	627,035
Little Maxine	1,181,010	106,110
Buckeye	482,860	61,300
Index	464,620	27,070
Okmulgee	421,750	66,040
Midas Lead & Zinc	306,490	21,530
Golden Hen	251,395	14,880
Miami Yankee	11,770	.....
Carson-Dodson	63,530	340,560
Tom Lawson	8,560	.....
Old Chief	6,210	.....
Neal	56,690	20,570
Sundry sales	768,540	63,500
Total	15,681,450	4,729,360
Total value	\$200,496	\$130,966

QUAPAW PRODUCTION IN 1911

Company	Zinc Concentrate	Lead Concentrate
Omaha Petersburg	841,790	61,375
J. R. Crowe	.....	85,540
Good Luck	571,390	.....
Mission	251,520	35,600
Big Jack	136,620	.....
Ethel Miller	153,400	.....
K. C. Quapaw	121,280	77,160
M. K. & T.	109,180	.....
Heap O'Brien	212,650	.....
Lincolnville	61,620	.....
Craig & Co.	80,110	.....
Webb & Co.	29,600	.....
A. W. Abrahms	24,110	.....
C. & P.	5,170	.....
Sundry sales	174,750	4,600
Total	2,822,190	264,275
Total value	\$52,215	\$8,679

the ore and will at once erect a mill. The Prairie Mining Co. developed some good prospects and will also erect a mill. The Miami Royalty Co., on the Wat-tah-noh-zhe land, has one of the best runs in the camp, on both the upper and lower levels. The Little Maxine lease is showing a good face of ore at the 170-ft. level. J. W. Barnes, who operates three drill rigs in the Miami mining camp, reports some good prospects, one mile north of the present camp.

Of the 20 mills in the Miami camp, five produced the bulk of the ore sold in 1911. There are 11 mills in the Quapaw camp. There are 15 drills in operation and from the showing made in the last of 1911 there seems no doubt but that the Quapaw field will soon extend the intervening four miles north to the Kansas state line, and south and west to the Neosho River. In an accompanying table is shown the production of lead and zinc concentrates from each mill. In addition about 120,000 lb. of calamine, worth \$1500, were produced in Peoria camp.

*Miami, Okla.

The Joplin District in 1911

By Jesse A. Zook

The year 1911 began with severe cold, a light output and small shipments. The output increased more rapidly than the sales and by the end of March an accumulation of 14,000 tons was in the bins of mine owners. Through this period spelter ranged up from \$5.35 to \$5.55 per 100 lb., while zinc sulphide ore declined from an opening price of \$47 down to \$44 for choicest grades. At this time ore prices and spelter began a decline extending to the middle of June, then a reaction leading up to \$6.40 for spelter and \$51 for ore with the advent of December. Here spelter toppled over and decended to \$6 before the end of the year, while ore prices declined a couple of dollars.

There was a decreased shipment of both sulphide and silicate ores. Missouri sustained a reduction of 19,000 tons zinc sulphide and 5000 tons zinc silicate; Kansas 4960 tons zinc sulphide and 80 tons zinc silicate; Oklahoma 4220 tons zinc sulphide and 24 tons zinc silicate.

In Jasper County, Joplin, Carl Junction and Cave Springs increased in zinc shipments during the year, while Webb City, Alba-Neck, Duenweg, Carthage and Sarcoxie made decreased shipments.

In Newton County, a decrease in zinc sulphide from Granby and Wentworth was more than offset by increased sales from Jackson and Spurgeon. An increase of zinc silicate from Granby and Saginaw was wiped out by decreased sales from Spurgeon, Wentworth and Seneca. In Lawrence, Dade and Green Counties the sales were decreased.

PRODUCERS' ASSOCIATION

Early in the year the Zinc Producers' Association adopted a contract selling base for zinc-sulphide ores grading 60 per cent and under. This created a dis-sention resulting in a disruption in which the opponents secured control of the association and denounced the contract plan. A crusade was inaugurated against contracting and many producers, who had looked favorably upon the plan, declined to sign the contracts. Along in midsummer the reorganized association began to talk of exporting ore. Later it was proposed to close down the mines and toward the end of the year there was talk of erecting a producers' smeltery. This talk undoubtedly assisted in boosting spelter prices, and while ore prices continued to rise the advance was meager in proportion to the metal advances. However, the collapse of metal at the

year-end indicated that no higher level of ore prices was warranted.

THE CONTRACT PLAN

The old association offered to place contracts covering 4500 tons for each week's delivery, if there were sufficient sellers to accept that amount. At one time it was claimed that a weekly production of 3700 tons was ready to be sold on contract; then the disruption came, and less than 1000 tons weekly

The base was formulated on a recovery of 87 per cent. of the metallic contents shown by assay. The close of the year ended the life of these contracts. A substitute contract is offered, for six months, based on a metal recovery of 87 per cent. of the metallic contents shown by assay, with a smelting charge based at \$21 per ton.

With very few exceptions contract prices ranged higher than the open market prices, while during the spelter sky-

JOPLIN DISTRICT ORE SHIPMENTS IN POUNDS, 11 MONTHS, 1911.

District.	Zinc Sulphide.	Zinc Silicate.	Lead.	Comb. Value.
Webb City—Carterville...	184,318,970	.....	46,402,480	\$5,045,484
Joplin	96,733,880	50,450	12,810,740	2,383,028
Alba-Neck	30,046,370	.....	411,990	666,081
Duenweg	20,975,370	3,459,250	2,146,120	532,424
Oronogo	18,582,350	.....	2,588,010	432,759
Carl Junction	7,942,600	.....	32,440	177,586
Cave Springs	5,149,250	.....	55,630	117,032
Carthage	3,386,770	215,580	87,300	71,677
Sarcoxie	2,789,070	752,650	26,380	63,783
Jasper County	369,924,630	4,477,930	64,561,090	\$9,489,854
Granby	7,538,740	17,323,640	1,159,530	\$377,053
Spurgeon	5,834,560	6,924,280	2,186,000	268,235
Jackson	9,087,740	.....	1,666,750	229,541
Saginaw .....	.....	540,740	188,910	13,699
Wentworth	451,040	.....	.....	8,937
Seneca .....	.....	.....	47,780	1,290
Newton County	22,912,080	24,788,660	5,248,970	\$898,755
Aurora	5,577,310	2,718,950	192,850	\$147,621
Stott City	1,093,930	.....	15,000	22,277
Lawrence County	6,671,240	2,718,950	207,850	\$169,898
Green County .....	.....	.....	74,980	\$2,174
Dade County .....	.....	77,270	.....	\$695
Galena	30,100,270	150,030	6,346,870	\$785,627
Badger	2,621,620	.....	134,510	55,948
Lawton	1,373,930	.....	44,990	30,886
Cherokee County	34,095,820	150,030	6,526,370	\$872,461
Miami	14,546,670	.....	4,856,170	\$352,872
Quapaw	4,024,820	18,010	585,310	88,269
Ottawa County	18,571,490	18,010	5,441,480	\$441,141
Missouri	399,507,950	32,062,810	70,092,890	\$10,561,376
Kansas	34,095,820	150,030	6,526,370	872,461
Oklahoma	18,571,490	18,010	5,441,480	441,141
11 Mo. Joplin District....	452,175,260	32,230,850	82,060,740	\$11,874,978
Approximate December ..	46,912,000	3,428,000	8,730,000	1,273,805
District Total 1911.....	499,087,260	35,658,850	90,790,740	\$13,148,783
District Total 1910.....	541,068,120	47,748,720	87,413,610	14,129,022
Increase .....	.....	.....	3,377,180	.....
Decrease	41,980,860	12,089,870	.....	\$980,239

have been sold on contract. The contract placed the price of zinc-sulphide ore at \$37 per ton on a St. Louis spelter market of 5c. per lb., with an advance or deduction of 8½c. for each 1c. up or down in the metal market. Ores carrying under 2 per cent. iron were not penalized, from 2 to 4 per cent. were penalized \$1 for each 1 per cent., and over 4 per cent. the penalty was 50c. per ton for each 1 per cent. of iron. A premium of \$1 per ton for ore carrying under one-half of 1 per cent. of lead was paid.

rocketing period in November and early December ores carrying over 4 per cent. iron sold \$2 to \$6 per ton higher than open-market prices for like grades. No attempt was made to secure contracts on ores above 60 per cent. grades, the limited output and strong demand for these keeping the market firm.

NEW AND REMODELED MILLS

In the Thoms station area, northwest of Joplin, a dozen new and remodeled mills were in operation at the end of the

year where four mills were standing and but two operating a year ago. New mills were erected in the Webb City, Carterville, Sarcoxie, Carl Junction and Jackson fields. Two were built west of Joplin, and several were built in Kansas, around Galena. During the year a number of mills were removed from one to another part of the district and re-modeled.

Buyers uniformly agree that the assessing of penalties has had good effect on ore-concentrating methods, but the contract clause of \$1 premium for zinc ores carrying less than one-half of 1 per cent. lead has brought better results than penalizing methods. It was

block of the stock and from their production the bulk of this smeltery's needs was drawn.

Lead shipments approximated 3000 tons in excess of 1910. The average monthly shipment was 3685 tons, or 921 tons per week.

Zinc Mining in Wisconsin

By J. E. KENNEDY*

The net tonnage of zinc ore shipped to smelteries from the Wisconsin district in the first 11 months of 1911 was 138,331,489 lb.—including 24,076,110 lb. from Jo Davies County, Ill.—showing an increase of 26,477,525 lb. over the corresponding period of last year. The gross tonnage shipped by the mines was 196,257,791 lb., of which amount 82,325,529 lb. was sent direct to the smelteries—including 9,327,149 lb. of zinc carbonate—and 113,932,262 lb. went to the five local separating plants. The shipment of zinc ore out from the separating plants was 56,005,960 lb. showing a shrinkage in tonnage of 57,-

\$46 during November and December. The highest premium price paid was \$47 per ton.

NEW DEVELOPMENTS

Prospecting was generally quiet throughout the district except in the Benton camp. The Wisconsin Zinc Co., the Vinegar Hill Zinc Co. and the Frontier Mining Co. developed a number of good properties in this territory. Ten concentrating mills were constructed and rebuilt during the year, the Wilkinson, Rowley, New Eureka and Little Minnie, at Benton; the Cleveland at Hazel Green; the Winkell and Milwaukee-Shullsburg at Shullsburg; the Coker and Dodger at Mifflin and the Merry Widow at Galena.

The Wisconsin Zinc Ore Separating Co. constructed a two-kiln magnetic-roasting plant at Benton; the Peaceful Valley and Lucky Twelve mining companies also installed roasters. The Campbell Magnetic Ore Separating Co., at Cuba City, increased the capacity of its plant to 100 tons daily capacity. The American Zinc Ore Separating Co.,

PRICES OF ZINC AND LEAD ORES IN JOPLIN DISTRICT IN 1911.

	ZINC.		LEAD.	
	High.	Aver.	High.	Aver.
Jan.	\$47.00	\$40.44	\$58.00	\$55.66
Feb.	46.00	39.16	58.00	55.38
Mar.	47.00	38.62	56.00	54.57
Apr.	44.00	37.54	59.00	56.21
May	43.00	37.04	58.00	55.37
June	45.00	37.15	58.00	55.91
July	45.00	38.32	63.00	58.46
Aug.	48.00	40.35	63.00	60.82
Sept.	48.00	41.53	61.00	59.56
Oct.	48.00	40.92	58.00	54.73
Nov.	50.00	42.61	61.00	56.45
Dec.	51.00	40.76	64.00	56.75
1911 ..	\$51.00	\$39.90	\$64.00	\$56.76
1910 ..	52.00	40.42	58.00	51.98
Inc. ....	.....	.....	\$6.00	\$4.78
Dec. ..	\$1.00	\$0.52	.....	.....

a definite offer to producers in a form and manner so ever-present that it could not be ignored. Human nature prefers premiums to penalties, anyway.

SHIPMENT AND PRODUCTION

The shipment of zinc ores the past year was nearly 30,000 short tons less than 1910. At the beginning of the year

ORE PRICES IN JOPLIN DISTRICT (11 Years)

Year.	Zinc Ore.		Lead Ore.	
	High.	Aver.	High.	Aver.
1911 ...	\$51.00	\$39.90	\$64.00	\$56.76
1910 ...	52.00	40.42	58.00	51.98
1909 ...	55.00	41.08	60.50	54.56
1908 ...	47.00	34.36	66.00	54.66
1907 ...	53.50	43.68	88.50	68.90
1906 ...	54.00	43.30	87.00	77.78
1905 ...	60.00	44.88	80.00	62.12
1904 ...	53.00	35.92	62.00	54.80
1903 ...	42.00	33.72	60.50	54.12
1902 ...	42.00	30.33	50.00	46.10
1901 ...	34.00	24.21	47.50	45.99

the reserve stock was but a little over 3000 tons while at the close it approximated 11,000 tons. The year's production was, therefore, close to 8000 tons greater than the shipment.

LEAD ORE

Lead prices were less variable than in most preceding years. The advent of the Webb City smeltery into the field had no immediate effect on advancing lead prices, as local producers hold a large

	GROSS FROM MINES		NET TO SMELTERIES	
	1910 lb.	1911 lb.	1910 lb.	1911 lb.
Highland	12,675,500	9,079,730	12,334,800	8,610,430
Harker	7,100,772	7,058,880	4,648,912	6,814,410
Linden	8,104,520	15,449,482	638,070	753,150
Mineral Point	5,514,780	2,285,359	28,635,505	35,002,319
Dodgeville	607,800	260,910	607,800	260,910
Montfort	2,572,000	2,865,060	434,790	1,008,120
Livingston	15,489,522	11,532,780	211,164	285,000
Rewey	5,738,990	5,650,540	812,800	1,391,000
Platteville	28,921,658	26,958,570	24,742,350	33,833,390
Cuba City	12,687,973	3,692,990	9,051,423	2,818,700
Benton	41,114,285	47,674,050	10,490,809	11,957,510
Hazel Green	23,073,500	36,231,420	78,000	10,042,220
Shullsburg	2,531,840	9,067,800	1,486,300	1,478,220
ILLINOIS				
Galena	18,474,861	18,450,220	16,906,241	24,076,110
Council Hill	475,000	.....	400,000	.....
IOWA				
Dubuque	375,000	.....	375,000	.....
Total	185,458,001	196,257,791	111,853,964	138,331,489

926,302 lb.; part of this weight was recovered in iron pyrites of which the district shipped 26,455,240 lb. The tonnage of lead ore shipped in the same period was 8,046,265 lb. The table below shows the shipment of zinc ore by camps for the first 11 months of 1910 and 1911. The stock of zinc ore in bins at the year end slightly exceeded 10,000 tons.

ORE PRICES

The highest base price paid during the first six months of 1911 was \$43.50 per ton of 60 per cent. zinc. The price steadily declined and remained at \$39 to \$40 during April, May and the early part of June. In the last six months of the year the base price worked up to

*Platteville, Wis.

at Platteville, also increased its plant to handle 100 tons of concentrates per day a short time before it was destroyed by fire on Oct. 21. The Joplin Separator Works at Galena, which was burned on Oct. 23, was under construction at the end of the year with added capacity of two more kilns. The Interstate Light & Power Co. extended its power transmission lines throughout the district.

SHIPMENTS OF ORE

The accompanying table shows, in pounds, the shipments of zinc ores from the various camps of the district. In addition to these, the weekly returns up to Dec. 23, give totals of 8,817,815 lb. lead ore and 28,429,840 lb. sulphur ore or pyrites.

The Iron and Steel Industry in 1911

By Frederick Hobart

Over production and too sanguine estimates of trade recovery in the latter part of 1910 left their ill effects to be worked out in 1911. The consequence was a half year of general depression and of efforts to work off accumulated stocks, which were only partially successful. In the second half, after a severe reduction of output had been made, there was a gradual recovery, slowly drawn out until November, when the trade began to wake up and there was a renewal of business which promises well for activity in the new year. Yet with all the vicissitudes of the year there was a large production; and in consumption the growth of population and of general industry began to assert itself. It still failed to come up to the capacity of the furnaces and mills, greatly enlarged as that was in 1907 and the two succeeding years. Averaging roughly, it may be said that the activity in finished steel, which is the final test, gradually increased from about 60 per cent. of the total productive capacity up to 75 per cent.; with the prospect that 1912 will open with nearly 85 per cent. employed.

It has often been said that every year in the iron trade has its parallel in the past; but we must go back 10 years or more to find a time when optimism received so severe a check. This resulted in undue pessimism, and that feeling persisted long after the causes for it had begun to wear away. A break in the curve of slow recovery led to a feeling that there was no recovery at all, and to a failure to recognize the great underlying volume of business which was done. This was, perhaps, natural; but the final statistics will show that while 1911 was not up to the preceding year, there was no such break as characterized 1908, for instance. If production decreased, it was in part because of using up the accumulated stocks of the previous year.

IRON ORE

The production and consumption of iron ore for two years past are estimated as in Table I herewith, the figures being in long tons.

The decrease in stocks in 1911 is chiefly in those visible, as on the Lake Erie docks; there are not statistics available for the exact determination of stocks in furnace yards. Imports and exports are estimated for the month of December. For the 11 months ended Nov. 30, for which we have full returns, the imports included 1,042,414 tons from Cuba; 202,362 from Sweden; 188,661 from Spain; 154,853 from Newfoundland; 50,424 from Can-

ada; 24,116 tons from other countries. There was a considerable fall in imports, owing chiefly to the lesser activity of the furnaces. Some large contracts for delivery of foreign ores to eastern furnaces in 1912 were made, principally for Swedish ore.

I. IRON ORE PRODUCTION AND CONSUMPTION

	1910	1911
Lake Superior.....	42,442,397	36,680,471
Southern states.....	7,500,000	6,475,000
Other states.....	3,325,000	2,660,000
Production.....	53,267,397	41,815,471
Decrease in stocks.....	.....	650,000
Imports.....	2,591,031	1,790,000
Total supplies.....	55,858,428	44,255,471
Deduct exports.....	644,875	780,000
Increase in stocks.....	950,000	.....
Approximate consumption.....	53,263,563	44,467,471

Accurate statistics are available for the Lake Superior iron ore from which nearly 80 per cent. of our pig iron is made. Dock records are carefully kept and are compiled each year by the Cleveland *Iron Trade Review*. Table II herewith gives the shipments from the upper ports and Table III the receipts and dock stocks at Lake Erie ports, to which over 80 per cent. of the ore goes. The remainder goes to Lake Michigan ports—Chicago, Milwaukee and Gary.

Bessemer ore—base 55 per cent. iron and under 0.45 phosphorus—\$4.50 per ton for Old Range and \$4.25 for Mesabi; nonbessemer—base 51.5 per cent. iron—

II. SHIPMENTS OF LAKE SUPERIOR ORES

Port	1909	1910	1911
Escanaba.....	5,748,042	4,959,869	4,278,445
Marquette.....	2,909,578	3,248,930	2,200,380
Ashland.....	3,834,286	4,093,822	2,429,290
Two Harbors..	9,181,132	8,271,169	6,367,587
Superior.....	6,540,505	8,437,261	9,920,490
Duluth.....	13,470,503	13,609,155	6,934,269
Total by water.....	41,683,599	42,620,206	32,130,471
By rail.....	903,270	822,391	550,000
Total.....	42,586,869	43,442,597	32,680,471

\$3.70 for Old Range and \$3.50 for Mesabi. These prices apply to not more than 20 per cent. of the ore mined. The rest is from mines owned by the Steel Corporation and other large steel companies, and the price to them is a matter of book-keeping, the real charge being the costs of mining and transportation. To the prices given above the cost of transportation from Lake docks must be added to get the cost of the ore at furnaces; this will run from 50c. to \$1 per ton, according to the situation of the furnaces. Toward the end of the shipping season these prices were quietly cut about 25c. a ton.

Prices of iron ore in the East are not

III. RECEIPTS AND STOCKS, LAKE ERIE PORTS

Ports	RECEIPTS			STOCKS		
	1909	1910	1911	1909	1910	1911
Toledo.....	1,374,224	1,225,202	493,345	332,456	433,215	661,382
Sandusky.....	11,088	.....	.....	39,557	17,728	2,471
Huron.....	243,082	197,951	223,947	477,333	375,118	344,371
Lorain.....	2,796,856	2,884,738	2,937,605	407,129	259,448	314,321
Cleveland.....	6,051,342	5,800,501	4,584,211	1,547,142	1,638,795	1,589,491
Fairport.....	1,734,277	1,516,434	666,365	867,640	839,970	636,566
Ashtabula.....	8,056,941	9,620,638	6,359,131	2,594,359	3,287,816	3,295,862
Conneaut.....	7,007,834	6,309,548	6,931,278	1,411,002	1,329,997	1,237,573
Erie.....	1,235,057	942,592	289,400	788,046	792,011	636,274
Buffalo.....	5,002,235	4,704,439	2,802,976	501,125	452,783	413,353
Detroit.....	159,889	296,412	243,292	.....	.....	.....
Total.....	33,672,825	33,498,455	25,531,550	8,965,789	9,426,681	9,131,664

The season shipments to furnaces from Lake Erie ports, to which about 80 per cent. of the Lake ore goes, and from which it is distributed, were as shown in Table IV.

IV. SHIPMENTS TO FURNACES

	1910	1911
Stocks on docks, May 1..	5,444,080	6,778,494
Receipts for the season..	33,498,455	25,531,550
Total.....	38,942,535	32,310,044
Shipments to furnaces....	29,515,654	23,178,380
Dock stocks, Dec. 1....	9,426,881	9,131,664

The season prices of Lake Superior ore on Lake Erie docks were fixed as usual early in the year. They were 50c. per ton below those of 1910, being as follows:

controlled by any agreement or association of producers. Sales made through the year at New York mines showed a basis of $5\frac{1}{2}$ @6c. per unit of iron at mines. Newfoundland and Spanish ores sold at about $7\frac{1}{4}$ @ $7\frac{1}{2}$ c. per unit of iron f.o.b. docks, Philadelphia. The furnaces using those ores, however, can generally get a low freight rate from Philadelphia, so that there is not much difference between them and domestic ores in cost at furnace.

Little or no Cuban ore is sold to outside furnaces, nearly all of it being used by the steel companies which control the mines.

The conditions in the Lake Superior region during the year are fully treated in a special article on another page.

In the South iron ore production is rather closely limited by the demands of the furnaces. The proximity of the mines to the points where the ore is needed and the fact that mining can continue without interruption through the year, render unnecessary the storage or accumulation of any large stocks of ore. Accordingly the decrease of about 15 per cent. in production corresponds pretty closely to the decrease in the make of pig iron.

Eastern mines were fairly active through the year, though their production was to some extent limited by the lower requirements of furnaces. Most of these ores are sold on yearly contracts. The mines of the Lake Champlain district in New York were more steadily worked than any others.

In Table I the imports and exports of iron ore are given for the year, with the month of December estimated. Actual imports for the 11 months ended Nov. 30 were 2,417,321 long tons in 1910, and 1,662,830 in 1911; a decrease of 754,491 tons. About 55 per cent. of these imports in 1911 was from Cuba. Exports for the 11 months were 638,578 tons in 1910, and 752,931 in 1911; an increase of 114,353 tons. A large part of these exports goes to Canadian furnaces.

Imports of manganese ore for the 11 months were 235,834 tons in 1910, and 176,486 in 1911; a decrease of 59,348 tons.

PIG IRON

The production of pig iron during the first half of the year was at the average rate of 1,944,300 tons monthly, not varying greatly from month to month. From July to October there was a gradual increase, followed by a drop in November and then by a rapid gain in December. The average for the second half of the year was 2,026,200 tons monthly.

I. PIG IRON PRODUCTION

	1909	1910	1911
First half.....	11,022,346	14,978,738	11,665,796
Second half...	14,773,125	12,319,807	12,157,250
Total.....	25,795,471	27,298,545	23,823,046

The accompanying table shows the production by half years for three years past. For the first half of 1911 the figures are those collected and published by the American Iron and Steel Association—as are the totals for 1909 and 1910; for the second half they are estimated on the basis of the monthly reports of the capacity of the active furnaces. The figures are in long tons. The production for 1911 was 3,475,499 tons less than in 1910; and—with the exception of the disastrous year 1908—was the smallest since 1905. The increase in the second half of 1911 was largely due to the blowing in of a number of furnaces early in December. At the close of the year there were 237 coke and anthracite furnaces in

blast, the largest number active since October, 1910, 14 months previous.

Assuming that the production of the second half of the year was approximately on the same lines as that of the first half, the division of the output according to the uses for which the iron was intended was approximately as in Table II.

II. PIG IRON PRODUCTION CLASSIFIED

	1910	1911
Foundry and forge.....	6,350,605	5,623,300
Bessemer.....	11,244,612	9,529,200
Basic.....	9,084,520	8,119,800
Charcoal.....	394,377	375,500
Spiegel and ferro.....	224,431	175,246
Total.....	27,298,545	23,823,046

It is probable that the final returns will make some changes in these figures; especially in the quantity of basic iron. The production of pig iron in the United States for 10 years has been as in Table III.

III. PIG IRON PRODUCTION FOR 10 YEARS

1902.....	17,821,307	1907.....	25,781,381
1903.....	18,009,259	1908.....	15,936,018
1904.....	16,497,003	1909.....	25,711,846
1905.....	22,992,380	1910.....	27,295,592
1906.....	25,307,391	1911.....	23,823,046

A year ago we noted a large increase in unsold or unused stock of pig iron at the furnaces. Those stocks were then estimated at 2,100,000 tons. During 1911 the stocks were gradually worked down, and at the close of the year, though no exact figures are available, it is estimated that they did not exceed 850,000 tons. We estimate the consumption of pig iron in the United States for two years past as in Table IV, in long tons.

IV. CONSUMPTION OF PIG IRON

	1910	1911
Production.....	27,298,545	23,823,046
Imports.....	237,233	143,000
Decrease in stocks.....	.....	1,250,000
Total supplies.....	27,535,778	25,216,046
Exports.....	127,385	119,000
Increase in stock.....	1,700,000	.....
Total deduction.....	1,827,385	119,000
Consumption.....	25,708,393	25,097,046

This consumption for 1911 was approximately 594 lb. per capita, being 45 lb. less than in the preceding year.

STEEL PRODUCTION

There are no accurate data for the production of steel in 1911. An estimate can be based upon the production of pig iron and other known facts. These would give an output approximately as follows: Openhearth steel 14,400,000 tons; bessemer or converter steel, 7,950,000; crucible and electric, 150,000; total 22,500,000 tons. This compares with 26,094,919 tons in 1910, showing a decrease of 3,594,919 tons.

In the same way there are no absolute data for finished iron and steel; but upon the known basis it may be estimated that the finished output included about 1,500,000 tons of rolled and forged iron, 900,000 tons of steel castings and 16,900,000 tons of rolled and forged steel; a

total of 19,300,000 tons of finished material. Structural steel held its own during the year and the quantity was pretty well up to that of 1910. In sheets and tinplates there was probably a small increase; but in other rolled products a decline in production.

EXPORTS AND IMPORTS

The exports and imports of iron and steel and their products in the United States for the 11 months ended Nov. 30 are valued by the Bureau of Statistics of the Department of Commerce and Industry as in Table V.

V. IMPORTS AND EXPORTS

	1910	1911	Changes
Exports.....	\$182,971,193	\$227,469,893	I. \$44,498,700
Imports.....	36,267,671	26,690,333	D. 9,577,338
Excess, exp.	\$146,703,522	\$200,779,560	I. \$54,076,038

The exports include a large quantity of material for the Panama Canal. A noteworthy change was found in the imports and exports of tinplate, owing to changes in the trade and the transfer of large contracts for foreign tinplate which were formerly let by exporters of oil and of canned provisions to Welsh makers. For the 11 months in 1910 the imports of tinplate were 147,307,845 lb. and the exports 25,540,361 lb.; in 1911, the imports fell to 30,663,470 lb., and the exports rose to 122,594,674 lb.; almost a reversal of the figures.

Railroad buying was light until nearly the close of the year, when large orders for steel cars were placed. Renewals of track were generally kept down as much as possible. Building of new roads was not especially active. The *Railway Age-Gazette* reports the construction of new road in 1911 at 3067 miles, against 4122 in 1910. The same authority puts the number of new locomotives ordered at 2850, or 937 less than in 1910; of passenger cars at 2623, or 1258 less; of freight cars at 133,117, or 8087 less. Practically all the cars built in 1911 were of steel, or had steel frames.

UNITED STATES STEEL CORPORATION

The net earnings of the Steel Corporation for the nine months ended Sept. 30 were \$81,150,448, being less than in 1910 and 1909, but greater than in 1908. No changes were made in dividends. The latest statement of the corporation showed that unfilled orders on the books on Nov. 30 amounted to 4,141,955 tons, being 1,031,036 tons more than in January. This increase is nearly equal to a month's production. The corporation early in the year was operating its mills to about 60 per cent. of their capacity. This rose gradually to 75 per cent. in November and December, with preparations made to work up to 85 per cent. after the New Years' stop for repairs and inventory. The corporation paid its regular dividends through the year, of 7 per cent. on preferred and 5 per cent. on common stock.

Iron and Steel Markets in 1911

By Frederick Hobart

The general course of the iron and steel markets showed in 1911 a business hampered in the first part of the year by the feeling of overproduction and large stocks carried over from 1911, and, by the persistent effort to maintain controlled prices at a certain level. This was followed by a gradual recovery from depression as the consumptive power of the country began to be felt; then by a general acceptance of the breaking of control and the establishment of an open market; and finally by a rapid extension of business as the full force of lower prices began to be felt.

The striking incidents of the year were the first break in prices in May, when the Republic Iron & Steel Co. announced its intention of cutting prices and pursuing an aggressive policy for business.

This was followed by a general cut in quotations, which was not, however, sufficient to induce a full recovery. The next was the later abandonment of the long struggle to maintain prices and the virtual acceptance of the open market and free competition.

An unfavorable effect upon the markets was exerted by the investigation of the Steel Corporation by a Congressional committee. In September this was emphasized by the heavy fall in steel stocks in Wall Street and the rumors that the Administration would forestall Congress by bringing suit to dissolve the Corporation. The effect was largely sentimental, however, and did not much disturb the volume of trade. By the time the suit was actually filed, in October, the effect had been largely discounted, and

the announcement did not greatly disturb the market. This was shown by the active buying of November, and the announcement that January will open with a large increase of active capacity at the mills.

The study of the market shows that great corporations may control production, but that they cannot yet entirely control the buyer. Conversely, that the time-honored rule of "boosting the market by getting under it" has not yet lost all of its truth and efficiency.

The letters which follow, give the history of the year at Pittsburg, the great primary market; at Birmingham, the primary market of the South; at Chicago, the great distributing center of the Northwest, and in the seaboard iron markets.

Pittsburgh Iron and Steel Markets

By B. E. V. Luty*

The steady decline in prices of all iron and steel commodities which characterized 1910 was arrested at the close of the year, apparently chiefly through the medium of a "Gary dinner" with a number of meetings in individual branches of the trade. The year 1911 opened with considerable promise, and as production had been greatly reduced a mild improvement occurred, sufficient to increase the pig-iron-producing rate of the country from about 21,000,000 tons per year at the beginning of January to nearly 26,000,000 tons in March. Chiefly for the sentimental effect which it was believed such action would have, wire products were advanced on Jan. 23, by \$1 a ton, to a basis of \$1.75 for nails. As there were but three advances in finished steel products during the first 10 months of the year the other two may be mentioned here: An advance of 10c. per box on tinplates to \$3.70, base, effected at an informal meeting in Pittsburgh Feb. 3, and a second advance of \$1 a ton, March 6, in wire products.

During the first two months of 1911 sentiment was fairly optimistic and buying was on a liberal scale, for early delivery. The iron trade was pleased with the improvement in general buying

and looked forward to heavier buying by the railroads as soon as the "advanced rate cases" were decided. From what source it came no one seems to know, but word was passed around that the railroads would be permitted to make about half the total advances they had scheduled. The decisions were handed down Feb. 22 and disallowed all the advances. Then a chill seized the trade. The railroads were disgruntled, but before many months it was quietly admitted that the decision was a blessing in disguise forcing the railroads to find remedies in better ways for the conditions of which they complained.

On May 24, occurred a meeting of steel-bar manufacturers in New York and on the same day chairman Topping, of the Republic Iron & Steel Co., made public announcement that his company was not satisfied with market conditions, having lost business through the cutting of some of the smaller mills. Accordingly the company would adopt "a more aggressive sales policy" and a price of 1.25c. on steel bars was announced, \$3 per ton under the nominal price at the time. This constituted a formal withdrawal of the company from the price-maintenance movement. On May 29, a general meeting of the steel manufacturers occurred, Republic not be-

ing represented. After the meeting it was announced that billets and sheet bars were reduced \$2 per ton, sheets \$4 per ton and plates and shapes \$1 per ton, the cut in steel bars being ratified. The main purpose of the meeting was not known, whether to decide upon the extent of formal cuts which should be made, reaffirm allegiance to the agreement despite Republic's defection, or to arrange matters for a quiet and orderly abandonment of the whole coöperative movement. Prices were held for a time, but June 20 a reduction of \$2 per ton occurred in wire products, restoring prices which prevailed at the opening of the year and at about the same time it developed that prices in other lines were being occasionally shaded. In July the Steel Corporation sought business very actively, at cut prices, but conducted its campaign so skillfully, making but slight cuts and then very quietly, that the independents did not, apparently, at first realize the extent to which the market had been opened. By the beginning of August it was universally recognized that there was an open market on finished steel products and that all semblance of coöperation or agreement had disappeared. Perhaps the trade was slow in recognizing the fact. The investigations of the

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Stanley committee of the House, commenced June 1, unquestionably made the previous position untenable.

Barring the reductions specifically mentioned, steel prices did not openly decline until late in July, but from that time until the close of November there was a continued succession of declines embracing all finished steel products except rails. The declines in May and June represented an average of between \$1.50 and \$2 per ton in the average of finished steel products, outside of rails, while the declines from July 1 to Dec. 1 represented further declines averaging \$4 to \$5 per ton. This brought the average level of finished steel products outside of rails, to a point between \$12 and \$13 per net ton below the level prevailing at the close of 1907, which was the highest since 1902, and only about \$1 per ton above the average at the lowest point in the history of the steel business, in 1897-8. Some products, particularly sheets and steel pipe, were materially lower than ever before. This price level was practically profitless. It is about \$4 per ton lower than the average during the third quarter of the year, for which quarter the United States Steel Corporation reported earnings of \$29,522,725, and those earnings were considerably larger than would have been expected from a comparison of earnings reported in 1906 and 1907, with allowance for the decline in prices and the change in tonnage output.

During the first half of the year the iron and steel market was subject to adverse political influences and the defection of the Republic Iron & Steel Co. with its attendant price declines. Dur-

ing the next four months it was subject to the disheartening influence of a constant decline in prices, prompting jobbers and consumers to withhold orders until the last moment and then buy in the smallest possible quantities. The fact that after a considerable decline production actually did increase, from a minimum rate of 21,400,000 tons of pig iron a year in July to 25,000,000 tons in Oct-

the month prices began to advance. This encouraged still heavier buying in December. In both months the actual tonnages entered on mill books for rolling exceeded the shipments materially, while a very large tonnage was placed under contract for first-quarter and first-half delivery. Doubtless much of the business specified was placed with the clear knowledge on the part of buyers

AVERAGE PRICES AT PITTSBURGH 1911

	Pig Iron.				Steel.					Nails.	
	Bessemer. \$	Basic. \$	No. 2 Foundry. \$	Ferro-manganese. \$	Bessemer-Billets. \$	Beams. c.	Plates. c.	Bars. c.	Black Sheets No. 28. c.	Wire per keg. \$	Cut per keg. \$
Jan.	15.90	14.19	14.65	40.20	23.00	1.40	1.40	1.40	2.20	1.71	1.60
Feb.	15.90	14.50	14.75	39.70	23.00	1.40	1.40	1.40	2.20	1.75	1.60
Mar.	15.90	14.65	14.90	39.25	23.00	1.40	1.40	1.40	2.20	1.79	1.63
Apr.	15.90	14.65	14.90	38.70	23.00	1.40	1.40	1.40	2.20	1.80	1.70
May	15.90	14.30	14.66	38.45	22.92	1.40	1.40	1.37	2.20	1.80	1.60
June	15.90	14.96	14.49	38.45	21.00	1.35	1.35	1.25	2.00	1.76	1.60
July	15.90	13.60	14.40	38.80	21.00	1.35	1.34	1.24	2.00	1.70	1.60
August	15.90	13.90	14.40	38.95	21.00	1.35	1.30	1.20	1.91	1.69	1.60
Sept.	15.90	13.57	14.40	38.45	20.60	1.33	1.28	1.18	1.90	1.65	1.58
Oct.	15.44	13.41	14.31	38.95	20.00	1.23	1.19	1.13	1.85	1.64	1.55
Nov.	14.92	13.18	14.15	39.00	19.50	1.14	1.11	1.07	1.84	1.56	1.51
Dec.	15.15	13.10	13.90	41.50	19.00	1.13	1.13	1.12	1.85	1.54	1.50
Year	15.72	13.94	14.49	39.20	21.42	1.32	1.31	1.26	2.03	1.70	1.59
Yr., 1910	17.10	15.65	15.83	42.48	25.20	1.46	1.45	1.43	2.29	1.75	1.72

per pound; of nails, per keg of 100 lb.

ober, did not create any confidence. The suit against the United States Steel Corporation sent a fresh chill over the market, and then the unexpected happened.

In about three weeks immediately following the bringing of the suit railroads placed orders for fully 40,000 cars, against only 20,000 in the preceding four months, and no more than 50,000 in the whole first half of the year. Prices continued to decline during November, but bookings were larger and at the close of

that delivery could not be made until after Jan. 1. While no definite increase occurred in production, plans for holiday closings were largely abandoned, and orders were issued for the starting of considerable idle capacity immediately after Jan. 1. The recovery in prices ran from \$1 to \$3 per ton in the products affected, and represented a general advance in the level of finished steel products, outside of rails, of between \$1 and \$1.50 per ton.

The Chicago Iron Market

By E. Morrison

Considered as a whole, the year 1911 was disappointing to Chicago dealers in pig iron and finished products.

In January pig iron sold lightly. The line between 1910 and 1911 was not marked by any change in buying conditions; melters bought in general for about three months ahead, preferring to contract for small lots—a carload to 500 tons—often and to make frequent inquiries for larger tonnage that showed their close watching for a return in the market.

Northern No. 2 pig iron sold for \$15.50@16; Southern No. 2 for \$11@11.50, Birmingham, or \$14.35@14.85, Chicago. Lake Superior charcoal iron brought \$18@18.50. Railroad supplies were in light demand and structural-material sales were confined to a few bridges. Plates, sheets and bars were

in light demand. Buyers and sellers were in a waiting mood.

February saw the relation between production and consumption so improved as to cause the blowing in of four local furnaces and a demand of about 50c. more for Southern iron for last-half than for early delivery. The founders, however, increased their buying only slightly. Rails and track supplies became in better demand and the spring contracts for structural material showed improvement. Plate specifications increased in volume of material. Sheets had a better sale. Bars improved to the extent of becoming in fairly good demand for agricultural-machine needs. In the middle of the month the International Harvester Co. bought 100,000 tons on deliveries extending into the third quarter, of Northern and Southern pig

iron, the price being said to be slightly below \$10, Birmingham.

In March, pig iron became stronger, Northern in particular strengthening after a sale of 10,000 tons to a Milwaukee foundry. Prices, however, did not advance on coke foundry irons, and Lake Superior charcoal dropped off to \$17.50 @18. Both buyers and sellers were still in a waiting mood. Sales of railroad material and structural materials became better; plates, sheets and bars also showed improvement, but production continued large for the demand.

April saw pig iron in very light demand and unchanged conditions continuing in the finished-materials market. Plate, sheet and bar mills were running at about half capacity.

May showed no revival in the demand for pig iron; the sales were chiefly in

carload lots. Founders bought very often but could not be induced to increase their contract time. Structural material became very quiet; the railroads bought reluctantly; plates, bars and sheets sagged in price.

June was a dull month in every line and the reduction in price of sheets had no stimulating effect. Everywhere buying was for immediate use. In July, sales of pig iron increased slightly, particularly of Southern, but the minimum price remained \$10, Birmingham. Lake Superior charcoal dropped to \$16.50@17. In finished lines only structural material had any fair demand.

August continued dull, with an effort by the Southern interests to obtain \$10.50, Birmingham, but consumers refused to pay more than \$10, at which price they obtained plenty of tonnage. Structural material sold well; other finished materials were in light demand and prices were slightly cut. In September the demand for pig iron dropped back to carload lots, with \$10, Birmingham, on prompt shipments and \$10.50 on more extended deliveries the rule. Prices of steel bars were cut very severely and remained low for the rest of the year.

Soft steel bars ranged from 1.58c. in January to 1.25c. in October, the price strengthening toward the end of the year. Plates sold at 1.58@1.63c. at the beginning of the year and sank to 1.33c. at the end. Sheets declined from 2.38c. in January to 2.03c. in December, for No. 28 black.

PRICES OF IRON AND STEEL IN CHICAGO

	1910		1911	
	High-est	Low-est	High-est	Low-est
Lake Superior charcoal.....	\$20.00	\$18.00	\$18.50	\$16.50
Northern No. 2 foundry.....	19.50	16.00	16.00	14.00
Southern No. 2 foundry.....	18.85	15.10	15.85	14.35
Bar iron.....	1.65c	1.35c	1.35c	1.15c
*Structural material.....	1.88c	1.58c	1.63c	1.30c

*Beams and channels, 3 in. to 15 in., and angles, 3 in. to 6x½ in. or heavier.

October developed a little better condition for pig iron, but the demand was still light and the efforts of Southern interests to advance prices from \$10, Birmingham, met with failure. All finished lines were dull. November saw pig iron very weak, with the end of the year bringing a slackening of purchases of finished products and generally low prices for them.

December brought a general improvement. Several large purchases of pig iron were made, Southern bringing \$10 @10.50 and Northern \$14@14.50 on first-quarter deliveries, while Lake

Superior charcoal iron held to \$16.50@17. The railroads began to buy more freely and good sales were made of plates and bars.

Alabama Iron Market

The year 1911 in pig iron and steel in Alabama was far from being satisfactory. The make was good, but the price record rather disastrous. The year opened with the market rather weak for pig iron, the average price around \$11 per ton, No. 2 foundry. The sales were not active by any means and the make not pushed. There started early in the year an accumulation of iron; in other words the make was greater than the demand. Until the eleventh month of the year, the sales were a little under or near production from month to month. Then, after the quotations had dropped at least \$1 per ton, some interests made concessions on the price and started a liberal buying movement. A little strength was found in the market during the first part of December and a recovery was secured up to \$10.25@10.50 which was under that price that prevailed when the year opened.

The steel market was quite active during the better part of the year. However, toward the end of the year the market slacked off and there was a cry for orders.

The year witnessed a good and steady demand for fabricated steel; a single rolling mill in the Birmingham district continued in operation through the twelve months. The bulk of this product was used by Southern manufacturers.

Cast-iron pipe makers melted the larger part of the iron that was consumed in the home territory. There was a little setback during the year in the pipe trade, the Dimmick Pipe Co.'s plans shutting down and the property changing hands. For several months there was no work done at all at this plant, this having an effect on the year's melt in the home territory. The Dimmick plant was finally taken over by the United States Cast Iron Pipe & Foundry Co., extensive repairs made and it is promised that there will be a resumption on a large scale early in 1912. There was a steady demand for cast-iron pipe in 1911, and shipments were made long distances. Great quantities of pipe from the Birmingham district went to California points while the Middle West also looked to this section of the country for much cast-iron pipe.

Toward the end of the year stove makers in the Southern territory and in Alabama in particular took on some activity and bought some pig iron. Foundries and machine shops did not do a big business through the year, the consump-

*Birmingham, Ala.

tion of iron on their part being under the previous year.

Charcoal-iron manufacturers in Alabama, with three and four small furnaces in operation from time to time, had a fairly good year in 1911. Despite the low prices prevailing in foundry iron, there was a good price maintained for charcoal pig, \$22@22.50 per ton being asked right along. There was not much accumulation of stocks.

The pig-iron production during 1911 in Alabama fell short of the make in 1910. Estimating the production in December at 150,000 tons, the make in Alabama in 1911 is to be placed at 1,763,100 tons. The figures for 1910 show a production of 1,939,147 tons. There was a decrease in the production every month in 1911 as compared to the same month in 1910, with the exception of September. The total figures for 1911 may show a small increase in the revising that will take place by the middle or latter part of January, but in round numbers there will hardly be a change.

The year closes in an encouraging way with large sales. In the latter part of the year the Tennessee Coal, Iron & Railroad Co. was prominent as a seller of foundry iron, though most of its active furnaces ran on basic pig for the Ensley steel works.

The Seaboard Iron Market

SPECIAL CORRESPONDENCE

Philadelphia and New York are the central points of the seaboard market; Philadelphia being a primary market for a considerable district in Eastern Pennsylvania, while New York is a central point for a large contracting business. The eastern markets are large buyers of foundry iron, and also take a considerable quantity of basic pig, but comparatively little bessemer iron. They are also buyers of steel billets and of finished iron and steel, being especially the chief markets for structural material.

In pig iron the seaboard markets opened the year rather quietly. Buying, as in the latter part of 1910, was generally limited to immediate needs, few foundries caring to purchase far ahead. Stocks in foundry and mill yards were generally small and were kept so during the greater part of the year; users of iron, as a rule, left the burden of carrying stocks to the blast furnaces. This plan necessitated frequent purchases and at times gave the market an appearance of greater activity than total bulk of the transactions actually warranted. An effort was made to keep up prices of foundry iron, with some success during the first quarter; but by

April the weight of unsold stocks in furnace yards and the pressure of Southern iron began to be felt, and general concessions were made, which could not afterwards be recovered. By June the general level of foundry iron was 50 to 75c. a ton lower than the moderate prices which were asked in January. Forge iron dragged throughout the first part of the year, and in fact it was a buyers' market in this grade from January to November. It was impossible to ask advances, under the prevailing conditions of large stocks and idle capacity. In July some good buying by pipe foundries gave a little boost to the market, but it did not last long enough to have any great effect. Buyers continued to take mainly small lots for early delivery, and were inclined to haggle over small reductions in prices.

With all these adverse conditions the business done reached a pretty good total, and the unsold stocks at the opening of the year were gradually reduced. Nevertheless business had to be characterized as rather uncertain and no important change came until November, when many people began to think that the bottom had been reached, and that an upward turn might be expected. This feeling brought about increased buying and the placing of contracts for the first

quarter of 1912. Some sales were made covering the first half, but users of iron for the most part were slow to give up the plan of short buying. Moreover, a special drive was made to sell Southern iron, and this was a weight upon the market. For some months \$10 Birmingham had been the accepted rate for No. 2 foundry, but at this time some considerable orders were placed at \$9.75 and even \$9.50 for early delivery. The sales then made relieved the immediate necessities of sellers, and a restoration to \$10, with \$10.25 for 1912 business, soon followed. The year closed with prices generally a shade firmer on all classes of pig iron.

Cast-iron pipe makers were generally busy during the year, and had a good trade, though many contracts were taken at low figures. The low prices stimulated city and public utility work, and sales of pipe were large and steady.

In finished material structural steel was easily the leader in the eastern markets through the greater part of the year, and it was not until October or November that other lines caught up fully. The reduction in prices which followed the break made by the Republic Iron & Steel Co. in May brought some additional business but it was not until the controlled prices were definitely aban-

doned and the open market became general that sales began to increase. As has been the case several times, the large fabricating companies began to take contracts at a rate which involved cheaper steel some time before the general break in prices actually came, and this kept structural steel in the lead. On the fall movement, however, the buying of other materials gained rapidly and then there was a general disposition to take advantage of the lower prices. Small building was stimulated and the purchases of material for this class of work reached a large total. The small buyer is on the lookout for low prices, and has more than once helped out the market in a notable way, since the aggregate of his purchases may be large.

Perhaps the most important of these was for the bridge over the East River and approaches for the New York Connecting R.R., which involves some 65,000 tons of steel. The new subways in New York, terminal and transit improvements in Philadelphia and proposed improvements in Baltimore will require large quantities of steel.

The accompanying table gives average monthly prices of pig iron and finished material at seaboard points in 1911; also prices of some leading classes of old material.

Iron Ore in Lake Superior District

By Dwight E. Woodbridge*

Insofar as the comparative figures of Lake Superior iron-ore shipments show, the year 1911 has been a disappointing one, as its total has been surpassed by every season since 1904, with the exception of 1908. Total shipments for the last year will aggregate about 32,900,000 tons, when the figures for all-rail forwardings shall have been announced. This compares with recent preceding years as below:

1902.....	27,585,904	1907.....	42,266,268
1903.....	24,308,510	1908.....	26,014,987
1904.....	21,849,401	1909.....	42,586,869
1905.....	34,384,116	1910.....	43,442,397
1906.....	38,565,762	1911.....	32,900,000

Excessive production for preceding years, as well as the condition of the iron trade at the beginning of the last season, were responsible for this tremendous shrinkage; and while there has been a decrease of about 500,000 tons in stocks of ore on hand at lower lake docks and at furnaces during the year, there is no expectation that the figures for 1912 will be much higher than those of 1911. The various mining companies of the Lake region evidently take this view, for

their preparations for the operations of next season are slight, and the winter is dull and quiet along the Lake. Many concerns are having difficulty in holding their organizations, much as they may wish to do so. The cessation of operation at mines, the lessened need of development work, both in underground and open-pit properties, and the lack of money with which to do much, have compelled the scaling down of both administrative and operative forces.

THE GREAT NORTHERN LEASES

Only in one direction has there been noteworthy activity, i.e., in the matter of taking ore from the lands under lease to the United States Steel Corporation by the Great Northern company. The contingencies of that lease were such as to demand as large shipments as possible, that minima already paid for but not mined should be forwarded, in order that interest charges on these advances might be saved. That this was no small item is evident from the fact that, at the commencement of 1911, there had been paid the Great Northern in advances on

ore not yet mined, considerably more than \$5,000,000, while the deficiency in tonnage moved was, of course, even greater. By concentrating its efforts on Great Northern lands the Steel Corporation has taken therefrom during the year nearly 5,500,000 tons. This is a most remarkable record; for not only must there be developed properties on Great Northern lands to permit such shipments, but there were difficulties of a physical nature—those due to contracts with other fee owners than the Great Northern, other minima aggregating enormous totals, all of which were to be met, and the requirements of furnaces, which demanded certain classes of ore, some of which could not be secured from Great Northern mines. Total shipments of ore for the year by the mines operated by the Steel Corporation have amounted to 13,943,000 tons, of which almost 40 per cent. was under the Great Northern lease. This total, be it remembered, is not alone from the Mesabi range, where the Great Northern lands are situated, but from all the ranges on Lake Superior on which the Steel Corporation has mines.

*Mining engineer, Duluth, Minn.

PORT SHIPMENTS

Shipments from the various Lake ports and by railroads, as given below, show the changes that have been forced by this necessity on the part of the Steel Corporation:

	1910	1911
Superior, Wis.	8,437,261	9,935,000
Duluth, Minn.	13,609,155	6,934,269
Two Harbors, Minn. .	8,826,545	6,417,523
Escanaba, Mich.	4,959,869	4,278,445
Ashland, Wis.	3,248,930	2,429,290
Marquette, Mich.	3,248,930	2,200,380
Michipicoten, Ont. . .	115,700	130,000
Key Harbor, Ont. ....	.....	6,645
All rail (1911 est.)	822,000	550,000
Total	43,568,532	32,881,552

While the Baraboo and Mayville districts have not been included in the Lake Superior region, their ores come in direct competition with it. For the year Baraboo has shipped but a few hundred tons, and Mayville the usual small amount, all rail to furnaces.

The abrogation of the Great Northern lease, assured now for the close of 1914, means that the Corporation will mine from those lands as much as possible of the minimum of 27,000,000 tons that will then have accrued. To mine it all will require the shipment of a little more than 6,000,000 tons for each of the three years, or but a trifle more than was produced therefrom during 1911. Doubtless all will be mined, and the corporation will retire from the Great Northern lands with a clean balance sheet. There is speculation in financial circles as to what effect the abrogation of this lease will have upon the Great Northern holdings. No doubt the exploration of these lands and the opening and development of mines, will enhance their value, though it will eliminate the element of speculative statement as to the tonnages existing thereon, an element that has been much in evidence the last few years. The purpose of withdrawing from this lease seems to have been to diminish the force of the allegation of monopolistic character of the Steel Corporation's ore holdings. In point of fact, and with the broad and general view of the situation that is the proper one, the ownership or loss of these lands is a matter of little importance, when viewed in connection with the reserves of available iron ore in the United States.

PROGRESS IN MINING METHODS

Progress of the year in the matter of engineering science, improvements in equipment, power, etc., has been marked. Of the items of advance in this line these stand preëminent: Electric utilization of water powers; the sinking of permanent concrete shafts, of which a dozen or more have gone down; the inauguration of scientific management and the inauguration of many plans for practical conservation of ore deposits by the dressing of lean ores and low-grade ferruginous materials.

While a first glance at the operations of the year lead one to the opinion that

abrogation of the Great Northern lease by the Steel Corporation and the reduction of ore freights from the Minnesota districts were all-important events, this is far from the truth. To the steps taken for the beneficiation of low-grade ores one should assign first place.

Space is lacking in this review to elucidate the remarkable change that has come over the iron trade in the matter of dressing and otherwise enriching Lake Superior ores.

EXPLORATION WORK

The exigencies of space forbid anything more than a passing glance at other features of an unusually interesting year. Explorations for additions to ore supplies have been more active than might have been expected, considering the practical impossibility of selling ore. But little new ore has been added to Mesabi totals, and this little was foreshadowed by work done in 1910. The tonnages near the northwest corner of T 58 R 15 have been more accurately defined, and it is now well known that a large deposit exists there, the mining of which will present some new and difficult problems in the diverting and handling of water in quantity. The runoff from a watershed of several hundreds of square miles must be diverted before this ore can be taken out. Certain arrangements of a private nature between the Oliver Iron Mining Co. and the estate of Henry Stephens resulted, toward the end of the year, in great activity in T 59 R 15, and some addition to known ore reserves may result. Throughout the year there has been active exploration by this company on its lands along the range, lands previously explored but the results on which were, for one reason or another, considered questionable.

Exploration on the Vermillion, very active a year ago, has diminished; the pace was too hot for most of those concerned. Four or five companies are working, and the prospects are excellent for an addition to known reserves in that most alluring and difficult field. On the Michigan ranges there has been little addition to former reserves, excepting around Iron River, where a great amount of work is underway, and where the tonnages known have been materially enlarged and the number of mines increased.

On the new Cuyuna range results have been encouraging. More is known of the formation, and exploration can be done more scientifically and accurately than earlier. Estimates of tonnage differ so widely that no attempt will be made to give figures, but it is unquestionable that the tonnage of merchantable ores actually measurable is still comparatively trifling. This is in part for the reason that it is extremely difficult to connect and correlate drill holes in a district

whose ore bodies dip deeply, may be narrow and short, and where no rule has yet been adduced for their appearance. An enormous amount of drilling has been done; single interests have spent, and unsuccessfully, too, as much as \$150,000, and the formations are such that holes must be frequent to prove anything definite. The district has entered upon its career as a shipper, with the forwarding of 149,000 tons by the Kennedy mine of the Rogers-Brown Ore Co. Several concrete shafts have gone down, good plants have been installed and half a dozen mines will be shipping in 1912. Most of these are bunched in the north center and northeast part of T 46 R 29, though Kennedy mine is in T 47 R 28, Adams mine in T 46 R 28 and Barrows in T 44 R 31. It is 25 miles from Kennedy to Barrows, these being the most widely separated developments of importance. But while the known tonnage of good ores is slight, there are large possibilities in the Cuyuna. Much of the ore drilled the last year is manganiferous, carrying, in rare instances, as much as 30 and 40 per cent. manganic oxide. Whether these ores exist in quantity is not yet known. Many drills are at work throughout the district, and a year from now more will be known of its deposits.

Indications are now for the shipment during 1912 from this district of not far from 400,000 tons, which is expected to come from the Kennedy and Armour mines of the Rogers-Brown interests and from the Thompson of the Inland Steel Company.

FREIGHT RATE AND ORE PRICES

Late in the year a reduction of ore freight rates from Minnesota districts to Lake Superior was made by all the railroads operating there. This reduced Mesabi range costs, effective in 1912, by 20c. and Ely rates 40c. per ton. The Cuyuna, which had a differential in its favor of 15c., is now 5c. above Mesabi rates, and the combined freight charge for a ton of Menominee range ore, delivered Lake Erie, which was formerly 55c. under Mesabi and 40c. under Cuyuna, is now but 35c. under Mesabi, though still 40c. under Cuyuna. Unless the rate from Cuyuna is modified this will affect shipments and values there unfavorably. Indeed, it is easy enough to see that the Iron River region of the Menominee has advantages that will be difficult to overcome. The Cuyuna rate will be lowered to 60c. soon.

Iron-ore prices were reduced a year ago by 50c. per ton, practically 1c. per unit, and now range from \$4.50 for Old Range bessemer down to \$3.50 for a Mesabi range nonbessemer. Notwithstanding the decline in pig-iron values since these rates were put in force there is a feeling that they are low enough, and any effort to reduce them further will be met with resistance.

Chronology of Mining for 1911

The following is a summary of the important events recorded by the JOURNAL in 1911. In some cases the dates represent the time of publicity rather than of occurrence:

JANUARY

Jan. 3—Explosion in No. 3 colliery of Nova Scotia Steel & Coal Co., at Sydney, N. S., imprisoned six men.—Fire at Rawhide mine of British Columbia Copper Company.

Jan. 4—Strike of 12,000 coal miners in Belgium.

Jan. 5—Stockholders of American Smelting & Refining Co. voted to increase capital stock by \$15,000,000, to provide for the conversion of bonds of the American Smelting Securities Company.

Jan. 10—Standard Oil 10,000-bbl. gusher in Kern oil field, California, took fire.

Jan. 14—Underground fire broke out in the workings between the Modoc and Butte & Ballaklava mines, at Butte, Mont., two men being smothered.

Jan. 15—Boston & Montana smeltery at Great Falls, Mont., shut down temporarily on account of ore freezing in bins.

Jan. 16—Announcement of phosphate discoveries near Butte, Mont.

Jan. 17—Powder explosion in Keating mine, Broadwater County, Mont., killed six, injured two and wrecked shaft.

Jan. 20—Forty miners killed in fire in Casimir colliery, Sosnowice, Russian Poland.—Five killed, seven injured by explosion in Gayton mines, about 15 miles west of Richmond, Va.—Executive Council of American Federation of Labor granted charter to Western Federation of Miners on same basis as United Mine Workers of America.

Jan. 25—Explosion at the Hughestown No. 10 colliery of Pennsylvania Coal Co., at Pittston, Penn., killed six men and seriously injured five more.

Jan. 30—Arrival at Toronto of first bullion shipment from Porcupine.

FEBRUARY

Feb. 5—Entrance of Bewick, Moreing & Co. into the Porcupine district, Ont.

Feb. 6—Three men killed at the mine of the Independent Coal & Coke Co., at Kenilworth, Utah, by striking Greek miners.

Feb. 9—Explosion at Cokedale mine of American Smelting & Refining Co., near Trinidad, Colo., killed nine men.—Organization of international antimony convention at Paris, embracing producers of all countries of the world, the purpose be-

ing to regulate production and prices, the agreement to continue for three years.

Feb. 14—The mill of the Veta Colorado company, at Parral, commenced crushing.

Feb. 18—The 40-stamp mill of the Tajo de Dolores mine of the Proprietary Mines Co. began crushing.

Feb. 23—Fire in the Belmont mine, Tonopah, Nev., resulted in the death of 17 men.

Feb. 26—Fire discovered in the Hazel mine of the Pittsburgh-Buffalo Coal Co., near Canonsburg, Penn.

MARCH

March 6—U. S. Circuit Court at San Francisco denied application for permanent injunction against the Montana smelters on account of alleged smoke damages.

March 9—Calumet & Hecla merger approved by the companies that were to go into the consolidation.—Lehigh Coal & Navigation Co. announced plan to build large power plants for transmission of power to be generated at its anthracite mines.

March 11—Slide of bank at Norman mine of Oliver Iron Mining Co. at Virginia, Minn., killed 14 workmen.

March 13—Announcement that Amalgamated Copper Company planned to absorb United Metals Selling Co. by purchase at \$12,300,000.

March 15—Miami mill went into operation with one section.

March 18—Explosion in mine No. 16 of M. K. & T. Ry. Co. at West Mineral, Kan., killed one man, and five men attempting to rescue him were killed.—David H. Moffat, of Denver, died in New York.

March 20—Ray Consolidated mill started first unit.

March 22—Nine men killed by fall of roof in Hazel mine, of Pittsburgh-Buffalo Coal Co., at East Canonsburg, Penn.

March 23—Ray Consolidated and Chino Copper Co. stocks listed on New York Stock Exchange.

March 28—S. F. Emmons died at Washington.

March 30—Completion of Copper River & Northwestern R.R. to Kennicott, Alaska.

March 31—Dr. Rossiter W. Raymond resigned secretaryship of the American Institute of Mining Engineers.

APRIL

April 1—Strike of coal miners in Alberta and British Columbia.

April 3—U. S. Supreme Court upheld commodity clause of the interstate com-

merce law which prevents a railroad from owning stock in a coal corporation along its lines.

April 6—First shipment of copper ore from Kennicott, Alaska, via Copper River & Northwestern Railway.

April 7—Seventy-three men killed in explosion in Pancoast coal mine at Throop, Penn.

April 8—Explosion at Banner Coal mine, Birmingham district, Ala.; 128 men killed.

April 11—U. S. Steel Corporation inaugurated its coke-oven plant at Gary, Indiana.

April 19—Strike of zinc smelters at Bartlesville, Okla.—Renewal of the Chilean Nitrate Association.

April 21—Cut of 50c. per ton in Lake iron-ore price.

April 24—Explosion in Ott mine, No. 20, of Davis Coal & Coke Company, near Elk Garden, W. Va., killed 10 men.

April 27—Settlement of zinc smelters' strike.

MAY

May 5—Seven men killed by fire in the Hartford mine of Republic Iron & Steel Co. at Negaunee, Mich.

May 8—Leaching plant of the Warrior Copper Co. in Gila County, Ariz., destroyed by fire.

May 11—Fire in the Boston colliery of the Delaware & Hudson company at Larksville, Penn., suffocated five men.

May 12—The mine tibble and buildings of the Pierson colliery near Jasonville, Ind., were destroyed by fire.

May 15—Supreme Court ordered dissolution of the Standard Oil Co. of New Jersey.

May 19—Bush fires at Porcupine destroyed surface plant of Hollinger and other mines in Pearl and Gilies Lake sections.

May 24—Cut in steel prices started by Republic Iron & Steel Company.

JUNE

June 1—Fire burns bunk and boarding house at Nevada Consolidated; loss, \$100,000.

June 15—First payment on Hidden Creek mine, British Columbia, made by Granby company.

June 20—Reopening of the St. Louis mine in the Lake Superior copper country started by Calumet & Hecla company.

June 21—Dissolution of the E. I. du Pont de Nemours Powder Co. ordered because of violation of the Sherman anti-trust act.

June 26—Denial of injunction asked by G. M. Hyams against proposed Calumet & Hecla merger.

June 26—Cunningham coal claims cancelled by the General Land Office.

June 28—Dismissal of suit brought by minority stockholders against Greene Consolidated Copper Co., the Greene-Cananea Copper Co. and their officers and directors.

June 29—Eighty-four wire officials and employees indicted for illegal restraint of trade.

JULY

July 1—Opening of railway into Porcupine.

July 5—International meeting of representatives of the steel industry at Brussels, Belgium.

July 11—Forest fires in Porcupine district resulted in great loss of life and property.—Coniagas smeltery and coke building at Thorold, Ont., destroyed by fire.

July 15—Explosion in mine of Cascade Coal & Coke Co., at Sykesville, Penn., killed 21 men.

July 17—Government filed suit to compel separation of Reading railroad from Reading Coal Company.

July 21—Government filed suit against American Smelting & Refining Co. for \$2,500,000 damages, in connection with Colorado coal lands.

July 22—Dismissal of charges against American Smelting & Refining Co., alleging a monopoly in restraint of trade.—Cessation of smelting at Balaklava works, owing to smoke trouble—Shafthouse and timbering No. 11, Calumet & Hecla, destroyed by fire.

July 25—Announcement of sale of Gold Road mine in Arizona to United States Smelting, Refining & Mining Co. for \$1,600,000.

July 29—Strike of zinc smelters at Caney and Deering, Kan., and suspension of operations at those smelteries.

July 31—Temporary injunction granted to minority stockholders of Osceola Consolidated Mining Co., in Calumet & Hecla merger.

AUGUST

Aug. 1—Explosion in mine of Standard Pocahontas Coal Co. at Shannon, W. Va., killed three men.

Aug. 4—Suit filed by government at Columbus, Ohio, against six railroad companies and three coal-mining companies, charging combination in restraint of trade.

Aug. 10—A four-deck cage dropped in the Krupp-Hannibal mine near Bochum, Germany, killing 25 men.

Aug. 14—Announcement of purchase by the American Smelting & Refining Co. of the Tiro General mines at Los Charcos, San Luis Potosi, Mex., and of the Central Potosi R.R., for \$800,000 gold.

Aug. 15—Granby smeltery in Boundary district, British Columbia, closed for lack of fuel due to strike.

Aug. 17—Collapse of strike at Caney and Deering, Kansas.

Aug. 19—Cave-in at the openpit of the Buffalo & Susquehanna mine on Mesabi range, buried 12 men and caused several fatalities.

Aug. 22—Contract executed for sale of Ray Consolidated smeltery to American Smelting & Refining Company.

Aug. 23—Explosion and fire at new shaft of Giroux Consolidated company resulted in seven deaths and damage to shaft.

Aug. 30—Confirmation of sale of Cleveland mine in Idaho to Federal Mining & Smelting Co.—Case of Fred J. Bliss against Anaconda Copper Co., based on smeltery fume troubles, reached United States Supreme Court.

SEPTEMBER

Sept. 1—Dissolution of the international antimony syndicate, it having proved a fiasco.

Sept. 2—Hoisting accident at Calumet & Hecla mine destroyed hoist and engine-house.

Sept. 3—Six men killed in a hoisting accident at Butte & Superior mine.—Fire caused total destruction of Hall smeltery at Nelson, B. C.

Sept. 4—Two miners were killed and several injured in hoisting accident at Red Jacket shaft of Calumet & Hecla mine.—Two men were killed in hoisting accident at Daly West mine.

Sept. 5—Second suit filed against Mason Valley Mines Co., to prevent operation of smeltery.—Butte & Ballaklava Copper Co. resumed ore shipments after a year's suspension due to litigation.

Sept. 16—Three men, imprisoned by a cave-in in Morning Star mine, Colorado, were rescued alive.

Sept. 23—Inauguration of strike at Mt. Lyell copper mines in Tasmania.

Sept. 30—Superior & Boston stockholders voted favorably on plan of consolidation with the Arizona Commercial Copper Company.

OCTOBER

Oct. 2—Announcement of plan for reorganization of Arizona Commercial Copper Company.

Oct. 6—Calumet & Hecla company announced the abandonment of the merger plans.

Oct. 10—Opening of the 101st meeting of the American Institute of Mining Engineers in San Francisco.

Oct. 18—Explosion in Bardot coal mine, France, killed 26 men.

Oct. 19—Raritan Copper Works instituted suit against the government for recovery of platinum contained in gold delivered to New York Assay Office.

Oct. 20—New Langdon shaft of Whar-ton Steel Company at Hibernia, N. J., flooded and 12 men drowned.

Oct. 21—First section of Chino mill placed in operation.—Explosion in a mine at Trabonella, Italy, reported to have killed or injured 100 men.

Oct. 22—Fire damaged Kingdon shaft of Old Dominion company at Globe, Arizona.

Oct. 23—Explosion in O'Gara mine No. 9, at Harrisburg, Ill., killed 8 and injured 10 men.

Oct. 24—The 14th annual session of American Mining Congress opened in Chicago.—Fire destroyed Butte Reduction Works at Butte, Mont., entailing \$350,000 loss, one-half insured.

Oct. 26—Steel Corporation officially announced intention to cancel Great Northern ore lease and to reduce freight rates 20c. per ton on its Minnesota range roads.—Government filed suit in Trenton, N. J., against Steel Corporation, its subsidiaries and officers, under Sherman anti-trust law.

NOVEMBER

Nov. 3—Waldemar Lindgren was appointed chief geologist of the U. S. Geological Survey.

Nov. 9—Explosion in Adrian mine, of Rochester & Pittsburg Coal & Iron Co., at Punxsutawney, Penn., killed eight men.

Nov. 11—Cripple Creek deep-drainage tunnel encountered a flow of water which resulted in draining the lower levels of several important mines.—Settlement of strike at Mt. Lyell copper mines in Tasmania.

Nov. 15—Freight reductions went into effect between Salt Lake City and Missouri River points.

Nov. 16—District court, at Colorado Springs, Colo., issued temporary injunction restraining the sale of 11 Cripple Creek properties for taxes.

Nov. 17—Canadian coal strike settled by agreement signed at Hosmer, B. C., under which the miners returned to work on Nov. 20.

Nov. 18—Explosion in mine of Bottom Creek Coal & Coke Co., at Vivian, W. Va., killed 18 men.

Nov. 22—Announcement that Consolidated Gold Fields of South Africa had acquired extensive interests in Alaskan dredging lands, through the operations of the Granville Mining Company.

Nov. 23—Bankruptcy proceedings were commenced in the United States Court, in New York, against the Nevada-Utah Mines & Smelters Corporation.

Nov. 24—John D. Ryan purchased control of Live Oak Development Co. at \$30 per share, preliminary to merger of porphyry-copper properties in the Miami district, Arizona.

Nov. 25—Governor Johnson appointed William H. Storms as state mineralogist of California.

DECEMBER

Dec. 1—Fifth unit of Miami concentrator started.—Standard mill of United States Reduction & Refining Co., at Colorado City, Colo., closed.

Dec. 4—Mill of Florence-Goldfield Company, at Goldfield, Nev., destroyed by fire, entailing a \$400,000 loss.

Dec. 10—Explosion in coal mine of Knoxville Iron Co., at Briceville, Tenn., killed 84 men.

Dec. 19—Announcement of formation of Inspiration Consolidated Copper Co., to include the Live Oak and Inspiration

companies.—Litigation in connection with the attempted Calumet & Hecla merger was officially dismissed.—Directors of the Butte Coalition Mining Co., voted to dissolve the corporation and to distribute its assets.

Dec. 20—Arrangements completed to distribute the assets of the Alice Gold & Silver Mining Company.

Dec. 21—Production was resumed by the Granby company in British Columbia.

Dec. 22—Arrangements completed to distribute the assets of the Parrot Silver & Copper Company.

Dec. 23—The Cross Tetley coal mine at Wigan, England, was flooded, 200 miners escaping with difficulty.

Dec. 28—Fire destroyed a portion of Golden City, in the Porcupine district, Ontario.

Dec. 29—Allis-Chalmers company announced its intention to default interest due Jan. 1, 1912, on its bonds.

Dec. 31—The firm of Wernher, Beit & Co., of London and South Africa, was dissolved by mutual consent, the diamond branch being transferred to the firm of L. Breitmeyer & Company.

Mining Company Dividends in 1911

The tables published herewith show the dividends paid in 1911 and to date by a number of the principal mining, metallurgical, holding and industrial companies in the United States, and by mining companies in Canada, Mexico and in Central America. The foreign companies listed are mostly those in which American capital is heavily interested. Drawing this line is, of course, to some extent a matter of opinion, and as at the present done, excludes many of the most noted Mexican mines and mining companies, for instance: Boleo, Mexican, Mexico Mines of El Oro, Soledad, Santa Gertrudis, Santa Maria del Paz, and Teziutlan.

Totals of such a list necessarily cannot be regarded as complete, as there are many profitable close corporations, the dividends of which are not published, and other companies are omitted for various reasons. Moreover, there is unfortunately a certain amount of duplication. For instance, a portion of the dividends of Utah Copper is paid from dividends received from Nevada Consolidated, while Anaconda and Amalgamated Copper dividends are two payments with the same money. However, the figures serve to indicate the importance of the mining industry.

COMPARISON OF 1911 AND 1910 RECORDS

Direct comparison of the table published herewith and that of a year ago cannot be made. To a certain degree the policy of frankness is becoming more prevalent in mining circles, and data are available which were not in past years, consequently a few names appear, new to the table, which are those of old dividend payers. The disappearance of a few old names will also be noted. Some, like Cumberland-Ely, are the victims of absorption; others, such as Atlantic, Central Eureka, C. K & N., Creede United and Findley, seem to have no present place in a dividend table.

MINING COMPANIES—UNITED STATES

NAME OF COMPANY AND SITUATION	SHARES		DIVIDENDS PAID					
	Issued	Par Value	1911		To Date	Latest		
			Per Share	Total	Total	Date	Amt.	
Acacia, g.	Coio.	1,438,989	\$ 1	30.00	\$7,195	\$122,004	Jan. '11	\$0.00
Adams, s.c.	Coio.	80,000	10			778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	50,000	25	2.00	100,000	100,000	Nov. '11	2.00
Alaska Goldfields	Alas.	250,000	5			342,500	Jan. '10	0.15
Alaska Mexican, g.	Alas.	180,000	5	0.70	126,000	2,868,381	Nov. '11	0.20
Alaska Treadwell, g.	Alas.	200,000	25	2.00	400,000	12,135,000	Nov. '11	0.50
Alaska United, g.	Alas.	180,200	5	0.45	81,009	738,689	Nov. '11	0.30
Am. Zinc, Lead & Sm.	Kan.	80,120	25	2.00	160,240	560,420	Oct. '11	0.50
Anaconda, c.	Mont.	6,000,000	25	2.00	12,000,000	66,960,000	Oct. '11	0.50
Argonaut, g.	Cal.	200,000	5			1,200,000	June '10	0.05
Arizona Copper, pf.	Ariz.	1,266,120	1.20	a	119,221	1,943,780	Nov. '11	0.047
Arizona Copper, com.	Ariz.	1,519,896	1.20	b	461,668	13,768,469	July '11	0.30
Bagdad-Chase, g., pf.	Cal.	84,819	5			202,394	Jan. '09	0.10
Bald Butte, g.s.	Mont.	250,000	1			1,354,648	Oct. '07	0.04
Baltic, c.	Mich.	100,000	25	10.00	1,000,000	7,500,000	June '11	5.00
Beck Tunnel, g.s.l.	Utah	1,000,000	0.10			675,000	Oct. '08	0.02
Benton, z.l.	Wis.	196,607	1			10,949	Oct. '07	0.01
Bingham-New Haven, c.	Wis.	228,690	5	0.80	197,812	225,612	Dec. '11	0.10
Board of Trade, z.	Wis.	120,000	1	0.05	6,000	60,000	Jan. '11	0.05
Bonanza Dev.	Colo.	300,000	1	0.20	60,000	1,425,000	Oct. '11	0.20
Boston-Sunshine, g.	Utah	150,200	1	0.03	5,632	27,261	Nov. '11	0.03
Boston & Montana, c.	Mont.	150,000	25	4.00	600,000	71,825,000	Feb. '11	4.00
Bull., Beck & Champ., g.	Utah	100,000	10			2,728,400	July '08	0.00
Bunker Hill Con., g.	Ida.	200,000	1	0.52	105,000	511,000	Oct. '11	0.07
Bunker Hill & Sull., l.s.	Ida.	327,000	10	2.65	866,550	13,159,650	Dec. '11	0.20
Butte & Ballaklava, c.	Mont.	250,000	10			125,000	Aug. '10	0.50
Caledonia, l.s.c.	Ida.	1,300,000	1			52,000	June '10	0.00
Calumet & Arizona, c.	Ariz.	650,000	10	4.00	2,150,000	13,850,000	Dec. '11	1.00
Calumet & Hecla, c.	Mich.	100,000	25	24.00	2,400,000	115,850,000	Dec. '11	6.00
Camp Bird, g.s.	Colo.	1,100,000	5	0.48	534,600	7,314,300	Sept. '11	0.24
Centennial-Eur., l.s.g.c.	Utah	100,000	5	6.00	600,000	3,300,000	Oct. '11	3.00
Center Creek, l.z.	Mo.	100,000	10	0.15	15,000	425,000	Oct. '11	0.05
Champion, c.	Mich.	100,000	25	2.00	200,000	6,100,000	Sept. '11	1.00
Cliff, g.	Alas.	100,000	1	0.50	50,000	155,000	Aug. '11	0.10
Cliff, s.l.	Utah	300,000	1	0.20	60,000	60,000	Dec. '11	0.10
Colo. Gold Dredging.	Colo.	100,000	10	0.25	25,000	125,000	Sept. '11	0.25
Colorado, l.s.g.	Utah	1,000,000	0.20	0.12	120,000	2,450,000	Dec. '11	0.03
Columbus Con.l.g.s.	Utah	285,540	5			226,832	Oct. '07	0.20
Commercial Gold.	Ore.	1,750,000	1			43,750	Dec. '09	0.00
Con. Mercur, g.	Utah	1,000,000	1			3,385,313	Dec. '06	0.02
Continental, z.l.	Mo.	22,000	25	0.50	11,000	242,000	Jan. '11	0.50
Copper Range Con., c.	Mich.	384,185	100	3.50	1,347,500	12,104,216	Oct. '11	0.75
Daly-Judge, s.l.	Utah	300,000	1	0.15	45,000	270,000	Oct. '11	0.15
Daly West, s.l.	Utah	180,000	20	0.90	162,000	6,363,000	Oct. '11	0.30
De Lamar, g.s.	Ida.	80,000	5			845,640	Sept. '08	0.30
Dr. Jack Pot Con., g.	Colo.	3,000,000	0.10	0.00	15,000	90,000	Mar. '11	0.00
Doe Run, l.	Mo.	65,782	100	6.00	394,698	2,941,849	Dec. '11	1.50
Elkton Con., g.	Colo.	2,500,000	1	0.06	150,000	2,929,460	Dec. '11	0.01
El Paso, g.	Colo.	2,450,000	1	0.01	24,500	1,438,045	June '11	0.01
Federal M. & Sm., com.	Ida.	60,000	100			2,708,750	Jan. '09	1.50
Federal M. & Sm., pf.	Ida.	120,000	100	7.00	840,000	6,851,250	Dec. '11	1.75
Florence, g.	Nev.	1,050,000	1	0.10	105,000	840,000	Apr. '11	0.10
Frances Mohawk, g.	Nev.	912,000	1			546,000	Apr. '08	3.00
Free Coinage, g.	Colo.	10,000	100			180,000	Dec. '09	1.00
Fremont Con., g.	Cal.	200,000	2.50	0.02	40,000	110,000	Oct. '11	0.02
Frontier, z.	Wis.	1,239	100	35.00	42,745	117,085	Oct. '11	3.00
Gemini-Keystone.	Utah	5,000	100	6.00	130,070	2,130,000	Oct. '11	0.02
Gold Coin of Victor	Colo.	1,000,000	1			1,350,000	Feb. '09	0.02
Gold Dollar Con., g.	Colo.	2,500,000	1			62,500	Oct. '09	0.00
Gold King Con., g.	Colo.	5,750,370	1			82,500	Feb. '11	0.03
Gold Roads.	Ariz.	300,000	10	0.03	172,511	1,407,319	Nov. '06	0.25
Gold Sovereign.	Colo.	1,800,000	1			150,000	Nov. '09	0.00
Golden Cycle, g.	Coio.	1,500,000	1	1.00	1,500,000	30,000	Oct. '11	1.00
Golden Star, g.	Ariz.	400,000	5			2,073,300	Nov. '10	0.05
Goldfield Alamo, s.l.	Nev.	700,000	1			140,000	Mar. '10	0.03
Goldfield Comb. Fra., g.	Nev.	925,000	1			42,000	May '09	0.10
Goldfield Con., g.	Nev.	3,558,367	10	2.00	7,117,696	32,111	Nov. '11	0.50
Grand Central, g.	Utah	250,000	1	0.05	12,500	18,144,772	Oct. '11	0.05
Granite, g.	Colo.	1,650,000	1			1,570,000	Dec. '10	0.01
Hazel, g.	Cal.	900,000	1			263,000	Dec. '10	0.00
Hecla, l.s.	Ida.	1,000,000	0.25	0.24	240,000	711,000	Dec. '11	0.02

Of the American mining companies, Ahmeek, Cliff (Utah), Insurgent, Jumbo Extension, Manhattan-Big Four, Moscow and Pittsburg-Idaho, entered the lists of dividend payers. The rejuvenated Mexican and Ophir on the Comstock lode also paid dividends, showing that there was more than sentiment behind the efforts to rehabilitate these old mines. The Comstock-Phoenix, a close corporation, also situated on the Comstock lode, likewise made returns to its shareholders. Possibly the most spectacular disbursement was the 100% dividend of the Golden Cycle, just before Christmas.

Alaska-Goldfields, Argonaut, Butte & Ballaklava, Caledonia, Golden Star, Goldfield-Alamo, Granite, Haze, Iowa, Kennedy, Liberty Bell, Little Bell, MacNamara, Mary McKinney, National, Pearl Consolidated, Pharmacist, Red Metals, Round Mountain, Tri-Mountain, United (Cripple Creek), Utah (silver-lead), Valley View, Victoria and Yak, all dropped from their position of dividend payers.

Excluding duplications of payment, so far as is possible, the Michigan copper mines in 1911 returned \$5,576,000 to their stockholders, an amount fairly comparable with the \$6,295,106 dividends paid by Utah Copper, Utah Consolidated, and by Nevada Consolidated (excluding payments to the Utah Copper Co). Unfortunately the Nevada-Utah district totals cannot be estimated as a whole, for the United States Smelting Co. dividends are not announced, and appear, merged with the totals from the refinery operations and the Mammoth smeltery and Real del Monte plant of the U. S. Smelting, Refining & Mining Co.

However, even including the total dividends paid by the last-named corporation, \$2,703,000, the Nevada-Utah district makes a small showing before the total of \$11,734,000 paid by Arizona companies to their shareholders, or to the \$12,000,000 and over of the Butte district.

New Idria is the only quicksilver-mining company paying dividends regularly. The dividend paid by Napa Consolidated was in final liquidation of its assets, and consequently was more of a return of stock subscription than a true dividend.

The banner gold mine, for dividends, was again Goldfield Consolidated, with \$7,117,696, the same as paid in 1910; Golden Cycle second, with \$1,500,000; Yukon Gold third, with \$1,312,000; and Homestake fourth, with \$1,310,400. Golden Cycle paid no dividends in 1910, Homestake \$1,092,000, and Yukon Gold \$1,400,000. Tonopah-Belmont, and the Tonopah Mining Co. also gave fine results, with \$1,350,000, and \$1,600,000 respectively, both increases over 1910.

Among the foreign mines listed, the Cobalt district still challenges admiration with \$5,813,000 in dividends, and earnings even greater. British Columbia

MINING COMPANIES—UNITED STATES—(Continued)

NAME OF COMPANY AND SITUATION	SHARES		DIVIDENDS PAID			
	Issued	Par Value	1911		To Date	Latest
			Per Share	Total	Total	Date Amt.
Hercules, I.S.	1,000,000	\$1	\$0.15	\$150,000	\$3,650,000	July '11 \$0.06
Homestake, g.	218,400	100	6.00	1,310,400	27,539,040	Dec. '11 0.50
Horn Silver, c., s.c.z.l.	400,000	25			5,642,000	Sept. '07 0.05
Imperial Copper	500,000	10			300,000	June '07 0.20
Insurgent, g.	100,000	1	0.12½	12,500	12,500	Apr. '11 0.12½
Iowa-Tiger, g.s.l.	12,655	1			12,655	..... '09 1.00
Iowa, g.s.l.	1,666,667	1	0.01	16,667	200,166	June '11 0.00½
Iron Blossom, s.l.g.	1,000,000	0.10	0.32	320,000	1,000,000	Dec. '11 0.03
Iron Silver, s.g.	500,000	20	0.15	150,000	4,450,000	July '11 0.05
Jamison, g.	390,000	10	0.02	7,800	378,300	Jan. '11 0.02
Jerry Johnson, g.	2,500,000	0.10	0.10	25,000	150,000	Aug. '11 0.10
Jumbo Ext., g.s.	971,657	1	0.10	97,166	97,166	July '11 0.10
Kendall, g.	500,000	5	0.08	40,000	1,365,000	Oct. '11 0.02
Kennedy, g.	100,000	100			1,831,001	Apr. '10 0.03
King of Arizona, g.	200,000	1			396,000	Aug. '09 0.12
Klar-Piquette, z.l.	20,000	1	3.62½	72,500	72,500	Oct. '11 0.25
Liberty Bell, g.	130,551	5			522,093	Oct. '10 1.00
Little Bell, I.S.	300,000	1			60,000	Sept. '10 0.05
Little Florence, g.	1,000,000	1			430,000	Jan. '08 0.03
Lower Mammoth	250,000	1			57,000	Sept. '07 0.02½
MacNamara, s.g.	728,341	1			40,213	May '10 0.07½
Mammoth, g.s.c.	400,000	25			2,220,000	Mar. '08 0.05
Manhattan-Big Four, g.	762,000	1	0.04	30,480	30,480	Aug. '11 0.02
Mary McKinney, g.	1,309,252	1			894,363	June '10 0.01
May Day, g.s.l.	800,000	0.25			108,000	Sept. '08 0.01½
Mexican, g.	201,600	2.50	0.10	20,160	20,160	Aug. '11 0.10
Mohawk Min. Co.	100,000	25	1.75	175,000	2,325,000	Aug. '11 0.75
Monarch-Madonna, g.s.l.	1,000,000	1.00	0.02	20,000	40,000	May '11 0.01
Montana-Tonopah, s.g.	921,865	1	0.12	120,000	330,000	Dec. '11 0.06
Moscow M. & M., g.s.l.	850,000	1.00	0.02	17,000	17,000	Dec. '11 0.21
Modoc, g.s.	500,000	1.00	0.02	10,000	275,000	Dec. '11 0.01
Mountain, c.	250,000	25			4,216,250	May '08 0.44
Napa Con., g.	100,000	7	0.40	40,000	1,840,000	July '11 0.40
National, g.	750,000	1			360,000	Sept. '10 0.05
Nevada Con., c.	1,995,547	5	1.50	2,957,538	6,729,540	Dec. '11 0.37½
Nevada Hills, g.	746,000	5			373,000	Dec. '07 0.10
New Century, z.l.	330,000	1			237,600	Oct. '09 0.01
New Idria, q.	100,000	5	1.60	160,000	1,450,000	Oct. '11 0.30
North Butte, c.	410,000	15	1.20	492,000	9,758,000	Oct. '11 0.30
North Star, g.	250,000	10	1.70	425,000	3,486,989	Dec. '11 0.80
Old Dominion M. & Sm.	162,000	25	3.00	486,000	1,822,000	Oct. '11 1.00
Ophir, s.g.	201,600	3	0.10	20,160	2,048,200	Nov. '11 0.10
Ophongo, g.s.l.	898,978	0.25	0.01	8,990	8,990	June '11 0.01
Oroville Dredging	700,000	5			1,383,036	Dec. '09 0.12
Osceola, I.S.	96,150	25	7.50	721,125	9,679,775	July '11 3.50
Osceola, I.Z.	500,000	5			245,000	June '07 0.10
Parrot, c.	229,850	10	0.60	137,908	7,014,511	Nov. '11 0.15
Pearl Con., g.	1,909,711	0.05			181,422	Dec. '10 0.02
Pharmacist, f.	1,500,000	1			87,500	Feb. '10 0.01½
Pioneer, g.	5,000,000	1	0.03	150,000	2,041,526	Oct. '11 0.03
Pittsburg-Idaho, I.	1,000,000	1	0.08	80,000	80,000	Oct. '11 0.04
Platteville, I.Z.	500	40			179,500	June '07 10.00
Portland, g.	3,000,000	1	0.06	180,000	8,917,080	Oct. '11 0.02
Quartette, g.s.	101,000	10			430,000	Sept. '07 0.10
Quilp, g.	1,500,000	1	0.02	30,000	52,500	June '11 0.01
Quincy, c.	110,000	25	4.00	440,000	19,880,000	Dec. '11 1.00
Red Metals, c.	110,000	100			3,500,000	Dec. '10 2.27
Republic, g.	1,000,000	1			85,000	Nov. '10 0.01½
Rochester, I.Z.	4,900	100			136,947	Jan. '09 1.00
Round Mt., g.	866,426	1			328,404	Sept. '10 0.04
St. Joseph, I.	1,000,000	10	0.50	600,000	7,958,357	Dec. '11 0.15
Shannon, c.	300,000	10			450,000	July '07 0.50
Shattuck-Arizona, c.	350,000	10	1.00	350,000	1,050,000	Jan. '11 1.00
Silver Hill, s.g.	108,000	1			81,000	June '07 0.05
Silver King Coal, I.S.	1,250,000	5			1,659,885	Jan. '10 0.15
Sioux Con., I.S.g.	746,389	1	0.12	89,448	872,097	July '11 0.10
Skidoo, g.	1,000,000	5	0.07½	75,000	175,000	July '11 0.07½
Snowstorm, c.g.	1,500,000	1			1,005,000	Aug. '10 0.01
Standard Con., g.s.	178,394	10			5,194,130	Dec. '08 0.01
Stratton's Ind., g.	1,000,000	0.60	0.06	60,625	303,125	Nov. '11 0.06
Success	1,000,000	1	0.02	30,000	685,000	Dec. '11 0.01
Swansea, s.l.	100,000	5			329,500	Mar. '07 4.00
Tamarack, c.	60,000	25			9,420,000	July '07 4.00
Tennessee, c.	200,000	25	1.50	300,000	2,606,250	Jan. '11 1.50
Tomboy, g.s.	300,000	4.85	0.56	168,000	2,792,400	June '11 0.56
Tonopah-Belmont, s.g.	1,500,000	1	0.90	1,350,000	2,093,003	Oct. '11 0.25
Tonopah of Nev., s.g.	1,000,000	1	1.60	1,600,000	8,050,000	Oct. '11 0.40
Tonopah Midway, s.g.	1,000,000	1			250,000	Jan. '07 0.05
Tri-Mountain, c.	100,000	25			950,000	Dec. '10 1.00
Tuolumne, c.	800,000	1	0.45	360,000	360,000	Aug. '11 0.15
Uncle Sam, g.s.l.	500,000	1	0.15	75,000	495,000	Sept. '11 0.05
United Copper, com.	450,000	100			5,962,500	Aug. '07 1.75
United Copper, pf.	50,000	100			1,500,000	May '07 3.00
United, z.l., com.	92,400	5			27,490	Oct. '08 0.05
United, z.l., pf.	19,556	25			312,782	Jan. '08 0.50
United (Crip. Ck.) g.	4,000,100	1			440,435	Jan. '10 0.04
United Globe, c.	23,000	100	5.00	115,000	494,500	Dec. '11 5.00
United Verde, c.	300,000	10	8.25	2,475,000	29,422,000	Dec. '11 0.75
Utah, s.l.	100,000	10			325,000	Dec. '10 0.02
Utah Copper, c.	1,526,599	10	3.00	4,687,788	11,497,238	Dec. '11 0.75
Utah Con., c.	300,000	5	0.50	150,000	7,050,000	Nov. '11 0.50
Valley View, g.	1,000,000	1			240,000	Dec. '10 0.04
Victoria, g.s.l.	251,000	1			207,500	Mar. '10 0.04
Vindicator Con., g.	1,500,000	1	0.09	35,000	2,407,500	Oct. '11 0.03
Wasp No. 2, g.	447,900	1	0.05	25,000	265,595	Oct. '11 0.02
Wolverine, c.	60,000	25	9.00	540,000	6,840,000	Oct. '11 4.00
Work, g.	1,500,000	1			172,500	July '08 0.00½
Yak, s.l.	1,000,000	1			1,417,685	Oct. '10 0.04
Yankee Con., s.l.g.	1,000,000	1			182,500	Jan. '07 0.03
Yellow Aster, g.	100,000	10			1,061,879	Aug. '07 0.20
Yukon Gold, g.	3,500,000	5	0.37½	1,312,500	3,412,500	Dec. '11 0.07½
Total				\$57,564,832		

Quicksilver in the United States

The production of quicksilver in the United States has been substantially stationary for many years. In 1911 there was a small decrease. The statistics of production for the last three years are given in the following table:

State	1909	1910	1911
California.....	16,217	18,536	17,000
Texas.....	4,188	3,382	4,000
Others.....	810	500	500
Total.....	21,215	22,418	21,500

The above figures represent flasks of 75 lb., which are now the standard of the trade.

Quicksilver in California in 1911

BY LEWIS H. EDDY*

Careful estimate places the production of quicksilver in California in 1911 at 17,000 flasks of 75 lb. Under normal conditions the 1911 output should have exceeded that of 1910 by 1200 to 1500 flasks instead of only approximately equaling it. The extraordinary floods in February and March, which washed out many miles of roads, both wagon and

traced or developed in these smaller mines was of low grade. The impression obtained in the early part of the year that the dissolution in April of the Eureka company, of California, which had for many years been the selling agency for practically all the product of the state, might stimulate production in the smaller mines; but if it had any effect it was apparently to discourage production.

Whatever the cause in part or in whole, the result was that in 1911 the total output of these counties outside of San Benito and Santa Clara was not more than 500 flasks. Of the total production in the state 10,000 flasks came from the New Idria and 6500, approximately, from the New Guadalupe and the Almaden. In the former mine there has been steady advance in development and, with the exception of February and March, a steady production. In Santa Clara County there have been some new orebodies opened and progressive development and increased output; this is true particularly of the New Guadalupe.

have been made in time to resume operations this winter. In Sonoma County the Cloverdale mine has been reopened and the furnace started. A company was formed in November for the taking over and reopening of the Mercy mine in Fresno County. The mine formerly operated by Alvinza Hayward in Stanislaus County has been taken over by a newly organized company. A good prospect and active development of claims located in Monterey County have been reported.

Altogether the outlook for new work both in the small and large mines and in new claims is encouraging, and the present indications are that 1912 will show a larger output of quicksilver than 1911, notwithstanding the decrease in the output of the former small producers. The fact that Santa Clara County mines increased their production and the normal output of the New Idria would have been an increase over 1910 offers an inducement to the prospector for new cinnabar deposits and is an encouragement to the owners and operators of the properties that have been idle during the last few years. While low prices seem to have had effect on the small mines that were in operation in 1910, that condition does not appear to be discouraging to the prospector or the prospective operator of old mines which have been a long time idle. The prices for 1911 did not vary greatly from 1910; the average was about \$44 per flask for 1911, though there were some small lots that sold as high as \$52, while the maximum for ordinary sales was about \$50.

Quicksilver in Texas in 1911

BY WILLIAM B. PHILLIPS*

In 1911, the quicksilver industry in Texas ran on an even keel, the estimated production for the year being 3400 flasks, about the same as for 1910. There was little or no exploitation of new ground and none of the companies that were idle in 1910 resumed operations.

The deep shaft of the Chisos Mining Co. should now be approaching the Buda limestone, if it has not already reached it, and it will be important to observe whether there is any material change in the character of the ore after it has left the overlying bituminous shales. No other shaft in that part of the district has reached so great a depth, 600 ft., nor have any workings in the entire region known as the Terlingua district yielded any better material. The

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AVERAGE MONTHLY PRICE OF QUICKSILVER
(PER FLASK OF 75 LB.)

	1910			1911		
	New York	San Francisco		New York	San Francisco	
		Domestic	Export		Domestic	Export
January.....	\$52.20	\$50.90	\$48.90	\$42.00	\$41.63	\$39.63
February.....	50.00	49.50	47.50	48.69	48.00	46.00
March.....	49.25	48.75	46.75	52.00	51.00	49.00
April.....	48.00	47.56	45.56	49.40	48.90	46.40
May.....	47.60	47.15	45.15	45.00	44.50	42.00
June.....	47.00	46.25	44.25	43.75	43.44	40.94
July.....	46.00	45.88	44.25	48.00	47.60	45.10
August.....	46.00	45.50	43.50	48.25	47.63	45.13
September.....	47.00	46.25	43.88	46.88	46.50	44.00
October.....	45.80	45.40	43.40	45.20	44.70	42.20
November.....	43.88	43.50	41.50	45.00	44.50	42.00
December.....	42.00	41.50	39.50	44.25	43.75	41.25
Year.....	\$47.06	\$46.51	\$44.51	\$46.54	\$46.01	\$43.62

rail, and destroyed furnaces and buildings and caused delay in forwarding provisions and supplies, were responsible for a reduction in the quicksilver output of approximately 1000 flasks in San Benito and San Bernardino Counties. The New Idria resumed operation after being out of commission for about a month and having reduced the output by 800 or more flasks.

The production by the small furnaces in the various counties, that produced in 1910 a fair share of the total, made a smaller aggregate showing in 1911 than in any twelvemonth for the last 26 years. The cause for this decrease is accounted for by the steady decline in price in 1910 from \$50 per flask in January to \$41.50 in December and the fact that much of the ore ex-

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Besides this there were encouraging developments in the prospect known as El Dinero in the immediate neighborhood of the New Guadalupe. The Helen and the Great Western in Lake County and the Oceanic in San Luis Obispo County have produced the greater part of the output of the smaller mines. The Altoona in Trinity County, which has been a small producer under a leasing system, had made no report of production for the year.

There are favorable indications of reopening of former producers and some new prospects and locations have been recorded. The Klau mine in San Luis Obispo County has produced no quicksilver in the last year, but the expectation is that the furnaces will be completed and other repairs necessitated by the fire which destroyed the plant will

furnace material continues to yield about 1½% of metal and it is likely that ore of this quality can be depended on for some years.

The mining of the rich pockets in the hard limestones west of Vogel's Draw (western part of the district) has been discontinued and interest now centers around the eastern part of the district, between Vogel's Draw and Rough Run Creek.

I say interest advisedly, for it is probable that old operations will be resumed or new ones undertaken within the next few months. It is stated, on what appears to be good authority, that certain large holdings of land in the heart of the producing area will be prospected vigorously. These lands are not state lands and they do not come under the provisions of the state mining law which has been for years and still is a great obstacle in the development of west Texas. These lands can be bought or leased or secured under royalty without the necessity of considering the vexatious and uncertain clauses of the mining law. Some of these lands have already yielded excellent ore.

QUICKSILVER PRODUCTION OF TEXAS

1899	1,000	\$42,000
1900	1,800	75,600
1901	2,932	132,438
1902	5,319	239,350
1903	5,029	211,218
1904	5,336	232,116
1905	4,723	172,362
1906	4,761	178,829
1907	3,686	148,387
1908	2,384	122,260
1909	4,188	194,084
1910	3,382	158,958
1911	4,000	166,000
13 years	48,540	\$2,075,602

Additional supplies of good drinking water have been found in the sandstones west of Terlingua Creek and north of Cigar Mountain, an important contribution to the economic resources of the region. While the present supply of wood for furnace use seems to be sufficient for the operations now in hand, yet we would strongly advise the use of local coal in gas producers, if more extended work is to be undertaken. This coal (sub-bituminous) carries from 29 to 50% of volatile combustible matter, from 19 to 49% of fixed carbon and from 15 to 21% of ash. In heating power it varies from 8000 to 11,000 B.t.u. It is much better than lignite but not so good as ordinary soft coal. Under proper conditions it can be delivered at the furnace for \$3.50 to \$4 per ton and it would yield from 60,000 to 70,000 cu.ft. of producer gas per ton, with B.t.u. from 125 to 150 per thousand cubic feet.

The assertion that quicksilver furnaces must use wood has been made so often that some people, who should know better, are still of this opinion.

The accompanying table shows the production of quicksilver in Texas from 1899 to and including 1911 in flasks of 75 lb. net. The figures for 1911 are estimated.

The Tungsten Industry

In 1911 there was a marked decrease in the production of tungsten in the United States, due largely to the lack of a wide market for tool steel, in which tungsten finds its chief use. There were produced in the United States, according to preliminary figures collected by Frank L. Hess of the U. S. Geological Survey, about 1125 short tons of concentrates carrying 60% tungsten trioxide. This compares with 1821 tons marketed in 1910. The prices in 1911 ranged from \$4.50 to \$8.50 per unit depending on quantity, quality and individual bargaining. This unit is 20 lb. of tungsten trioxide per short ton of ore and at the close of the year \$5 per unit was offered.

COLORADO AND CALIFORNIA CHIEF PRODUCERS

As usual, the Boulder County region, Colorado, was first in importance and the Atolia deposits in California, second. Smaller amounts were produced in Arizona, Nevada, Idaho and Washington. Several new companies were formed to operate in the Boulder field where ferberite, iron tungstate, is obtained in larger quantities than anywhere else in the world. Two companies profitably worked over tailings left from former operations. Much of the ore mined here and elsewhere was not marketed.

The Atolia field carried on work through most of the year, but not so extensively as in 1910. Some work was done near Nipton, Calif., but most of the ore was left at the mines for better prices. New mills for treating tungsten ores were operated at Osceola, Nev., and in the Blue Wing district, on Patterson Creek, Idaho. At the close of the year, a new mill was being built at Round Mountain, Nev. The companies operating at Osceola, Nev., and in Washington, were beset by financial difficulties and little was done at those places. New discoveries of wolframite were reported from the vicinity of Oroville, Wash., and in silver-bearing veins in the Sonoma Range, south of Galconda, Nev. Hübnerite was found in veins once worked for silver in the Potosi district, nine miles from Pony, Mont., and scheelite was found in gold veins in the New Goldfield district, near Rebel Creek, Nevada.

TUNGSTEN IN ARIZONA

In Arizona operations at the close of the year were inactive in the Dragon Mountains, the region where wolframite was first found and which has produced most of the state's output. There were several reported sales of tungsten properties in the Guijas Mountains, in Pima County, where the ore occurs in strong quartz veins, up to 30 ft. wide, cutting an aplitic granite. These veins also carry some gold. The only deposit of scheelite yet uncovered in the state was in pro-

cess of development by the Cody-Dyer Mining Co. This deposit is in the Catalina Mountains, 50 miles north of Tucson, and occurs as a lenticular quartz vein in shales, close to the margin of the intrusive Oracle granite. The oreshoot is small but has been opened to a depth of 200 feet.

Bismuth in 1911

BY WILLIAM J. DWYER*

The amount of metallic bismuth consumed in the United States in 1911 varied little from that of previous years. The imports for the fiscal year amounted to 178,297.75 lb. valued at \$321,360. This compares with 200,221.41 lb. valued at \$316,838 imported in 1910 and 176,729 lb. valued at \$274,662 in 1909. The average import price in 1911 was \$1.80 per lb.; in 1910, \$1.58; in 1909, \$1.55 per pound.

The United States Metals Refining Co. has been a producer of this metal at its Grasselli, Ind., plant since 1908. The American Smelting & Refining Co. reported no production of the metal, but is said to have experimented extensively on the recovery. The electrolytic plant of the Monsanto Chemical Co. at St. Louis is understood to be dismantled. This plant was erected in 1906 to treat lead bullion from Mexico, but operations were suspended in 1908. The National Lead Co. is reported to have produced some of the metal from corrodors' residues. Bismuth has been recovered in the reduction of tungsten ores, but the Primos Chemical Co. states that no material of this nature was treated by it in 1911. Domestic production is estimated at about 95,000 pounds.

Sixty-three per cent. of the 1911 import business was done through the port of New York. This trade is in the hands of eight houses. Of these, six are engaged in the manufacture of pharmaceutical preparations, while one company manufactures composition metals and the other is a metal broker. The high price of bismuth naturally tends to restrict its use in composition metals and according to the leading pharmaceutical importing houses fully 90% of the bismuth consumed in this country enters into the manufacture of medicinal preparations, such as face and toilet powders and other bismuth compounds. The consumption of these products appears to be more or less stationary and has shown but little variation during recent years.

Bismuth compounds were quoted as follows throughout the year; citrate, \$2@2.05; salicylate, \$1.60@1.65; subcarbonate, \$2.10@2.15; subgallate, \$1.65@1.70; subnitrate, \$1.80@1.85 per pound.

Prices of metallic bismuth are controlled from London and all imports into

*50 Pine St., New York.

this country come by the way of England. Saxony is an important producer but Bolivia still retains her lead in this field. The latest Bolivian custom returns record the exportation of 471,151 lb. of bismuth valued at 1,923,417 bolivianos or \$748,209 in 1910. On this basis the export value was \$1.58 per lb., equivalent to the 1910 import value into the United States from Europe.

Vanadium in 1911

SPECIAL CORRESPONDENCE

Vanadium steel found many new applications and its use was greatly extended in 1911 as a result of scientific and practical demonstrations of its special advantages. Particular adaptations were in the fabrication of automobile frames and machinery parts. Vanadium also found more extended use in iron castings. Reported successful attempts were made to develop the therapeutic qualities of certain vanadium compounds. Interesting results are expected from experiments underway with the use of vanadium as an additive agent with other metals than steel.

An important source of vanadium ore supply continued to be the patronite mines of the American Vanadium Co. at Minasragra, Peru. Vanadium is also being obtained from carnotite deposits in western Colorado, and from eastern Utah. The principal operators of the carnotite ores in the Paradox Valley, Colorado, are the International Vanadium Co., of Liverpool, Eng., and the Standard Chemical Co., of Canonsburg, Penn. Some of these ores carry (besides vanadium) uranium and radium and the utilization of salts of these metals will give miners of carnotite ore a decided advantage over producers of straight vanadium ores.

The mill at Vanadium (Newmire), Colo., controlled by the Primos Chemical Co., treated about 30 tons of roscoelite ore daily throughout 1911 with reported satisfactory metallurgical results. Much development was carried on in this district but practically no ore shipments were made nor was any new treatment plant established. Plans for at least one new mill are underway and the district promises to continue an increasingly important producer of vanadium.

The vanadinite (lead vanadate) deposits at Cutter, New Mexico, were operated to some extent in 1911 by the Vanadium Mines Co. of Pittsburg but operations were limited by reason of metallurgical difficulties with this ore. Experiments were made with the ore-treatment problem the results of which are not available. Satisfactory development of ore in the district was reported. Other vanadinite deposits in New Mexico, Arizona, California, and Chihuahua received some attention during 1911, but no important production resulted.

The reported discoveries of rich deposits of vanadium in Russia apparently did not materialize, for at the close of the year the European consumers were still buying largely from the American producers and were increasingly concerned in acquiring vanadium supplies.

Discoveries of vanadium ore in Oklahoma, Virginia and elsewhere were reported, but so far these have not materialized in production. The fact is vanadium is found widely distributed but the deposits of commercial grade and of a character that can be treated by present methods are as yet few in number.

Satisfactory statistics of the vanadium trade are impossible to obtain. The consumption in a measure is controlled by the state of the steel trade, but by reason of the expanding uses of vanadium steel it is likely that the consumption for 1911 was greater than any previous year notwithstanding the lessened steel output.

The price of the vanadium product as usually marketed—ferro-vanadium—at the beginning of 1911 was \$5 per lb. for the metallic vanadium content. During the year one of the large operators made price concessions and the alloy was openly quoted at \$3.50 per lb. and sales were reported at \$3 per pound.

The Cement Industry

As regards the Eastern states, at least, the cement business in 1911 was the most unusual in its history. Prices at the close of the year were down to 60c. in bulk at the mill, which is a low record mark for the industry. Lower prices have been reported in isolated places inland.

Over-production and a lack of cooperation among producers resulted in a most demoralized twelve months. Rumors of combinations and the absorption of smaller companies have been rife throughout the year, but in view of the stand the Government has taken regarding combinations of competing corporations, it is not presumed that the rumored absorptions actually occurred. Business has been so bad that notwithstanding the fact that any number of the smaller mills were eager to be taken over, the larger operators even with a more favorable interpretation of the anti-trust laws could hardly afford to assume control of a larger production and heavier finances than already in hand. The general consensus of opinion at the end of 1911 was that a number of the smaller mills are in financial straits, as it is hardly possible to produce cement and realize a profit at 60c. per bbl. of 375 lb. The sharp decline in the stocks of most cement companies tends to confirm this supposition.

Under the influence of low prices, however, the markets have broadened con-

siderably and the production during 1911 was in all probability well in excess of that of 1910, which amounted to 77,785,141 bbl. The Western cities use much larger quantities of cement for structural purposes than the Eastern. The tendency in the East of late, in New York particularly, has been to an increased use of concrete for building purposes.

It was assumed that the taking over of the Atlas Portland Cement Co., by the Morgan interests, which are prominently identified with the Universal Cement Co., through the Steel Corporation of which it is a subsidiary, would gradually tend towards betterment. This, however, has not occurred, and each company to all intent is operating independently of the other. The Universal company, which manufactures cement from basic slag and limestone, entered the northern New York field more actively during 1911 through Pittsburgh.

Cement for the Panama canal is being furnished at the rate of about 1,000,000 bbl. annually and these withdrawals have had a slight stimulating effect on an otherwise depressed market. The contract with the Government averages about 68c. per barrel.

Imports of foreign cement are declining to a marked extent and with present low prices there is little likelihood of an increase. The imports for the fiscal year amounted to 46,648 tons comparing with 81,550 tons in 1910 and 96,187 tons in 1909. Germany is the largest shipper to this country, with Belgium second.

Cadmium

The chief supply of metallic cadmium continues to come from Upper Silesia, but we understand that there is now a considerable production in Great Britain. A small production is made in the United States by the Grasselli Chemical Co., at Cleveland, Ohio, and the United States Zinc Co., at Pueblo, Colo., the latter being a new producer in 1911. The price for metallic cadmium during 1911 varied from 70 to 85c. per lb., f.o.b. Cleveland, Ohio, the quotation varying according to quantity and quality.

Copper Sulphate

The production of copper sulphate as a byproduct was 33,454,000 lb. in 1911, against 26,356,788 lb. in 1910 and 45,000,000 in 1909. The decline in the output of this byproduct from 1909 to 1910 was due to improvements in the practice of some refiners, enabling them to avoid making this byproduct. Thus several refiners now report no copper sulphate at all. Our statistics include the bluestone recovered in the refining of base lead.

The Metallurgy of Zinc

By W. R. Ingalls

In the metallurgy of zinc there was no radical change in 1911. There seldom is in a single year, progress being naturally by small steps, the effect of which does not become apparent until they have been cumulative. It may be positively stated, however, that the metallurgy of zinc does not stand still. Many improvements in details have been made, and are constantly being made, with the results of decreased cost of operation, increased extraction of metal and ability to handle successfully ores of considerable impurity. High percentages of lead and iron have ceased to have terrors. Silver and lead contents can be recovered either by smelting the entire residue from zinc distillation or by subjecting it to mechanical concentration and smelting the concentrate. The choice between these alternatives depends simply upon commercial conditions. Available ore supplies are constantly being increased by improvements in the art of mechanical concentration.

In general, the zinc smelting business both in Europe and America was prosperous in 1911, the margin between the value of zinc in ore and in spelter having been unusually large. The experience of American zinc smelters is an alternation of periods of feast and famine, the latter being always longer than the former. In 1911 conditions were distinctly in favor of the smelters.

NEW WORKS

The construction of several new works in the coal field of Illinois was begun in 1911, bearing out my previous forecast respecting the destiny of that state as a zinc smelting center. Two new plants were also built in the gas field of Oklahoma. So long as a gas supply is obtainable there, new plants will, of course, be erected from time to time in that region. Smelteries to use natural gas as fuel are relatively cheap and quick to construct. Smelteries to use coal are more permanent, but are more costly in their construction, not only for zinc smelting proper, but also because a plant of this kind in order to compete successfully must be provided with an accessory sulphuric acid works. The relative cheapness and facility of construction of works to use natural gas are, of course, attractive to the smelting interests who are willing to take chances or have obtained contracts, etc., that permit of a quick writing off of the cost of plant. As to the point of facility of construction,

it is interesting to note that the first furnace of the new works of the Bartlesville Zinc Co. at Collinsville, Okla., was put in operation on Dec. 18, just five months after the beginning of construction of the works. So far as I am aware, this is the shortest time on record.

Interesting events of 1911 were the inauguration of zinc smelting by the Broken Hill Proprietary Co. in New South Wales, which has erected at Port Pirie a plant of considerable capacity, equipped with furnaces of modern design; and the beginning of zinc smelting, on a small scale at Osaka in Japan, where the production of about 4000 tons of spelter in 1912 is projected. As is well known, Japan possesses fair resources of zinc ore, shipments from which have heretofore been made to Europe.

The operation of these new plants will be watched with interest. Zinc smelting is more dependent upon human factor than are many other branches of metallurgy, and for this reason it has heretofore been confined in the main to the districts in Silesia, Rheinland, Belgium, Great Britain and the United States where a working population trained in the art through several generations of practice has become established. The successful prosecution of zinc smelting at new and remote places has generally been a tedious development, although, of course, by no means impossible. The entry of the Japanese into this field of metallurgy is of peculiar interest from this standpoint.

ORE-DRESSING

The enormous output of zinc ore at Broken Hill continues to be made by the oil-acid flotation process, the patent rights to which are the subject of bitter litigation. In 1911 this process was introduced by James M. Hyde at the mill of the Butte & Superior Copper Co. at Basin, Mont., where ore from Butte containing about 20% zinc is raised to a product assaying 45 to 50% zinc. The ore is first jigged, the tailings then being reground and floated. Mr. Atwater, manager of the company, informed me that an extraction of 90% was being made, the cost of the process being about 75c. per ton. This company is paying no royalty. Suit on the ground of infringement has been brought against Mr. Hyde by Minerals Separation, Ltd. The Butte & Superior is engaged in the construction of a new mill at Butte, which will be of capacity of about 200,000 tons of ore per annum.

The Macquisten tubes have been introduced in the Morning mill at Mullan, Idaho, for the treatment of middlings, and it has been reported that an installation of them is to be made by the Grasselli Chemical Co. at Park City, Utah. Henry E. Wood operated the flotation separator of his invention in his testing works at Denver, Colo.

PYROMETALLURGICAL CONCENTRATION

A good deal of attention was devoted in 1911 to what may be called the pyrometallurgical concentration of zinc ore by burning off the zinc after the fashion of the Wetherill process of zinc oxide manufacture, but without the refinements that are necessary when the oxide is to be collected for use as a pigment. Such a process of concentration may find a useful field in the treatment of ores and metallurgical products that are not amenable to mechanical concentration and consideration of this possibility has been inspired by the success of Pape in extracting zinc from the slags of Oker, in Germany. Among others who have been experimenting on this line are Babé, Blum, Hommel, Witter, and Huntington. Some useful developments may be expected under favorable conditions. In general the metallurgists who have been giving their attention to this subject have been endeavoring to improve mechanically the apparatus to be employed. Huntington, however, presents a new idea in the application of the down-draft principle, while Blum is perhaps novel (Hommel contests this) in the idea of conducting the operation in a modification of the Huntington-Heberlein pot. Mr. Blum has informed me that he is erecting a small plant in Mexico for the trial of his process upon a commercial scale.

GRADES OF SPELTER

At the annual meeting of the American Society for Testing Materials in June, 1911, Prof. William Campbell, of Colum-

Grade.	Pb.	Fe.	Cd.	Total not over
A. High grade*	0.07	0.03	0.05	0.10
B. Intermediate*	0.20	0.03	0.50	0.50
C. Brass special*	0.75	0.04	0.75	1.20
D. Prime Western	1.50	0.08	.....	.....

*To be free from aluminum.

bia University, chairman of the committee on "Non-Ferrous Metals and Alloys" reported a classification of the grades of smelter as above, the figures representing the maximum percentages of impurities allowable.

This classification is rational. It corresponds substantially to the understanding among American zinc smelters, but it is useful to have an official pronouncement.

ROASTING FURNACES

In the United States the furnaces in common use for blende roasting continue to be the Hegeler and the Zellweger, the former being employed invariably when it is desired to use the roast-gas for sulphuric manufacture, while in the natural gas field the Zellweger furnace is employed. At Cherryvale and Neodesha, where the supply of natural gas has seriously diminished, these furnaces are now, I understand, being fired with petroleum.

In Europe blende roasting continues to be done generally by hand. One reason for this is the relative cheapness of labor there, and another reason is the legal requirement in many countries that the roast-gas must be restrained, which practically means that it must be converted into sulphuric acid, a condition that bars out many forms of mechanical furnace.

Many of the zinc smelters in Germany have spent large sums of money in the trial of furnaces of their own design and construction, without arriving at any successful result. It is difficult to see why the European smelters have not seen fit to adopt the Hegeler furnace, which has been well proved in American practice, and although being far from perfect from the economical standpoint is, nevertheless, immensely superior to hand work.

At certain works in Swansea, Wales, the Merton furnace has found successful employment. With reference to hand-raked furnaces the Rhenania continues to be the standard, but in Belgium and France the new furnace of Delplace has found more or less use. This is an elaboration of the old Maetra shelf-burner. As to the results accomplished with it, some remarkable stories are told. It is said that in a furnace-roasting 15,000 kg. of ore per 24 hours the consumption of coal is as low as 90 to 120 kg. per 1000 kg. of raw ore. This is better than is done in the best form of the Rhenania furnace, so far as I am aware, and indeed is lower than anything else whereof I know.

DISTILLATION FURNACES

In all modern smelteries the distillation furnaces are of the regenerative type, either reversing or counter-current. In recent years the latter has increased in use. It has certain distinct advantages, but has not generally proved so economical of fuel, as the other system. However, that particular, in either system, is

governed largely by the proportions of the furnace, and some excellent results have been reported of counter-current furnaces.

The counter-current type of furnace is a favorite of the New Jersey Zinc Co., at whose Palmerton works the Convers & De Saulles furnace is employed. The Schmidt & Desgraz furnace, which has lately found rather extended employment in Europe, is also of the counter-current type. Furnaces of the Schmidt & Desgraz construction have been installed at the works of the Broken Hill Proprietary Co. in Australia.

As to the furnaces of the reversing-regenerative type, the Overpelt furnace is still, perhaps, most generally in use among European smelteries. Furnaces of this kind exist in the United States at the works of the United States Zinc Co. at Pueblo, Colo. A new design of reversing-regenerative furnace is that of Dor-Delattre, which is in use in Europe. This furnace is said to have been operated with a consumption of heating coal of only 900 kg. per 1000 kg. of ore, which figure is undoubtedly better than anybody else has been able to achieve. Heretofore a fuel consumption of 1000 to 1100 kg. has been considered extraordinary work in the case of reversing-regenerative furnaces, while in the case of the counter-current furnaces the figure is 1300 to 1400 kg. and upward.

At the Birkengang works, near Stolberg, Rhenish Prussia, experiments have been made with a new furnace containing vertical retorts. This furnace is reported to have been constructed upon a fairly large scale. The results attained have not yet been made public.

The tendency among European zinc smelters to drive their furnaces harder seems to increase. A furnace temperature of 1400°C. was once thought to be high, but now 1500° and upward is reported. Such high temperatures imply, of course, the necessity for much more substantial furnace construction and a high class of refractory material. Of course the average life of the retorts is reduced. In comparison with such figures the practice of American smelters is extremely moderate.

As to the arrangement of the retorts of the distillation furnace, European practice tends toward the Rhenish system; American toward the Belgian. Among American works using natural gas the Iola type of furnace still prevails, in spite of certain disadvantages. At Cherryvale, where furnaces of the Belgian type were originally installed, it was possible to adapt them to firing with petroleum when the supply of natural gas failed, but other smelters in Kansas have been able to use petroleum only in connection with their roasting furnaces.

ACCESSORY APPARATUS

Almost all zinc smelters now employ hydraulic presses for the manufacture of their retorts, all of these presses conforming to the original lines drawn by M. Dor, the inventor. There have been mechanical improvements in this apparatus, examples of which are to be noted in European works.

The subject of machine charging of the retorts is always engaging to inventors, but nothing of great practical value seems yet to have been developed on this line; certainly nothing that has come into general use. However, the charging machine of Dor-Delattre is said to be in use at Budel, Holland. In this machine the charge is thrown into the retort by centrifugal force. This is the simplest of the mechanical charging machines of which I have seen drawings. At Budel it is said to charge 72 retorts in 20 minutes, i.e., 16 to 17 seconds per retort. Another new charging machine that has been described is that of Rosdzin. The Saeger machine is in use at works of Giesche's Erben, in Silesia.

ELECTROTHERMIC SMELTING

Much attention was given in 1911 to the development of electric furnaces for zinc smelting, and some optimistic reports were made to the effect that previously baffling difficulties had been overcome. It was authentically reported that commercial ore smelting had been accomplished at Sarpsborg and Trollhättan, in Scandinavia, and that the capacity of those works is to be enlarged. Plans to finance the proposed extension were made in London and an elaborate report upon the works mentioned was made by F. W. Harbord.

At these Scandinavian works electric zinc smelting has been carried on after a fashion for five or six years back, the DeLaval arc furnace having been first adopted. The works at Sarpsborg still have those furnaces, but at Trollhättan a resistance furnace is now employed. Metallurgically both furnaces are said to behave in the same way, but the resistance furnace at Trollhättan is very much more economical of power than the arc furnace of Sarpsborg.

For many years it was impossible to smelt ore at these works and obtain spelter in one operation. The product of ore smelting was a metallic powder. By resmelting that powder a spelter containing a large percentage of lead was obtained. Finally by a third smelting spelter of high grade was produced. This sequence of processes did not seem to be commercially profitable, and such spelter as has come from these works has been chiefly derived from the treatment of dross, scrap, etc. The subject of ore smel-

ting was not, however, abandoned, and lately this has been accomplished in a way, i.e., it has been succeeded in smelting a charge consisting mainly of powder, to which, however, a small proportion of ore is added. The product from this charge is partly a very leady spelter, and partly powder, the latter going back for resmelting, and thus going around and around in the process, probably cumulatively. The leady spelter is refined by re-distillation. The recovery of metals is low and there would not be possibility of commercial success were it not for the extremely low cost of power available in Scandinavia.

In the smelting of 537 metric tons of ore at Trollhättan the consumption of electric power was 2078 kw.-hr. per ton of ore, this not including the refining of the leady spelter. At \$10 per kw. per year (0.116 c. per hr.), which is approximately the rate at Trollhättan, the cost per ton of ore is \$2.41. There is of course the prospect of reducing that figure if the necessity for resmelting blue powder can be avoided. The inability to condense a reasonably high percentage of the zinc as spelter, not as powder, has been a difficulty experienced by nearly all experimenters in this field; and this difficulty has not yet been solved.

In the United States experiments in electric zinc smelting were conducted in 1911 by W. McA. Johnson at Hartford, Conn. At Hohenlohehütte, Silesia, an experimental plant of Imbert-Thompson-Fitzgerald was erected and run with results that have not been publicly reported. These were the most ambitious attempts in 1911. Besides them, experimental work on a small scale has been done by numerous metallurgists.

In spite of all of the experimental work in electric zinc smelting that has so far been done, and the reports of success achieved, it must still be pronounced that this art is absolutely in its infancy and it is impossible yet to say definitely that certain metallurgical obstacles are surmounted, much less that the process will offer any commercial advantage.

HYDROMETALLURGICAL PROCESSES

Several hydrometallurgical processes for zinc extraction were exploited in 1911, but none of these commanded any very serious attention. Among them are the Malm process, (chlorination) for which a mill (not yet in operation) has been erected at Georgetown, Colo.; a chlorination-electrometallurgical process that is to be tried at Helena, Mont.; and the so-called bisulphite process that is

being exploited in Great Britain. The bisulphite process consists essentially in dead-roasting the ore and then digesting it with water into which sulphur dioxide from the roasting is introduced in a special apparatus. The solution of zinc bisulphite thus obtained is separated, the residue going to lead-smelting furnaces and the solution to an apparatus in which the zinc is precipitated as monosulphite, the sulphur dioxide that is evolved at the same time being returned to the process. The zinc monosulphite is calcined to oxide, which is said to be of the density required for reduction and distillation in retorts in the ordinary way.

As thus described, the process possesses no features differing from the proposals of many metallurgists in the past, and it is to be supposed that the novelty of the present process lies in the methods of conducting the several operations and the design of the apparatus employed. The literature of this process is replete with estimates of profit to be expected in the treatment of certain ores, but has failed to give any real technical data. The process has been developed at a works in Swansea, and a plant for the treatment of the ore of the Roseberry mine is now reported to be in course of erection in Tasmania.

The Metallurgy of Lead in 1911

By H. O. Hofman*

In the last year no radical changes took place in the treatment of lead ores. Matters proceeded along well known paths, although changes were made here and there in details to meet local needs. The two main lines in which lead smelters are seeking for improvement are in blast roasting and in the collection of flue dust, combined with the disposal of sulphurous gases.

BLAST ROASTING

Blast roasting in some form or other has replaced other methods of roasting in hand and mechanical reverberatory furnaces. Its different phases in the treatment of Broken Hill ores have been reviewed by W. Poole,¹ who, however, omits the last, the replacement of the Carmichael-Bradford process by that of Dwight-Lloyd.

An interesting modification of the Savelsberg process was adopted at the silver-lead smeltery of Przibram, Bo-

hemia,² where limestone was replaced by blue billy, the residue from treating burnt pyrite in the wet way by the Longmaid-Henderson process, and the work appears to be satisfactory as to the galena concentrate produced in the local ore-dressing plants.

At Trail, B. C.,³ two 100-ton Dwight-Lloyd straight-line sintering machines with three men on a shift have been put in operation to work in competition with the Huntington-Heberlein plant consisting of seven mechanical reverberatory roasting furnaces and 24 converting pots.

A valuable development of the Dwight-Lloyd machine is its use in the sintering of fine iron-bearing materials.⁴ Flue dust from the iron blast furnace containing: Fe, 46%; SiO₂, 9%; and C, 14 to 17% is treated without any addition, while magnetite concentrate with: Fe, 57%; and SiO₂, 9 to 10%, requires an addition of about 10% of coal to furnish a hard

porous clinker. It may be added that Savelsberg developed a similar idea with the usual pot-roasting operation.

Blast roasting, which first started with galena concentrates, branched out into the treatment of various lead ores; later it was successfully applied to the treatment of fine sulphide copper ores, and flue dust, to prepare them for blast-furnace work; the difficulties of blast roasting matte have been overcome; a start has been made in the working of speiss; now finely divided iron ore is being sintered in a cheap and effective way. Thus all the vexatious troubles of fine ore in the blast furnace are being met by blast roasting to the satisfaction of all concerned.

CONVERTING LEADY MATTES

In connection with the bringing forward of blast-furnace copper-lead matte in the basic converter to blister copper, the question of loss of precious metals due to the presence of lead has attained a fresh interest. The lead, of course, is slagged and volatilized in the process, the fume being collected in a chamber

¹O. H. Hahn, Eng. and Min. Journ., 1911, XCII, 1038.

²E. Jacobs, Met. and Chem. Eng., 1911, IX, 405.

³James Gayley, Trans. A. I. M. E., June, 1911.

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¹Mines and Minerals, 1911, XXXII, 315.

and baghouse. Some metallurgists have held that lead greatly increased the volatilization loss, others that it did not. The data published by C. C. Semple⁵ about the converting at Aguascalientes seem to show that the loss in precious metal is proportional to that of copper and independent of that of lead.

CONDENSATION OF FLUE DUST

In the dry condensation of flue dust⁶ the two leading steps are the cooling of the gas and the retardation of its velocity. As the mutual attraction of particles decreases with the square of the distance, cooling, which diminishes the volume of the gas, will bring the particles closer together and thereby increase the mutual attraction, when they form flakes and settle out; the reduced volume of gas will also have a smaller velocity which again favors settling. No decided improvements have been made in the devices for settling dust excepting that Freudenberg plates are being hung staggered instead of one back of the other. The Rösing wires at Great Falls, Mont., are giving much satisfaction.

The filtration of gases from blast-roasting and reverberatory-roasting appliances, as well as from converters, has been made possible by the Sprague process⁷ used at the plants of the U. S. Smelting, Refining and Mining Company, e.g., the Mammoth smeltery⁸ in which the sulphuric acid which corrodes all filter cloths is neutralized by feeding powdered lime into the flue carrying off the gases and by introducing zinc oxide produced from blende on a Wetherill grate. The neutralizing effect of zinc oxide apparently was the reason that the gases from the furnaces of the Bartlett process, Cañon City, Colo., treating sulphide concentrates of lead, copper, iron and zinc, could be readily filtered in spite of their richness in sulphurous and sulphuric acids, the sulphurous acid not attacking the filter cloth, and the corroding sulphuric acid being neutralized by zinc oxide.

COTTRELL'S ELECTRIC PRECIPITATION PROCESS

A radical departure from the ordinary methods of condensation is the electric precipitation process of F. G. Cottrell⁹ in operation at the Selby lead works near San Francisco and tried at the Balaklala copper smeltery, Coram, Calif. Experi-

ments of Lodge and Walker have shown that an alternating current will cause the agglomeration of particles suspended in a fairly quiescent atmosphere. In a moving gas current the agglomeration and settling are too slow to be effective. Cottrell, therefore, uses a high-potential direct current. If a needle-point be connected with one pole of such a current and a flat plate with the other, the air space between the two becomes highly charged with electricity of the same sign as the needle point, and any insulated body brought into this space receives a similar charge. If this body is free to move, as is the case with suspended flue dust and vapor, these will be attracted to the plate of the opposite charge; they will move, therefore, toward the plate and do this at a speed which is proportional to the charges and to the potential gradient between the point and the plate. Observation has shown that in a perfectly transparent gas there is a strong wind from point to plate.

In order to obtain a high-potential direct current, an alternating current from a lighting or power circuit of from 20,000 to 30,000 v. is connected by means of a special rotary contact maker driven by a synchronous motor.

For the needle point of the laboratory there was substituted at first a cotton-covered wire, the loose fiber of which furnished innumerable fine, sharp points for the discharge of the high-potential current, since it was sufficiently conductive from its natural hygroscopic water. The cotton, readily attacked by hot acid gas, was replaced by asbestos or mica, the fiber, resp., the edges of the scales furnishing the desired discharge points.

COTTRELL PROCESS FIRST USED ON SULPHURIC ACID

At the Selby works the first unit was introduced in a gas current of 5000 cu.ft. per min., to condense the fumes resulting from the sulphuric-acid parting plant. In a lead flue, 4x4 ft., there were placed rows of vertical lead plates 4 in. apart, alternating with suspended lead-covered iron rods carrying mica. A current of 460 volts and 60 cycles was transformed up to 17,000 v., and then passed through a rectifier to the electrodes. The power consumption was found to be only 2 kw.; the result attained was an elimination and collection of the sulphuric acid in the gas as a liquor of 40° Bé. The plant has been in operation for three years; the monthly outlay is \$20; the acid recovered in this period has paid five times the cost of the installation.

The second unit was intended to handle 50,000 cu.ft. of gas per min. from the roasting and blast-furnace departments. It was thought at first that the suspended material would be precipitated in a reasonably dry form, which would permit

brick and iron construction. Experience showed that this was not the case, and that lead was necessary as building material. A flue 6x6 ft. and 32 ft. long, containing 38 rows of 16 lead plates, each 6 ft. long and 4 in. wide, alternating with discharge electrodes, was sufficient to collect the sulphuric acid, arsenic, antimony, lead, etc., in the gases, provided these had been cooled to below 150° C. The collected material is a grayish mud, easily washed off the plates and run into settlers. For this purpose, every four to six hours the gases were turned into a bypass. For continuous work there would be erected two or three units, so that one could be cleaned at stated intervals. The power consumption was from 10 to 15 kw. A permanent installation has not yet been made.

EFFECT OF SULPHUROUS ACID ON VEGETATION

The effect of sulphurous acid upon vegetation continues to occupy investigators. Thus Sorauer¹⁰ finds that chemical analysis and microscopical examination have to supplement one another in determining accurately in doubtful cases the effects of sulphurous acid. In considering the harm done a distinction has to be made between the clearly visible effect of a large volume of gas acting at intervals, and the slow but steady influence of gases containing but little acid. The question whether injury to plant life results from gas or infected soil can be solved only by experiment. This consists in placing in suspected ground a box of 1 cu.yd. capacity, filled with soil from a sulphur-free section, and doing the same with supposedly sulphur-tainted soil in a sulphur-free atmosphere and planting in both string or pole beans (*Phaseolus vulgaris*). If the plants in the first show signs of decay, the sulphurous acid in the air is the cause; in the second the soil is poisoned.

DISSIPATION OF SMOKE

An interesting development in connection with disposing of smoke is the Wislicenus smoke-stack.¹¹ The sulphurous smoke issuing from the stacks of lead and copper smelteries remains undispersed for a long distance, the dust falls out gradually, but the gases come down not sufficiently diluted to make them harmless to vegetation. In order to dilute the gas it is necessary that air be introduced at an early stage in such a manner as to divide the smoke column into strips surrounded by air. This is done by the Wislicenus stack, which consists briefly in placing a lattice-like extension on top of the ordinary chimney.

⁵Eng. and Min. Journ., 1911, XCI, 508.

⁶Rzekulka, Zeit. f. angew. Chem., 1911, XXIV, 1803.

⁷U. S. Pat. Nos. 984,498, Feb. 11, 1911, and 992,391, May 16, 1911.

⁸Eng. and Min. Journ., 1911, XCI, 615-985.

⁹Journ. Ind. and Eng. Chem., 1911, III, 542; Eng. News, 1911, LXVI, 495; Min. and Sci. Press, 1911, CIII, 255-286; Min. Science, 1911, LXIII, 337; Eng. and Min. Journ., 1911, XCII, 763.

¹⁰Sammlung von Abhandlungen über Abgase und Rauchscheiden, 1911, No. 7.

¹¹Austin, Mines and Methods, 1911, II, 269; Hahn, Eng. and Min. Journ., 1911, XCII, 596.

Air will pass through the lattice from whatever direction the wind may be blowing, it will come in contact with the ascending smoke, divide it into bands and pass out with them at the opposite side. Thus, instead of a single column of smoke rising from the stack, strips of smoke, each surrounded by air, will pass off at the sides. The smoke of each band will readily diffuse into the inclosing air, and be dissipated so that when it finally comes down, the sulphurous acid will be sufficiently diluted to be harmless.

The reduction of sulphur dioxide with

recovery of sulphur has been repeatedly suggested. S. W. Young²² has taken up the matter and developed what he calls the thio-gen process. This consists of the following steps: (1) Action of dry SO₂ upon warm CaS, as expressed by $2\text{CaS} + 3\text{SO}_2 = 2\text{CaSO}_3 + 3\text{S}$; (2) recovery of sulphur from the intermediary product by sublimation; (3) treatment of the latter with a hydrocarbon at an elevated temperature when $2\text{CaSO}_3 + \text{CH}_2 = 2\text{CaS} + 2\text{CO}_2 + \text{H}_2\text{O}$ takes place with

²²Min. and Sci. Press, 1911, CIII, 375, 386.

the regeneration of the original reagent. It appears that the presence of pyrite is favorable, being decomposed according to $3\text{FeS}_2 + 2\text{SO}_2 = \text{Fe}_2\text{O}_3 + 8\text{S}$, although very slowly. Instead of the imaginary CH₂ given in the formula, there would be used C₂H₄, CH₄, petroleum vapor, etc. In this connection it may be noted that Kosmann²³ experimented with the action of H₂SO₄ upon a solution of CaS in H₂O, when CaSO₃, S and H₂O formed, but the process was not successful.

²³Glückauf, May 2, 1894.

Cyanidation in 1911

By Burr A. Robinson

The record of 1911 shows that cyanidation not only maintained but materially strengthened its position in the realm of gold and silver metallurgy. An old time rival abandoned the field; stubborn ores were whipped into submission and the potentialities of the process remain unfathomed.

In July, the Portland mill at Colorado City, which up to that time was a combination chlorination-cyanidation plant, was changed to an all-cyanide plant. This left the Standard plant of the United States Reduction & Refining Co. as the only chlorination plant in the state. The closing of the Standard plant in November, ended an interesting chapter in the metallurgy of Colorado. The chlorination process, which dominated the field for so many years, is dead, but who has the temerity to predict that conditions will never arise which will warrant its resuscitation?

TREATMENT OF REFRACTORY ORES

Colorado was again brought into the limelight, when a little over a month ago the Colburn mill at Victor was put into operation. This mill has the distinction of being the first to install the Moore-Clancy process about which so much was written in the last year. Considerable interest is naturally manifest as to the outcome of this undertaking, for the treatment of the highly refractory sulphotelluride ores of the district without preliminary roasting or concentration seemed like a daring venture when first proposed. It is a little early yet to pronounce judgment, but if the results reported by A. W. Warwick, metallurgist of the Moore Filter Co., can be maintained the ultimate verdict will undoubtedly be highly favorable. Mr. Warwick states that the total cost of operation is less than \$1 and that the tailings assay

40c. per ton. Those familiar with metallurgical conditions in the Cripple Creek district, cannot but agree that these results are little short of phenomenal. With this process a demonstrated success, enormous quantities of low-grade ore will be available as a source of gold with which to swell the world's production.

The means by which the difficulties of treating an antimonial gold ore were abated is described¹ by H. T. Brett, metallurgist of the Globe & Phoenix mine, Rhodesia. The ore which carries from 1 to 3 per cent. of stibnite, is washed, sorted to remove massive stibnite, crushed by stamps, passed over amalgamated plates and blankets, and concentrated to remove as much of the pyrite and stibnite as possible, the tailings being reground, classified and cyanided as sand and slime. The concentrates are roasted, dropped into cyanide solution, partially ground and amalgamated in pans, slimed in tube mills, followed by agitation, washing and decantation. While the method has not yielded thoroughly satisfactory results, it is undoubtedly the best solution of a difficult problem so far advanced, and will serve as a stepping stone to the one best method which is bound to be reached eventually.

A notable triumph for the cyanide process was scored at the Alaska Treadwell. The concentrates, which were formerly shipped to the smeltery at Tacoma, Wash., are now cyanided at the company's mill on Douglas Island, the net saving by this change being reported by W. P. Lass, cyanide superintendent, as \$6.22 per ton. The fact that the 100-ton plant operated smoothly from the start is a justification of the expendi-

¹Min. Mag., July, 1911.

ture of \$27,794 for the two years' experimental work. Such a far-sighted policy is greatly to be commended, and a more general adoption of it would result in fewer metallurgical monuments.

SLIME AGITATION

The Pachuca tank, which has always received first mention as an agitating device, was called upon to defend its right to this place and much interesting discussion was the result. The most important criticism was to the effect that while the pulp as a whole might be well circulated, the relative position of the ore particles and the surrounding solution remained practically unchanged. The result of such a condition would be that the solution in contact with the ore would become saturated and therefore ineffective as a solvent. As one of the aims of agitation is to provide means by which the above condition is avoided the charge was a serious one. A. Grothe became the champion of the Pachuca agitator and endeavored to discredit such criticism by giving figures to show that the velocity of the descending ore particles is much greater than the suspending solution and therefore meets the requirements of good agitation.

The Pachuca was further criticized on the ground that the air is not effectively utilized. While these objections may hold with the original Pachuca they seem to be largely eliminated in recent modifications. The use of the shortened central tube, whereby the air lift discharges below the surface, and the ingenious spreaders or baffles at Stratton's Independence mill tend to prevent the passage of the air from the tank before it accomplishes its work.

In the matter of economical use of air the Trent agitator seems to be particularly efficient. Since the air in a highly comminuted state is introduced at the bot-

tom of the tank its passage upward through the pulp is slow. Further, the condition of the air is such that the oxygen is readily absorbed by the solution. Theoretically this agitator contains the essentials of an ideal device, and from all accounts it is giving good results in practice.

SLIME FILTRATION

Although the vacuum filter was introduced in South Africa no earlier than October, 1910, the use of this form of apparatus is already recognized as standard Rand practice. The Butters installations subsequent to the original one at the Crown Mines of 310 leaves were as follows: New Modderfontein, 350 leaves; Brakpan, 350 leaves; Bantjes, 250; Robinson, 460 leaves; South Randfontein, 84 leaves; New Modder, 235 leaves; Langlaagte, 112 leaves. The New Modder and Brakpan plants are on the gravity plan, while the others use the pumping system. That the Rand slime is especially suitable for this method of filtration is evidenced by the fact that while the Crown Mines' installation was designed to treat 500 tons it is regularly handling 900 tons per day. On Gold Coast, West Africa, four Butters plants are in operation using a total of 302 leaves. Butters plants are also to be installed in Japan, Russia and India.

It is interesting to note that at the old mill of the Santa Gertrudis Co., in the Pachuca district, Mexico, a Moore filter plant is being used, while at the new mill of the same company a 90-frame Merrill was installed. In the Porcupine district, Ontario, a somewhat similar condition prevails, for a 500-ton Moore plant is being installed at the Hollinger and a Merrill plant at the Dome. With these two types of filters operating under parallel conditions in the same districts a fine opportunity is offered for a comparison of the relative merits of the vacuum filter and the filter press.

The recent investigations of George J. Young⁵ seem to point to the conclusion that in some instances each type of filter has a niche which it alone can best fill. For instance, with slimes containing a large proportion of clayey material vacuum filters should be used; with slimes containing a small proportion of clayey material and much fine sand both vacuum filters and pressure filters could be used with perhaps equally good results; while with slimes containing much coarse and fine sand the chamber filters with air agitation and high pressures would perhaps give the best results. The fact that each type of filter can claim at least one new installation is of interest in connection with the above statements.

⁵Bull. 59, A.I.M.E., November, 1911.

In the realm of slime thickening the Dorr device seems to be answering the requirements of a simple and efficient thickener. A thickener, designed and patented by Mark R. Lamb, may possibly be open to the criticism of being more complicated than the Dorr without promising a corresponding increase in efficiency. I know of no installation of the latter machine so that a comparison of the two devices from a practical standpoint is impossible.

CONTINUOUS CYANIDATION

Continuous cyanidation has reached the period where the installation of this system no longer is looked upon as a novelty. The possibility that in its present state of development this system is not adapted to all conditions, is suggested by the unsuccessful attempts to use a continuous system at the Oriental Consolidated, Chosen.

Of interest from the theoretical side is the discussion of the "phase rule" as applied to cyanidation and the advantages of continuous systems in avoiding equilibrium conditions. The phase rule in this connection, as presented by H. B. Lowden,⁶ briefly is this: Gold in ores when in contact with cyanide solution dissolves at a decreasing rate as the solution increases in precious metal content and decreases in free cyanide. Dissolution will proceed until equilibrium is established between the undissolved metal, the metal in solution and the free cyanide. When this condition is approached only a slight additional extraction is obtained by prolonged treatment or the addition of free cyanide; the latter because the alkali auricyanide remaining in solution continues to exert an influence upon the velocity of dissolution. This suggests the advisability of the separation of ore from pregnant solution when the rate of dissolution slackens and the use of fresh, barren or low-grade cyanide solution for further treatment.

A continuous system aiming to apply the phase rule in practical operations is suggested by John E. Rothwell⁷. The essential operations of this system are the counter-current of continuous agitation, decantation and dilution. A series of agitators and corresponding thickeners are used. The pulp, previously thickened, passes to the first agitator then to the first thickener. The thickened pulp goes to the second agitator while the solution passes to the zinc boxes. The operations of agitating and decanting are repeated in the second set, the thickened pulp passing to the third agitator but the solution going to the first agitator instead of to the zinc boxes. These operations are repeated throughout the series, the thickened pulp passing to the following agitator and the solution going to the

⁶Met. and Chem. Eng., May, 1911.

⁷Met. and Chem. Eng., September, 1911.

preceding agitator. Fresh low-grade cyanide solution is added at the last thickener. As indicated the solution passes in the opposite direction to the ore, gradually gaining in richness as it proceeds. By this use of counter-currents the richest ore and the richest solution are in contact; the solution lowest in precious metal content and highest in free cyanide being applied to the ore after the greater part of the metal is dissolved. The system seems to offer many advantages not the least of which is its simplicity.

PRECIPITATION

Zinc-dust precipitation has made rapid strides toward establishing itself as the preferred method in modern practice. The former objection to the process on the ground of the greater metallurgical skill required is no longer considered a valid reason for deciding against it.

A patented process recently announced for the manufacture of atomized lead and zinc for precipitation purposes directly from pig lead and spelter seems to promise many advantages. The atomized zinc has the appearance of zinc filings and can be used in the same manner as zinc dust in the precipitation process.

The apparatus for making atomized lead or zinc designed for cyanide mill requirements is said to produce 100 to 150 lb. per hour in one simple operation. This apparatus measures approximately 2 ft. in diameter by 4 ft. in height and requires a collecting chamber approximately 3 ft. in diameter by 18 ft. long.

Zinc dust, besides containing appreciable quantities of inert zinc oxide, readily oxidizes and thus loses some of its precipitating power. The fact that atomized zinc can be made at the mill as required largely eliminates the above objection. Since both atomized lead and zinc can be produced separately, a proper mixture can be made to gain the required electro-galvanic action. Scrap zinc can be converted into atomized zinc. In short, all the arguments for zinc dust as a precipitant, with the additional ones given above, are urged for atomized zinc. Results from actual operations will soon be available as the process is to be given a trial at the Nova Scotia mill, Cobalt.

The directors of the East Rand Proprietary gave the metallurgical world somewhat of a start when, on Sept. 2, they made public announcement that a large amount of gold had been allowed to go to waste. No adequate explanation was given by the officials, but those who know something of the internal workings of the company have advanced opinions which in a measure clear up the mystery. Apparently an attempt was made to propitiate the evils of frenzied finance by making a scapegoat of the metallurgical process.

In an attempt to keep up the total profits when lower-grade ore was encountered, a suicidal increase in tonnage, far in excess of the efficient capacity of the mill was ordered. This naturally caused a greater loss in the tailings, but not enough to account for the total loss announced. The chief reason for the great discrepancy was probably that the directors upon finding that they still lacked funds sufficient to declare the customary 40% dividend borrowed on the future with the gambler's logic that they would have better luck next time. If

the above is true we must not judge the metallurgical management too harshly, for it must have hurt to be compelled to follow a policy so diametrically opposed to the first principles of good milling practice.

We are likely soon to lose an old friend, the Consolidated Mercur, for President Dern has read the handwriting on the wall and his interpretation begins, "You have been a good servant" and ends "thy days are numbered." Consolidated Mercur enjoys the double distinction of being the "cradle" of the

cyanide process in this country and the godfather of the Moore filter.

In this article I have endeavored merely to sketch the happenings of the year which appeal to me as being a little more prominent than the rest. New cyanide plants in most of the prominent fields together with mills in new districts are an indication that cyanidation widened its field of usefulness in a geographical sense; and in an economic sense, progress was made in the adaptation of the process to the treatment of refractory ores.

The Metallurgy of Copper in 1911

By Arthur L. Walker *

For the year 1911, but little can be recorded in regard to new construction for copper metallurgical plants—probably owing to the great depression in the copper market. The International company's smelting plant at Tooele, which was blown-in in the summer of 1910, is the last of the large plants put in commission, and this plant has been operating since then most successfully. At present, however, there promises to be extensive developments in construction work during the next 12 months, as several new plants are now being built in this country and the erection of more is contemplated.

IMPORTANT NEW WORKS

A smeltery is being erected at Hayden, Ariz., by the American Smelting & Refining Co., primarily for the purpose of smelting the concentrates from the Ray Consolidated mill. This plant will consist of reverberatory furnaces, roasters and converters, and will have a capacity of 400 tons of ore or concentrate, and is expected to output 80 tons of copper per day.

The United Verde Copper Co. is to build a new and modern copper smeltery at Jerome, Ariz. The present plant has been adversely affected by the condition of the ground, owing to caving-in of the mine and by the fact that large additions to the plant have been made from time to time, the result being an arrangement which is not conducive to the most economical metallurgical methods and the new plant is expected to reduce the cost of smelting very materially.

The Arizona Copper Co., Ltd., definitely decided to build a new smeltery to enable it satisfactorily to treat the large bodies of low-grade ore which cannot

be smelted in its present plant. The new site selected¹ is near Clifton on the present line of the Arizona & New Mexico R. R. In constructing this plant it is contemplated to divide the ore into three classes, two of which will be treated in reverberatory furnaces and the third in converters. It is not intended to erect a blast furnace, but provision will be made so that one can be installed if it should be found necessary in the future. The capacity will be 1,000,000 tons of ore per year from which about 43,000,000 lb. copper will be produced annually.

The Shattuck-Arizona Copper Co. contemplates building a smeltery at Douglas, Ariz., for the purpose of treating its own ore instead of having it smelted at the Copper Queen smeltery, as in the past.

The smeltery of the Mason Valley Mines Co., in Mason Valley, south of Virginia City, Nev., is nearly completed and should be ready to treat ore in the near future. All of this indicates in a very decisive manner a much greater activity in copper operations during the coming year.

THE BRADLEY PROCESS

An elaborate undertaking in the hydro-metallurgy of copper is being made at Anaconda, Mont., where a plant for the extraction of copper by the Bradley process is being erected by the Copper Extraction Process Co. This plant, which is expected to have capacity for the treatment of 250 tons of material per 24 hours, is situated below the slime pond of the Anaconda Copper Mining Co., and is intended to treat the slime of that accumulation, a waste product of the Anaconda concentrator from which it has been impossible to extract any addi-

tional copper by previously existing methods. The Bradley process, which is the invention of Charles S. Bradley, was developed in an experimental plant at Bayonne, N. J. As described in the patents just issued², the invention claims an economical method of dissolving the metals in copper ores by the use of a chlorine compound as a carrier and transformer by which means waste products are made insoluble and the metals taken in solution are removed from the gangue and other constituents of the ore, from which solution they are afterward recovered.

In the actual operation of the process the ore containing a sulphide is subjected to a carefully conducted roasting operation in what is known as an amphidizer in which operation the copper in the ore is roasted to a sulphate and most of the iron is converted into ferric oxide. This step involves heating the finely crushed ore in the amphidizer (which is a rotating roasting furnace) to a temperature of from 450 to 550°C., air being blown into the amphidizer to accelerate oxidation. The roasted ore is then brought into association with an excess of calcium-chloride solution in a reaction drum which is maintained at a temperature of about 100° C. Cupric chloride is produced by the reaction between copper sulphate and calcium chloride, while any ferric sulphate in the ore coming from the amphidizer reacts with calcium chloride to produce ferric chloride which is soluble. The calcium sulphate resulting from both these reactions is of course insoluble and is separated by filtration in the succeeding step. The production of ferric chloride at this point is advantageous in that it dissolves any copper oxide, copper sulphide or metal-

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¹Eng. and Min. Journ., Dec. 16, 1911.

²U. S. Pat. No. 1,011,562.

lic copper which was unaffected in the amphidizer, producing copper chloride, and this ferric chloride also maintains the copper chloride in the cupric state.

Gold and silver present in the ore is brought into solution by making all the copper into cupric chloride and then adding a small amount of chlorine, chlorous or chloric compounds. The chlorides of silver and gold being soluble in calcium-chloride solutions may afterwards be precipitated with the copper and subsequently separated. After leaving the reaction drum the mass of gangue, solutions and precipitates is subjected to filtration. The solid matter forms a cake which consists of the gangue in the ore except a small amount of iron and alumina which have been taken into solution and the calcium-sulphate precipitate already mentioned. The solution comprises a carrier in which has been dissolved the metals to be recovered, a small amount of iron and alumina and any zinc which may have been in the ore; the arsenic will have been separated by filtration as it has been rendered insoluble. The solution is then subjected, if necessary, to a further oxidizing operation in order to be sure that the metals are all combined at their highest valence.

IRON AND ALUMINA REMOVED AS HYDRATES

The solution is then in condition for treatment for separation of the metals dissolved. The precipitation of iron and alumina may be made by cupric oxide, hydrate or calcium carbonate and as this precipitate will carry some copper it is returned to the amphidizer, after having been removed from the solution by filtration. In the amphidizer the iron and alumina in the precipitate are rendered insoluble, while the copper is left in a soluble condition and can be recovered. The solution from which the iron and alumina has been removed and which then contains the bulk of the copper is run to a second tank in which copper is precipitated by carbonate of lime as oxide of copper. This precipitate is filtered from the solution and the copper is recovered by further treatment such as by reduction in an ordinary smelting furnace.

Any silver and gold present in the solutions is carried down during the precipitation of the iron, aluminum and copper and finally recovered by separation from the latter metal. Zinc contained in the ore passes into the solution as chloride of zinc and accumulates. It is therefore necessary at stated times to run the solution, or part of it, after the final treatment and before returning it to the reaction drum, to a third precipitator in which the zinc is precipitated by

means of burned lime. The regenerated solution from which the gangue and all metallic compounds has been removed and which contains calcium chloride is returned to the reaction drum for the treatment of additional ore from the amphidizer, thus completing the cycle.

While the above description may indicate rather a complicated process the actual operation is comparatively simple and involves novel features and apparatus for the design and construction of which the inventor and his assistants deserve a great deal of credit. By this process it is hoped to recover copper from material which cannot be satisfactorily treated in any other manner and possibly to even make a greater extraction from certain ores than is now accomplished by other processes. In actual operation the regeneration of the carrier solution is so complete that it can be used over and over again in a cyclic manner, there being practically no loss. On account of this a considerable excess of calcium-chloride solutions can be used and by means of this excess operations can be conducted in a very elastic manner and the exact balance required in the hydro-metallurgical process as heretofore tried is not absolutely necessary. The practically complete chloridizing of the metals takes place in a solution drum and not in a preliminary roasting process, and the reactions in this solution drum can be simply and easily regulated. The results obtained by the plant now being erected at Anaconda and which should be in operation early in the year of 1912 will be awaited with a great deal of interest.

BASIC COPPER CONVERTIG

During 1911 the practice of using basic-lined instead of acid-lined converters increased to a remarkable degree, and the former are now almost entirely taking the place of the latter for converting copper matte. Many additional installations of the Peirce-Smith converters were made, not only in this country but in Canada, Peru, Chili and Russia, and in other cases the old acid-lined converters were changed to basic by the substitution of magnesite brick for the former acid lining material. The many advantages of the Peirce-Smith type of converter have been noted³ and the claims for these advantages are well founded. The grade of matte which can be satisfactorily treated in these converters varies greatly, and at present the Kyshtim Corporation in Russia is converting 25 to 30-per cent. copper matte, the International Nickel Company 25 to 30 per cent. nickel-copper matte, while the Tacoma Smelting Company in

³Eng. and Min. Journ., Apr. 8, 1911, and May 13, 1911.

Washington and the Steptoe Valley company in Nevada are treating 50-per cent. copper matte. The life of the converter lining is even longer than was first expected and a record of three converters shows that each produced over 3000 tons of copper before being shut down for re-lining. The runs were 3170 tons, 3276 tons and 4031 tons. A converter will produce, on an average, 2000 tons of copper before the lining requires repairing and this is very remarkable when we consider the former life of a converter lining. Another record shows that for nearly 60,000 tons of copper produced the loss of magnesite material per ton was a fraction over 10 lb. While claims are made for a lower consumption of air and a better efficiency, practice seems to indicate that the consumption is about the same as for acid-lined converters, namely, about 150,000 cu. ft. of air per ton of copper produced from straight copper matte, and about 100,000 cu. ft. of air per ton of copper produced from leady matte. On account of the large charges sometimes 25 per cent. of the weight of the charge can be made up of cold material such as ore, cleanings, etc.

At the U. S. Metals Refining Co. at Chrome, N. J. and the Anaconda company's plant, at Anaconda, Mont. the regular type of horizontal or barrel converters is still used, being lined with magnesite brick, and it is claimed at the latter plant that by this means the lining costs have been reduced to less than 30c. per ton of copper, and that one of these converters, 12½x8ft., has produced over 2000 tons of copper with one lining from a 40-per cent. matte. At Anaconda the magnesite lining is laid with an improved mortar consisting of a mixture of five parts of sodium silicate to 100 parts of magnesite dust, which mixture is said to be superior to the linseed oil-magnesite mixture usually employed. The tuyeres have been increased in size from 1-in. to 1¼-in. diameter, and the latest reports indicate that one lining has been used for 130 days in one converter, during which period 10,000 tons of matte were treated. It is estimated that this lining is good for 15,000 tons. Comparing the operation of these remodeled basic-lined converters with that while they were acid lined, it is found that the temperature of the charge is much lower and does not average over 1150 deg. C.

At Cananea⁴ the practice of blowing fine slimes into the converter through the tuyeres was experimented with, using the Day process, and several thousand tons of rich fine concentrates were treated, blowing them through a single tuyere at each converter stand. Blowing the con-

⁴Eng. and Min. Journ., Oct. 7, 1911.

concentrates into the converter in this manner increased the dust losses in the gases, but by means of a comparatively inexpensive dust chamber the metals were recovered and the practice is now considered satisfactory. The rich concentrates treated are very fine, 50 per cent. being under 200-mesh in size.

SMELTERY SMOKE

Comparatively little agitation occurred during 1911 to damage by smeltery smoke, and with one exception, conditions were apparently quite satisfactory.

At the Tennessee Copper Co.'s plant at Copperhill, Tenn., the sulphuric acid department was increased to a capacity of about 200,000 tons of 60-deg. Baumé acid per year, and in producing this large amount of acid so much sulphur is extracted from the gases that the resulting smoke has not been complained of.

The primary object in the installation of this acid plant was to consume fumes that damaged timber and agricultural products in the vicinity, and in order to demonstrate the success of the operation the Tennessee Copper Co. itself has instituted farming operations on some of its adjoining lands to prove that the gases now produced are not harmful. From a financial standpoint, the acid plant has also been a great success, since, on account of its geographical situation, a ready market is found for the acid, especially in connection with the manufacture of fertilizers.

In Salt Lake City no objection has been raised to the continued operations of the lead smelteries in the valley and the smoke from the copper smelting plants at Garfield and Tooele has not as yet been the cause of complaint. At Anaconda but little trouble was experienced on account of smeltery gases, the efforts made by the company to show that its fumes were not harmful evidently having been convincing.

In Shasta county, Calif., the smoke question is still being agitated; and while the United States company's smeltery at Mammoth is still in operation, all the gases must be specially treated by neutralizing the sulphur trioxide with zinc oxide, which is formed by the oxidation of zinc in the ore itself, and then passing the gases through a baghouse. The capacity of the plant is limited on account of the size of the latter, and only two furnaces out of the five were in operation. The baghouse contains 3000 bags and filters 250,000 cu. ft. of gas per minute⁵.

At the Balakalala smeltery at Coram, Calif., the Cottrell system was installed on a large scale, and at a cost of some-

thing over \$110,000⁶. At this plant, by the use of the Cottrell system, it was the intention to deposit from the gas all of the solids and all of the sulphuric acid by means of powerful electric discharges between electrodes placed in the flue. At the start the discovery was made that while particles of solid matter can be precipitated by alternating-current discharges when the gas is at rest, in swiftly moving gasses direct-currents are required, and therefore intermittent direct-current discharges of 20,000 to 30,000 volts were used. By these discharges from electrodes suitably arranged, 72.8 per cent. of the total solids, including the dust, sulphuric acid and sulphur trioxide, was deposited, but of course the sulphur dioxide was unaffected and passed out with the gases. As a result the smeltery is now closed until it can conform to the original decree of the United States Circuit Court, which was that all solids must be removed, that there must never be over 0.75 per cent. of sulphur dioxide in the exhaust gas, and the gases must do no damage. The third condition would seem to cover everything. It is rumored that an attempt to comply with these conditions will be made by the erection of a baghouse. Inasmuch as at both the plants above mentioned the solid matter and sulphuric acid were eliminated from the fumes, the problem remaining is to remove sulphur dioxide so that the discharged gases will not contain more than the limit mentioned by the court.

THE THIOGEN PROCESS

For this problem the thio-gen process for eliminating sulphur dioxide from fumes is proposed by Stewart W. Young, of Stanford University, California. In substance this process recovers free sulphur from sulphur dioxide in the gas. When vaporized fuel oil is heated with sulphur dioxide at high temperatures a more or less perfect reduction of the sulphur dioxide and oxidation of the oil occurs, but the reaction is incomplete and it is found necessary to use some reagent as an intermediary. Calcium sulphide is such a reagent and when treated with sulphur dioxide at a temperature of 100° C. reacts to form calcium sulphite and sulphur. In fact, the sulphide of any sufficiently basic metal would act equally as well from a chemical point of view, but for physical reasons calcium sulphide offers distinct advantages. In carrying out this idea it has been found that if a mixture of gas containing sulphur dioxide and hydrocarbon vapor, which react imperfectly, is passed over a mixture of calcium sulphite and sulphide, the reaction is rapid and complete. The sulphite is at-

tacked by hydrocarbons and is reduced to sulphide which in turn is attacked by sulphur dioxide and reconverted into sulphite, sulphur being produced at the same time, and so on. The application of this principle involves some unique and interesting problems, but it is claimed that the process has been worked out so successfully in the laboratory it could undoubtedly be applied to smelter gases in actual practice. The advantage of course is that sulphur produced from smelter gases could be made a source of profit at many plants where sulphuric acid would not only be worthless, but difficult to dispose of in any way.

THE USE OF OIL IN SMELTING

The practice of using oil in metallurgical operation in lieu of coal, is becoming more and more evident all the time, especially in reverberatory-furnace smelting. In this class of work it is frequently used even where oil costs more than coal per unit of heating value on account of its greater flexibility, the possibility of obtaining almost any heat desired and the ability to regulate the temperature to a nicety. At present reverberatory furnaces are fired with oil wherever it is possible to obtain it at a reasonable price; as for example, at the plants of the Nevada Consolidated Copper Co., the Copper Queen, at Douglas, the Cananea smeltery, at Cananea, the Garfield Smeltery, at Garfield, Utah. Oil has not as yet been used successfully for blast-furnace smelting, but E. H. Hamilton⁷ used oil in his blast-furnace operation in Arizona and obtained satisfactory results for several days, replacing some of the coke with oil injected at the tuyeres with a hot blast. The amount of saving is not stated, but the only difficulty experienced was slagging of the furnace tuyere. Possibly in some cases oil could be used in blast furnace operations to replace a certain amount of the coke but no satisfactory experiments have as yet been made to show to what extent, and the question of manipulation appears to be a most important one.

Flux Used in Iron Furnaces

So much has been said about the depreciation of the grade of iron ores that a large increase in the production of cinder made per ton of ore might be expected, as well as an increase in the use of flux; especially the latter, as the increase in lime in the slag may be made to pay for itself by the use of the cinder for cement manufacture. However, the limestone used per ton of iron made has changed but little in 10 years, being at present about 1200 lb. per ton.

⁵Eng. and Min. Journ., March 25, 1911.

⁶Eng. and Min. Journ., Oct. 14, 1911.

⁷Eng. and Min. Journ. Jan. 28, 1911.

Metallurgy of Iron and Steel

By Bradley Stoughton *

Iron-ore discoveries were made in the Lake Superior ranges and elsewhere in America and two new sintering processes were tried. The Gayley blast-drying process was developed to cheapen the cost of installation and new uses discovered for blast-furnace gas. There are important improvements emanating from Germany in the design of openhearth furnaces; electric ore-smelting and steel refining processes were developed, while the production of high-grade alloy steels increased materially, as did also the American exports of iron and steel.

SINTERING OF FINE ORE

The special continuous process of "blast roasting" of non-ferrous ores invented by Arthur S. Dwight is quite adaptable to the sintering of iron ores, as suggested by H. O. Hofman a year ago. With the cooperation of James Gayley, whose name is well known for his important services in the manufacture of pig iron, and especially in recent years for his invention of the dry-blast process, this sintering process was tested on iron-bearing materials, and the results communicated to the American Institute of Mining Engineers. The sintering process has for its prime object the agglomeration of fine particles into lumps, and the advantage of the Dwight-Lloyd method is that the lumps have a cellular structure which gives them a large area of contact with furnace gases and other substances, thus increasing the chemical activity, as well as decreasing the resistance offered to the upward current of blast furnace gases. Efficiency of blast-furnace operation is promoted by a pretty uniform size of particles charged.

It is therefore now customary in America to crush lumps of unusually large size with advantageous results, but the cheapness and abundance of the fine Mesabi ores has led on the other hand to the use of as much as 50 or even 80 per cent. of fine material. This practice brings an additional burden on the furnace, and also results in the formation of large amounts of flue dust. Some managers wet this flue dust and recharge it to the furnace, while others consider it almost a waste product. It may, however, be readily sintered into cellular lumps without the addition of any fuel to provide the necessary heat, because it already contains sufficient coke dust for the purpose. This sintering is accomplished by the Gayley-

Dwight-Lloyd process with satisfactory results.

It is even suggested that economy would be promoted by sintering the fine ores themselves. Such practice would not only remove the disadvantages of using the fine Mesabi ores, but would also render available many other ores which are too impure to be treated economically and cannot be concentrated mechanically without very fine crushing. An enormous amount of ore of this character is available in North America alone. Tests made with the sintering process on these ores, after mixing with them about 7 per cent. of coal to give the necessary heat, produced a material that was well suited to smelting. Finally, the treatment renders available some ores too high in sulphur to yield a good grade of iron, by reducing the amount of this element in them. Patents for ore agglomerating processes which have also aroused interest were those of David Baker, whose improvements in blast furnace practice, and especially in charging apparatus are well known, and those of a German inventor named Weiss.

DEVELOPMENT OF BLAST DRYING APPARATUS

The undoubted advantages of dessicated blast in blast-furnace practice has been handicapped always by the heavy cost for installation of the necessary drying apparatus. This has been reduced at a Welsh blast furnace by dispensing with the use of brine, and refrigerating with liquid ammonia direct. The ammonia is used over and over again by evaporating the strong liquor from the condensation apparatus with the latent heat in the waste steam. At a Luxemburg blast furnace, refrigeration is dispensed with altogether, and the air is dried by dessication with calcium chloride, which is said to reduce the cost of installation 70 per cent. After about 6 to 8 hours, the calcium chloride is charged with moisture; it is then regenerated by heating with the flue gases from the boilers and hot-blast stoves. A triplicate installation of calcium-chloride apparatus always affords one unit for drying purposes.

TURBINE BLOWING ENGINES

J. E. Johnson suggested the use of turbine blowers, employing waste steam from the steam blowing engines of blast furnaces, and supplying the steam engines with air at low pressure, which is by them raised to high pressure neces-

sary for blowing, thus bettering the conditions of operation of both types of apparatus, increasing their efficiency and reducing their cost. Although this combination was not tried at a furnace, the turbine was introduced in simple form at at least three American blast furnaces, with the result of more uniform blowing conditions and decreased cost of blowing. This innovation is doubtless of far-reaching importance in mechanical equipment of blast-furnace plants, although the significance of it seems to be slow in obtaining recognition.

NEW USES FOR BLAST FURNACE GAS

Probably there is no sub-department of iron and steel manufacture in which improvements effecting economies in operation have been more notable and far reaching than in the better use of blast-furnace gas. Several of these improvements have originated as an indirect result of better cleaning of the gas for its use in gas engines, which has also facilitated and improved the care and operation of the hot-blast stoves, conducting pipes, etc. Where byproduct coke ovens are operated in conjunction with a blast-furnace plant, the blast-furnace gas may be used for burning in the coke-oven flues, thus making available a larger proportion of the richer coke-oven gas for more valuable purposes. For heating openhearth furnaces, blast-furnace gas has not sufficient calorific power when used alone; we may estimate it at about 85 to 95 B.t.u. per cu.ft., as compared with 130 to 145 B.t.u. for good coke-oven gas, and 970 to 1010 B.t.u. for natural gas. Another deficiency of blast-furnace gas for radiation heating (openhearth, annealing, reverberatory, and similar furnaces) is its lack in luminosity. But by mixing some coke-oven gas with blast-furnace gas, it may be brought to the desired degree of calorific power and luminosity, and thus employed economically. It is stated by Dr. Rudolph Buck, who cites many experiments made in Germany in this connection, that a mixture having 170 to 213 B.t.u. per cu.ft. gives satisfactory results.

BRIQUETTING IRON BORINGS

A byproduct of almost every machine shop consists of borings, turnings and drillings of cast iron, wrought iron and steel—in short, metallic chips which are melted only with excessive waste of metal due either to much oxidation on ac-

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count of the proportionately large surface exposed, or to being blown out of the furnace, if a cupola is used. A new method of treating these in the cupola or open-hearth furnace is to briquet them into solid masses which do not disintegrate during their passage through the furnace. By means of the Ronay process, of which there are now several installations, the chips are agglomerated by means of pressure alone, but allowing a few moments for the force to exert its full influence. The pressure employed is 35,000 lb. per sq. in., and the cost of the process is said to be about 50c. per ton. As metallic chips can be bought for \$6 or so per ton, and the briquets are nearly equal to pig iron or heavy steel scrap costing \$10 to \$14 per ton, the process seems to have a bright future before it under the proper conditions.

CHANGEABLE OPENHEARTH FURNACE PORTS

The ports of the openhearth furnaces must be maintained fairly constant in size and form in order that they may direct the gas and air efficiently and uniformly throughout the operation. The brick work at these points, however, suffers more damage from heat than almost any other part of the furnace, and is consequently comparatively short lived, because of the intense temperature to which it is subjected by the outgoing gases. Water cooling and other devices have been installed in order to increase the endurance of this part of the furnace with noteworthy success. A recent German innovation, in manner somewhat similar to Alexander L. Holley's improvement of the Bessemer converter, by supplying interchangeable bottoms, consists of a construction that permits of the removal and replacement of the ports of the furnace without closing down for more than five hours, which can easily be accomplished during the customary week-end shutdown. This makes the life of the openhearth furnace practically independent of the life of the ports. In this way basic openhearth furnaces whose life might normally be 350 to 500 heats, have been made to last for 1000 heats with three changes of ports.

ELECTRIC SMELTING OF IRON ORE

The success of electric smelting of iron ore under special conditions of high-priced coke and cheap power were further confirmed, not only at the two previous furnaces—at Domnarvet, Sweden, and Heroult, California,—but by the establishment of the new furnace and new plant of the Swedish Association of Iron Masters at Trolhattan. In the *ENGINEERING AND MINING JOURNAL* of Sept. 30, 1911, and in *Metallurgical and Chemical Engineering* of October, 1911,

are given complete descriptions of this plant and practice. An important innovation is the use of screw joints on the carbon electrodes, thus avoiding the waste due to having to throw away the butts of old electrodes. This improvement has reduced the consumption of electrodes from 10.28 kg. per ton of pig iron produced to 5.5 kg. The consumption of electricity is said to be 1736 kilowatt-hours per ton of iron, or 5.05 tons of pig iron produced per kilowatt-year. The results of this furnace operation has led to the contemplated early installation of three additional furnaces in Sweden and one in Norway. The Trolhattan furnace has been in continuous operation since Aug. 4, 1911, having been first started in November, 1910. This furnace is substantially the same general type as the Domnarvet furnace, with certain changes suggested by experience at the latter plant. One of these changes is an increase in the pressure of the tunnel-head gases, which, it will be remembered, are taken off from near the top of the furnace and blown against the vault of the smelting crucible to cool it; another is charging the ore nearer the middle of the shaft. By these means, the efficiency of carbon reduction is increased, and the carbon dioxide in the escaping gases is brought to over 30 per cent.

COMBINATION ELECTRO-OPENHEARTH AND ELECTRO-BESSEMER FURNACES

The chief function of electric refining processes from the industrial standpoint is doubtless the super-refining of steel which has already been purified as far as is commercially practical in furnaces using cheaper sources of heat,—namely, openhearth or bessemer furnaces, and perhaps even puddling and Bell-Krupp furnaces, as the electric processes develop. Substantially all of the 50,000 tons of electric steel produced in America in 1910 was made by purification in bessemer or openhearth furnaces, followed by further refining in electric furnaces, this super-refining consisting virtually in the removal of the last traces of phosphorus, and of sulphur, gases and entangled solid particles of oxidized metals. Realizing this, the Homestead steel works has been operating for some time an openhearth furnace to which have been added two graphite electrodes, which can be brought into play for heating purposes in a manner similar to the action of the ordinary Heroult steel furnace, after the customary openhearth process of purification is completed, thus avoiding the transfer of metal from one furnace to another. An unconfirmed consular report from England states also that a firm in Sheffield is installing a double-ended bes-

semer converter, in one part of which the metal can be purified by the ordinary bessemer process, and then transferred to the opposite end by merely tilting the converter. In this further end, are situated electrodes by means of which electric current is brought to heat the charge by arc and resistance, thus maintaining the metal at the desired temperature while the super-refining is carried on. The general report for the year 1911 is that electric refining in the three chief siderurgical countries,—America, Germany and England—is progressing at a rate as rapid as could be reasonably expected in view of the large cost for installation and operation, and the financial conditions in the industry at present. One German plant has even gone so far as to produce regularly ingots by purification complete from pig iron to finished steel in the electric furnace.

THE ELECTRIC FURNACE FOR HEATING, ROLLING AND FORGING

One of the great factors contributing to the advantage of using an electric furnace is its ability to heat in a non-oxidizing atmosphere. Further advantage has now been taken of this characteristic by an American forging plant which has installed an electrically heated furnace for heating previous to forging. Since the loss of metal by oxidation in this operation is often as great as 5 per cent. of the weight of the piece, and greater than that when the pieces are small and have to be heated many times, so that occasionally so much metal may be lost that the piece will not fill the die where drop forgings are being made; the advantage of reducing oxidation to a minimum can be readily appreciated. The accompanying advantage of such a furnace is that it may be occasionally used for annealing, in which its unexcelled control of the temperature would tend to improve the quality of the product.

SOLUBILITY OF CARBON IN IRON

Ruff and Goecke publish in *Metallurgie* for July 22, 1911, an account of some discoveries they have made in the solubility of carbon in iron. They heated carbon in contact with iron in an electric furnace, to temperatures ranging from 1100 to 2500 deg. C. (2012 to 4532 deg. F.) and determined the amount of carbon absorbed. On plotting their results in graphic form, there is seen to be a rise in solubility with increase in temperature up to 6.7 per cent. of carbon, which corresponds to the chemical compound Fe₃C, and which was obtained at 1837 deg. C. After this point there is a temporary decrease in the rate of absorption with increasing temperature, but carbon continues to be dissolved until, at 2220 deg.

C., there is 9.7 per cent. absorbed, corresponding to the formula Fe_2C . This is the maximum amount dissolved; with further increase in temperature less carbon was absorbed.

G. K. Hooper patented and installed in at least one malleable iron foundry in America, a form of spout which permits the continuous pouring of metal from air furnaces and openhearth furnaces, by means of which the metal may be distributed to as many different ladles as desired without closing the tap-hole, thus saving time, heat, oxidation of metal, drip of metal and use of large ladles.

The manufacture of cement from iron blast-furnace slag has grown from 32,000 bbl. in the year 1900, to over 7,000,000 bbl.—equivalent to over 1,000,000 gross tons in 1910. Thus a waste product now supplies 10% of the production of an important industry.

The following statistics of the pro-

duction of alloy steel ingots and castings, presented by the American Iron & Steel Association, show not only great improvements of this high-grade industry at the present time, but also the large increase during 1910, which bids fair to be again exceeded when the 1911 figures are published.

PRODUCTION OF ALLOY STEELS

Alloy	Tons	Per cent.
Titanium	326,316	57.5
Nickel	106,707	18.8
Nickel-chrome	52,021	9.1
Chrome	23,550	4.2
Manganese	19,360	3.4
Vanadium	9,049	1.6
Chrome-vanadium	6,908	1.2
Nickel-chrome-vanadium	8,760	1.5
Miscellaneous	15,153	2.7
Total	567,819	100.0

Included in miscellaneous are 3163 tons of tungsten steel. Of the total reported, 296,298 tons were made by the bessemer process; 296,135 were basic openhearth; 44,394 tons acid openhearth;

20,392 tons crucible, electric, etc. The total includes 29,357 tons of direct castings, chiefly of manganese nickel and chrome alloys. As compared with 1909 there was an increase of 385,839 tons, chiefly in titanium steel.

It is doubtful whether the term "alloy steels" is really applicable to the steels which have been subjected to a super-refining by vanadium or titanium. Nevertheless the vanadium and titanium steels are included in these special classes for convenience. In this connection it is worthy of note that nearly 196,000 tons of rails, out of a total production of 6,334,000 were treated with titanium in the United States, and the indications are that double this amount will be so treated during 1911. An illuminating discussion was carried forward in *Iron Age* as to the advantages of using titanium for super-refining with or without aluminum.

Stamp Milling in 1911

By Louis D. Huntoon*

In 1911 extensive experiments were carried on in South Africa to increase the crushing capacity of stamp mills and to determine whether some other machine or combination of machines cannot be substituted to advantage for the stamp mill. Amalgamating plates were also investigated, resulting in decreased area of plate per ton of ore treated and in segregating the plates into one building. In the United States the weight of the stamps was not increased, but the introduction of Chilean mills preceding the tube mills greatly increased the milling capacity and was most satisfactory. At one plant in Colorado rolls were substituted for stamps. In Mexico the weight of the stamp was increased following the practice in South Africa. In Ontario the practice follows that in use in the United States.

On the Rand, preliminary hand dressing is still practiced to a large extent. The new mill of the City Deep, designed for a capacity of 65,000 tons per month, installed four separate sorting belts, showing the importance which is placed upon this method of disposing of waste rock or rock low in value. Considerable discussion took place this last year regarding the percentage of waste which can profitably be discarded. E. C. Huntoon stated, "The smaller the percentage of sorting, the lower the value of the waste rock." With the consolidations which are in progress, resulting in the larger mills being erected, together with more economical treatment of ores, the cost of milling per ton will be reduced

materially and a smaller percentage of waste rock discarded. The amount discarded resolves itself into a commercial proposition in which the cost per ton of waste discarded, added to the extraction which might be obtained from such waste, is equivalent to the cost of milling.

In the United States hand sorting is gradually being looked upon more favorably. The new plant of the Tonopah-Belmont installed ore-sorting belts from which 15 to 20 per cent. of waste is discarded at a cost of 68c. per ton of waste. At the Tonopah Mining Co. 11 per cent. of waste is discarded at a cost of 80c. per ton of waste. Hand sorting is also practiced to a large extent in Cripple Creek, Colo., and the Cœur d'Alene district of Idaho. At the North Star mine specimen ore is collected after blasting in the mines and is amalgamated in one battery at clean-up time or in a Berdan pan.

STAMP WEIGHT AND CAPACITY

The increase in weight of stamps up to 2000 lb. apparently reached the limit in South Africa. The advantages claimed for the heavy stamps are a reduction in the initial capital expenditure in erecting a lesser number of stamps for the same capacity, a smaller building to contain them, less shafting, belts and other moving parts to maintain, and less labor for operating. It is estimated that the capital charge of a modern reduction

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plant per ton milled is but one-third of what it was 15 years ago. The Rand Central mill, which is the largest on the Rand, was designed for 1000 stamps weighing 1650 lb., 300 of which were started in March. The framework is of timber, whereas the framework at the City Deep has been made of reinforced concrete, due to the high price of timber. The new mill of the City Deep contains 200 stamps weighing 2000 lb. This mill was designed to treat 20 tons per stamp, crushing through $\frac{3}{8}$ in., but it is expected that a capacity of 24 tons will be obtained. To obtain this capacity bypass screens preceding the stamps were installed. The undersize from these screens will go direct to the tube mills. The new Brakpan mill contains 160 stamps weighing 2004 pounds.

Some interesting experimenting¹ was done on the Rand at the City Deep mine, where four Nissen single stamps, weighing about 2000 lb., were operated side by side with two City Deep five-stamp batteries, each stamp of which weighed about 1800 lb., and indicated a saving of 2.6c. per ton for the Nissen stamps.

In the United States we have a few small mills operating stamps weighing 1400 lb. and over, but no large mills operating heavy stamps have been built. In Mexico the tendency is to adopt Rand practice, and the stamp weights are gradually increasing. At the Santa Gertrudis 1500-lb., and at the Providencia 1600-lb. stamps are used. At the Rosario mine in Honduras 20 stamps have

¹Eng. and Min. Journ., Dec. 23, 1911.

been installed, weighing 1800 lb. In the Porcupine district of Ontario, the Dome Mining Co. is installing 1250-lb. stamps, and two mills of the Cobalt district, Ontario, are reported to contain 1500-lb. stamps.

BYPASSING OF UNDERSIZE

To increase further the capacity of stamps, screens are being introduced preceding the stamp mill, and the undersize from the screen is bypassed directly to the tube mill. On the East Rand, E. H. Johnston proved recently that 10 stamps weighing 1634 lb., together with one tube mill, will crush 26.1 tons per stamp in 24 hours by the introduction of a bypass for the fines, whereas 80 stamps weighing 1680 lb., together with 8 tube mills and no bypass, crushed only 20 tons per stamp. The introduction of the bypass was tried in 1905, but never carried into practice on a large scale.

OTHER PULVERIZERS AND COMBINATIONS

The Giesecke mill, which is a combination of a ball mill and a tube mill revolving on the same trunnion, is being tested on the Rand by the Geldenhuis Estate. It resembles an ordinary tube mill with the exception of having two different-sized divisions. The first section, or ball mill, is 7 ft. 6 in. in diameter by 6 ft. long, and the second section, or tube mill, is 6 ft. in diameter and 18 ft. long. The feed to the mill comes directly from the crushers and should be about 1½ to 2 in., although it is built to receive a feed of 7-in. material. It is claimed by the manufacturers that one mill, in one operation, will do the work of 50 stamps and 2 tube mills. The tests have not been carried far enough to offer any positive opinion, but the final results from these tests will be looked forward to with much interest. If the results are favorable and the mill is introduced, it will eliminate amalgamation plates for ores containing no coarse gold. In Kalgoorlie ball mills are in use and have been most successful for crushing gold ores, and it is claimed by the operators that they show a much greater efficiency than stamps.

At Victor, Colo., the Ajax mill was designed along the lines advocated by Philip Argall, of Denver. The mill has a capacity of 200 tons and can be enlarged to 460 tons. The ore is broken to 1¼ in. and further reduced by rolls to ¼ in., thereby eliminating the stamps. The product from the rolls is fed to classifiers, from which the coarse is fed to tube mills and the overflow, together with the product from the tube mills, is then cyanided.

CHILEAN MILLS FOLLOWING STAMPS

Chilean mills between the stamp and tube mills were introduced in the Goldfield Consolidated mill, Goldfield, Nev.,

and in a 10-stamp mill at Wonder, Nev. The results obtained by the Goldfield Consolidated mill have been published and can be summarized as follows: It was decided in 1909 to increase the capacity of the mill from 600 to 850 tons per day. Two schemes were considered. The first required the installation of 40 stamps, 3 tube mills and 25 concentrators, together with the enlargement of the building for increased floor space, and the building of heavy foundations. The time required for this installation would have been six months and the cost would have amounted to \$175,000. The alternate scheme, which was adopted, consisted of the installation of six 6-ft. chilean mills between the stamps and tube mills, together with the necessary tables. The time required for this installation was three months and the cost amounted to \$75,000. In the present flow sheet the discharge from the 4-mesh battery screen is conveyed to classifiers from which the coarse product is fed to chilean mills having a discharge screen of 16 mesh. The sands from this crushing are fed into the tube mills. Not only has the installation cost \$100,000 less, but the cost of pulverizing is also slightly reduced, as will be seen from the following figures, when the stamps are crushing 8.5 tons per day through four mesh.

CRUSHING COSTS AT GOLDFIELD CONSOLIDATED

	Two-stage Reduction Cents	Three-stage Reduction Cents
Stamping	13.4	13.4
Chilean milling ..	..	10.3
Tube milling	30.0	16.6
Total	43.4	40.3

The crushing installation of the Nevada Wonder mill consists of 10 stamps weighing 1400 lb. each and crushing through four mesh. The product from the stamps is fed to a spitzkasten from which the coarse is fed to one 6-ft. chilean mill crushing through 30 mesh. The products from the spitzkasten and chilean mill are fed to a Dorr classifier, from which the coarse is fed to one tube mill.

AMALGAMATION

The suggestion was made to do away with amalgamation plates entirely in South Africa, pulverize the ore and cyanide direct. The objection to such a method would be the loss of coarse gold. There is a tendency to do away entirely with the apron plates, decrease the plate area and assemble the plates in a separate building together with the precipitating boxes for cyanide solutions. This building is known as the reduction house. The advantages of having the plates in a separate building are that there is freedom from grease and oil, that stamps do not have to be hung up while plates are being cleaned, and that there is less

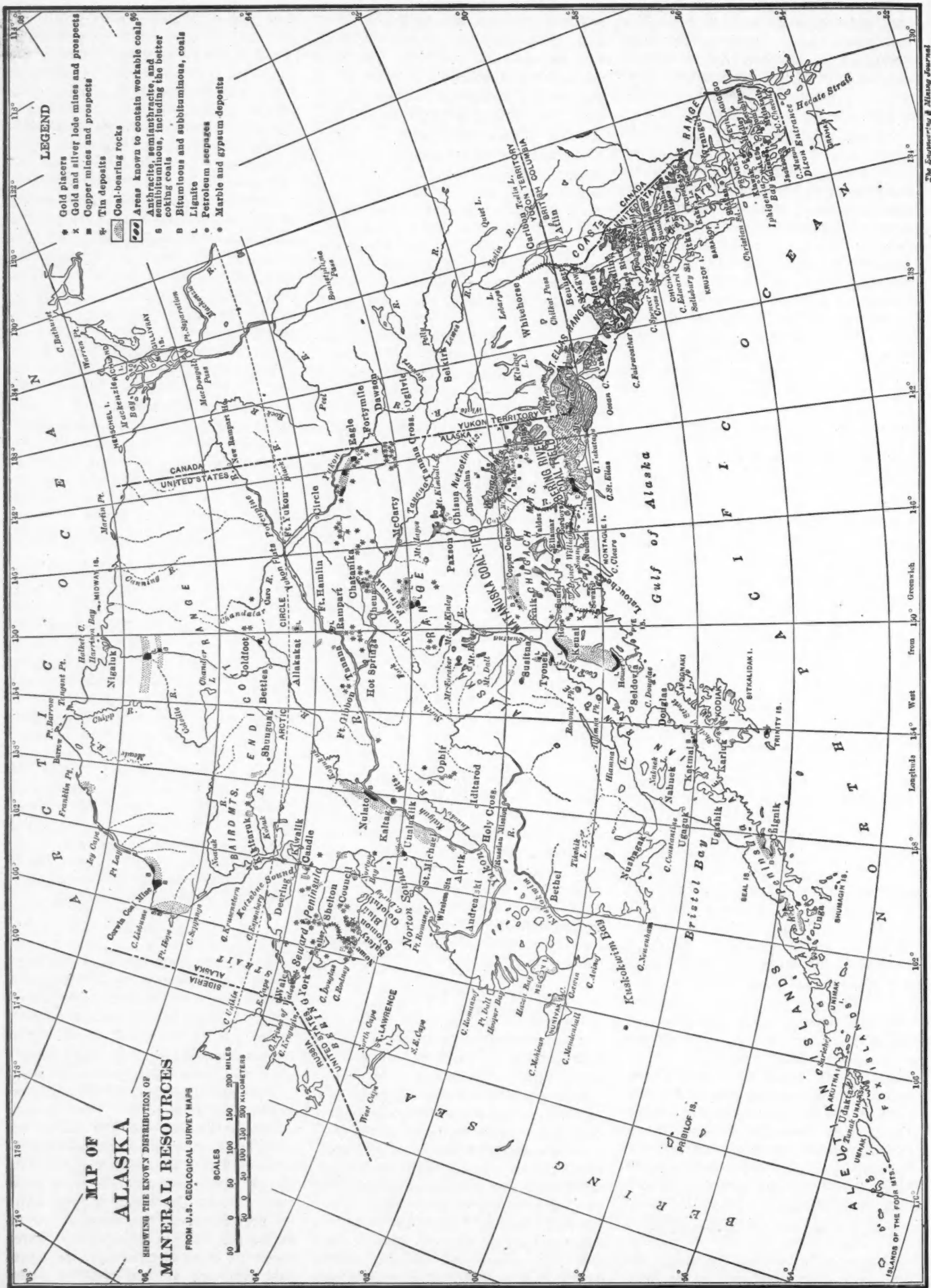
likelihood of amalgam being stolen. At the new mill of the City Deep, containing 200 stamps weighing 2000 lb., the ore, after preliminary sorting, breaking and stamping through 10 mesh, is pulverized in tube mills. The product from the tube mills is conducted to amalgamating tables in the gold-recovery house. In this house are also placed the precipitating boxes for cyanide solutions.

At the Simmer Deep-Jupiter the opening in the battery screen was enlarged, the apron plates abandoned, extra tube mills installed and the shaking plates replaced by stationary plates. The total plate area was decreased from 5276 sq. ft. to 1700 sq.ft.; the gold saved by amalgamation was 56.8% with the old arrangement and is 55.52% with the new arrangement. The total extraction by the old arrangement was 93.38%, and with the new arrangement the recovery has increased to 94.23%. At the Robinson Deep 74% of the amalgamable gold is saved on plates following the stamps and 26% on plates following the tube mill. Of the total gold recovered 56% is saved on the apron plates, 19.5% on the tube-mill plates and 24.5% by cyaniding of the tailings.

At the Goldfield Consolidated mill of Nevada, apron plates were used for the ores obtained from near the surface, but as depth was obtained the character of the ore changed and apron plates were abandoned. The practice at the present time consists of concentrating the slimes from the tube mills and amalgamating the concentrates. The concentrates contain 72% of the gold contained in the ore, from which 20% can be recovered by amalgamation. The concentrates, after being passed over amalgamating plates, are given a special treatment. In Ontario the only large mill nearing completion is situated at the Dome mines in the Porcupine district. The specifications call for apron plates and plates following the tube mill.

SUMMARY

Preliminary hand sorting is still being extensively practiced on the Rand and is becoming more in favor in the United States. The weight of stamps in South Africa was not increased but we find an increase in weight in Mexico. Experiments are being conducted on the Rand, to increase the crushing capacity per square foot of mill area. The Giesecke combined ball-and-tube mill and the advisability of screening the fines from the stamp-mill feed are being tested. In the United States chilean mills were introduced between the stamps and tube mills, thereby increasing the capacity and reducing the cost. In amalgamation, apron plates are being discarded and the coarse gold extracted on amalgamating plates following the tube mills.



Mining in Alaska in 1911

By Alfred H. Brooks*

The value of the total mineral output of Alaska in 1911 is estimated at \$20,370,000, compared with \$16,883,678 in 1910. The gold output in 1911 is estimated to be worth \$17,150,000; that of 1910 was \$16,126,749. It is estimated that the Alaska mines produced 22,900,000 lb. of copper in 1911, valued at about \$2,830,000; in 1910 their output was 4,241,689 lb., valued at \$538,695. The silver production in 1911 is estimated to have a value of \$220,000, compared with \$85,236 for 1910. The value of all other mineral products in 1911, including tin, marble, gypsum and coal, was about \$170,000, an increase over that of 1910.

By using the above estimates for the output of 1911, the total value of Alaska's mineral production since 1880, when mining first began, is found to be, approximately, \$206,600,000, of which \$195,950,000 are represented by the value of the gold output. The total production of copper in Alaska since 1901, when systematic mining of this metal began, is about 56,700,000 lb., valued at about \$8,170,000.

GENERAL CONDITIONS FAVORABLE

The favorable showing made by the Alaska mining industry during the year is due, first, to the large output of copper and, second, to the greater production, compared with 1910, of the gold placer mines in the Innoko-Iditarod region. Aside from the increased production, the most important event of the year was the opening of the Copper River region by the completion of the railway into it. The industries already stimulated by this line strikingly illustrate the importance of railway communication to Alaska. As no progress was made in the opening of the coal fields, the needs for cheap fuel in Alaska are being met by the substitution of oil-burning for coal-burning engines. The importation of California crude oil is rapidly increasing, with a corresponding decrease in the use of coal. Some new drilling was carried on in the Katalla oil field during 1911, one or two old wells being reopened and a small production made. The oil was refined and the gasoline sold in the local market.

Although most of the gold still comes from the placers, much progress was made during 1911 in paving the way for an increased output from auriferous lodes. This work was carried on in most of the gold-bearing areas of Alaska,

but the most notable advances were in the Juneau, Valdez, Kenai Peninsula, Willow Creek and Fairbanks districts. Aside from the increase in copper mining, the advances made in developing lode gold mines are the most encouraging feature of the year's operations. Dredge mining also made great progress, notably in the Nome region. It is estimated that, in the entire territory, 22 dredges were operated for the whole or a part of the open season of 1911. In addition to those operated, at least six were in process of construction.

TRANSPORTATION FACILITIES INCREASED

As improvement in transportation is the most important element in the advancement of the mining industry, the progress of the year in this respect will be briefly summarized. The Copper River & Northwestern Ry. was completed to Kennicott in April, 1911. There was no other railway construction in Alaska during the year, though some railway surveys were made. At the close of 1911 there were 465 miles of railway in the territory, compared with 371 miles in 1910. This mileage is distributed among nine different railways, from 5 to 196 miles in length. The existing lines emphasize the need of additional transportation facilities. The most urgent need is for a railway to connect an open port on the Pacific with the Yukon basin. Until such a line is built only the richest placers of the interior and only the most favorably situated lodes can be profitably operated.

IMPORTANT NEW TRAILS

The Alaska Road Commission continued its important work of making mining districts accessible by the building of wagon roads and trails. Probably the most important undertaking of this kind was the completion of the winter trail from Seward, on the Pacific seaboard, to the Iditarod placer district. This not only serves several placer camps, but also shortens the winter route to Nome by about 300 miles. Work was also continued on the Valdez-Fairbanks trail, which can now be used both as a winter route and as a wagon road in summer. A cutoff was built which connects the wagon road with Chitina, on the railway.

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Note—Abstract of preliminary report to the director of U. S. Geological Survey.

LARGER PRODUCTION FROM GOLD LODES

It is estimated that there were 15 mines in Alaska which produced in 1911. Custom mills at Valdez, Chena, Fairbanks, Nome and Skagway were operated and milled ore from many prospects which can not yet be classed as productive mines. Some development work was done during 1911 on several hundred prospects widely distributed over the territory. The output from auriferous lodes in 1911 is believed to have been somewhat larger than that of 1910, which was valued at \$4,105,459.

Auriferous lode mining was first attempted in the Ketchikan district about 12 years ago. Several conspicuous failures made at that time so discouraged operators that relatively little attention has since been paid to gold mining in this district. However, some development work has been continued, and in 1911 work was pushed on several properties near Dolomi and on Georges Inlet. The advances made in the Portland Canal region of British Columbia stimulated prospecting on the Alaska side of the boundary and within the Ketchikan district. Some encouraging results were reported in this field.

JUNEAU CENTER OF LODE MINING

In point of production the Juneau district continues to be the center of the gold lode mining industry of the territory. In 1911 the Alaska-Juneau Co. began driving a 6000-ft. tunnel from lower Gold Creek, which by the use of a tram from the entrance of the tunnel will form an outlet for the mine to tidewater and permit operations throughout the year. The Treadwell group of mines and the Perseverance mine continued their normal activity. Work was continued at the Eagle River mine, and much systematic prospecting was accomplished in the region lying between the Juneau and Berners Bay districts. In the Berners Bay district work was done which will soon put both the Kensington and Jualin mines again on a productive basis.

The Chichagof and Golden Gate mines, in the Sitka district, each supplied ore to 10-stamp mills. The success of these two properties has stimulated the development of a number of prospects in the adjacent portions of Chichagof Island.

PRINCE WILLIAM SOUND REGION

Gold lode prospecting and developing were active in the Prince William Sound region during 1911. Interest centered in the Port Valdez district, though much was accomplished in the McKinley Lake region near Cordova, and some promising prospects are said to have been found near Port Wells and Gravina Bay.

The gold-bearing region of Port Valdez, as defined by the prospecting already accomplished, stretches from Columbia Glacier on the west to the east side of the Valdez Glacier on the east, a distance of about 20 miles. It can be roughly blocked out on the north by a line paralleling the axis of the inlet and three to five miles from tidewater and on the south by a similar line from one to two miles from tidewater. Some gold-bearing veins have, however, also been found to the east of the above-described boundary, in the vicinity of the Valdez-Fairbanks trail, and the Port Wells prospects lie in what may be a western extension of the same belt. Most of the important development work in the region has been confined to the vicinity adjacent to Shoup Bay, to Mineral Creek, and to the west side of Valdez Glacier.

The bedrock consists of closely folded and faulted slates and graywackes, with some quartzites, cut by a few porphyry dikes. Well-defined fissures are not uncommon in the district, and some of them carry the metalliferous quartz veins which furnish the orebodies now being prospected. Fissuring seems to be especially marked in the Shoup Bay region, where two systems were noted. Besides the fissure veins there is a larger number of stringers, some of which carry high gold content. The vein filling consists chiefly of quartz. The most abundant metallic minerals are pyrite, galena and free gold. In most places there is marked surface enrichment in gold content, but this does not usually extend to a depth of more than a few feet. It seems improbable that the grade of ore found below this superficial zone will continue in depth.

The Cliff is the only productive mine yet developed in the district, but a score or more of other properties have produced some ore that has been milled at Valdez. A depth of 100 ft. below tidewater has been reached in the Cliff mine, with, as reported, no marked changes in grade.

DEVELOPMENTS IN KENAI PENINSULA

The year 1911 witnessed much activity in the prospecting and developing of gold lodes in Kenai Peninsula. The bedrock of this field is similar to that of the Port Valdez district, being composed

of closely folded and faulted slates and graywackes cut by porphyry dikes. As much of the bedrock is mantled by vegetation or alluvial deposits, less information regarding the fissuring is available than in the Port Valdez district, but some well-defined fissure veins have been uncovered. Quartz, with some calcite, forms the chief vein filling, and the dominating metallic minerals are pyrite, arsenopyrite and free gold. Another form of deposit is found in the mineralized porphyry dikes. These are fractured and permeated by quartz and calcite veins, and the dike rock itself is in places heavily charged with pyrite. In 1911 a 5-stamp mill was installed on the property of the Kenai Alaska Gold Co. and a 3-stamp mill on the property of the California Alaska Mining Co. The smaller mill appears to have been utilized only in prospecting, but the larger one was operated for a part of the summer. Considerable development work was also accomplished on a number of other properties, notably on some near Seward, at the head of Kenai Lake, and on Crow Creek.

In the Willow Creek district of the Susitna Valley there were two productive lode gold properties, the Gold Bullion and the Alaska Gold Quartz. Development work was done on three other properties. The claims of three companies, the Gold Bullion Co., the Alaska Gold Quartz Mining Co. and the Brooklyn Development Co., were surveyed for patent, and preliminary surveys were made on other properties. Considerable prospecting was also done on other claims. An average of about 50 men was employed in the district during the summer. Five 1000-lb. stamps were added to the 2-stamp mill in use at the Gold Bullion mine in 1910. A 3-stamp mill with 500-lb. stamps, driven by a Pelton waterwheel, was erected on the property of the Alaska Gold Quartz Mining Co. Aerial tramways were installed on both these properties.

Lode gold mining advanced but little in southwestern Alaska during 1911. The Apollo mine, on Unga Island, was operated during the summer and some developments were made on other properties in the vicinity. Some veins were also prospected on Afognak Island, near Malina Bay.

THE FAIRBANKS DISTRICT

Much work was done during the year on lode gold properties in the Fairbanks district. Many of these shipped ore from development to the custom mills at Chena and Fairbanks, and it is estimated that over \$50,000 worth of gold was recovered from this source. Late in the summer small stamp mills were installed on the Free Gold and Tolovana properties, in the upper Cleary Creek

basin, and on the Newsboy, which is situated near the divide between Eldorado and Cleary Creeks. Although claims were staked and more or less prospecting was done during the year in much of the Fairbanks district, the most important developments were confined to certain areas. These will be mentioned in geographic order from east to west.

A more or less ill-defined belt parallels Fairbanks Creek. In this belt the most easterly prospect reported is on Coffee Dome, where a vein is reported to be 18 in. wide. A 50-ft. shaft, showing 3 ft. of ore is said to have been sunk on the Eureka claim, and work was continued on the McCarty Creek vein. Both these properties produced some ore, which was milled at Chena. A 30-ft. shaft, in which a vein 1 ft. wide is reported to have been exposed, was sunk on the Governor claim, situated in the upper Fairbanks Creek basin.

To the west the Fairbanks Creek belt merges with a second center of mineralization, which lies on the divide between Fairbanks and Cleary Creeks. An adit tunnel was driven on the Russian Kid claim, at the head of Wolf Creek, for about 300 ft. to intersect a vein which outcrops higher on the hill. Though at last reports the adit had not reached the main vein, a rich stringer was crosscut. On the adjacent Rexall claim a vein was crosscut at a distance of 127 ft., then followed for about 52 ft. This vein is said to be from 8 in. to 2 ft. 10 in. wide, and the ore recovered was shipped to the Chena mill. A new vein about 18 in. wide is said to have been found not far from this region.

CLEARY CREEK REGION

A third zone of mineralization is that defined by numerous properties situated in the headwater region of Cleary Creek. Among the important developments were those at the Gold Bullion mine, which was operated for most of the year. Here a 5-stamp mill was installed in September, before which the ore had been treated at the custom mill. The Tanana Quartz Hydraulic Co. is opening what is said to be an extension of the same vein. Here a 100-ft. shaft was sunk and the ore followed by a 20-ft. drift. The vein is said to range from 10 in. to 7 ft. in width. A 4-ft. vein is also reported to have been stripped on this property. This work, as well as that done on the Free Gold, shows that faulting is not uncommon. A small mill was installed at the Tolovana property, which lies in the same belt. An adit tunnel was also driven on a claim near the junction of Rex and Chatham Creeks, and a 4-ft. vein is said to have been exposed. Skoogy Gulch, on the Pedro Creek side of the divide, has been the scene of consid-

erable development work. The reports indicate that the most important advances in this field were those on the Rainbow claim. A 45-ft. shaft was sunk on a vein said to be 2½ ft. wide. Considerable ore was shipped to the Chena mill from this property.

In 1911 some discoveries of gold-bearing quartz were made in the divide between Cleary and Eldorado Creeks. Here the Newsboy property was developed by a shaft 112 ft. deep and the vein was followed by drifts on two levels. An air compressor and a 5-stamp mill were installed on this property in the late summer, before which considerable ore had been shipped to Chena. Some work was also done on claims situated near the divide between Dome and Cleary Creeks. A 78-ft. shaft was sunk on the Friederichs property. A 370-ft. tunnel and 100-ft. shaft were put down by the Reliance Mining Co., and are reported to have opened a 7-ft. vein. The Ryan vein, situated near the divide between St. Patrick and Eva Creeks in the western part of the Fairbanks district, marks a new center of lode-mining development. This vein has been opened by a 45-ft. shaft, said to have revealed a thickness of 3 ft. of vein matter.

COPPER MINING INCREASES

Copper mining in Alaska received an enormous impetus in 1911, due chiefly to the activity in the Prince William Sound region and the Kotsina-Chitina belt. The production was more than five times that of 1910. In the Ketchikan district productive mining was continued in the Mount Andrew, It, Rush & Brown and Jumbo mines during 1911. The Red Wing mine was equipped with a compressor and drills and preparations were made to begin shipping ore. Considerable development work was done on the Victory property, near Seal Bay.

Of the Prince William Sound properties the Beatson-Bonanza and Ellamar were operated on a productive basis throughout the year. Some shipments were also made from the Threeman property, on Landlocked Bay. This mine has been systematically developed on three levels, and the completion of a new wharf in 1911 places it in a position to become a regular producer. The Fidalgo Bay Copper Mining Co. has also arrived at the stage of shipment, an aerial tram having been completed from mine to wharf in 1911. The Seattle-Alaska Copper Co. installed a concentrating plant at its mine on Latouche Island, which has been developed by an adit said to crosscut the orebody 400 ft. below the outcrop. Some developments were also made on the Barrack Girdwood claims on Latouche Island. The Knight Island Copper Co., at its

property near Drye Bay, installed an air compressor and drove two tunnels in which an orebody said to be 12 ft. wide is exposed at a depth of 85 ft. below the outcrop.

IMPROVED TRANSPORTATION

The improved transportation facilities furnished by the Copper River Ry. led to more development work on copper properties in the Kotsina-Chitina region than in any previous year, but details in regard to this work are lacking at present. The shipping of ore from the Bonanza mine began in April and continued throughout the rest of the year. A plant was installed at the end of the railway for concentrating the lower-grade ores of the talus slope at the Bonanza mine. Much development work was done on the Mother Lode property, which is on the McCarty Creek side of the Bonanza divide, and a large body of high-grade ore is said to have been blocked out. Systematic development work was also undertaken at the Nikolai property, also in the McCarty Creek basin. At Copper Mountain, near the western end of the belt, the orebody was crosscut at a depth of 1000 ft. below the outcrop. It appears that developments in this vicinity have been sufficient to block out a large amount of ore, and the depth to which the lode has been traced is an encouraging feature, indicative of the permanency of at least some of the ores in this part of Alaska.

TIN RECOVERED BY DREDGING

There was much mining activity in the York tin-bearing district of Seward Peninsula during 1911. The tin placers of Buck Creek have been worked in a small way for nearly 10 years. In 1911 these operations gave way to dredging. A dredge with 2½-ft. buckets was installed about the middle of September and operated until the close of the season. According to current reports, between 80 and 100 tons of concentrates were recovered in this way. It is reported that new drifting on the Lost River and Cape Mountain cassiterite-bearing lodes met with encouraging results.

PLACER YIELDS NEARLY \$13,000,000

The value of the output of the gold placers of Alaska in 1911 is estimated at about \$12,700,000; the corresponding value in 1910 was \$11,985,000. This increase in 1911 is to be credited to the Iditarod-Innoko region, for the output from both the Fairbanks and Seward Peninsula districts was less than in 1910. Placer mining is a relatively unimportant industry in the Pacific coast region of Alaska. In 1911 one placer mine was operated on Gold Creek, near Juneau,

and several in the Porcupine district, north of Lynn Canal. Beach mining occupies the time of from 25 to 50 men during part of each summer at Yakataga, east of Controller Bay, and at several places in southwestern Alaska. Some new beach diggings are reported to have been discovered near Uyak, on Kodiak Island, during the year. Two hydraulic plants and several smaller outfits were employed in placer mining in the Nizina district. About 20 claims were worked in the Chisna district. A hydraulic plant was installed on Chisna River and considerable drilling was done to test placer ground in other parts of this field.

No noteworthy advances were made in the mining of Kenai Peninsula placers. The discovery in 1910 of gold-bearing gravels near the head of Kenai River was followed by the staking of practically the entire length of the river as possible dredging ground. In 1911 a small dredge was installed below Copper Creek, but it appears to have given unsatisfactory results. The installation of a large dredge, started during the summer, was not completed at the end of the season. Hydraulic plants were in operation on Crow, Resurrection, Canyon, Gulch, Quartz, Cooper, Mills and Sixmile Creeks. On Cooper Creek a Ruble elevator was in use.

PROSPEROUS SEASON IN SUSITNA BASIN

The Yentna district of the Susitna Basin, where about 100 men were employed, had a more prosperous season than usual, although the shortage of water during the latter half of the summer somewhat cut down the production. Most of the gold output came from Cache and Peters Creeks and their tributaries. The largest production in 1911, as in 1910, was from Nugget and Willow Creeks, although the discovery of an old channel in the bench of Dollar Creek placed that stream among the important producers of the district and gives promise of a still larger output for 1912. Mining operations were continued in the basins of Twin and Mill Creeks. Some excitement was caused late in the summer by the discovery of coarse gold on Lewis Creek, a tributary of Theodore River, on the west side of the Susitna Mountain. The creek was visited by a number of men, and most of it was staked, but the lateness of the season prevented a thorough prospecting of this valley.

Placer mining continued in a small way on Valdez Creek during 1911. The most important event of the year was the consolidation of a group of claims, with a purpose of their development as a single unit. Preliminary steps were taken looking to the installation of a large hydraulic plant.

FAIRBANKS LEADS IN PLACER MINING

Fairbanks continues to lead all the other Yukon camps in placer gold mining, though the output of 1911 was considerably less than that of the previous year. The most important advancement of the year was the installation of a dredge on upper Fairbanks Creek, the first dredge in this district, though plans have been made for others. Mining operations were somewhat hampered in June and July by the lack of men, due to the stampede to Ruby Creek. The water supply was, as usual, inadequate, and this condition was probably of more serious consequence than in the previous year. Goldstream, Engineer, lower Cleary, and Fairbanks Creeks were the principal producers. It is estimated that about 75 claims were worked in the winter and about 124 claims in the summer of 1911, and that from 900 to 1200 men were employed.

CIRCLE DISTRICT SECOND

Of the Yukon camps Circle was second in importance as a gold producer. Three hydraulic plants, all on Mastodon Creek, were installed in this district during the summer of 1911. All these suffered for lack of water and operated only a part of the season. In addition to this, the two existing hydraulic plants on Eagle and Mammoth Creeks were operated so far as water permitted. The principal producing creeks were Mastodon, Deadwood, Mammoth, Eagle, Independence and Switch. It is estimated that in the Circle district 29 claims were worked during the winter and 37 claims during the summer of 1911. In the Beaver Creek region no important advances were made. The best prospects in this basin are said to be those on Ophir Creek.

SMALLER YUKON DISTRICTS

The Hot Spring district had a successful season. The mines in the Sullivan Creek region had the largest production. Some new placer ground was discovered on American Creek, 15 miles west of Sullivan. Mining continued to yield about a normal production in the Koyukuk, Rampart, Salchaket and Bonfield districts.

Two dredges were successfully operated in the Fortymile region. One on Walkers Fork worked the entire open season; the other, situated on the South Fork, 3 miles below Franklin, began operations about July 1. The latter had been moved from Walkers Fork to its present site during the winter. The smaller operators were hampered during the summer by lack of water, and the Ruby Creek excitement carried many men away from the district. A large ditch was under construction at Dome

Creek. It is estimated that in the Fortymile district proper about 115 men were working on 35 claims during the winter and 90 men, including those engaged in dead work, on 15 or 20 claims in the summer.

Mining was continued in a small way in the region tributary to Eagle, which includes the American, Mission and Seventymile basins. It is estimated that winter work was done on 20 claims by the same number of men, and summer mining on 19 claims by 30 men.

NEW PLACER DISTRICTS

In the summer of 1911 some placer gold was found near Red Mountain, on the headwaters of Indian River, which is in the Koyukuk River drainage basin. There are said to be about 50 men prospecting in this region, and a little placer gold was mined. The auriferous gravels of the Nowitna River region also excited some interest in 1911, though no important discoveries were reported.

The Ruby Creek region of the Yukon attracted renewed interest in 1911. Ruby Creek is a small stream flowing into the Yukon from the south opposite the mouth of Melozitna River, about 200 miles below the Tanana. Gold was found in the Ruby Creek gravels in 1907, and since then there has been a little productive mining each year. Considerable excitement was caused among the Yukon miners by the reported discoveries during the summer of 1911 of rich placers in some creeks situated in this general region and from 20 to 30 miles from the Yukon. As a consequence, there was a general movement toward the new find from the Yukon camps. These discoveries of placer gold were made in the headwater regions of Solatna River, which heads on the south side of the Ruby Creek divide and flows northeastward to join the Nowitna, a southerly tributary of the Yukon. The creeks reported to carry gold are Glenn and Birch, both tributary to Flint Creek, and Long Creek.

It is known that there is a considerable area lying south of the Yukon, in which the bedrock is the schist and intrusive granite typical of most of the Yukon placer districts, and that alluvial gold has been found at a number of places within this area. This region is one, therefore, worthy of careful attention on the part of the prospector.

IDITAROD-INNOKO YIELD

Little detailed information is available regarding the season's operations in the Iditarod-Innokko region. It is reported that the total gold production for 1911 is worth \$3,500,000, compared with \$800,000 for the previous year. It appears that much of the gold produced was

from the Flat, Otter, Willow, Happy and Chicken Creek basins, in the region tributary to the town of Iditarod, and that in this field some work was also done on Black, Little and other creeks.

On the Kuskokwim side of the divide, including the Georgetown and Tokatna regions, Julien and Moore creeks were reported to be the scenes of the most important mining and it is said that gold placers have also been found on Doulin, Crooked, Beaver, Marietta and Michigan creeks. In the Innoko region Ganes and Little creeks are said to have been the chief producers. There was much prospecting during 1911 in the lower Kuskokwim region. Mining continued in a small way on Tuluksuk Creek, and it is reported that some promising finds of gold placers had been made near Goodnews Bay.

DREDGING IN SEWARD PENINSULA

The gold production of Seward Peninsula for 1911 is estimated to be worth \$3,100,000; that of 1910 had a value of \$3,500,000. In view of the fact that the winter operations of 1910 produced almost \$1,000,000 worth of gold, while those of 1911 probably had a value of less than \$200,000, the output of the summer was far greater than in the preceding year. It seems probable, therefore, that the peninsula may have reached its minimum gold production for some time to come.

As in 1910, the important feature of the mining industry was the building and operating of dredges. Nineteen dredges were operated for a part or the whole of the season, of which five were built during the summer of 1911. Of these, seven were in the Nome region, seven in the Solomon River basin and five in the Council district. In addition to these, five more dredges were in process of construction, of which three are in the Nome region and one each in the Council and Kougak districts. While dredging was the most important industry, other phases of mining were not neglected. A number of hydraulic plants were operated in the Kougak, Nome and Fairhaven precincts, and there were in the aggregate many small plants in operation. An important feature of the year's mining was the fact that a large number of the dredges continued operations until the first week in November.

Interest in the Kobuk region appears to have subsided somewhat. A number of claims were worked in the Squirrel River region, but, so far as known, no new discoveries of importance were made. There was a little mining in the Shungnak region of the upper Kobuk and a \$600 nugget was found on Dahl Creek.

Metal Mining in Colorado in 1911

By George E. Collins*

The history of mining in 1911 throughout the State of Colorado was comparatively uneventful. No bonanza discovery was recorded, and the most important new developments were the continued opening up of bodies of zinc-carbonate ore at Leadville, and the completion of the Roosevelt drainage tunnel, which is bound in time to exert a great effect in the Cripple Creek district.

GOLD AND SILVER

Cripple Creek retains its position of undisputed primacy in the production of gold, and is likely to do so for many years to come. The greatest mines are those which have held the lead for several years past; namely, the Golden Cycle, Portland, Vindicator, Elkton and El Paso. The Golden Cycle has displaced the Portland as the premier producer, and it is generally understood that it has by far the largest ore reserves. A special dividend of a million and a half dollars was recently declared, but this may have some relation to the announcement that a suit has been brought against the Golden Cycle by the Christmas Mining Co., the control of which is held by the Vindicator. It is claimed that the Christmas contains the apex of one of the most extensive orebodies now being worked in the Golden Cycle. There is no change in the milling situation at Cripple Creek, excepting that the cyanide process has virtually displaced the chlorination method, both for the treatment of high-grade and low-grade ores.

Reports are current that the plant of United States Reduction & Refining Co. will be acquired by the Golden Cycle company. Meantime, the mill has been closed, the reason given being the difficulty of obtaining a sufficient ore supply in competition with the Golden Cycle and Portland mills. For the handling of material from the dumps, raw cyaniding, preceded by concentration, is a proved success at the Stratton's Independence and Portland mills. At the Ajax a new mill, employing the Clancy method, is being completed, and its results will be looked forward to with deep interest.

SMUGGLER-UNION WILL WORK ZINC ORES

In the San Juan district, San Miguel County continues active. The Liberty Bell, Smuggler-Union and Tomboy each maintains a large production. The Smuggler-Union has, however, seen its best

days, and will in the future have to depend for its output largely on dumps and old stope-fillings. The vein contains considerable zinc, especially in the lower levels, and the Smuggler mill is in process of being remodeled, with a view to saving this. The life of the Tomboy will probably be greatly extended by the recent purchase from the Revenue company of the Montana group of claims, which will be worked through the Ophir tunnel, and the ore trammed direct to the Tomboy mill. At Ouray the large production during recent years has been furnished almost entirely by the Camp Bird, which is now practically exhausted. The outlook for this district is, therefore, somewhat unpromising. It is indeed probable that many other bonanza mines will be developed, but they have yet to be found.

In the Silverton district the Sunnyside is now the only large producer of gold. The Gold King and Iowa are being operated only in a small way by leasing companies. The continuation of the large orebodies formerly worked in the Gold King, which were cut off by faulting, has not been found. In the southeastern part of San Juan County, and in the Bear Creek district, a number of veins have been opened up carrying gold and silver in the form of tellurides. Experiments indicate that these can best be treated by modifications of the cyanide process, preceded in most cases by wet concentration. The main drawback is that the orebodies at present exposed are relatively small, but the grade is often high, and but for the difficulties in transport, due to severe winter climate and rugged topography, it is probable that cyanide custom mills would have been built before now.

Several promising discoveries of high-grade ore are reported from the La Plata district, but its output has been restricted by the inactivity of the Idaho and May Day, which are still engaged in litigation. The Neglected mine is practically idle, awaiting some comprehensive plan of reorganization.

The Creede and Aspen districts continue to make a large production of silver. In the latter the consolidated Smuggler and A. J. properties have been unwatered through the Free Silver shaft, and the management has been transferred to W. W. Davis and John Campion, well known in connection with the Yak tunnel, at Leadville.

NEWHOUSE TUNNEL DRAINS LARGE AREA

In Gilpin County the expected revival has been delayed, owing largely to the

exhaustion of the resources of the local mining men, in consequence of the long period of stagnation and the difficulty of raising capital outside under present conditions. Work on the Gregory-Bobtail group is entirely suspended, and this great property is advertised for sale in the United States bankruptcy court. Meantime, the water has not risen as high as was feared, and it seems evident that it is carried off to some extent, at least, through the Newhouse tunnel. The latter has drained the Gunnell, and partially all the other mines north of Nevada Gulch, while its influence has been felt for a great distance along an east-west line in the direction of Black Hawk. The Quartz Hill mines are, however, practically unaffected, and will doubtless continue so until some lateral is made from the tunnel toward the west, so as to cut the California watercourse. The largest producer has been the Frontenac, the new concentrating plant of this company having commenced operations early in the year, while good ore is said to have been opened up in the Topeka.

In Clear Creek County the bulk of the production has been made by lessees. The largest producers were the Gem and Bellman, worked through the Argo (Newhouse) and Central tunnels, respectively, and situated on the same fissure. The continuation of the same line of fissure has just been intersected in the Lucania tunnel, where it is understood that extensive bodies of mineral were found. At Georgetown tributaries have been busy in the Capital property on the Aetna vein. As a whole, however, the industry is distinctly depressed in this district.

PROFITABLE DREDGING OPERATIONS NEAR BRECKENRIDGE

At Breckenridge the Revett and Reiling dredges, on French Gulch, were actively and profitably operated, and the large dredge on the Swan, operated by the Colorado Gold Dredging Co., was also kept at work. A steam-shovel plant was installed to operate the Buffalo placers in this district, with what commercial result is not known. The Twin Lakes placer, near Granite, has been idle, and its future operation is likely to be hampered by opposition of those owning water rights on the Arkansas River. The other placers in Colorado have been unproductive; but plans have been made for reworking on a large scale some of the alluvial ground near Fairplay. The discovery of placer gold in commercial quantity is reported at Newlin's Gulch, near Denver.

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LEAD AND ZINC

It is believed that the lead production of the state continued to decrease, and it is hardly probable that any great development of lead ore can be looked for at present. The production of zinc has, however, increased, owing to the important discoveries of zinc carbonate at Leadville, previously referred to. These discoveries were made during the preceding year, but have only now begun fully to show their effect on the production. No great extension has yet been added to the productive area, which still centers in the Wolf Tone, Maid of Erin, Morning Star and Evening Star. So far, there is only a market for such ores when they contain over 30% of zinc. It is, however, certain that Leadville has great resources in zinc-carbonate ores of much lower grade, running from 15 to 30%, which at present are awaiting some method of utilization.

The largest aggregate production of lead is made in the San Juan, particularly at Silverton. Here the chief individual producing mines are the Iowa, previously referred to, and the Silver Lake, which is now being operated again on a small scale by the owners. Considerable bodies of mixed lead-zinc ore have been opened up in the Silver Ledge. At Telluride the Alta is a large producer of lead ore.

Aspen continues to produce a large tonnage of low-grade silver-bearing lead ore. The same may be said of Creede, where the various claims along the Amethyst vein are actively producing lead-zinc concentrating ores, and where a project is under way to sink below the tunnel level. The principal lead resources of the state are intimately associated with zinc, and usually also with pyrite. Such mixed-sulphide ores are capable of making a great aggregate production, the chief difficulty being that most of the individual mines are small, and therefore do not warrant the provision of the elaborate separating plant necessary to produce marketable products. Large orebodies of this character exist in the Iron Mask and other mines at Red Cliff; and the Wellington mine at Breckenridge may also be cited as a case where complex lead-zinc ores are being treated successfully. Other important deposits occur at Rico, at the Mary Murphy, in Chaffee County, and many other localities scattered throughout the state. At Bonanza a deep tunnel is being driven to unwater and develop in depth the Rawley mine, which promises to become a considerable factor in the lead output.

COPPER

There has been no change in the output of copper, the production of which continues to be incidental to the mining of other metals, and particularly of gold

and silver. A number of small producers of purely copper ores may, however, be noted in the San Juan. The principal of these, the Frank Hough, has been idle throughout the year on account of the destruction by fire of its surface equipment. It is probable that this mine will be reopened by tunneling through Engineer Mountain during the coming year. The greatest production, however, is at Leadville, where copper occurs intermixed with the well known complex sulphides of that district.

RARE METALS

The falling off of the demand for tungsten concentrate, due to the depression in the steel market, occasioned a sharp fall in the prices paid, which was followed by a great diminution in the activity of mining for this metal in Boulder County. No production of tungsten was made in the San Juan, or in the other known localities throughout the state, the occurrence in every case outside of Boulder County being pockety and uncertain. A little uranium ore (pitchblende) has been mined in Gilpin County, where occasional lenses of this mineral are found, associated with gold ore, in a belt of country on either side of the western part of Quartz Hill. In San Miguel County the mill at Newmire, now owned by the Primos Chemical Co., kept steadily at work treating the vanadiferous sandstone of that district, while an active market has existed for the uranium- and vanadium-bearing sandstone, impregnated with carnotite, from the neighborhood of Paradox Valley. Several teams were kept continuously busy hauling ore from the latter district to the railroad, and many claims are reported recently to have changed hands. There is, however, little accurate information available with reference to these deposits, or the market for the ore.

GENERAL CONDITIONS

The labor situation remains unchanged. There is, if anything, a gradual increase in efficiency, as the supply of miners overtakes the demand, and especially because the Western Federation of Miners is less active. It will, however, take many years before mining labor generally will be as efficient as it was previous to 1900. The older districts, such as Gilpin and Clear Creek Counties, where no important improvements in mining methods or ore treatment have yet been evolved to counter-balance the higher underground costs, have been the greatest sufferers in this respect.

In October a great blow was struck at the prosperity of the San Juan region, and particularly the Silverton and Rico districts, by a destructive flood, which destroyed many miles of the Denver & Rio Grande and Rio Grande Southern railroad tracks. Railroad communication

with Durango and Silverton is now restored; but the road between Durango and Rico is still blocked. The railway blockade necessitated the temporary closing of the Durango smeltery, and of such of the mines as are dependent on coal for power. The experience of the last few years has shown conclusively that the economic bearing of such recurring disasters has hitherto been under-estimated.

Apart from Leadville, the only district in which increased activity may be looked for in the near future in Cripple Creek. The Roosevelt drainage tunnel has not relieved the deep mines of their water quite so rapidly as was hoped by the more sanguine operators; and it appears that the volcanic plug is less permeable in depth, the water discharge being more confined to definite channels. The total quantity of water, on the other hand, as estimated from the amount discharged in proportion to the rate of recession of the water-level in the mines, is less than was estimated. The lowest levels of the El Paso, Elkton, Portland and other mines are becoming accessible for the first time since 1907. Even if it proves correct, that the orebodies at great depth are on the whole fewer than at surface, it is probable that the production from those already proved, together with the encouragement to prospecting which will follow the liberation of large sums of money in dividends, will together suffice to maintain the production of the district at or above the present level for several years.

The greatest need of Colorado is vigorous prospecting; and a praiseworthy attempt was made, by a committee appointed by the Denver Chamber of Commerce, to stimulate this. A fund was raised to grubstake prospectors, who were outfitted and sent into the hills. As a result, a large number of claims have been located, from several of which encouraging assays are reported. One-half interest in the claims was reserved by the Chamber, and a development company is now being organized under its auspices to develop them. It need hardly be pointed out that the expenditure of a few thousand dollars to grubstake prospectors is a mere drop in the bucket, and nobody realizes this better than some of the gentlemen who gave their gratuitous services to organize the work. The greatest value of the undertaking will doubtless be in the direction of legitimate advertising; and it is very probable that the Chamber's venture may be the indirect means of stimulating a really noteworthy increase of interest in prospecting. The great difficulty—that of finding competent prospectors—still remains. Prospecting is a rough life at the best, fuller of hardships than rewards; and it is probable that the prospector, like the pioneer, belongs to a vanishing race.

New Mexico in 1911

Special Correspondence

The chief interest in mining in New Mexico in 1911 centered in the developments at the mine and mill of the Chino Copper Co. On Oct. 21, the first section of the mill at Hurley, about 10 miles from the mine at Santa Rita, was placed in commission, after several years of continuous and well directed mine development and mill construction. The mine is by no means a new one, having been worked in former years under the name of the Santa Rita. While the ore is a "porphyry ore," it differs in some respects from that found in the other "porphyry" properties. The successful development of the mine has been largely due to John M. Sully, now manager of the company, who made a minute study of the peculiarities of the deposits, over a period of about seven years. Up to October there had been developed approximately 50,000,000 tons of 2.3% copper ore, of which a large percentage is capable of removal by steam shovels. In October, also, there were five large shovels at work preparing the property to supply the mill.

During the first four weeks that the mill was in operation it was reported that the average extraction amounted to 66% on oxidized surface ores running between 2.5 and 3% copper. One unit of 750 tons per day capacity was used. The original plans for the mill called for three sections, of 1000 tons daily capacity each. Two additional sections are contemplated but have not been started. It is expected that transportation to the mill will amount to 10c. per ton and that copper can be produced for 8c. per lb. The orebody is well adapted to steam shoveling, there is ample dumping ground available near the mine and there is a good labor supply at moderate wages. In consideration of these factors and the results of the Nevada Consolidated company, it is not unlikely that the prediction as to ultimate costs will be realized.

MOGOLLON DISTRICT

Development and mining in the Mogollons continued and new installations were made at some of the properties. At the Ernestine, some new stamps were added;

and at the Socorro and several other plants De La Vergne oil engines were placed in use, owing to the high cost of power from wood fuel, which is becoming scarcer each year. No unusual discoveries of new orebodies were recorded, but development continued to open about the average grade of ore in most of the mines.

The Deadwood mill handled a quantity of custom ores in addition to its own product. During the year an option was given on the Ernestine property to A. Chester Beatty, of New York, and other Eastern men. This expired in December and it is stated that nothing resulted from the negotiations.

The Republic or Union iron mines of the Colorado Fuel & Iron Co., about halfway between Hanover and Fierro, in Grant County, continued to produce steadily throughout 1911. The iron ore outcrops as magnetite mixed with a little limonite and it has been worked in previous years mostly in opencuts by quarrying. Some underground stoping has also been done in the past.

Mining in California in 1911

By Lewis H. Eddy*

The value of gold produced in California in 1911 is conservatively estimated at \$20,800,000; an increase over 1910 of more than \$1,000,000, of which approximately 75% was due to the increased output of the gold dredges, the balance chiefly to advancement in quartz mining. That the quartz mines did not show a larger increase is due to the fact that the greater effort was directed to the development of new orebodies in established mines and the exploiting of prospective mines. Large amounts of money were expended in this class of development and in the installation of modern machinery. The reopening of old mines in most instances proved the wisdom of the undertaking. These features of advancement in quartz mining were particularly notable in Nevada and Sierra Counties and in several counties of the Mother Lode district. In Nevada County the North Star Mines Co. took over the old Champion group, and under the management of A. D. Foote ex-

ploited new ground, repaired and enlarged the Champion shaft to be employed as the central working and pumping shaft, installed an electric pump that will handle all the water from five separate shafts; new roads were built, old ones repaired, and other improvements made. The mine will be thoroughly developed before the milling capacity is increased. The working force was increased to 175 men. It is reported that the North Star will exceed \$1,000,000 output for the year; the company devoted some attention to other districts, including Nevada City and Alleghany. The Empire mine installed a modern 100-ton cyanide plant, took over on lease the Pennsylvania and W. Y. O. D. mines, and began the work of extensive development and installation of machinery. Other active advancement in 1911 includes the Sultana, Cassidy, Cedar Hill, Mountaineer, Coan, and numerous small mines. The Alleghany district in Sierra County near the Nevada County line came into particular prominence through the taking over of the Tightner and Red

Star by J. M. O'Brien of San Francisco. These properties have been developed under the management of C. Derby and Lawrence Y. Wagner, consulting engineer. A new electric plant, and compressor and 10-stamp mill were installed. In the course of development the property produced about \$100,000, and employed 35 men. The Plumbago, one of the oldest producers, increased its production and started a new shaft. A mill and machinery were installed at the Independence. The Caeser began operation in November and prepared for installation of a new compressor.

USE OF ELECTRIC POWER

The dividend-paying mines on the Mother Lode continued to pay during 1911 besides making extensive and costly improvements, and directing the main effort to the opening of new orebodies and proving others. The attractive feature in this district was the completion of the installation of electric power, new hoists, and added milling capacity. The Bunker Hill, South

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Eureka, Central Eureka and Argonaut completed electrical installations, while the Kennedy and the Zeila hoisted with steam, though the Zeila mill ran by electric power. In all the important installations during 1911 in this district, electricity was employed, and some of the smaller mines also discarded steam or water power. Reopening of old producing mines in all instances proved well, and resulted in taking over old properties with the evident purpose of practical and extensive development. Notable among these were the Plymouth Consolidated in Amador County where preparations were made in December for the installation of modern machinery by Bewick, Moreing & Co., the Georgia Slide in Eldorado County, by Sacramento men who installed machinery and did extensive development work; the Lightner in Calaveras County which did extensive development, made improvements, and paid a large amount of the purchase price. The Lincoln and the Lucky Baldwin are among the prominent old mines that were reopened. These mines mentioned are typical of the district and briefly illustrate the activity in that branch of development. The demand for electric power induced the construction of a new power line by the Pacific Gas & Electric Co. extending from Electra to Sutter Creek, which will supplement the old line.

The activity in development was not confined to the Nevada-Sierra region and the Mother Lode, but extended to nearly all the gold-producing counties of the state. Plumas drew capital along the line of the Western Pacific; Butte and Yuba had new prospects that promise well; Mariposa attracted attention by improvements made on the old Fremont grant, and the opening of several small mines; Inyo, San Bernardino, and Kern had a prosperous year.

In Trinity County the extensive development, production, and the installation of stamp mills and cyanide plants formed the attractive feature of the year. In the last half of the year the bonding of a number of old mines in the Weaverville basin gave new interest to that section, and promised renewed development and operation. In Humboldt, an adjoining county, the development of copper claims on Horse Mountain gave an impetus to exploitation. A plant for reduction of copper ores was being installed at the close of the year.

IRON, TUNGSTEN AND ANTIMONY

The mining of iron ore in California was in 1911, as in 1910, confined chiefly to the requirements of the Noble Electric Steel Co. at Heroult, Shasta County, where experiments in electric smelting were in progress. One thousand or more

tons of ore was mined. While the experimental work and furnace construction were not fully completed, it was demonstrated that the pig iron produced contained a high percentage of pure iron and can be produced at probably 25% less than in the eastern iron districts. There is an abundance of iron ore of high grade.

The output of tungsten in California in 1911 was less than in 1910, owing to a decline in price and a falling off of the demand. The principal production came from the Atolia Mining Co. in the Randsburg district in San Bernardino County. The plant was not operated full time during the year, but the company had a good supply of ore on hand, so the suspension of operations gave opportunity to make some needed repairs and improvements. The usual run of about 40 tons per month of 65 to 67% concentrates was made while in operation. Other tungsten ores were mined in the district during the year and some development made in prospects. Tungsten was discovered in the Forbestown district in Butte and Nevada Counties, associated with the gold in the sulphide ores; but it was not determined of commercial value, owing to the presence of sulphur and pyrite. No antimony ores were smelted in 1911 owing to the low price of the metal.

Mining in Oregon in 1911

By Frederick W. Scofield

The depression resulting from the general uncertainty of business did much to retard the active development of Oregon mining properties in 1911, and at the close of the year the full measure of activity had not been realized which the beginning of the year promised. Many companies and individuals, with properties of conceded merit on which extensive development work was planned, were obliged, through inability to raise money, to hold their plans in abeyance or curtail them in a marked degree.

The mining industry in Oregon still has to contend with the unenviable reputation it acquired during its boom period, and while this reputation is probably deserved insofar as stock operations are concerned, it is not altogether so when the value of its mining properties is given just consideration. During the time that the smeltery at Sumpter was in

active operation, covering a period of three years ended Nov. 15, 1907, there were smelted 19,068 dry tons of ore, both crude and concentrates, showing an average assay of 2.75 oz. gold; 9.9 oz. silver and 2.8% copper. At present prices of metals this represents a gross value of \$1,282,514 or an average of \$67.26 per ton which compares not unfavorably with more active mining districts.

MINES BUREAU ESTABLISHED

Mining in Oregon in the past received little aid from the state, but there was passed at the last session of the legislature a bill establishing a State Bureau of Mines and making an annual appropriation for its maintenance. The work of the Bureau is being carried on by the Department of Mines of the State Agricultural College, thus bringing at once to its aid a complete organization. The first work of the Bureau will be de-

voted to compiling statistics of Oregon's mineral production, which figures have heretofore been sadly lacking.

In the Snake River district the Iron Dike Mine remained idle on account of lack of available funds. There was some work of a desultory nature carried on at other properties in the district, but little was accomplished in the way of substantial progress. In the Mormon Basin district, the United States Smelting, Refining & Mining Co. completed its purchase of the Rainbow mine, early in the year, since which active development work was carried on and it is reported that the results achieved both as to extent and grade of ore verified the estimated value of the mine.

Development work was carried on uninterruptedly at the IbeX, Ben Harrison and Dixie Meadows mines and the results obtained are, in each case, reported as entirely satisfactory to the owners and the management. The successful devel-

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opment of these properties, which should become early shippers of a regular tonnage, demonstrates what may be done with many properties, now idle, when provided with a sufficient fund to prosecute development work, and arrangement made for its disbursement under competent and intelligent management.

One of the notable transactions of the year was the sale of the North Pole mine. This property, recently taken over by its purchasers, has produced more than \$2,500,000 in gold, but has been closed for about five years, and reported to be worked out. The new owners began extensive development work and in a short time opened up an orebody which it is reported promises

to make the mine a greater producer than it was in the past.

The Keystone Dredging Co., which purchased extensive placer areas in the Powder River Valley, began the work of installing one dredge, but owing to the lateness of the season, together with delay in shipment of machinery, work was suspended until the spring of 1912, when two or possibly three dredges will be installed. The Northwest Smelting & Refining Co. did not blow in its smeltery at Sumpter due to lack of ore tonnage sufficient to keep it in operation, but the plant is being maintained in condition to begin the handling of ores as soon as produced. In Josephine, Jackson and Lane Counties, constituting the southwestern mining district of the state, a

number of smaller properties and prospects were purchased and development work inaugurated on them, and many older properties completed plans for resuming operations and installing new equipment.

Another company was organized in 1911, for operations in Lincoln County in treating beach sands, said to contain gold and platinum, but the experience of others in this direction creates some doubt to its success. Although 1911 was somewhat disappointing in the extent to which operations were resumed, conditions showed a substantial improvement over 1910, and with a readjustment of general business conditions the immediate success of Oregon's mining industry seems assured.

Montana in 1911

By F. L. Fisher*

The absorption of the various operating companies, formerly constituting the property of the Amalgamated Copper Co. in Butte, by the Anaconda Copper Mining Co. was completed in 1911, making the Anaconda company the foremost producer of copper in the Butte district, the only other companies being the Tuolumne, East Butte, Davis-Daly, North Butte, Butte & Ballaklava and Alex Scott. The reduction of the output of the mines to from two-thirds to three-quarters of their normal capacity, which was instituted in 1910, was continued through 1911 on account of the low price of copper. Probably the most important change made by the Anaconda company was the substitution of compressed air for steam as the power used for the hoisting engines, as it was demonstrated that a great saving in fuel expense was made by the change. The first mine in the camp to make the change was the Mountain View, and after one or two false starts it was found to be as efficient as steam.

ANACONDA OPERATED 23 MINES

The mines operated during 1911 by the Anaconda company were the Anaconda, Never Sweat, St. Lawrence, Mountain Con., Bell, Diamond, High Ore, J. I. C., Original, Moonlight, Tramway, Stewart, Gagnon, East Gray Rock, West Gray Rock, Silver Bow, Berkeley, Mountain View, Pennsylvania, Leonard, East Colusa, West Colusa and Badger State. At the Pennsylvania mine the airshaft was continued to the 1600-ft. level by up-raising from that level to the 1400-ft. level. A crosscut 1200 ft. long was driven

between the West Colusa and Pennsylvania mines for a new route to carry the mine water from the latter mine to the Leonard mine pumps. A large amount of development work was done on the 600-, 1300-, 1400-, 1500-, 1600- and 1800-ft. levels and electric motors, as ore carriers, were installed on the 1600-ft. level, and an air fan was installed in the tunnel level for the purpose of ventilating the upper workings of the mine. The airshaft of the Mountain View mine was continued to the 1800-ft. level and a station was cut on the 1600-ft. level, after which the level was developed by cross-cutting, and drifting on several veins which were cut. The mine was closed down about two months in the middle of the year for changes in the engine, for the use of compressed air; after resuming operations the daily output was kept at about 1500 tons of ore. Electric motors were installed on the 800-ft. and 1100-ft. levels, and new ore bins were completed. The Leonard hoists over 1200 tons of ore daily from the 1200-, 1300-, 1400-, 1600- and 1800-ft. levels. The No. 1 shaft of the Leonard mine was extended from the 1600-ft. to the 1800-ft. level by raising from the 1800-ft. level; also the East Colusa airshaft was extended to the 1400-ft. level from the Leonard workings by raising from the 1200-ft. to the 400-ft. level, from the 1300-ft. to the 1200-ft. level, and from the 1400-ft. to the 1300-ft. level, and an exhaust fan, having a capacity of 100,000 cu. ft. of air per min., has been placed at the collar.

At the West Colusa mine a winze was sunk from the 1800-ft. to the 1900-ft. level, from the bottom of which cross-cutting was done to the extent of 40 ft.

both north and south. About 800 tons of ore are hoisted daily from this mine. An air fan was installed at the collar of the East Colusa airshaft for exhausting the bad air from both the East Colusa and Leonard mines. Considerable development work was done at the Badger State mine on the 1300-, 1600- and 1800-ft. levels, and several large bodies of ore encountered and drifted on; about 200 men were employed there and in the vicinity of 500 tons of ore were hoisted daily. The Tramway, Rarus and Minnie Healy mines were all operated through the Tramway shaft; the Rarus shaft was used only for lowering supplies, and the Minnie Healy shaft was allowed to cave. A single-deck cage was also installed in the Rarus airshaft to facilitate keeping the shaft in repair.

FIRE IN THE HIGH ORE MINE

At the High Ore mine what promised at first to become a difficult fire to subdue, was discovered in the stopes in January, but it was put out after a month's siege. The mine was closed down for a month or more to allow of remodeling the hoist for compressed air. At the West Gray Rock mine a new hoist operated by air was installed, and the East Gray Rock was also operated through this shaft. The shaft was extended from the 1100-ft. level to the 1300-ft. level by raising. At the Silver Bow and Berkeley mines, work was confined mostly to stoping and little development was done. A raise was driven from the Silver Bow 1000-ft. level to connect with the Berkeley shaft on the 800-ft. level, and the Silver Bow No. 1 shaft was sunk 15 ft. to allow for a sump. The two mines hoisted together about 15-

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000 tons of ore monthly. The shaft of the Speculator mine of the North Butte company was extended approximately 100 ft. to the 2800-ft. level and much development work was done on the lower levels with the result that richer and more extensive orebodies were discovered under the somewhat barren zone between the 2000- and 2300-ft. levels. The shaft of the Granite Mountain mine was enlarged to three compartments from the 1800-ft. level to the surface. Production was maintained at the rate of about 2,000,000 lb. of copper monthly. Skip pockets were cut on the 2600- and 2800-ft. levels and a pump station was cut near the bottom of the shaft.

BUTTE & BALLAKLAVA STILL IN LITIGATION

The shaft of the Butte & Ballaklava mine was repaired between the 1200- and 1400-ft. levels, where it was damaged by water during the High Ore fire, and shaft sinking was continued near the end of the year; development work was done on those veins where no injunction in the suit of the Anaconda company prevented the work from being carried on, also considerable legal representation work was done in the interest of the suit with the Anaconda company. The Ballaklava company brought a counterclaim against that company attacking its title to the Right Bower claim, alleging that the certificate of location as recorded in the county clerk's office was void, in that it was not verified as required by law.

Production at the East Butte company's property was held at about 1,000,000 lb. of copper monthly. Extensive improvements were made upon the smeltery at the mine; work was begun on a new dust chamber and a slime pond was constructed for working over the old tailings dump. Extensive development work was done on the 1000- and 1200-ft. levels. At the property of the Tuolumne Copper Co. many improvements were made during the year and considerable ore developed and blocked out. A complete new hoisting apparatus was installed consisting of a Nordberg engine with capacity for hoisting from the 3500-ft. level and provided with automatically dumping skips; a new steel gallow's frame and steel engine house were constructed, and new ore bins, having a capacity of 1000 tons, were built; a railroad spur was laid from the bins to the main track, a quarter of a mile, effecting a saving of 60c. per ton in haulage rates. About 100 tons of ore, mined on the 1200-, 1400- and 1600-ft. levels, were shipped daily to the Washoe smeltery at Anaconda.

At the Colorado mine of the Davis-Daly company development work was done on the 1400- and 1700-ft. levels and ore shipped at intervals. Walter H. Wiley, of Los Angeles, who examined the property, recommended extensive develop-

ment work, and that the company mine only its high-grade ore until an advance in the price of copper should make it more profitable to work the low-grade. Development work was done at the Alex Scott company's mine, principally on the 1500-, 1600- and 1800-ft. levels, and an average of 1.5 cars of ore was shipped daily to the East Butte smeltery. The company also operated the Little Annie mine, a silver property near Walkerville. At the Ophir mine of the Butte Central Copper Co. the shaft was sunk to the 1000-ft. level and a pump station cut there. Mining was confined chiefly to the silver ore on the 100- and 300-ft. levels from which several shipments were made. Plans were perfected for the building of a concentrator at the mine. The Washoe sampling works, which was destroyed by fire early in 1910, was replaced by a new all-steel and concrete plant, modern in every particular and equipped with the Brunton automatic sampling system. Operations were begun with the new plant about the middle of the year.

CORBIN-WICKES DISTRICT

In the Corbin-Wickes district the Corbin Copper Co. operated its property to some extent, the ore being mined from the tunnel level and conveyed to the concentrator near the mouth of the tunnel. The concentrator was started again in November after a shutdown of some months. Operations at the Boston & Corbin mine were confined principally to development work and blocking out of ore in readiness for the proposed concentrator. Sinking the shaft from a point a short distance above the 1300-ft. level to the 1500-ft. level was begun. At the property of the Wickes-Corbin Copper Co. 4 ft. of ore were cut in Tulare Tunnel No. 2, and in the Bunker Hill No. 4 tunnel six veins of various width were passed through.

GOLD AND SILVER

Mining activity was renewed in a number of gold and silver districts, which have been practically deserted since the slump in silver about 18 years ago. In the Georgetown district in Deer Lodge County a number of old properties were rejuvenated and work started on several new ones. The Hidden Lake group of mines was worked until Oct. 1 by Harry Bacorn, who gave up his lease at that time, however, and since then the owners have operated there. The George Hill Mining Co. was incorporated by Anaconda men, and some work was done on the George Hill claim owned by them, adjoining the George mine. The Silver Lake Mining Co. operated the George mine and made several shipments of ore to the Washoe smeltery. Other properties where mining was conducted in this district were the Venezuela, Old Bonanza, Roundup, Oro Fino, Holdfast, Montana, Twilight and the Cochrane.

The Radersburg district in Broadwater County was also the scene of considerable activity. The Keating Gold Mining Co. operated steadily and made regular shipments of ore. At the Black Friday mine development work was done on the 600- and 700-ft. levels. The Calumet & Corbin company sank a shaft and developed its property to some extent. The Black Diamond group of claims was operated by a company of that name composed of Butte men. The Ohio Keating company also operated and shipped ore to some extent. The Combination Keating company installed an electric hoist on its property and developed some ore. The De Lome Gold Mines Co. was incorporated and operated the De Lome and Sunlight claims after installing an electric hoist for sinking purposes.

In the Marysville district in Lewis and Clark County, mining was done at a number of properties. The St. Louis Mining Co. resumed operations after winning its suit over disputed ground against the Montana Mining Co., and treated its ore in the 60-stamp mill of the latter company. The Bald Mountain and Belmont claims were operated by Col. Cruse, of Helena, and considerable rich ore opened. Riley Hendricks kept his 5-stamp mill in operation most of the time with ore mined from his claims, and a 5-stamp mill was erected by the Boyer brothers at their property. Others who worked claims in the district were James Schaffer, Albert Price, Barney Moran and Thomas O'Connell.

GOLD DREDGING PROFITABLE

Madison County easily took the lead in the production of gold, due principally to the working of the four gold dredges of the Conrey Placer Co., at Ruby, which produced steadily from the first of the season. A mill was erected at the Gold Coin mine in the Rochester district, Madison County; the shaft was continued to near the 400-ft. level, and considerable mining was done. The Easton mine employed a force of 60 men, and mined about 25 to 30 tons of ore daily, which was treated at the mill at the property. The Alder Gulch Consolidated Mining Co. operated its placer ground near Virginia City from the middle of April.

A gasoline hoist was installed at the St. Lawrence mine near Virginia City, the shaft was retimbered to a depth of 170 ft. and a level driven at 150 ft. At the Highland Chief mine a vertical shaft was sunk to replace the old inclined shaft on the vein, and a vein 6 ft. wide and running about \$15 to the ton in gold and silver was developed. In Jefferson County the Comet mine in High Ore Gulch was mined in the upper levels by leasers, who shipped ore occasionally, and a vein of zinc ore was cut on the 100-ft. level. The Ruby mine and mill in the Lowland district were operated the latter part of the year, employing three

shifts. The Norma Mining Co. was incorporated by Butte people to operate the Norma mine, one mile from Clancy.

The Elkhorn silver mine at Elkhorn was worked steadily during the year, a large force being employed and regular shipments made. In Lincoln County several companies operated placer mines on Libby Creek, near Libby. At the Libby Placer Mining Co.'s property work was begun early in the season after a shut-down of seven years; a new hydraulic plant was constructed, and after its completion in October the output was greatly increased. The Comet-Placer Mining Co.

operated its property until forced to suspend operations in October, owing to lack of water. The Snowshoe mine, in Lincoln County, was purchased by E. H. Wilson, of San Francisco, and three additional claims were acquired by the firm for which he bought it. The mine was operated from early spring, and the ore run through the concentrator on the ground. Shipments of the concentrates were begun late in the fall.

In Gallatin County placer gold in paying quantities was discovered in the West Gallatin Basin near Bozeman; most of the river-bed was staked and a number

of companies formed for operation there. The property of the Bi-Metallic company in Granite County was worked in a small way by leasers, who made regular shipments. The Snow Creek Mining & Milling Co. operated the Snow Creek mine in Cascade County, the ore being treated in a cyanide mill erected there over a year ago. The Johannesburg mine was considered worked out and closed down in March. A gold dredge was constructed by the Kennedy Creek Gold Mining Co., owning 400 acres of placer ground in the Nine-Mile district near Missoula, and operations started late in the year.

Mining in South Dakota in 1911

Special Correspondence

The mines of the Black Hills have been prosperous in 1911 and the value of the total output will exceed \$7,500,000, and equal that of 1908. The mills were able to operate throughout the year, notwithstanding the prolonged drought which caused great distress in the surrounding agricultural country, but which was terminated by early and heavy falls of snow.

In spite of the strike nominally existing there is no labor trouble. All the mines which resumed work on a non-union basis have had an ample supply of men, and the only visible reminder of the threats of two years ago is the nightly operation of the seachlight from the Ellison hoist at Lead. During the 12 months ended June 30, 1911, the Western Federation of Miners' reports having paid out nearly \$230,000 for strike benefits in the Black Hills, out of a total of \$365,000 collected, which includes \$60,000 obtained from the State of Colorado. The monthly sums appropriated ranged from \$25,000 to \$12,000, and it is understood that at present \$10,000 is being expended per month at Lead. One of the men charged with firing the Homestake cyanide plant at Blacktail, in 1910, was tried last year and found guilty, and the other, a Western Federation of Miners organizer pleaded guilty to arson.

PROSPECTING TO BE ENCOURAGED

Prof. C. H. Fulton resigned the presidency of the State School of Mines at Rapid City, to take charge of the mining and metallurgical department of the Case School of Applied Science, at Cleveland, Ohio; his successor is Prof. C. C. O'Harra. Following the example of Denver, the Deadwood Business Men's Club took up during the summer the question of encouraging prospecting,

and perfected an arrangement with some of the mining companies for making free assays for prospectors.

The Homestake company nearly completed its Spearfish hydro-electric system, which, together with the present plant, will deliver current to a substation at Lead for distribution to the mills and other works. All its underground shops for drill sharpening and car repair were removed to a single large shop at the surface, near the Golden Star shaft, and the change is said to be decidedly advantageous. The Mogul company operated its mines and mills without intermission. The position of general manager of this company, vacant by the death of W. L. McLaughlin, was filled by the appoint-

ment of J. V. N. Dorr, who designed the present mill. The Golden Reward further developed its new sulphide orebody, and prepared to erect a Wedge furnace at the Astoria shaft, near Terry, for roasting this ore before shipping to its cyanide plant at Deadwood. The Wasp No. 2, on Yellow Creek, completed its new mill early in the year, and has been milling ore with a recovery of about \$2 per ton at a cost of about \$1. A steam shovel will shortly be in operation for stripping the overburden, and another will be put in this year for handling ore. The Bismark Consolidated, on adjoining ground, is enlarging its mill

NEW SMELTERY

In the Garden City district the Maitland, or North Homestake, and the Minnesota companies actively developed their properties, but have not milled any ore; and the Echo company prospected its ground. In the Carbonate district the Black Hills Development Corporation has reopened some of the old workings of the Iron Hill and Seabury & Calkins mines, formerly large producers of silver, and shipped several cars of ore. Near Galena a smeltery has been under construction for the Black Hills Smelting Co. under the direction of Paul Danckwardt and H. C. Osterman of Chicago. A contract calls for its completion by Feb. 1, 1912. It is announced that pyritic ore from the Gilt-Edge Maid will be treated, together with silicious gold ores. Part of the equipment was obtained from the old Deadwood & Dakota or Golden Reward smeltery near Deadwood. A diamond drill-hole was sunk on the ground of the Pluma Mining Co., near Lead.

DATA OF SOUTH DAKOTA GOLD MINES

Company	Men employed	Tonnage	Production	Yield per Ton
Homestake	2,700	1,510,300	\$5,875,000	\$3.89
Mogul	210	135,000	481,700	3.57
Golden Reward	134	66,900	392,700	5.87
Wasp No. 2	75	148,700	295,900	1.99
Lundberg, Dorr & Wilson	22	21,000	75,700	3.61
New Reliance	40	8,300	31,500	2.80
Individuals and small companies	793	55,100	390,000	6.90
Total	3,974	1,945,300	\$7,532,500	\$3.88
Placer mines about			\$83,000	
Total including Placers			\$7,615,000	

The Castle Creek dredge, near Mystic, south of Lead and west of Rapid City, worked the greater part of the year, and the results appear to be satisfactory although no details have been made public. It is operated by electricity generated at a power station on the bank. Another dredge is likely to be erected by the St. Louis Placer Mining Co. on Box Elder Creek,

and a third on the Sherman Bros. ground on Rapid Creek, near Pactola.

Some work was done in the Tinton tin mines, and on the Custer Peak copper properties, and attempts are being made to work some complex ores by the Deadwood Lead & Zinc Co. Amblygonite and spodumene continue to be shipped from the Southern Hills, but none of the other

rare minerals are now worked. The Westinghouse mica mines, near Custer, are reported to have shipped about the same amount as the preceding year, nearly 1000 tons.

The accompanying table of statistics of gold production for the year ended Nov. 1, 1911 are taken from the report of Robert L. Dougherty, who succeeded Nicholas Treweek as State Inspector of Mines.

Arizona in 1911

By C. F. Tolman, Jr.*

The bettering of transportation facilities now in progress, and the increase in population, are directing attention to the nonmetallic products of the state, and the production of fuels, building material and the rarer metals should assume more importance in the near future. Following is a brief summary of some of the more important mining developments during 1911, with some suggestions as to the possibilities that may be realized in the future.

GOLD AND SILVER

The gold production of Arizona is obtained from two sources; as a byproduct in the production of the base metals, and from mines where gold is the most important content in the vein being worked, with silver of secondary importance. The production of gold from these two sources is about equal. The group of older gold-bearing veins is found in or near granites or allied rocks. The most valuable of these deposits are characteristically grouped together in certain regions, the same class of veins in less favored regions developing too great irregularities in grade, size and shape to permit successful exploration. Yavapai County contains the majority of important deposits of this kind, and while at present mining is at a standstill in this region, when the revival comes, real mining should become profitable in many cases.

Examples of the second group are distributed over the southwestern United States and Mexico, such as Goldfield, Nev., Cripple Creek, Colo., etc. These are younger veins in effusive rocks, "porphyries" of the miners, and the three most famous producing gold mines of Arizona belong here, viz., the Gold Roads and Tom Reed, in Mojave County, and the Golden Star (North Star), in Yuma County. The first mentioned mine was purchased during the year by the United States Refining, Mining & Smelting Co. The famous Commonwealth mine, Cochise County, was bonded to the Montana-Tonopah company, and the

Commonwealth Extension was reported to have opened important new orebodies. The silver content exceeds the gold in these mines. The Mammoth mine, Pinal County, noted for its former production and the beautiful cabinet specimens of the rare minerals, wulfenite, vanadinite, descloizite, etc., was reported to have consolidated with the surrounding properties, and to have been taken under option by Colorado mining men. New mines of this type are most likely to be found in Mojave and Yuma Counties and less often in Pinal, Pima and Cochise Counties.

SILVER, LEAD AND ZINC

Silver mining, long on the decline in Arizona, received a severe setback by the failure of Tombstone. The cost of pumping 7,000,000 gal. of water, with a 1000-ft. lift, proved too great a task for the old mine. Curiously enough, Tombstone history was repeated on a smaller scale at the Jack Rabbit mine, near Casa Grande, Ariz. A superficial deposit of rich silver ore was mined in early days, and an attempt was made to pump down the water level in a limestone basin, fed by the underground drainage of the Santa Rosa Valley. The attempt, well planned and thoroughly carried out, to reopen the Vekol silver mine, Pinal County, was finally abandoned in 1911, and resulted only in demonstrating that the extensive orebodies are superficial.

Arizona lead mining offers a little more promise than the silver mining, and a moderate increase can be expected on its revival. The Golconda mine, Mojave County, is the only zinc property that has made a record during the last few years. Improvement in financial conditions and better railroad facilities, may result in other producers.

Vanadium and molybdenum were found in several regions, but the small demand for these has not as yet justified extensive development of the deposits. The mercury deposits, Yuma County, were not successful in the attempts to produce continuously. Cobalt was reported from the Saddle Back district, and nickel in a

superficial deposit of silver ore in schists, near the Southern Pacific R.R., in Yuma County.

OIL

The following is a partial list of the drilling operation for oil, conducted during the year: Two drills working near Bowie, Ariz.; two drills east from Tucson, Ariz.; one rig at Mammoth, 60 miles north of Tucson. Drilling was also done at Agua Caliente, Yuma County, and was reported in a region two miles north of Phoenix. Two companies are also prospecting for oil in the Verde Valley.

If oil is found in Arizona, it will probably not be in the mountain ranges, composed either of lavas or of quartzite, limestones and schists broken into by intrusions, but in the desert valleys, where the softer and more recent shales are often protected under thick deposits of desert gravels. These later strata of the valleys have as yet received almost no study, but some information along these lines will be contained in the report on the Tucson quadrangle, to be published by the U. S. Geological Survey. Lack of information regarding the possible oil-bearing strata, however, does not excuse boring for oil in formations that have suffered sufficient heat and pressure to turn the carbonaceous matter into graphite, or in broken formations turned up on end, without structures capable of holding oil, and least of all in granite gneisses.

STRUCTURE MATERIALS

Marbles of excellent quality were opened in the quarries of the Huachuca Marble Co., Cochise County, and the Santa Rita Marble Co. found an unusual variety of marbles and granites in its properties, 30 miles east of Tucson. Slate of good quality exists south of Phoenix, and cement materials are distributed throughout the territory. An interesting development was the manufacture of ornamental pressed bricks, at Tucson, from shales which contain a large proportion of fusible volcanic ash,

*State geologist, Tucson, Ariz.

Mining in Nevada in 1911

Special Correspondence

Broadly considered, the mining industry prospered in Nevada in 1911. In a few cases developments did not confirm the earlier predictions, but it is safe to say that in general, mining is on a sounder basis in this state now than at any previous time. There were no unsavory fiascos, such as marked the mining history of Nevada in previous years; the nearest approach to such that could be cited is the case of the Nevada-Utah Mines & Smelters Corporation, and apparently this company has fallen into more responsible hands; it is believed that the change presages more prosperous times for the Pioche camp. As an instance of unfulfilled hopes may be mentioned the Montgomery Shoshone Co., which found that it was operating at a loss.

Two important tendencies were noted in mining developments: (1) concentration; (2) deep prospecting. There was a tendency throughout the year for larger companies to absorb smaller ones, or to take over properties strategically situated. This was evident in Pioche and Tonopah. The tendency towards deep prospecting was made plain at Goldfield in the formation of the Goldfield Deep Mines Co. This attempt to test the ore bodies at depth is commendable and fills a long-felt want, frequently commented on by mining men. In the outlying camps noteworthy progress was made at the Nevada Wonder, Nevada Hills and Mason Valley properties. Jarbidge and several other districts received attention from prospectors and investors, but no important developments took place. With a few exceptions, work was confined to sound, legitimate development of the older properties.

THE ELY DISTRICT

In 1911 as in 1910, the only producing property in the Ely district was the Nevada Consolidated. Stripping operations were continued throughout the year at the Liberty pit; the intention being to continue this until 2000 tons of ore per day can be mined, when necessary to supplement the Eureka pit output. Improvements were made at the reduction plant and the reverberatory furnaces were altered to operate with oil instead of coal. The results have fully justified the installation of oil as fuel. In addition, one basic converter was installed and work on a second one was started. In the concentrator experiments were conducted with slime tables with a view to the installation of such a plant; other experiments

were also made to effect a greater saving of metal contents. During the quarter ended Sept. 30, 1911, the ore treated averaged 1.7% copper. Near the end of the year, production was started from the Veteran mine, which had been idle for several years because of labor troubles.

Giroux has yet to become a regular producer. During the year exploratory work was continued and the tenth level on the Alpha orebody was connected with the large 5-compartment shaft. More pumping equipment was installed and the Giroux shaft sunk to the 1400 ft. point. The permanent hoist was also placed in commission at this shaft. Work since August was retarded somewhat by a fire which occurred in the Giroux shaft. The shaft was sealed and permitted to flood, since when much time was consumed in dewatering operations.

After a visit to the property in October, T. F. Cole, president, announced that plans for development included a concentrator of 1000 tons capacity, the building of a railroad from the Bunker Hill shaft to connect with the mill, the equipment of that shaft and the stripping of the sulphide zone where it outcrops near the surface; and that actual construction would start soon.

Prospecting and development work was carried on less actively in 1911 than formerly at the smaller properties, and operations at the Ely Consolidated, Ely Central and Boston-Ely were practically at a standstill.

GOLDFIELD

In the Goldfield district, the two large producers in 1911 were the Goldfield Consolidated and the Florence-Goldfield; of these the former maintains its position as the largest gold producer in the world. The gross value of the production from the Consolidated mines in 1911 was about \$10,540,000. With the estimated December production, the average for the year amounted to approximately 28,300 tons of ore per month, which yielded an average of \$31.02 per ton gross and net \$22.11. The company purchased the Bulldog Fraction claim from the Red Top Extension Co. While development work has continued to disclose rich orebodies from time to time throughout the properties of the company, it is quite evident from the comparison of the monthly reports that the net profits per ton have decreased somewhat with the depth thus far attained. The indications are stated to be that the Jumbo mine will produce a large tonnage of \$15 ore. Additional equipment, including roasting furnaces

and tanks were added to the mill to treat the residue from the present concentrating process. During the year a one-half interest was purchased in the Vinegerone claim from the Jumbo Extension Co., for \$195,000. During November the production was 28,628 tons, which yielded \$766,351 gross and net \$510,596. This was secured with an extraction of 94.45% and the average net profit was \$17.83 per ton.

At the Florence-Goldfield production continued at the rate of from 100 to 170 tons per day, a satisfactory recovery being maintained from low-grade ore. The low tonnage was reached in October when a shortage of ore necessitated a reduction of working force and mill operations. New mill equipment was added during the year, including Akins classifiers and Dorr thickeners, which resulted in a reduction of costs and an increase in capacity. In December a fire occurred which destroyed the mill and its machinery, entailing a loss estimated at about \$400,000. Slight damage was done to the shaft collar. The company has not yet announced its plans in connection with the rebuilding of the plant.

Leasing operations were continued at the Goldfield-Belmont, but during the year it was reported that no more leasing would be done; that a deep shaft was contemplated, to open the property at depth and that exploration would be carried on from this shaft. A change of control occurred in the affairs of the Silver Pick Mining & Milling Co., and it was announced that a deep shaft would be started in January, 1912.

GOLDFIELD DEEP MINES COMPANY

An event of interest was the formation of the Goldfield Deep Mines Co., about the middle of the year. The company was formed to operate at depth in the Goldfield district and Sen. William A. Clark was reported to be interested. The company controls the Goldfield Merger Mines Co. In October an announcement was made that operations would start soon on the property of the latter company, and that a 4-compartment shaft, from 1500 to 2000 ft. deep was planned. The St. Ives was one of the properties included in the merger.

TONOPAH

In the Tonopah district the Tonopah Mining Co., during the year easily maintained its position as the first producer of the camp. During November, 14,799 tons of ore were milled with an extraction of 91.81%. The ore averaged gross

\$20.75 per ton and net profits for the month were \$172,316. The Tonopah-Belmont company did much development work and started the construction of a new mill. This plant was originally planned to include 60 stamps, eight tube mills, concentrators and a complete cyanide plant; the whole was designed to treat 500 tons of ore per day. The company maintained a good production throughout the year and in November sent 7807 tons of ore to the mill and 2730 tons to the smeltery. Net profits for that month were \$156,459. Retimbering of the main working shaft is expected to start soon, because of which the output may be curtailed temporarily. In February a fire in the East Belmont shaft did considerable damage and caused the death of 17 men. Operations were hindered by this for a short time.

Mining and development were conducted at the Tonopah Extension and in December it was announced that the company had paid the final installment of its bonded indebtedness and had a surplus. The output for November was 4362 tons of ore, which yielded net \$25,000. In December a friendly settlement was concluded between the Tonopah company and the Jim Butler company over the question of apex right on the Fraction claim.

In April the MacNamara company announced its intention of building a mill of 2000 tons monthly capacity, the equipment to include stamps, tube mills and cyanidation. Mining was discontinued following this announcement and pending the completion of the plant.

On November 14 the Montana-Tonopah company made the first payment on the Commonwealth mine at Pearce, Cochise County, Ariz., which it purchased on a working option. Development work was started at that property. The West End company purchased the Midway mill at Tonopah, with the intention of reconstructing it, its original capacity being 120 tons per day.

THE COMSTOCK

The revival of operations at the Comstock mines continued unabated throughout the year and while assessments were still the rule, dividends were paid by the Mexican, Ophir and Comstock-Phoenix companies. Underground developments were generally satisfactory, new orebodies being opened in several of the properties. Pumping facilities were increased, the Ward shaft continued sinking and the old workings were reopened in several places. The Mexican company continued the construction of its new mill and the Butters plant conducted tests on the ore.

The following mines were producing during the latter part of the year: Ophir, Mexican, Union Consolidated, Crown

Point, Yellow Jacket, Chollar, Potosi, Gould & Curry, Justice and Comstock-Phoenix. Of these the Ophir, Mexican and Comstock-Phoenix produced high-grade ore. Ventilation and pumping continued to be the most serious obstacles to successful operation. The latter was apparently solved by electrically driven pumps; an entirely satisfactory solution of the former remains to be found. The opening and satisfactory development of orebodies in the Mexican mine furnished a stimulus which was badly needed and were responsible for the renewed activity and interest which followed.

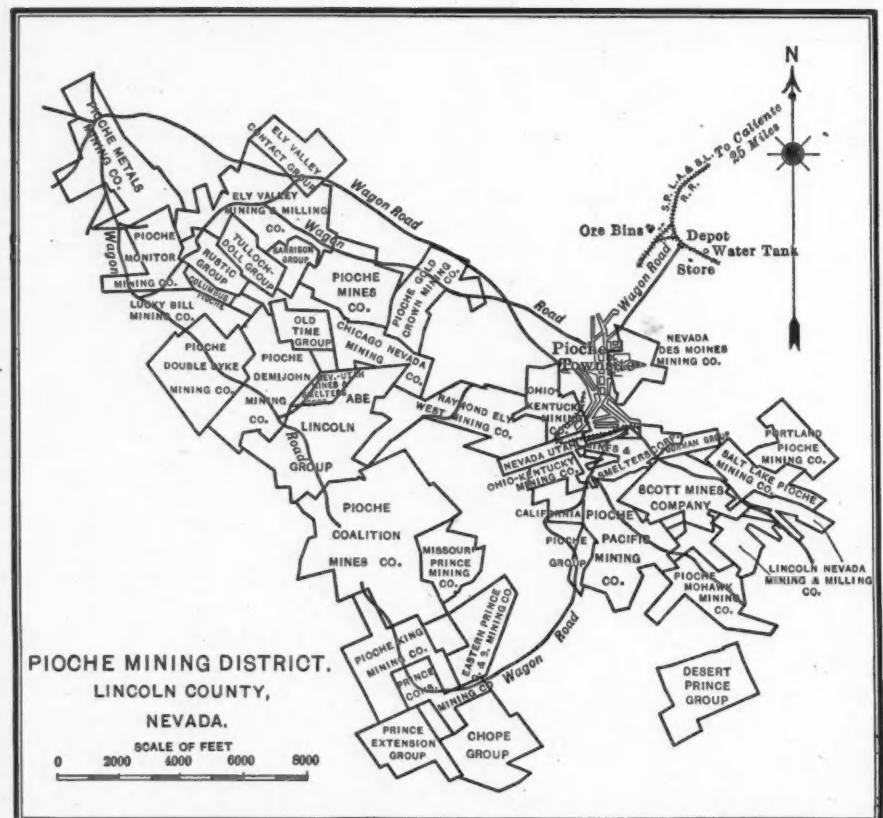
OTHER DISTRICTS

The Nevada Hills company at Fairview continued the construction of its 20-stamp mill and finished it during the

Mining in the Eureka camp was retarded by lack of adequate transportation facilities. Reconstruction of the 10 miles of line washed out in 1910, was started. The mine is in readiness for production as soon as the railroad can take consignments. Activity continued in the Jarbidge and Manhattan camps, chief interest in the former having been aroused through an option secured by George Wingfield on the Bluster group.

PIOCHE DISTRICT

By A. L. Scott—On Dec. 15, 1911, the Prince Consolidated made its first shipment of four cars of tailings from the old dump at Bullionville, over the new spur just completed by the Salt Lake Route. On the same day T. J. Bivens, who was



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latter part of the year, when it was placed in commission. There still seems to be some uncertainty as to the continuance of the vein beyond the large fault. The company secured control of the Fairview-Eagle company, during the year. In August, the mill of the Nevada Wonder company at Wonder, was started, thus marking the culmination of several years of development and experimenting.

During the year 1911 the Mason Valley company continued development work underground and the construction of the smeltery and electric power line, the latter being 69 miles long. The smeltery is expected to go into commission at any time.

in charge of the construction of the Bingham & Garfield R.R., arrived in Pioche with a force of engineers and commenced a survey for the construction of about nine miles of standard-gage track to connect the Prince mine with the present terminus of the Caliente branch at Pioche. Also on the same day letters were received from Robert G. Mead, recently elected president of the Nevada-Utah Mining & Smelters Corporation that "plans have been completed for a readjustment of the affairs" of said corporation, which plans "call for the organization of a new company," "that a syndicate is being formed by Theodore Gross, New York, manager of the Hirsch Syndicate, Ltd., of London, for underwriting a sub-

stantial amount of bonds"; that "Willard V. King, president of the Columbia Trust Co., William J. Palmer of Trippe & Co., and L. Vogelstein of L. Vogelstein & Co., all of New York, have consented to act as a nominating committee to select the personnel of the new company and its first board of directors"; and that Allen H. Rogers of New York would probably "take full charge of the development work on the properties." In consequence, the above date will undoubtedly mark the birth of a new Pioche, to be raised on strictly business principles.

The tailings at Bullionville, near Panaca and about 14 miles from Pioche, are from an old pan-amalgam process mill which handled the ores from the Raymond & Ely in the early days of the camp. The first dump to be shipped, at the rate of 200 tons per day, contains about 15,000 tons which is expected to net about \$5 per ton. It is being shipped to the new International smeltery at Tooele. The extension of the railroad to the Prince mine has been under consideration for several years and has finally materialized through the action of the Prince Consolidated in advancing \$100,000 to defray the cost of construc-

tion, to be remitted to the mining company by the railroad in freight charges. Contracts for the work will specify that the work shall be completed by May 1, 1912. The length of the road will be between nine and 10 miles. The average grade from the depot up to the western end of the Ely Range, known as the Point, and thence down to the Prince mine will be about 2½%. Few, if any difficulties should be encountered in the construction work.

At the Prince mine about 5000 tons of ore, already extracted, are awaiting the completion of the road, and blocked out in the mine are about 1,000,000 tons of manganese ore occasionally carrying high lead and silver contents. With the present incline shaft, possibly 100 tons per day could be handled from the mine, but when the road is in operation the company may sink a new vertical shaft to increase the output to 500 tons per day. If the Prince were the only mine benefitted by the extension, it would mean much for Pioche. The road, however, will pass in the immediate vicinity of the Pioche mines, Ely Valley, Pioche Metals, Pioche Demijohn, Abe Lincoln, Pioche Coalition and the Pioche King, all of which will then have payable

ore; the mines in the Highland district, such as the Mendha and the Highland Mary, will be able to save \$1.25 per ton on shipments by cutting out what has always been the worst part of the wagon haul, between the Point and the present depot.

Referring to the action of the Nevada-Utah, the reorganization of the company by the parties mentioned above means early shipments from the famous black vein on the hill just back of Pioche town, and the financing of the Day-Bristol tunnel in the Jack Rabbit and Bristol districts about 15 miles from town. The Nevada-Utah had just tapped the black vein at a depth of 1200 ft., when the recent entanglement of its affairs, caused a cessation of work. The Day-Bristol tunnel would have the same effect on the Bristol properties as the railroad extension has on the Prince Consolidated, that is, it would cut out about 10 miles of expensive wagon haul. The reduction in transcontinental freight rates which became effective on Nov. 15 and the fact that at least two companies are now in the field to exploit agricultural possibilities in the vicinity of Pioche, will be potent factors in the development of the district.

Mining in Idaho in 1911

By Robert N. Bell*

The mining industry of Idaho during 1911 was dull except in a few districts. This state, however, enjoyed a record year in metal production, with a total output of lead approximating 275,000,000 lb. and 8,750,000 oz. of silver. This splendid result is accounted for by the remarkable vitality of the main Coeur d'Alene producers and the new sources of rich lead and silver ore that were developed and put on a producing basis during the last two years, especially in the Wardner end of the district.

GILMORE DISTRICT REVIVED

The production of lead-silver ore was greatly stimulated in Idaho in 1911 by the mining revival in the Gilmore district in the central part of eastern Idaho, made possible by the completion of the Gilmore & Pittsburgh Ry., which gives an easy transportation outlet to the Salt Lake Valley smelteries for these desirable smelting ores. This district is rapidly assuming considerable importance in shipping lead-silver ore.

The Gilmore district is situated at the head of the Lemhi river in Lemhi County, Idaho, near the Montana line and about 140 miles south of Butte, Mont. It presents a more extensive connected field

of lead, silver, copper and gold mineralization that does the Coeur d'Alene district at the north end of the state.

Its principal producers, the Pittsburgh-Idaho and the Latest Out mines, with a mere prospecting equipment, are already shipping and are making a profit equal to some of the steady dividend payers of the Coeur d'Alene. They are showing such strength and ore resources in the deepest workings as to indicate permanency and the probable birth of a lead-silver district of exceptional merit and lasting production.

GEOLOGY RESEMBLES THAT OF PARK CITY

The geology of the district is entirely different from the Coeur d'Alene and more resembles that of Park City, Utah. In fact, one or two members of the Park City series of formations are recognized here. The Pittsburgh-Idaho mine is situated near the foot of a bold mountain uplift which parallels the main range of the Rocky mountains about 20 miles to the west. This range is made up of a broad core of Silurian quartzite with overlying limestone formation in conformable layers, which are believed to include the Devonian and lower Carboniferous series. The elevation at the Pittsburgh-Idaho mine is 7500 ft. Two

miles farther west at the crest of the range the elevation is 11,000 feet.

The Pittsburgh-Idaho deposits are contained in a series of nearly vertical parallel fissures, with a connecting ore course at an angle of 50°, with two series of intrusive dikes resembling diorite porphyry. One of these dike series is found associated with the ore and the other, of later date, cuts the ore course at a slight angle.

The orebodies have been developed through a vertical shaft and winze to a depth of 500 ft. and have shown steady improvement in quantity with every succeeding level. The formation is dry and the ore so far encountered consists entirely of hard and sand carbonate of lead, with brown iron-oxide. The main ore courses in this mine have been developed for a total length of 600 ft. The mine produced 19,000 tons of crude shipping ore during 1911, containing an average of about 35% lead and a half ounce of silver to each unit of lead, together with 50c. gold per ton. This splendid output was made without any mill equipment or second-class ore dump, only a mine equipment of a 15-hp. gasoline hoist.

On the Latest Out mine, adjoining the Pittsburgh-Idaho 1000 feet farther west,

*State inspector of mines, Boise, Ida.

with a 12 hp. gasoline hoist, an output of ore amounting to 9000 tons was made during the year, containing about the same metal contents with probably a little more silver.

NEW MINES IN BLAINE AND BONNER COUNTIES

On the opposite side of this high range of mountains and 40 miles farther southeast, the Wilbert mine developed a measurable reserve of rich concentrating ore estimated at 20,000 tons with an average content of 22% lead. This deposit occurs in the Silurian quartzite in a nearly vertical zone of fissuring several hundred feet wide. It is being equipped at the present time with a concentrating mill of 150 tons daily capacity, that will afford another interesting source of rich lead concentrates during the coming year. This mine is in Blaine County and it will be necessary to haul the products by wagon 40 miles over a level desert road to Arco, a station on the Salmon River branch of the Oregon Short Line R.R.

Another important producer of lead-silver ore that is likely to add materially to Idaho's production is being developed in Bonner County within three miles of the Canadian line, where the Idaho Continental mine shows a reserve of practically measurable ore amounting to 175,000 tons, which by extensive and careful sampling is shown to contain an average of 14% lead with 5¾ oz. silver per ton, and probable ore that may quite safely be anticipated with additional adits amounting to 145,000 tons. This is one of the strongest and most persistent manifestations of lead-silver ore at the surface that has been found in Idaho and occurs in a close succession of definite shoots for nearly 3000 ft. on the strike of the vein which is a nearly vertical and intensely sheared fissure in quartzite and shows every evidence of persistency to great depth. The ore is a fairly coarse galena free from zinc and maintains its sulphide condition almost to the grass roots. The mine has a shipping record of 1200 tons of hand-sorted ore that averaged 45% lead and 18.5 oz. silver per ton. The property is situated 25 miles from the nearest shipping point at Port Hill, a station on the Great Northern Ry., from which point a wagon road is now being constructed with a maximum grade of 4%, which will probably be transformed into a light railway in the near future. The company is planning a large mill to be erected next season, when it is likely to become one of the producers of high-grade lead-silver concentrates and crude ore before the close of another year.

GOLD PRODUCTION INCREASED

The gold production of Idaho in 1911 showed a marked improvement over the

previous year amounting to fully 26%, which is accounted for by the successful operation of two new dredging enterprises. One of these dredges is at Idaho City, 40 miles north of Boise, and was put into commission in June by the Boston-Idaho Gold Dredging Co. It was built by the Yuba Construction Co. of Marysville, Cal., and has a capacity of 8000 to 10,000 cu.yd. per day, with 13¾ cu.ft. buckets, close connected. It is operated by hydro-electric plant owned by the company, and uses 500 hp. It is working on ground that runs from 10 to 20c. per cu.yd., and has been in steady operation since June and expects to be able to continue throughout the winter.

Another dredge built by the same company, with 9 cu.ft. buckets was put in operation on the Kirtley Creek placers near Salmon, Idaho, in September on ground of similar value. These two large plants have extensive resources of gravel and should continue to make a rich and profitable yield for years.

Some new gold-ore discoveries and developments were made in central Idaho during the last summer that promise good results in vein-gold production when more fully developed and equipped. These discoveries were made near the head waters of Big creek, a tributary of the middle fork of Salmon River and are in Idaho county, 100 miles by wagon road east of Meadows, the nearest railroad shipping point. This is one of the best watered and timbered parts of the state which may prove an offset for the present isolation. Here an immense zone of gold-bearing mineral strikes north and south across the high mountain spurs which are drained by a series of large tributary streams running to the middle and south forks of Salmon River. The elevations range from 6000 to 8000 ft. above-sea level. The lode can be traced along its strike for 10 miles.

A WIDE ORE ZONE OPENED

At the Moore property, its most interesting development so far occurs. The total width of the zone is 250 ft. and 1500 tons of ore were mined and milled in a crude old-fashioned stamp mill, with a 4-mesh screen, that yielded \$5 per ton to plate amalgamation. A sample of clean concentrates from the sulphide ore below the tunnel level gave an assay of \$32 per ton in gold and silver, of which \$6 was silver, and showed 94% extraction by fine grinding and agitation in a cyanide test.

At intervals of about two miles to the north from this property three other properties are showing similar great ore-shoots. On the Laufer & Davis property, which is a new discovery, the surface croppings indicate a shoot of ore over 100 ft. in width that shows more free gold upon panning than does the Moore property, but its development so far con-

sist only of discovery cuts. Following north on the strike, there is another shoot of ore or the Golden King group of claims possibly over 100 ft. wide and 300 or 400 ft. long, on which rich ore has been found by panning.

At Smith Creek, two miles farther north, the Independence mine has a crosscut showing a body of white quartz heavily impregnated with bright, yellow, iron sulphide 200 ft. thick, that is conservatively estimated to assay \$4 to \$5 per ton in gold and silver, of which two-thirds is gold and one-third silver.

PHOSPHATE DEPOSITS EXTENSIVE

One of the most interesting new mineral developments in Idaho is that of phosphate rock, which were made in four of the southeastern counties of the state, where the government has withdrawn 1,100,000 acres of rock-phosphate land for classification. Of this great withdrawal, the government's geologists examined and reported on only nine townships, which are estimated¹ to contain within a reasonable minable depth 1,425,000,000 tons of phosphate rock of the finest quality.

This mineral occurs in pitching beds in the middle Carboniferous series known as the Park City formation. The principal bed is from five to six feet thick and is uniform in quality and texture. It is black in color, rather soft, and mined in the same manner as pitching coal veins with the same kind of tools, and at about the same cost per ton. The rock contains on an average 70% calcium phosphate, with less than 1% of iron and alumina for all the samples of the region tested.

The northern border of this extensive withdrawal, 100 miles north of these recent investigations, is known to be fully as rich as the area already examined, and the resources of this mineral in this state are practically exhaustless. It is conveniently situated in relation to transportation lines, and with the utilization of the waste sulphur fumes in the copper smelters of Montana and Utah, presents the basis of an extensive mining and fertilizer manufacturing industry.

So far, the only shipping phosphate mine in the state is that of the San Francisco Chemical Co. at Montpelier, Idaho, which is opened on a five-foot bed at a depth of 500 ft., with a crosscut, from which an entry 1000 feet long has been driven on the course of the seam. This mine is shipping at the rate of about 5000 tons per year to the company's works near San Francisco, where it is reduced to superphosphate.

In addition to the great lead and silver output of Idaho, the state produced during 1911, 65,000 oz. gold, 3,377,000 lb. of copper, and ore containing 10,087,000 lb. of zinc.

¹Bull. 470, U. S. Geol. Surv.

Mining in Utah in 1911

By Edward R. Zalinski*

The year 1911 in Utah was one of steady production. It is not yet possible to obtain the output of the various metals accurately, but from the tonnages available from Park City and Tintic, also from the known greater lead output of Bingham it is safe to say that the production of lead and silver increased largely over that of 1910. The gold production will probably show an increase, on account of the greater tonnage of low-grade copper ores and silver-lead ores mined. More gold and silver bullion was received by the U. S. Assay Office than during 1910, though part of this came from other states. The gold production from silicious ores decreased, as few gold properties, with the exception of the Consolidated Mercur, operated steadily. The production of zinc was about the same or greater on account of the greater tonnage mined at Park City, from which it is obtained as a byproduct. There was an increase in copper, due to the larger output of the porphyry mines at Bingham, whose tonnage increased from the beginning to the close of 1911.

ORE AND BULLION PRODUCTION

The ore tonnages from Park City and up to November 30, shown in the accompanying table, were obtained through the courtesy of the railroad. The month of December is estimated for the Park City shipments, while for Tintic the month of November also is estimated in part. The Park City shipments, include crude ore and concentrates. Deducting for moisture 6%, the average in Park City ores, there would be 103,139 dry tons as compared to approximately 83,474 dry tons in 1910, an increase of over 23%. The Tintic shipments include iron ores from the Dragon Iron, now part of the Dragon Consolidated. These amounted to 28,623 tons during seven months when this class of ore was shipped. There were also small shipments from the Iron King. Deducting the iron ore, and allowing for 4% moisture, the average in Tintic ores, there would be 322,001 dry tons of copper, lead, and silicious ore as compared to approximately 250,541 dry tons in 1910. This is an increase of 28.5%. The large increase in shipments is partially due to the marketing of some of the lower- and middle-grade ores, while shipments of high-grade ores also increased. The copper ores are roughly 46% and the lead ore about 50% of the total.

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The bullion handled by the U. S. Assay Office at Salt Lake City in standard ounces of gold and standard ounces of silver in 1911, amounted to about 70,500 oz. gold and 37,343 oz. silver having an approximate total value of \$1,330,000. The bullion came from Utah, Nevada, Idaho, Montana, Wyoming, Arizona, and from some points in Colorado and California. There was considerable variation in the monthly receipts caused by the closing down of milling plants undergoing alterations or repairs. The Salt Lake Office was established in February, 1909, and during the first 11 months received bullion valued at \$1,056,945.56. During 1910, \$926,306.73 worth of bullion was received.

During the first quarter of 1911 the output of Bingham was about the same

PARK CITY AND TINTIC ORE SHIPMENTS IN 1911.

	Park City Tons	Tintic Tons
Jan.	5,963	26,517
Feb.	6,981	27,863
Mar.	8,421	34,487
Apr.	6,584	31,173
May.	9,423	27,057
June.	8,958	32,958
July.	9,140	28,610
Aug.	12,171	31,542
Sept.	12,104	26,255
Oct.	11,333	30,805
Nov.	9,484	33,524 (b)
Dec.	9,160 (a)	33,249 (a)
Total	109,722	364,040

(a) December estimated. (b) Partly estimated.

or slightly less than the average production for 1910. It increased steadily each succeeding quarter. As nearly as can be learned, the average daily output was in the neighborhood of 18,000 tons. This is an estimate based on the production of the Utah Copper, Highland Boy, Bingham-New Haven, Yampa, United States properties, Ohio Copper, Bingham Mines, and Utah Apex. It includes ore produced by the Ohio Copper, Utah Apex, and Bingham-New Haven, which was milled in the camp; also shipments by the New England, Last Chance, and by leasers. Taking 18,000 tons per day the production was 6,570,000 for 1911 as compared to 5,840,000 tons estimated for 1910. The production of Bingham is equal or in excess of the total production of the state in 1910, averaging over a half million tons per month.

The tonnage mined in Tooele (including Mercur), Beaver (including ore milled by the South Utah); Box Elder, Iron, Piute, and Sevier Counties aggre-

gated approximately 415,000 tons, judging from past production and the data available on this year's output. In round numbers the total estimated production of the state was in the neighborhood of 7,458,000 tons.

The production of ore of all kinds was stimulated by the wider market offered, as is shown by the total tonnages for 1911 which are considerably in excess of the ore mined in 1910. The production in the first quarter from Tintic, Park City, Bingham, and other camps amounted to about 1,331,000 tons, which was less than the average for the last three quarters.

The Utah Ore Sampling Co., the only independent sampler in the Valley, operated plants at Murray and Sullivan City, and sampled custom ores from Utah, Idaho, Montana, Oregon, and Nevada. More ore was sampled than in 1910.

SMELTING OPERATIONS

The smelting plants at Midvale, Garfield, and Tooele employ an average of 2470 men, who are paid \$2,178,000 in wages annually. The present investment in plants, power houses, and machinery aggregates \$12,250,000, exclusive of land and mining ground. The four plants have a combined capacity of 11,700 tons of ore daily, and in the first half of 1911 handled 1,078,820 tons. In 1910, the value of the ore smelted was placed at \$27,825,176.

RAILROAD FACILITIES INCREASED

The Western Pacific, crossing a relatively undeveloped mineral section of the state, operated regular freight and passenger service. Two roads were projected for eastern and southern Utah. The Bingham & Garfield R. R. was completed and put in operation. All of the grading on this line was finished about the middle of the year, and work on the steel bridges, trestles, etc. was completed a little later. The first cars were sent over the line Sept. 6, and passenger and freight service started Sept. 15. Ore shipments are reported as high as 14,500 tons in one day. The Denver & Rio Grande handled 7500 tons, as compared to 6000 tons, the maximum contracted for last year. This made a total available railroad capacity of 22,000 tons.

The B. & G. R.R. is reported to have cost \$3,000,000 being one of the most expensive for its length in the country. Bingham now has railroad facilities am-

ple to handle the present tonnage, and to accomodate probable future developments.

UTAH COPPER DEVELOPMENT

In 1911, the Utah Copper produced steadily, remodeled its Arthur mill in part, and completed the Bingham & Garfield R. R. New steam shovels were added, bringing the number at work up to 21, the greater part of which was used in stripping operations. Additional shovels were put on overburden on the Boston Consolidated side in June bringing the number of shovels worked on overburden to 19, while an average of two shovels were worked on ore. Steam shovel operations now extend vertically 1500 ft. Underground mining was done on the Boston Consolidated, but in order to discontinue this as soon as possible stripping operations were pushed, and 3,947,748 cu. yd. of capping, were removed from the Utah and Boston groups in the first three quarters. Additional territory was acquired, including the Payroll group of eight claims (175 acres) covering ground between the original holdings and the Boston Consolidated. Ten acres of ground in McGuire's Gulch were purchased for dumping purposes from the Bingham Amalgamated.

ARTHUR MILL REMODELED

Five or six sections of the Arthur mill were remodeled, and chilean mills substituted for the Nissen stamps. Garfield roughing tables and Janney classifiers were added. The plant was not operated at full capacity, but only to such an extent as to take care of the excess of ore produced above the capacity of the Magna plant. The operation of four of the remodeled sections was about equal in capacity to that of the 13 original sections. The remaining stamp mill sections were permanently closed down, and will be gradually remodeled to keep pace with ore production. An extraction of up to 72% on ore running 1.46% copper was reported. When the Arthur plant is completely remodeled it will have a capacity of about 8000 tons, which with the 12,000 or more tons treated by the Magna will bring the capacity up to 20,000 tons. The Magna and Arthur mills employ 1460 men.

The Magna plant was operated steadily, but not crowded. A few minor changes were made, including the installation of larger motors, etc. The Copperton plant was dismantled, and the buildings torn down.

The total amount of ore treated in the first quarter, as given in the reports was 981,104 tons of an average grade of 1.55% copper; for the second quarter, 1,060,414, of an average assay value of 1.63%; for the third quarter 1,273,373 tons averaging 1.48%. This makes a

total of 3,314,891 tons of ore milled in this time. In the third quarter about 24% of the ore came from underground mining, and 76% from steam shovels. The Magna plant in the last quarter handled about 83% of the ore, and the Arthur plant about 17 per cent. In December 18,000 tons per day are reported to have been milled, the Magna treating 12,000 and the Arthur 6000 tons.

The production was 21,296,709 lb. for the first quarter; for the second, 24,469,812 lb.; for the third, 25,851,456 pounds. This makes a total of 71,617,977 lb. for the first three quarters. The average monthly production for this time was 7,957,553 lb. as compared to 7,834,188 lb. for the last three quarters of 1910. The average cost per pound was 8.43 for the first quarter, 8.02 for the second, and 7.56 for the third, the latter being the lowest in the history of the company.

Quarterly dividends of 75c. on 1,504,100 shares amounting to \$1,128,075 per quarter were paid, bringing the total for the year to \$4,512,300. There was also a net surplus. The Boston Consolidated sulphide mine was not operated on company account, but leasers at this property shipped one car of lead-copper ore daily.

SILVER AND LEAD PRODUCERS

The greater part of the silver produced came from the Tintic district in Juab and Utah Counties, and from Park City in Summit and Wasatch Counties. The silver in the copper and lead ores from Salt Lake County also added appreciably to the output. Bingham produced an increased tonnage of lead ore from the Utah Apex, Highland Boy, Yampa, and other properties.

The Utah Apex developed important bedded deposits of silver-lead ore, which were opened in December, 1910. The Parvenu tunnel orebody was followed 400 ft. on the strike, 100 to 150 ft. in width, with a known thickness of 90 ft. at one point and an average thickness where opened of 60 ft. The real extent of this orebody has not yet been determined. Up to September, 28,000 tons of first-class ore from this deposit were shipped and for the balance of the year 200 tons per day were mined, or a total of 24,000 tons. During this period 115 tons of ore and concentrates daily were shipped. At the beginning of September the ore reserves were 143,000 tons, of which ore developed amounted to 83,000 tons and partially developed to 60,000 tons. Mining was discontinued November, 1910 and resumed April, 1911, during which time work was devoted to development. A mining profit of \$121,299 was made for the six months.

GOLD PRODUCTION

The Consolidated Mercur was the chief producer of gold from silicious ores. This company treated from 600 to 700 tons of ore daily. The February cleanup brought \$45,000. The annual report for the year ended June 30 shows that 239,190 tons were treated; the heads averaged \$3.21 and the tailings 88c. This is lower than in former years because the tonnage included 12 per cent. of the old tailings retreated with the ore. Mining costs were \$1.29; milling, \$1.04; total, \$2.33 per ton.

The gold produced for the year was 26,675 oz., which cost \$20.92 per oz. to produce, making a loss of 25c. per oz. There was a small gain for the year from receipts from other sources.

SOURCES OF ZINC

The zinc output for 1911 did not vary much from that of 1910, but will probably show an increase, due to the increase in the production of Park City lead-silver ores from which zinc is obtained as a byproduct. The production from the remainder of the state remained practically unchanged. Bingham produced a limited tonnage, and Beaver County added to the output. Zinc ores proper were mined by the Scranton in north Tintic. This property produced from 700 to 900 tons of zinc and lead ores monthly, the zinc ore coming from high-grade lenses of zincite. The output was shipped to Oklahoma, Kansas, Wisconsin, and other points in the East.

Zinc concentrates were produced by the Daly West and Daly-Judge, while the Grasselli company's mill at Park City treated zinc middlings, and shipped concentrates to its works in Cleveland. Some repairs and changes in the machinery were made. An auxiliary plant built to treat tailings along Poison Creek was tried out, but was not operated continuously. The main Grasselli plant shut down in September, after working the 30,000 tons of accumulated zinc middlings. Numerous small tailing plants treating from the Daly West, Daly-Judge, etc., operated at Park City, and made occasional shipments of zinc concentrates to the East.

A mill is being built below Park City for re-treating tailings for zinc and lead. Wilfley tables and the Macquisten flotation process will be used. The capacity will be about 40 tons daily.

The Huff electrostatic zinc plant at the Midvale smeltery of the United States company handled zinc middlings produced by the company's wet mill. This mill was operated three shifts, and treated over 300 tons of ore per day, producing about 50 tons of zinc middlings, treated in the Huff electrostatic plant.

Ontario Mineral Output in 1911

By Thomas W. Gibson *

The production of silver in 1911 reached the highest point in the history of Ontario, say 31,500,000 fine oz., an increase over 1910 of about 1,000,000 oz. The entire output came from the mines of Cobalt, which from their opening in 1904 down to the end of 1911 have yielded 125,500,000 fine oz. of silver, worth say \$64,000,000, each year showing an increase over the one previous.

How long will Cobalt maintain the pace? While it is quite possible that the climax of production may prove to have been reached in 1911, the indications are that for many years to come the Cobalt mines will be yielding silver, and in considerable quantities. Naturally the phenomenally rich ore at first obtained is now less in evidence, although by no means worked out, and more and more dependence is being placed on the low-grade concentrating material. This is shown by the fact that while the aggregate tonnage of shipments from the camp was less than in 1910, the shipments of concentrates increased from 6874 tons to over 9000 tons. Some of the high-grade ores are also now being refined on the spot.

TENDENCY IS TO REDUCE ORES AT COBALT

The Nipissing company introduced a novel and ingenious amalgamation method for recovering the silver from their rich ores. Silver bullion was first produced in the camp in 1910 when 980,633 oz. were turned out. The bullion output for 1911 will be much greater. This tendency towards final treatment in the camp, or at any rate within the province, was a strongly marked feature of the operations of 1911. There are now 13 concentration plants in operation, and two more—at the Beaver and Cobalt Lake properties—are under construction, with a total capacity of about 1350 stamps.

The producing mines remain much as before, the most important being Nipissing, La Rose, Crown Reserve, Coniagas, Kerr Lake, McKinley-Darragh-Savage, O'Brien, Buffalo, Beaver, Temiskaming, Trethewey, Townsite, Hudson Bay, Nova Scotia (Peterson Lake), Cobalt Lake; Wettlaufer in South Lorrain, and Millerett and Miller Lake-O'Brien in Gowanda. A fault has been found in the La Rose property which increases the depth of the conglomerate formation and opens up fresh possibilities for that mine.

*Deputy Minister of Mines, Toronto, Canada.

Like conditions exist on the Cobalt Lake. The Temiskaming mine had good ore at 575 ft. Its vein is wholly in the Keewatin.

The power conditions were unsatisfactory during the early part of 1911 when the continued severe frost checked the run-off into the Montreal and Matabitchouan Rivers, the falls on which supply the camp with electric power, and also to some extent with compressed air. Hydraulic operations are being projected by the Nipissing for removal of the drift on their property, thus facilitating the discovery of veins.

Mercury has been recognized in small proportions in some of the Cobalt ores. As byproducts of silver, white arsenic and cobalt and nickel oxides are being largely produced by the Canadian refineries, which now treat most of the high-grade ore and concentrates from Cobalt, and the output of these substances for 1911 was much in excess of any previous year. Cobalt oxide as such, and also mixed with nickel oxide, is exported to the European market.

PORCUPINE NOT YET PRODUCING

The actual output of gold for the year was small, perhaps not exceeding 3400 oz., but much is being hoped for from Porcupine. Production from this field would doubtless have been begun ere this, had it not been for the disastrous fires of last summer which destroyed the mills at the Hollinger and Dome, and greatly retarded development. These mills are being rebuilt and will probably be in operation before spring. The owners are satisfied that there is plenty of ore of milling grade, some of it rich. Numerous other properties are being developed. The Vipond mill is far advanced, and the McIntyre and several other mines are also proposing to put in stamps. Fresh discoveries of spectacular free-gold showings have been made since the fires, particularly at the Dome, where a new lead containing much valuable gold has been christened "the golden sidewalk." The fire-swept towns of Golden City and South Porcupine have been rebuilt. The construction of the Temiskaming & Northern Ontario railway spur into the camp has given much needed facilities for transportation.

Electric power from Sandy Falls is already on the ground, and another large installation is going in at Wawaitin, both on the Mattagami River. At Swastika, Munro and Larder Lake camps there are

stamp mills and considerable activity. The St. Anthony mine at Sturgeon Lake, northwestern Ontario, has been taken over by Messrs. Glendenning, Mackie & Kennedy, who have overhauled the mill and resumed production of bullion. At West Shining Tree Lake, gold was found in quartz veins, and one of the largest and most promising claims, known as the Gosselin, Messrs. Mackenzie & Mann are preparing to test by means of a diamond drill. In some of the finds free gold is abundant.

ONLY TWO NICKEL PRODUCERS

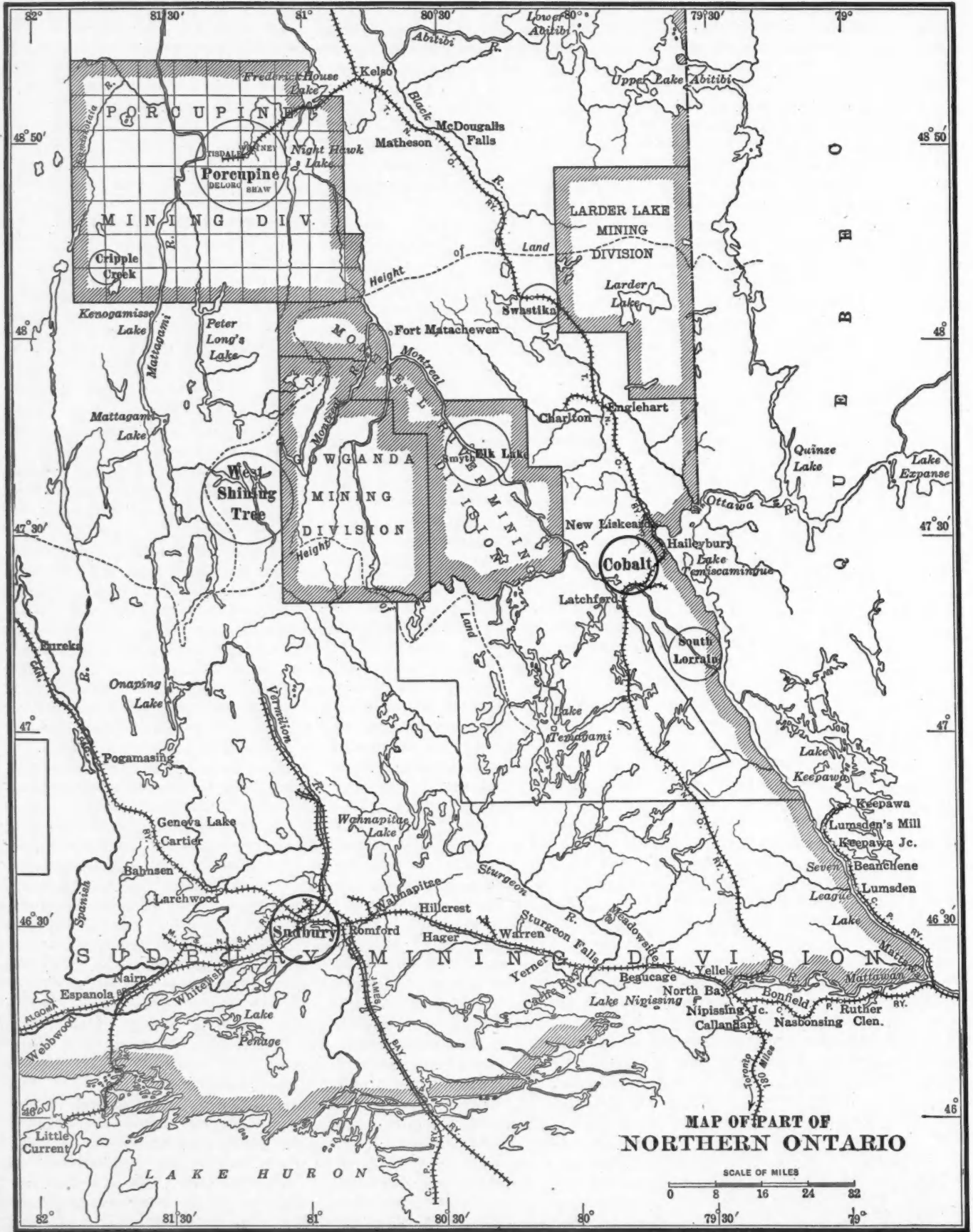
The output of nickel was about 4,000 tons, or say 1000 tons less than in 1910. The mines of Sudbury remain the sole source of production. The operating companies were the Canadian Copper Co., and the Mond Nickel Co. The works of the former are at Copper Cliff, to which place the ore is brought from the Creighton and Crean Hill mines, whence the bulk of the production has come for the last few years. The Mond company is rapidly getting its new smelting grounds into shape near Rumford, and when ready will remove its smelting plant from Victoria Mines thither. Both companies roast the ore, smelt it in blast furnaces and then convert it into bessemer matte, containing say 45% nickel and 35% copper. The Northern nickel range has not yet begun to produce ore, but drilling is going on at Blue Lake. It is proposed to raise a quantity of ore from a location in Dundonald township, where nickel is found in pyrrhotite similar to that of the Sudbury mines.

About the same quantity of iron ore, say 230,000 tons, was raised and shipped in 1911 as in 1910. It is mainly hematite from the Helen mine, Michipicoten, owned by the Lake Superior Corporation, the output of which goes to the company's furnaces at Sault Ste. Marie. Other producing mines were Atikokan, west of Port Arthur, and Moose Mountain, northwest of Sudbury, both of which are of magnetite. At the last mentioned mine a Gröndal concentrator is being erected with a capacity of 375 tons of finished material per day. The iron mines of eastern Ontario shipped nothing during the year, but a concentrating plant is talked of for Trenton on Lake Ontario, to treat ore from deposits on the Central Ontario railway. The production of pig iron for the nine months ended Sept. 30, 1911, was 22,842 tons less than in the corresponding period of

1910. The total for the year will be about 400,000 tons.
 Practically all of the copper raised in Ontario comes from the nickel mines of Sudbury, where the pyrrhotite is mixed

with chalcopyrite. The output in 1911 was in the neighborhood of 9000 tons, or slightly less than in 1910. There are many other deposits of copper ore, mainly sulphide, on the north shore of

Lake Huron, west of Lake Superior, and elsewhere, but for the present they are nonproductive.
 The decline in the production of the petroleum wells of Ontario, which are



situated in the Southwestern peninsula, continued during the year, and it is probable that the yield was not more than 10,000,000 gal. as against 11,000,000 gal. in 1910. Twenty years ago the output was 35,000,000 gal. The great bulk of the crude product of Ontario has come from the Petrolia, Oil Springs and Bothwell fields, which have been yielding oil for over 40 years. Here the oil-bearing rocks belong to the Corniferous formation (Onondaga limestone), and the wells are not of great depth, say 400 or 425 ft. In the newer field of Tilbury and Romney the oil is more deeply seated, being found mainly in the Guelph formation. This field is showing a much more rapid falling off than the older ones. The latest pool, in the township of Onondaga, has not so far made a large production. The oil here is found in the White Medina, a still earlier formation. There is a little flurry at Delaware, where shows are obtained from the Corniferous. The thickness of the oil-bearing rocks from the Trenton up to the Corniferous is great, as is also their superficial extent, and these conditions provide a fair chance of striking new oil fields. So far all the Ontario oils have been of the paraffin-base variety.

The natural-gas area of Ontario is steadily spreading, and now covers a large part of the northern shore of Lake Erie. There are two fairly distinct fields

—one in the counties of Welland, Haldimand and Norfolk, and the other in the counties of Kent and Essex. There were in 1910, 828 producing wells in all, of which 781 were in the former and 47 in the latter field. A population of about 250,000 in southwestern Ontario enjoys the advantages of natural gas both for fuel and lighting purposes, the gas being piped to the cities, towns and villages for some considerable distance outside of the gas fields. It is also used to some extent in manufacturing industries. The production in 1910 was valued at \$1,491,239 at an average of 20.5c. per 1000 cu.ft. and the output for 1911, owing to the extension in the use of the gas which has been going on, will probably amount to \$2,000,000.

PYRITES AND OTHER MINERALS

There are numerous deposits of iron pyrites in Ontario. In 1910, 33,812 tons were raised and shipped, part of the product being used in the manufacture of sulphuric acid in Ontario, and part exported for similar purposes to the United States. The Vermilion mine on the Grand Trunk Pacific is now in shape for large shipments, and a good deal of pyritic sand is extracted from the workings of the Helen iron mine. The production for 1911 will show an increase over that for 1910.

Talc of good quality is mined near Madoc and ground at that place into

several grades of product used in the manufacture of cosmetics, paper, soap, etc. In 1910 the output was 5824 tons, worth \$46,592, and this will no doubt be exceeded by the production in 1911.

Construction materials are abundant in Ontario, including clay, stone, limestone and sand. As a consequence the towns and cities of the Province are largely built of brick and stone, and there is annually a large output of drain tile, sewer pipe and similar products. Marl for portland cement is being displaced by solid limestone, of which there are deposits of suitable quality. The cement industry is rapidly expanding. In 1910, 2,471,837 barrels were made, and no doubt the statistics for 1911 will show an increase. Fine variegated marbles in striking and harmonious colors are being taken from newly opened beds near Bancroft.

Corundum in Renfrew and Hastings Counties, feldspar along the Kingston & Pembroke Railway, gypsum in the valley of the Grand River, mica in Lanark and Frontenac Counties, salt on the east shore of Lakes Huron and St. Clair, graphite in Lanard and Renfrew, and quartz in several parts of northern Ontario, all form the bases of important local industries. The output of the mineral industry of Ontario for 1911 had a value of about \$40,000,000 based on the selling price at the mines or works.

Mining in British Columbia in 1911

By E. Jacobs*

When the British Columbia Bureau of Mines issues its official annual report, next summer, it will be found that there were in 1911 decreases in the quantities of all metals produced, and in coal and coke, and these to such an extent as may make the recorded value of the year's mineral production the lowest of any since 1904. The chief reason for this was the strike of the men employed in the coal mines and at the coke ovens in Crow's Nest Pass district, southeast Kootenay. Besides largely reducing the output of coal and coke, smelting operations were interfered with, so that the Granby Company's reduction works were non-productive nearly half the year and the output of metals from other smelteries also lessened, though in smaller degree. Other unfavorable conditions are mentioned below. The general shortage in production does not, however, truly represent the actual condition of the min-

ing industry of the province, for notwithstanding this, satisfactory progress was made in various directions. Reviewing the several minerals separately, the following comments are submitted.

THE PRECIOUS METALS

The production of placer gold is believed to have been less than in 1910. Atlin creeks yielded less, by about \$50,000. There will probably be a smaller production from Cariboo division of the Cariboo district, but this is in part compensated for by an increase in Quesnel division. The 1911 total production in all districts is not expected to reach \$500,000 in value. The output of lode gold, too, may be expected to be less than in 1910. The largest decrease was in the gold from Granby ores, of which only about half the usual yearly tonnage was smelted. Nelson mining division will probably also show a decrease. A gain of about 6000 oz. is expected from

the Hedley Gold Mining Co.'s Nickel Plate group, Similkameen, while Rossland's total should be about 5000 oz. larger and the British Columbia Copper Co.'s output approximately 3000 oz. more than that of 1910. A preliminary estimate of the 1911 Hedley production is 57,000 tons of ore averaging \$12.10 per ton. Dividends from this mine in 1911 totalled \$300,000, or 25% of its capitalization. In the absence of details of production of numerous smaller mines, a close estimate is not practicable; roughly, the 1911 total production may be placed at 250,000 to 255,000 oz.

An output of 2,000,000 oz. of silver, as compared with 2,450,000 oz. in 1910, seems likely, judging by the returns available. Preliminary figures indicate decreased production at 10 or a dozen of the larger silver-producing mines. Generally the loss in output is temporary, attributable to causes already, or shortly to be, removed. In one case, however—that of the St. Eugene, East Kootenay—

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the decrease is a result of gradual exhaustion of known ore deposits. On the other hand, the Rambler-Cariboo, Slocan, made an increase larger than any single decrease, and it may reasonably be expected to do even better in 1912, for it has comparatively large reserves of ore the stoping of which will shortly be commenced, following completion of a concentration mill and railway transportation facilities.

Although conditions unfavorable to the production of silver-lead ore were experienced in several parts of both East and West Kootenay, much development work was done in these districts in preparation for an enlarged output in the future. Deep development in several Slocan mines proved the occurrence at considerable depth of ore of good grade and in quantity, consequently the outlook for enlarged production is better now than for years past.

LEAD

A combination of adverse conditions appears to have caused the total production of lead in 1911 to be smaller than in any other year since 1903. The largest individual decrease was that of the St. Eugene, which in 1910 produced nearly 15,800,000 lb. out of a total for the whole province of 34,652,000 lb.; its output for 1911 was from approximately 35,000 tons of ore from which 5300 tons of concentrate were produced, containing 5,882,000 lb. lead and 136,000 oz. of silver. Other decreases were those of the Blue Bell, in Ainsworth division, from which no production was made; the Whitewater group, also in Ainsworth division, which in the summer of 1910 was deprived by forest fires of both concentrating mill and railway transportation; and the Standard, Slocan Lake district, at which production was suspended during the greater part of the year, while power, concentration and transportation facilities were being provided, all of which became available late in the year.

Several Slocan mines increased their respective outputs, and in less degree two in Nelson division also produced more lead. On the whole, though, the known supply of lead ore has during recent years gradually become smaller. Developments in Slocan mines promise a change for the better, and there is, as well, hope of considerable improvement near Salmo, Nelson division.

COPPER

Notwithstanding that during about half of 1911 production was suspended at the Granby company's mines, the net decrease in total production of copper was less than had been feared. Preliminary figures show that the British

Columbia Copper Co., as compared with its 1910 output, made a gain of between 2,000,000 and 3,000,000 lb., and it is reported the Britannia mine produced 7,000,000 lb. more than in 1910. The marked improvement at the Britannia is noteworthy. Robert H. Leach, before ill-health necessitated his relinquishing its management, had during the last two years effected an entire transformation in its capacity to produce ore of profit-yielding grade. Allowing for a decrease of 2,000,000 lb. from the Snowshoe (Boundary) and say 9,000,000 lb. from Granby, and placing against these an estimated gain by other mines of not less than 9,000,000 lb., the year's aggregate production should be within 2,000,000 to 3,000,000 lb. of that of 1910. A prominent feature of the year was the development by the Granby company at its Hidden Creek mine of a large tonnage of ore—variously calculated by different engineers at 6,000,000 to 12,000,000 tons—estimated to contain a minimum of 2% of copper for the smaller tonnage and 1.65% for the greater. Some large shoots in this mass of ore give an average assay return of 5% of copper.

METALLURGICAL NOTES

At the Consolidated Mining & Smelting Co.'s works, at Trail, West Kootenay, a Dwight-Lloyd sintering plant was put in. This was found to give most satisfactory results when roasting gold-copper concentrate from the Le Roi No. 2 Co.'s Josie mine, Rossland. It has not been so successful, however, with lead-zinc ores and concentrates, with which a second roasting was found necessary. Some changes in the arrangement of the Huntington-Heberlein roasters and converter pots are being made at Trail. The operation of the electrolytic lead refinery there was continued with excellent results. At Grand Forks, Boundary district, the Granby company constructed flumes, bins and an incline trestle (with conveying belts) up to a height of 100 ft., for disposal of granulated slag, thereby making the old dump again available for use for this purpose.

Approximate figures indicate that in 1911 the total value of metal products at the Consolidated smeltery was \$4,750,000, in the following proportions: Gold, \$2,745,000; silver, \$715,000; lead, \$770,000; copper, \$520,000.

THE CONSOLIDATED COMPANY'S MINES

The Snowshoe is a low-grade copper property, situated in close proximity to the Granby company's mines in Phoenix camp, Boundary district. While the tonnage received during the year from the company's lead mines was also less, owing to the practical exhaustion of the St. Eugene mine, development work in

progress at the Sullivan, Molly Gibson, and on some claims near Salmo, Nelson mining division, on which there is a large surface showing of lead carbonate ore, together with the opening of large shoots of silver-lead ore in Slocan mines, warrants the expectation that more lead ore will be received in 1912 and that the quantities of silver and lead recovered in that year will be proportionately larger. Further, not only has there been developed, during recent months, below the 12th level of the company's War Eagle mine, Rossland, a larger tonnage of ore and of higher gold value than was expected, but a considerable quantity of ore is being obtained from the Le Roi mine, now owned by this company, which will add substantially to the 1912 ore receipts at the smeltery. The Center Star group at Rossland, owned by the Consolidated Mining & Smelting Co., in 1911 shipped about 195,000 tons of ore containing, approximately, 86,512 oz. gold, 57,670 oz. silver, and 2,183,000 lb. copper. Nearly 12,000 lineal ft. of development work was done and about 20,000 ft. of diamond-drilling.

MILLING OPERATIONS

At the Hedley Gold Mining Co.'s 40-stamp mill, Similkameen, where no gold is saved on amalgamating plates, but is chiefly recovered in a concentrate which is smelted, the gold-carrying cyanide solution passes to Merrill presses and the slimes to Oliver filter presses, the final result being an average total extraction of 92% of the gold contained in the ore fed to the stamps. At Sheep Creek, Nelson mining division, the Motherlode Sheep Creek Mining Co. has erected and equipped a 10-stamp gold mill and cyanide plant. Near Silverton, Slocan Lake, the Van-Roi Mining Co.'s concentrator was completed last spring and has since treated about 30,000 tons of silver-lead-zinc ore, making silver-lead and silver-zinc concentrates; the Silverton Mines, Ltd., put in one unit of the Elmore Vacuum Process plant at its Wakefield mill, to treat zinc middlings from the jigs; and the Standard Silver-Lead Mining Co. built a 100-ton concentrating mill, also near Silverton, and commenced operations with it in November. In the coast district, satisfactory results were achieved at the Britannia mill in concentrating ore containing chalcopryrite, and the unit of the Elmore Vacuum plant put in here proved well adapted for saving the mineral from fines and slimes. These combined processes promise to give a high total extraction and a nearly neutral product for smelting. The Portland Canal Mining Co. increased the capacity of its concentrating mill to 75 tons per day, and made a good average saving in two classes of concentrate—iron with gold, and lead with both silver and gold.

Mining in Mexico in 1911

By Kirby Thomas*

During 1911 the condition and progress of the mining industry of Mexico was directly related to and concerned with the outcome of the political revolution which began in November, 1910 and terminated sensationally in April, 1911. The revolution as far as directed and controlled by Francisco I. Madero and his associates was directly aimed at reforming and changing domestic political conditions, and fortunately was absolutely free from any prejudice or antagonism toward the foreign interests, which in the mining industry are so preponderant.

Following a carefully considered and well promulgated policy, the revolutionists, particularly in the northern part of the republic, gave full and complete protection to foreign property interests and to foreigners. This situation was reciprocated generally by the American and English operators in Mexico by a policy of absolute neutrality, although there was undoubtedly a large element of sympathy and approval for the Madero movement among the foreigners, particularly among Americans. During the war, however, the foreign mining operators in Mexico conducted themselves with noteworthy calmness and judgment, with the result of creating the basis for a good relation between the foreigners and the new government.

INTERRUPTIONS CAUSED BY THE REVOLUTION

During the revolution the operating mines were seriously hampered by the interruption of the usual means of transportation, and particularly by the restrictions placed, as a war measure, upon the distribution of dynamite. However, most of the large operating companies continued active, and all of them were in position to resume activities at the close of the war. The revolution had the effect of discontinuing a great many development and exploratory operations, partly by reason of the special caution of foreign investors and partly because of the difficulties and disadvantages of trying to operate with the disturbed economic and social conditions in the country. It is undoubtedly true that many of the top-heavy and inflated Mexican mining enterprises found the war a convenient excuse to enable them to haul in sail.

Until recently American investors have been somewhat timid about reëntering the field, particularly in the way of new enterprises, but it is to be noted that even during the time of the disturbances

certain English investors became more active and took advantage of the naturally advantageous terms and prices offered.

RESUMPTION OF MINING

Following the sudden termination of the war and the inauguration of a provisional government representing the successful revolutionists, the mining industry of the republic began rapidly to resume a normal condition. The transportation systems were quickly restored to normality, and the scarcity of labor which was a factor in some districts was relieved by the availability of the ex-soldiers of both sides. The policy of the new government, as expressed in interviews and official messages, indicated a distinct fairness toward foreigners engaged in the mining industry. In one respect some alarm was felt; that was with regard to the announcement of restrictions as to the granting of concessions and monopolies. While this policy, partly inaugurated under President Diaz, was one which would in ways interfere with some of the special privileges granted to foreign companies, yet, on the whole, it is just and wise, and is generally considered by the individual foreign investors not participating in these favorable concessions, as beneficial. One of the issues of the revolution was the discontinuance of the policy of granting these special concessions, and the confirmation and continuation of the policy of an open field will be for the best interests of the industry and the individual.

The vast Madero family estate is largely interested in mining and is closely identified with the industry in a number of ways. This fact alone had a favorable tendency in forming public opinion locally and abroad and in creating confidence in the outcome of the new government as regards the mining industry of the country.

WAGES MAY RISE

Owing to the prevalence of extremely liberal ideas among the people resulting from the political changes and to the natural social disorganization following the transformation of the government, more or less local labor and class disturbances arose throughout the republic, but these were mainly local, and were on the whole easily handled by the grant-

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ing of moderate concessions on the part of employers. In one or two instances these strikes, so-called, took the form of riots and necessitated the calling out of the local soldiery. On the whole, the labor situation in Mexico, while uneasy and disturbed, is not serious. The tendency to rising wages is, of course, to be recognized, and in some cases the demands are large. The adjustment of the labor question is one of the problems which the mining industry will have to meet and gradually work out.

RAILROAD EXTENSIONS

Little advance in railroad extension in Mexico was made in 1911. The Southern Pacific late in the year resumed construction on its Pacific Coast line in Tepic and it is expected that trains will be running to the city of Tepic in January, 1912. No work was done on the westward extension of the line from Magdalena in Jalisco nor is there any prospect of early work being done. Work on the Yaqui River extensions was suspended all the year. It is now announced that the southward extension from Nacozari will be begun soon and that the line as planned may be changed to go by the Cieneguita district. The Mexico Northwestern road completed its connection between the line from El Paso and the line from Chihuahua via Madera. Nothing is in sight as to the proposed extensions of this system to the Pacific. The National Railways of Mexico is building a line westward from Gutierrez, north of the city of Zacatecas, to Durango tapping the important camps of western Zacatecas. There is a revival of the project for a line along the Pacific coast northwestward from Acapulco, concession for which was granted to Americans in 1910. A branch was built into the Cusihiuriachic district in central Chihuahua. In many parts of Mexico the extensions of the railroads to adjacent mining districts is a long delayed need and it is hoped that the new administration will be able to direct the policy of the National Railways and to encourage private enterprise so that this situation can be relieved soon. No work was done on the Orient road in Mexico during 1911, but operations were concentrated on the trunk line in the United States. It is announced that this work will be resumed at once on the gap in the line to connect the westward extension from Chihuahua with the line now built from Topolobampo.

EXTENSION OF POWER PROJECTS

During 1911 a number of mining companies, particularly in the mountain regions where transportation conditions are unfavorable, found it necessary to utilize the available hydro-electric power. In the western Sierra Madre the Sierra Consolidated and Cocheño companies built power plants. The Dolores mine is also using hydro-electric power. The Guadalajara power plant in Jalisco was partly completed during the year, but in the main its relations with the mining companies were more or less unsatisfactory owing to certain inflexible conditions imposed by the company which is controlled by Mexicans. The Guanajuato plant increased its power capacity and extended its lines to San Luis Potosi and Aguascalientes.

The use of gasoline or oil engines for exploration, and particularly for hoisting purposes, is becoming more frequent in the Mexican field. Particularly the multiple-cylinder, automobile type is found advantageous in connection with hoisting operations, inasmuch as intermittent operation is permitted. The use of the gas engine in the republic is increasing, and advantage is taken of the wider range of fuel available for the modern types of gas-producer plants.

The Conchos River project is underway and promises within a year to supply power to a number of important Chihuahua camps. This project is financed by English capital, represented by Lord Cowdray. The project to develop the power on the Balsas River has been in abeyance for some time, and at present no movement is being made to realize it.

ZINC SHIPMENTS RESUMED

In the latter part of 1911 there was a resumption of the shipment of zinc ore from northern Mexico. Most of the shipments going to Europe, but some ore came into the United States, paying the new duty. However, the zinc industry is still seriously hampered in Mexico. A notable feature in connection with the possibilities of the zinc industry is a contract made by the San Francisco del Oro company with certain Europeans, under which it is profitable to ship roasted concentrates containing 10% zinc and 30% lead, or the reverse percentages. This special contract has attracted considerable attention because of the possibilities it holds out with regard to other properties.

THE COAL AND OIL INDUSTRY

The coal production during the year was reduced greatly. However, work in exploration and development was underway, and a new district was developed northeast of the present coal area near the Rio Grande River.

The oil industry, particularly at Tampico, was prosperous in 1911. The production increased greatly and a number of new wells were brought in, greatly extending the oil areas and also indicating large possibilities for the field. A number of independent American companies became engaged in the exploitation of oil in the Gulf region.

MINING IN SONORA

In Sonora the Greene-Cananea, Moctezuma, Creston-Colorada, Chispas and several other large mines maintained practically continuous operation during 1911. Little new work was undertaken and many pending negotiations were suspended or entirely broken off. The Greene-Cananea continued to introduce economies in operations and the present earnings hold out hopes for an early dividend. In November, Phelps, Dodge & Co. acquired the Promentorio copper mine near Nacozari, under mortgage greatly extending the company's large copper properties in northwest Sonora. The Mina Mexico in the Yaqui River district started operation late in the summer of the new furnace installed at the mine. The Pacific Mining & Smelting Co. completed arrangements for a supply of sulphide ore and will operate the smeltery at Fundicion soon. The Chispas mine recently suspended work owing to differences over water rights and labor disputes. But little progress was made in the Altar district or in any of the West Coast properties. The Sahuaripa district was practically idle most of the year. Development operations were continued at the San Antonio in the Yaqui River district. Investigations of the coal area in central Sonora have been underway with reported good results. No results from the desultory attempts at oil discovery in northern Sonora are reported. In the Alamos and Rio Mayo districts a new property, the Muchacho Grande was extensively developed and some work was done at Minas Nuevas near Alamos, and also in the nearby new gold district of Sobia. Resumption of work in the northwestern part of the state was begun and the activity promises to be great for 1912, especially if the proposed extension of the railroad is assured. Arrangements for the operation of the smeltery at Toledo in the Yaqui River district are being made.

CONDITIONS IN CHIHUAHUA

The mines maintained production very well for 1911 under the conditions of interrupted traffic. The Batopilas, Palmarajo, Dolores, Sierra Consolidated, Cocheño, Yoquivo and others in the western Sierra Madre were in practically continuous operation. With the operation of the railroad to Cusiuhiriachic much work was done in that old camp. Santa

Eulalia continued to show remarkable richness in new and deep development. The copper smelting project at Terrazas was resumed late in the year. Much of the mining in northern and eastern Chihuahua was suspended throughout the year. Recently some interesting rich gold discoveries were made at San Sostones, about 60 miles east of the city of Chihuahua.

The Parral camp made much progress during 1911 and promises greater production than ever before. The Palmilla, Sierra Plata and Veta Colorada mills were put in commission and several new smaller mills were planned. Recently men allied with the Conchas power project acquired wholesale options in the camp presumably with the intention of providing an outlet for an expected power surplus. The electric power should be in the camp within a year and several companies are anticipating it. The Esmeralda disclosed rich ore at depth and the Europa opened an extension on the El Tajo vein. The famous Palmilla mine is still idle, the mill finding its ore supply from the dumps and from other properties owned by the company on the Veta Colorada. The Naica mines produced less ore and several operations in the camp were discontinued. At Almoloya operations continued. The Francisco del Oro mine, near Parral, made changes in its mill plans and expects to ship soon. At Santa Barbara operations continued during 1911. El Rayo made important new discoveries and increased its output and ore revenue.

The mining situation in Sinaloa was quiet in 1911 and operations still await the full restoration of political stability.

MINING IN NORTHEASTERN STATES

In the northeastern states of Mexico, Nuevo Leon and Coahuila, there was but little change in mining during 1911. The coal mines after some interruptions, resumed usual activity. A new coal area near Ciudad Porfirio Diaz was developed in 1911. The principal output of the metal mines of these states continued to be lead, silver and zinc. The zinc-lead operations in Tamaulipas were resumed in the latter part of the year. The smelteries at Monterey and Torreon continued operating during most of the year except for a short interval at the Torreon plant during an acute labor strike. The zinc output of these estates continued small and is much less than two years ago before the United States tariff was revised.

In Durango there was a practical suspension of all mining except at the larger camps as Velardeña and Mapimi during much of 1911. The Indé district showed few changes and little progress. The Lustre district was revived by the reorganization of the Magistral company and the project for

a railroad. Guanacevi operated on a reduced scale during the year. The Mexico Consolidated passed through a period of reorganization, the end of which is not yet in sight and only operated on a small scale. In the remoter Sierra Madre camps political conditions were unsettled up to the end of the year. Some new discoveries were reported near San Dimas on the western boundary. The operations at Mapimi during the year were successful as to output and ore development. The Peñoles company is now operating also the San Juan. The Velardeña smeltery was interrupted during the war but is now in full operation.

IN THE CENTRAL STATES

In the central states there was but little change during the year. At Zacatecas the Goerz company of London is continuing development on the Rio Tinto. The Magistral smeltery is successfully operating. New negotiations are underway for the San Roberto. The camps in southern Zacatecas have remained unchanged and quiet. In the northwestern part of the state the Mazapil company continued large operations at Mazapil and Concepcion del Oro. The camps in the western part of the state are being revived preparatory to the new conditions

which will result from the railroad projection into that section.

The operations at the Aguascalientes mines were interrupted during the first part of the year and again recently by labor troubles. The smelting plant at Aguascalientes continued in operation throughout 1911. The mining conditions in San Luis Potosi were resuming normality toward the close of 1911. The smelteries at Matehuala and San Luis Potosi are in full operation again. The Tiro General mine at Charcas was acquired by the American Smelting & Refining Co.

In Hidalgo operations were largely suspended for most of the year except in the important Pachuca camp. The Cortez company of Boston continued extensive developments in the northern districts. At Pachuca the new activities were largely represented by the work on the Santa Gertrudis mill which has a daily capacity of 600 tons. A new plant to treat the tailings on the Pachuca River was installed. The Real del Monte y Pachuca company continued satisfactory earnings as did the San Rafael, La Blanca and several other of the old mines. The Blaisdell treatment plant for tailings made a good showing. Improvements in transportation between the mines and the mills were begun.

The Tezuitlan smeltery in Puebla resumed after some technical adjustments and is now operating. In Guerrero work was and still is hampered by political conditions. At Taxco work on a railroad is being done and some new investments have been made in the camp. The situation in Oaxaca has been generally unsatisfactory owing to the political disturbance and only in recent days have the prospects seemed better. The extensive operations of the Oaxaca Iron and Coal Co. near Nochtitlan were suspended late in 1910 and have not yet been resumed. The Taviche camp continues to yield rich shipping ore but milling is limited.

In Jalisco activities continued during 1911 in the Hostotipaquillo district and several new enterprises were undertaken. The district is still awaiting satisfactory power and the extension of the Southern Pacific railroad from Magdalena. The Amparo mine at Etzatlan yielded good returns and extensive development was carried on at the Magistral copper mine near Ameca. Some work is being done in the Bolaños district north of Guadalajara. The operations in Jalisco are more fully described and a resumé of mining in Guanajuato for 1911 given in other articles in this issue.

Mining in Oaxaca in 1911

Special Correspondence

In general there was a considerable falling off in the production from mines in the state of Oaxaca during 1911. While there were no serious disturbances in the mining districts during or after the revolution, most of the small properties, the production from which did not pay running expenses, suspended operations, and others reduced expenses to a minimum. Practically all non-producing prospects suspended. At the same time the two chief producers of the state, the Natividad and San Juan mines, increased their production considerably over that of 1910. Data are not available at this time as to the exact production of the various mines, but it is probable that the total gross production of the state for 1911 was in the neighborhood of 1,200,000 pesos, of which about 1,000,000 pesos were produced by the Natividad and San Juan mines.

The San Juan mine worked steadily, producing about 400 tons of shipping ore monthly. All ore extracted from the mine was sorted, the sorted product shipped to Aguascalientes, and the poorer ore stored for future treatment. It is planned

to erect a 10-stamp cyanide mill at this mine. The shaft was sunk to a depth of 500 ft., and a 200 h.p. first-motion steam hoist was installed. The Escuadra and Zapote mines produced more or less regularly, and some production was made from the San Francisco mine, though it is now idle.

The ores of the Taviche district are silicious silver ores, largely in the form of sulph-antimonides of silver, with little pyrite or base metals other than antimony, and, as shipped, seldom contain more than five kilograms of silver per metric ton, with a proportion of 5 to 15 grams of gold per kilogram of silver, so that a considerable percentage of the gross value is paid for the high shipping and treatment costs. Several mills have been put up in the district, but have all failed to make a success of the treatment of the ores.

OCOTLAN, EJUTLA AND TOTOLPAM

The 10-stamp amalgamation and concentration mill belonging to the Mimiaga family ran about a quarter of the

year on low-grade ore from the old open-cuts of the Natividad del Valle mine at San José. The San Martin mine between Ocotlan and Ejutla continued development and made small shipments.

The Ocotes mine, the property of the Tezuitlan Copper Co., continued development work, and it is understood that the already large reserves of silicious copper ore were considerably augmented. It seems probable that this mine in the Ejutla district will not be placed on a productive basis until a concentrating mill is erected that will economically bring the concentrate to a grade that will readily stand the expense of shipment to the company's smeltery at Tezuitlan. No other work of importance has been done in this district.

Two new cyanide mills were completed in 1911 in the Totolopam district. Of these the Victoria y Tapada mill ran intermittently, and operations were suspended towards the end of the year. The Soledad mill was also shut down having run but a short time. The ores are chlorides and bromides near the surface; sulphides in depth.

SIERRA JUAREZ DISTRICT

The 30-stamp cyanide mill of the Natividad company ran at two-thirds capacity all the year, owing to lack of sufficient motive power in the present 300 h.p. hydro-electric plant. Ground was broken in March for the construction of a new 1000 h.p. hydro-electric plant for this company, which is now nearly completed and is expected to be in operation in January, 1912. Power will be generated by two 500 h.p. Pelton wheels under a 566 ft. head, each directly connected to a 375-k.v.a. generator. The ore of the Natividad mine contains pyrite, galena and blende, with a gold and silver content in the proportion of 80% of the

value in gold and 20% in silver. The ore is crushed in cyanide solution, completely slimed in the tube mills and afterwards concentrated on vanners and the concentrate returned to the tube mills for regrinding. The whole pulp passing from the vanners is agitated and filtered in a slime filter plant. An extraction of about 85% of the gold and 50% of the silver is secured. From 10 to 15 tons of high-grade ore were shipped monthly, of an average gross value of 1500 pesos per ton. A foundry, new machine shops and several buildings were added to the equipment during the year.

No other mining operations of importance were undertaken in this district during 1911, though the San José de

Gracia mill of five stamps was operated for a short period.

VILLA ALTA AND PERAS DISTRICTS

Development work was carried on at Santa Gertrudis in the Villa Alta district by British investors.

The mines of Wenceslaus Garcia in the Peras district of Oaxaca were worked successfully during 1911, and the ore was milled at the 20-stamp mill of the Los Reyes company, which was rented. A production of something over 5000 pesos per month of small gold bars was also made by the *buscones* who worked the oxidized surface ores and treated them in arrastres turned by waterwheels. The ores of this district are free-milling gold ores in the oxidized zone.

Mining at Guanajuato in 1911

By Austin C. Brady*

The political upheaval in Mexico affected Guanajuato only to the extent of keeping out capital that otherwise might have been invested for the furtherance of plans of established companies, or for new enterprises. The operations of the principal producing companies continued through the year with but few interruptions. The production of the Guanajuato district in 1910 was placed at 14,000,000 pesos, and it is estimated that the 1911 production will at least equal that of the previous year.

The Peregrina Mining & Milling Co. has had a successful year. In addition to treating about 7000 tons monthly from its own properties, it has been milling 6000 tons per month from the Villapando mine, of the Cubo Mining & Milling Co. The Villapando ore is the product of new development, and the Cubo company has been making a good profit on the deliveries made to the Peregrina mill. During the year the Peregrina has continued payments on its preferred stock.

WORK RESUMED ON NUEVA LUZ

Early in the year the Providencia Mining & Milling Co. placed in commission its 200-ton cyaniding plant, and good results are being obtained in the all-slime treatment of the Tajo de Dolores ores.

Of late the company has been handling about 200 tons daily, and has been operating at a good profit. The Providencia has been financed by the Proprietary Mines Company of America, and in order to concentrate attention on that enterprise until such time as it should reach a profitable basis, the Proprietary Mines, also controlling the Mineral Development

Co., early in the year suspended work on the latter's Nueva Luz project. Recently this work has been resumed, the mechanical plant has been overhauled, shaft improvements have been made, and crosscutting for the mother lode of the Guanajuato district now is in progress. If the work continues without interruptions, it is believed the *vea madre* will be cut in February or March.

During 1911 the Guanajuato Reduction & Mines Co. treated approximately 20,000 tons monthly. About one-third of the ore treated has been taken from new workings in the old Rayas and Tepeyac mines, the remainder has been from dumps and fills. The company plans to push steadily new development, and the percentage of ore from new workings probably will be considerably increased in 1912. The earnings of the company have been more than sufficient to keep up interest payments on its \$3,000,000 bond issue.

The Guanajuato Consolidated Mining & Milling Co. has been operating only 40 of its 80 stamps during the greater part of the year, but higher-grade ore has been treated, and the showing for 1911 is expected to be as good, if not better than that for 1910, when 80 stamps were dropping. The Carmen-Guanajuato Gold Mining Co., which is controlled by the Guanajuato Consolidated, has been milling at a satisfactory profit.

The mill of the Pinguico Mines Co. has been treating from 5000 to 7000 tons of ore per month. Less high-grade ore has been shipped than in 1910. The Humboldt-Guanajuato Co., owning properties

adjoining the Pinguico, has continued development.

EL MONTE VEIN A RICH PRODUCER

The year's production of the rich El Monte de San Nicolas mine was over 1,000,000 pesos. Shipments have been made regularly, and lower-grade ore has been treated in arrastres. In the adjoining Pasadena property, of which E. A. Montgomery, of Los Angeles, Calif., is the principal owner, a parallel vein has been cut and some rich ore has been taken out. Sinking for the El Monte vein has been continued.

The San Cayetano Mines Co., controlled by the Lewisohns, of New York, and of which much was expected, abandoned operations some time ago. The company was organized to work the old San Cayetano properties, and in 1910 took over several adjoining mines. It is reported that the results of the extensive development accomplished were not up to expectations.

The Oro Grande Co., organized to operate the famous old mines of La Luz, has not met the success that was hoped for. The old Bolañitos mine was unwatered, but so far new development has not opened extensive orebodies. The deal made last year with the Guanajuato Amalgamated Mining & Milling Co. for its Jesus Maria mines and mill may not be consummated. At present only 50 of the 100 stamps of the Amalgamated mill are in operation.

The 10-stamp concentrating and cyaniding plant of the Tula Mining Co., placed in commission early in the year, has been shut down, pending the development

*Guadalajara, Jal., Mex.

of reserves of higher-grade ore. The capacity of the plant is not sufficient for profitable operation on the grade of ore that can be supplied.

MILLING ORE FROM THE SIRENA DUMPS

The San Matias mill, of the Mexican Milling & Transportation Co., has been making a good profit monthly operating as a custom plant. Much ore from the Sirena dumps and croppings, connected with the San Matias by aerial tramway, has been milled. The Santa Natalia mill of Cooper Shapley, leased to the French interests that last year took over the Santo Niño and other properties, has been shut down. The French interests are carrying on development. The Nayal mine, leased by the Dwight Furness Co. to Martin Hines, has been returning profits of 500 pesos weekly on ore sent to the Nayal mill. Important deals on the Dolores, San Gregorio and other properties in which the Dwight Furness Co. is heavily interested, are pending.

The Guanajuato Power & Electric Co. has had a successful year. Its third power plant on the Angulo River, in the state of Michoacan, was completed and the power capacity was doubled thereby. A branch from the transmission line, extending to San Luis Potosi, is supplying the Providencia San Juan de la Luz properties, at San Felipe. Arrangements were completed for the building of a 50-mile transmission line from Guanajuato to supply the mines of the important Angustias Mining Co., at Pozos.

El Oro District in 1911

BY FREDERICK MACCOY*

The end of 1911 found the camp of El Oro producing about the same amount of gold and silver as in 1910. The mines from which come practically all of the production are those of the Dos Estrellas Mining Co., Mexico Mines of El Oro, Ltd., El Oro Mining & Railway Co., and the Esperanza Mining Co. Other mines in the district which produced during 1911, but not sufficiently to be self supporting, were Oro Nolan, and the Victoria; while still in state of being prospects, may be mentioned the Descubridora, Reforma, Carmen, Buen Despacho, Planeta, La Lucha and San José.

About the only effect that the recent revolution in Mexico had on the camp was to slightly lower the value of the shares on the stock market. During 1911 the control of Mexico Mines of El Oro, Ltd., passed from the London-Mexico Exploration Co. to French owners, representing practically the same interests as those in the Dos Estrellas company. The only new company of any size to enter the field in 1911 was the Compañía Minera San Vidal y Anexas, which has organized with

*Esperanza Mining Co., El Oro, Mexico.

a capitalization of 600,000 pesos to undertake the exploration of the northwestern extension of the El Oro-Tlalpujahua mineral zone. This company has now been financed, and will start work on the above mentioned San José claim, acquired by the company within the year.

Little change is to be noted in milling practice during 1911; the Mexico Mines of El Oro and Esperanza increased their tankage room, the Mexico Mines by the addition of mechanically agitated tanks, and Esperanza by the addition of six more Pachuca tanks.

The El Oro Mining & Railway Co. is installing additional Burt revolving filters and there were installed in the various plants several Esperanza-Federal drag classifiers.

Nicaragua in 1911

BY T. LANE CARTER*

Mining in Nicaragua in 1911 did not make the progress that was indicated at the beginning of the year. The greatest disappointment was the collapse of negotiations regarding the Bonanza gold mine, the most promising property in the Pis Pis district. At one time it looked as if the sale of this property to some influential Western capitalists for the sum of about a million and one-half dollars, would go through, but unfortunately after six months' work the deal was declared off. The failure of this sale was a distinct setback for mining in Nicaragua. Had it gone through, other large capitalists would have undoubtedly gone into the country.

The La Luz y Los Angeles made an excellent showing in 1911. This property is about 35 miles south of the Pis Pis district. The minority interest of 18½% was bought during the year by the majority interests in Pittsburg, for \$185,000, thus putting a valuation of \$1,000,000 on this property.

DEFECT IN MINING LAW

A serious defect in the mining law of Nicaragua was discovered in 1911, while negotiations were going on for the purchase of the Bonanza property. This is in relation to the status of deep-level claims. Now that the fault has been pointed out, it is probable that this law will be changed.

[According to the law, which does not recognize extralateral rights, the owner of a property could not denounce new claims adjoining and paralleling his own, nor could the land be denounced by others without actual discovery of ore on the land.—EDITOR.]

Most attention has been given to the Pis Pis district, but the year closed with rather discouraging conditions in this part of the country. The Bonanza mine is doing well. Its neighbor, the Lone Star, is

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still running, but it is to be hoped that this property can soon be put in other hands. At present a deal is under consideration by Eastern men. An attempt in 1911 to sell the Lone Star to some London capitalists proved unsuccessful. As yet Nicaragua does not appeal to them.

The Siempre Viva mine recently closed down. It is said that the oxidized ore is nearly exhausted and that the plant is not suitable for the treatment of sulphide ores. It will be necessary to put in a regrinding plant and other machinery in order to treat this ore successfully. Whether the Siempre Viva people can finance this deal remains to be seen.

The Concordia mine, on which several rich strikes have been made in the past, continues in successful operation. In 1911 one or two fairly promising prospects were opened up in the Pis Pis district.

So far there has been no answer to the important question as to what will happen in depth on the veins in the Pis Pis district. At present there is not a really large company in this section of Nicaragua. What is most needed there is sufficient capital to carry out the work of exploitation. It is now fully realized that Nicaragua mines, being comparatively low grade, require plenty of capital.

In 1911 little was done in Nicaragua mining save in gold. The country has considerable promise in other metals, but present conditions are such that they cannot be worked. The all-important question of transportation was much discussed during the year, and it is now fairly assured that a railroad will be built from Bluefields to connect with Managua. It is to be hoped that one can be built from the coast into the Pis Pis district. Negotiations are now pending with American bankers to supply Nicaragua with sufficient money to construct railroads and help the development of the country. This will mean a great deal, not only for the agricultural interests, but mining as well.

Political interests in Nicaragua, which have such a vital bearing on mining, have been comparatively satisfactory. There were one of two "flare-ups," but this is to be expected in that country. President Estrada was succeeded by Adolpho Diaz, a man who is well acquainted with the needs of Nicaragua. It is to be hoped that in 1912 the country will make distinct advances under his administration. The total output of gold in 1911 was about \$1,000,000. The outlook for 1912 is not overbright.

More than a third of the new gold now produced by the United States goes into the arts and manufactures. Ten years ago the proportion put to this use was only about one-fifth of the total production, or \$18,000,000. About \$35,000,000 is now annually used in the arts.

Central American Operations

Special Correspondence

The year 1911 was one of steady progress and development throughout Central America. The most interesting work was done and is still going on in Guatemala. A company known as the Guatemala Mining & Development Co., in which A. E. Spriggs, formerly of Montana, and William Sulzer, of New York, are interested, obtained an important concession covering all the mineral deposits of the country. A corps of engineers was, and still is in the field. The entire country was blocked out in squares, each division was placed under the supervision of a superintendent and thoroughly explored. No development work was done nor was the task of prospecting the country anything like completed. The only producing property was that at Quebradas de Oro, near Morales, on the Guatemala railroad. This is a hydraulic mine, owned and operated by John Knight. The production is not made public, but has been variously estimated from \$10,000 to \$30,000 per year.

SALVADOR

The principal mines of Salvador are the Butter's Salvador in Santa Rosa and the Divisidero mine, in La Union. The Salvador property produced about \$60,000 per month in gold during 1911. The treatment included roasting, but toward the end of the year changes were made in the treatment process without interfer-

ing with regular production, so that when completed roasting will not be necessary. The ore will be crushed in rolls and cyanided. At the Divisidero mine the production was \$40,000 per month in gold and silver bullion. This property is equipped with a 20-stamp mill and cyanide plant.

HONDURAS

The New York & Honduras Rosario Mining Co., operating mines at San Juanito, north of Tegucigalpa, continued to be the principal producer in Honduras. The new mill, to be equipped with twenty 1800-lb. stamps, was not completed. Development work was continued, the results of which are to be published in a report within a few weeks. American engineers examined the iron mountain at Agalteca, near Tegucigalpa. Various small mines were in operation in the department of Choluteca, on the Pacific Coast. In the department of Olancho, some gold prospects were examined, and several placer deposits in other parts of Honduras were tested, but no results were made known up to the end of the year.

COSTA RICA

The Abangarez mine, in the province of Guanacaste, operated throughout the year and was the principal producer of the country. There were two mills in

operation, with a total of 60 stamps dropping. At the Montezuma mines, in the province of Puntarenas, the mill was operated only in wet season, when there was sufficient water power. The production was about \$70,000. At the Aguacate mine, a 10-stamp mill was operated toward the end of 1911. The first shipment of bullion was received in New York in December. A small cyanide plant was being planned at the close of the year. The mine is developed to the 500-ft. level, and a tunnel was being driven toward the vein, with the expectation of cutting it at the 750-ft. level.

PANAMA

It was confidently expected that the acquisition of the Canal Zone by the United States would stimulate interest in prospecting the mineral resources of Panama. Such has, however, not been the case. Some prospecting was done and some old mines and newly discovered prospects were examined, but in the year 1911 no important discoveries or beginnings of operations were made. It was reported that the United Fruit Co. interests had mining engineers in the field in the eastern part of the country, near Bocas del Toro, but this report has not been confirmed. The heavy rains of the wet season, dense vegetation and prevalence of malaria were serious obstacles to prospecting.

South America in 1911

Special Correspondence

In general the mining industry of South America was characterized by slow, steady progress in 1911, as in preceding years. The figures of production are always difficult to obtain, for although all the governments maintain records of production, statistics are tardily published, if at all. The quantities of metals produced by the large English and American companies are usually obtainable, but such is not the case with the native-operated mines and they contribute a large proportion of the total output. Estimates have therefore largely to be based on the imports into other countries.

GOLD

The total production of gold was probably \$13,000,000. The principal sources were the placer deposits of the eastern countries. In 1910 the leading producer was Colombia with \$3,370,000 with French Guiana a close second with a production of \$3,100,000. The English syndicate that operates dredges at Oroville, Calif., owns a large area of placer ground on the Niche River near Zaragoza in Colombia. It was the intention of this company to dismantle some of the smaller Oroville dredges and use them in Colombia, but this plan was not carried into effect. The bulk of the pro-

duction came from a number of small operations, mostly placer mines although a few lode mines were worked.

Some small progress was made in dredging on the Elysee placers in French Guiana. The principal producer was the Syndicat Mana. The gravels are richer than those of Colombia, but hostile climatic conditions and transportation difficulties hindered progress even to a greater degree than in Colombia.

The principal producers of Brazil were the Minas Geraes mines which contributed most of the \$2,000,000 produced in Brazil in 1910. The ore reserves now exceed a million tons. In Argentina gold was produced in the provinces of San

Juan and Rioja. The 1910 production of \$165,000 will be exceeded in 1911, especially by the increase caused by the operations of the Famatina Development Corporation, Ltd., in Rioja province. In 1912 the new mill and cyanide plant of the Argentine & General Exploration Co., Ltd., in San Juan province will be in operation.

A company was formed late in 1910 to operate placer ground in the province of Esmeraldas, Ecuador and in 1911 a dredge was ordered. The principal producer of Ecuador was the lode mine operated by the South American Development Co. north of Guayaquil. In Peru considerable development work was done on the placer deposits in the southern part of the country. The principal company engaged was the Inambari Gold Dredging Concessions, Ltd., that took over the placer property of the Inca Gold Development Co. in the Carabaya and Sandia districts. Another company that operated in the latter district is the Aporoma Goldfields, Ltd. of London, which owns placers near the Hauri Hauri River. Hydraulic machinery was installed. In the same vicinity, an Argentine company operated the Poto deposits with 15 monitors.

The most notable discovery of new gold fields was that made at Putú, Chile, in September. Little work was done in the new field before the close of 1911, except by the discoverer who, under the Chilean laws, had a long period of time in which to measure his claims before any others could be registered.

SILVER

While Bolivia was the largest producer of silver in 1910, contributing 7,000,000 out of a total South American production of 16,500,000 oz., Peru was a close second with 6,500,000 oz. As most of the Peruvian silver was produced from copper ores from the Cerro de Pasco, Yauli, Morococha and Casapalca mines and as there was much greater activity during 1911 at these mines than at those of Bolivia, and production fell off in the latter country, Peru ranked as the leading producer and the South American output probably exceeded 18,000,000 oz. While Chile produces more copper than Peru, the ores usually contain far less silver so that a production of 1,500,000 oz. is a fair estimate for that country.

COPPER

The copper production of South America is constantly increasing. During 1911 the Braden Copper Co. entered the list of Chilean shippers, but the effect upon the production will not be fully felt until 1912. The company is nearly ready to operate its mills to full capacity to treat 3000 tons of ore per day. The Cerro de Pasco Mining Co. was by far the largest

producer of Peru and shipped more copper than in 1911.

The Famatina Development Corporation, Ltd., an English company, owning 700 acres of mining land in the Mejicana district in the province of Rioja operated a 100-ton smeltery equipped with converters and produced about 400 tons of copper, 75,000 oz. of silver and 4000 oz. of gold. An aerial tramway 21½ miles long was built by the Argentine government from Chilecito at the foot of the Andes to the district. Railroads connect Chilecito with Buenos Aires, La Plata and Rosario. This is but one example of the government's projects to aid in the development of the mineral resources of the country.

OTHER MINERALS

During the first half of 1911 the Chilean nitrate production was 1,232,492 metric tons, an increase of 33,091 tons over the corresponding period of the previous year. The demand from Germany fell off considerably owing to the increase in use of ammonium-sulphate fertilizers in that country. Improved processes made it possible to treat caliche that was formerly unprofitable.

The oil wells of northern Peru continued producing throughout the year; no falling off in production was reported. The oil produced was of unusually high grade, and considerable quantities were shipped to California for refining, while California oil was sent to Peru for fuel purposes. The Titicaca Oil Co. is drilling in the southern portion of the country in the province of Huancane. The government of Argentina appropriated \$850,000 for the exploitation of petroleum at Comodoro Rivadavia. The German Transmarine Electricity Co., contracted to take the total production. Three test wells yielded not less than 10 tons daily. The locomotives of the railroad to Lake Buenos Aires were supplied with 2000 tons of petroleum through the Ministry of Agriculture. Late in the year some oil fields were examined in Venezuela by American engineers, but none of the facts have been made known.

Bolivia produced about 25,000 metric tons of tin. There was only normal activity in the tin fields. One property in La Rioja province operated with 75 men and had 2000 tons of ore ready to supply a mill, but the lack of transportation facilities hindered and will continue to hinder development until railroads are built.

At Minasragra, near Cerro de Pasco, Peru, vanadium ore was produced by the American Vanadium Co. and shipped to the United States. Tungsten ores in the province of Caluyo, department of La Paz, Bolivia containing 56% tungstic acid were not shipped on account of the fall in the price of the metal. Most of the

mines were closed. In northern Peru, in the department of Piura the Sociedad Azufrera de Sechura produced 150 tons of sulphur daily. English engineers investigated some iron-ore deposits in Chile. It was reported that the average analysis showed 68% iron, 0.03% phosphorous, and little sulphur. The Sociedad de Altos Hornos del Central developed iron deposits at Topo near Totoraillo. The production of platinum in Colombia continued to be irregular. The estimated value of the output in 1910 was \$260,000, but it is impossible to determine even approximate statistics of the production for 1911.

Arsenic in 1911

The general arsenic-products situation has not materially changed in 1911. One large factory for the manufacture of paris green has been erected at Grand Rapids, Mich., and by some the announced reduction in the price of paris green is attributed to this competition.

There is a constant increase in the amount of insecticides used, as reflected in the increased production in the United States and Canada, due to the vigorous spraying propaganda of the various agricultural bureaus and colleges. The Grasselli Chemical Co. is understood to be the largest arsenate of lead producer in the United States, with the Merrimac Chemical Co. second.

The year opened with white arsenic at 2¼c. per lb., which was followed by a gradual decline until about July 1, when arsenic could be bought for 1½c. The market then suddenly stiffened, due to stoppage of supplies from the Compañía Minera de Peñoles, in Mexico, and the restriction in production of two American producers, and prices rose until they now stand at 2⅜@2½c. per lb. A small amount of English white arsenic was sold during a great scarcity of spot goods. About 125 tons per annum of red arsenic, and 50 of metallic arsenic were also imported. Ordinarily no European white arsenic is sold in the United States except some poor-quality Belgian.

The Canadian producers are the same as in 1910, the Deloro Mining & Reduction Co., Deloro, Ont.; the Canadian Copper Co., Copper Cliff, Ont.; and the Coniagas Reduction Co at St. Catherines, Ont. In the United States two plants of the American Smelting & Refining Co., the Washoe smeltery at Anaconda, Mont., and the United States Smelting Co.'s plant at Midvale, Utah, are the largest producers, but there is a small amount of arsenic recovered by the manufacturers of sulphuric acid.

According to information furnished by the producers, the total United States production of white arsenic in 1911 was 3081 tons, against 1326 tons in 1910, and 1008 tons in 1909.

Mining in the Transvaal in 1911

By Hugh F. Marriott*

The production of gold from the mines of the Witwatersrand in 1911 showed the remarkable increase of approximately £3,000,000, with a total production for the year of £33,680,000, obtained from roughly 24,000,000 tons crushed, an increase of 2,500,000 tons on 1910. A total of 10,500 stamps were at work at the end of the 1911 and 245 tube mills, as compared with the maximum totals of 9756 and 190, respectively, in 1910; and the stamp duty was increased from 7.19 tons per stamp per day to 7.82 tons. Individual rates of duty per stamp were 14 tons per day at the Bantjes, 14.6 at

The amalgamated company—the name of which is the Randfontein Central—has an issued capital of £4,000,000, and a crushing capacity of 3,100,000 tons per annum or 258,000 tons per month; at present, the crushing is about 200,000 tons per month. The crushing plant of this huge concern consists of 1000 stamps (of which 600 are in the new Central mill), besides which 23 tube mills are in commission.

Another amalgamation was that by which the Princess Estate absorbed the West Roodepoort Deep and the Roodepoort Central Deep.

Deep mine under the auspices of the Mines Trials Committee. So far, the trial has not led to the installation of a plant on any mine, but further tests may be made.

Experiments with the Nissen gravity stamp mill were made at the City Deep, and satisfactory results were obtained. A feature of this mill is its great simplicity. With the gradual increase in the weight of stamps up to the present high limit of 2000 lb. and over, it began to be believed in some quarters that battery-construction in groups of five stamps was not entirely satisfactory. The Nissen stamp is the result of an endeavor to obtain the greatest crushing capacity possible with very heavy stamps, and to combine this with sound mechanical construction. Each stamp has its separate mortar, and the inventor claims that in large installations it has been found possible to obtain an actual operation of over 95 per cent. of the total possible running time. The tests at the City Deep were carried out with four Nissen stamps, with running weights varying from 1920 to 2240 lb., and the duty per stamp per day with a 9-mesh screen varied from 24.47 to 30.8 tons; with a $\frac{3}{8}$ -in. screen the average duty per stamp per day was about 37 tons. Power consumption per ton of ore crushed varied from 2.7 to 4 hp.-hours as compared with 4.45 to 5.5 hp.-hours with the City Deep ordinary stamps of weight averaging about 1800 lb. A comparative table—

TABLE I. TRANSVAAL GOLD PRODUCTION.

Year	WITWATERSRAND DISTRICT.			OUTSIDE MINES	Total Value for Transvaal.
	Tons Milled.	Value.	Value per Ton Milled, Shillings.	Value.	
1884-89	1,000,000	£2,440,000	48.83	£238,231	£2,678,231
1890	730,000	1,735,491	47.4	134,154	1,869,645
1891	1,154,144	2,556,328	44.2	367,977	2,924,305
1892	1,979,354	4,297,610	43.4	243,461	4,541,071
1893	2,203,704	5,187,206	47.0	293,292	5,480,498
1894	2,830,885	6,963,100	49.2	704,052	7,667,152
1895	3,456,575	7,840,770	45.2	728,776	8,569,555
1896	4,011,697	7,864,341	39.2	739,480	8,603,821
1897	5,325,355	10,583,616	39.74	1,070,109	11,653,725
1898	7,331,446	15,141,376	41.3	1,099,254	16,240,630
1899	6,872,750	15,067,473	48.84	661,220	15,728,693
1900	459,018	1,510,131	65.82	.....	1,510,131
1901	412,006	1,014,687	49.25	81,364	1,096,151
1902	3,416,813	7,179,074	42.00	74,591	7,253,665
1903	6,105,016	12,146,307	39.79	442,941	12,589,248
1904	8,058,295	15,539,219	38.46	515,590	16,054,809
1905	11,160,422	19,991,658	35.82	810,416	20,802,074
1906	13,571,554	23,615,400	34.8	964,587	24,579,987
1907	15,523,229	26,421,837	34.04	981,901	27,403,738
1908	18,196,589	28,810,393	31.6	1,147,217	29,957,610
1909	20,543,759	29,900,359	29.1	1,025,429	30,925,788
1910	21,432,541	30,703,912	28.5	1,297,823	32,001,735
1911*	23,950,000	33,680,000	28.0	1,466,000	35,146,000

the Brakpan, 13.73 on the City Deep; 17.26 at the Jupiter, 20.6 at the Roodepoort United, and 17.5 at the Simmer Deep. These figures show the tendency to increase the duty of stamp mills.

The principal additions to the list of gold producers were the Brakpan, City Deep, and Modderfontein B, which are together crushing about 130,000 tons a month for a yield of roughly £200,000. Besides these the Benoni made a beginning, but at present no returns are available. The new mills of the Randfontein Central and the Crown Mines also swelled the total.

During 1911 the amalgamation took place of the Randfontein Central and the Randfontein South, two important groups of mines under the Robinson control.

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The yield per ton milled was again reduced slightly, the average for the year being 28s. as against 28s. 6d. during 1910 and 29s. 1d. in 1909. The average working costs for the whole of the Witwatersrand showed an increase of 5d. per ton, due, chiefly to the higher cost of native labor.

The total yield of the districts outside the Witwatersrand again showed a gratifying increase, the figures constituting a record.

METALLURGICAL PRACTICE

During 1911 metallurgists on the Rand were constantly endeavoring to improve methods and results in their department, and they may fairly claim to have made considerable progress in these respects.

An extended trial was made with the Giesecke ball mill on the Geldenhuis

presented by Mr. Nissen in a paper read before the Chemical, Metallurgical, & Mining Society in Johannesburg—between 4 Nissen stamps of 2000 lb. each and 10 ordinary stamps of 1800 lb. each showed an estimated total saving in favor of the Nissen stamps in cost of power, interest on capital, and maintenance costs of 1.3d. per ton milled.

The recently completed Benoni plant contains several metallurgical innovations. The battery consists of 55 stamps of 2000-lb. weight, supplemented by four tube mills, coarse screens being used. Stadler classifiers are used throughout the plant. The cyanide plant includes 32 Way-Arbuckle treatment agitators, the pulp passing from agitator to agitator. The whole process is practically continuous; sands and slimes are treated together. Experiments carried out with large quantities of ore showed a high

extraction after four or five hours' treatment. The consumption of cyanide is also reduced to a minimum. It is claimed that the capital cost of the plant on the basis of tonnage treated works out to approximately only one-half of the cost of the most up-to-date plants running.

TABLE II. STAMP DUTY IN TONS PER DAY AT RAND MINES.

1902	4.85	1907	5.60
1903	4.91	1908	6.27
1904	4.90	1909	6.79
1905	5.05	1910	7.19
1906	5.34	1911	7.82

One of the most interesting developments was the increased use of the Butters filter, which is now installed at a number of important mines. Statistics show that where the filter is in use large reductions in final residue values have been obtained. The average value of slimes residue on several mines where Butters filter plants are installed has been reduced to 0.1 dwt. Altogether nine such plants are now in operation in the Transvaal with a combined capacity of 6000 tons of slime per day.

The trials given to the Merrill zinc dust process were so successful that plants are being installed on several mines.

A new type of agitation, so far as the Rand is concerned, is to be introduced in the Trent agitator, of which good accounts come from America.

DUST ALLEVIATION

Yet another method was devised for solving the dust problem in rock-drilling operations. In this case the improvement was due to a miner in the Nourse mines. His principle is to "kill the dust at the point of creation," and, in effect, it is to pass, at the very moment of drilling, a jet of water on to the face by means of a piece of rubber hose inserted in the hole alongside the drill. It is hoped that great benefit will result from the use of this idea, which has already been adopted largely.

The greatest difficulty the mine managers have to contend with in their efforts to reduce the dust trouble is the apathy of the miners and native laborers themselves; and although the contrivance mentioned above has already done something to alleviate the trouble, it cannot cure the evil entirely. Dust is created in various other ways than by drilling; for instance, in such operations as blasting, shovelling and transport. Probably the worst that has to be contended with is the fine dust made after blasting. The mine authorities have tackled this dust question in no half-hearted way, and much has been done by installing mechanical ventilators to improve the mine air.

An interesting occurrence was the commencement of the sinking through

water-bearing strata at the Western Rand Estates of a circular shaft lined throughout with lead-jointed cast-iron tubing. The whole shaft is designed to be completely watertight, the lining being strengthened by concrete filling behind. A novel bajing skip was used in connection with the sinking shaft, consisting of a tubular contrivance with a capacity of 600 gal., the interior of which is fitted with a piston capable of being operated by the wire.

At the New Modderfontein mine a new departure was inaugurated towards the end of 1910, when a circular shaft was commenced. This shaft, which is to be brick-lined throughout, is now down about 950 ft. The cost of sinking compares favorably with the cost of rectangular shafts sunk on the Rand, and

amongst the natives, particularly amongst those from the more tropical districts of the recruiting area. Table V shows the death rate from accident and disease amongst the natives employed by members of the Witwatersrand Native Labor Association from 1902 to 1911, inclusive. It will be seen from this table that a considerable and fairly regular reduction in mortality rates has been obtained, but it is thought there should be a possibility of effecting still greater reductions in the death rate from disease.

With the object of combating sickness the Chamber of Mines set aside a large sum for the establishment of a laboratory for the study of mine employees' diseases, and the annual upkeep of this will also be the care of the Chamber. In addition, the eminent bacteriologist and

TABLE V. MORTALITY AT MINES. RECORDS FOR YEARS 1902 TO 1911 INCLUSIVE.

	Average No. Natives Employed	ACCIDENT.		DISEASE.		TOTAL.	
		No. of Deaths	Death Rate Per 1,000	No. of Deaths	Death Rate Per 1000	No. of Deaths	Death Rate Per 1000
1902 (11 mos.)	38,320	—	No	Records	—	1,698	48.34
1903	62,056	200	3.22	4,822	77.71	5,022	80.93
1904	69,831	296	4.24	3,076	44.05	3,372	48.29
1905	88,617	371	4.19	4,158	46.92	4,529	57.11
1906	78,260	425	5.43	2,591	33.11	3,016	38.54
1907	92,421	466	5.04	2,931	31.71	3,397	36.76
1908	131,194	602	4.59	4,096	31.22	4,698	35.81
1909	154,908	858	5.54	4,985	32.18	5,843	37.72
1910	177,795	867	4.87	5,485	30.85	6,352	35.72
1911	184,620	882	4.78	5,602	30.34	6,484	35.12

TABLE VI. PREMIER (TRANSVAAL) DIAMOND MINING CO., LTD.

Year Ending Oct. 31	No. of Loads Washed	No. of Carats Found	Value of Diamonds	Yield Per Load	Value Per Carat	Value Per Load	Cost of Production Per Load
1903	76,931	99,208	£ 137,435	1.29	£ s. d. 178.5	p s 1156.7	p s 47.2
1904	939,265	749,654	866,030	0.798	131.2	0185.3	27.62
1905	1,388,071	845,652	†994,687	0.609	136.29	0143.98	33.44
1906	2,988,471	899,746	†1,277,739	0.301	184.82	086.61	35.71
1907	6,538,669	1,889,987	†1,702,630	0.290	0180.20	052.49	24.14
1908	8,058,844	2,078,825	1,536,719	0.258	0149.40	039.75	110.24
1909	7,517,793	1,872,137	1,172,378	0.249	0126.29	031.43	111.42
1910	9,331,882	2,145,833	1,496,641	0.230	0131.39	032.49	20.56
1911*	.....	1,771,000	1,324,550	.....	0150.	.....	.....

* Estimated. † Proceeds of Cullinan Diamond not included. ‡ Includes Cullinan Diamond at nominal valuation. § Subject to the loss on contract with Diamond Syndicate.

it is anticipated that the cost of maintenance will also be considerably lower. Further, it is expected that rapid hauling and ventilation will be much facilitated.

MINE LABOR

A glance at Table IV will show that there was an increase in the total number of negro employees, although that increase was not commensurate with increased requirements. Unfortunately, competition amongst the various controlling groups for the acquisition of recruits to the native force resulted in an increased average cost for this class of labor. It is hoped that some way will be found to reduce the ill effects of this competition.

Another question which occupied the attention of the heads of the gold mining industry was that of mortality

pathologist, Sir Almroth Wright, is conducting, with a staff of London experts, an investigation into the mortality amongst mine natives, particularly in regard to pneumonia amongst those from British and Portuguese territories north of the 22d parallel.

POWER TRANSMISSION

The year 1911 saw a great development in the use of electric power on the Witwatersrand by the coming into operation of the central power stations of the Rand Mines Power Supply Co. The present electric installation of the company consists of one station of five turbine sets, each of which is designed to generate 11,000 k.w. In addition, the company installed four 3000-k.w. steam compressors for the manufacture of compressed air and six electrically-driven

compressors of 3000 k.w. each. A further station is about to be erected.

The Victoria Falls Power Supply Co., to which the Rand Mines Power Supply Co. is allied, has also two large power stations, and it is stated that, when all the stations of both companies are working to their full capacity, 128,000 k.w. will be generated.

An important piece of legislation from the point of view of the mining industry

TABLE IV. LABOR EMPLOYED IN TRANSVAAL GOLD MINES. (MINES DEPARTMENT STATISTICS.)

		White.	Colored.	Chin-ese.	Total Colored and Chinese.
1902	July	8,162	32,616	.....	32,616
	Dec.	10,292	45,698	.....	45,698
1903	June	11,825	66,221	.....	66,221
	Dec.	12,695	73,558	.....	73,558
1904	June	13,413	74,632	1,004	75,636
	Dec.	15,023	83,639	20,885	104,524
1905	June	16,939	104,902	41,340	146,242
	Dec.	18,159	93,831	47,267	141,098
1906	June	17,959	90,882	52,352	143,234
	Dec.	17,495	98,156	52,917	151,073
1907	June	17,166	111,862	51,517	163,379
	Dec.	17,697	129,618	37,118	166,736
1908	June	18,181	147,557	21,460	169,017
	Dec.	19,605	164,826	12,275	177,101
1909	June	21,620	175,895	7,317	183,212
	Dec.	23,077	168,665	2,038	170,703
1910	June	24,794	201,779	.....	201,779
	Dec.	25,376	191,784	.....	191,784
1911	June	25,960	206,197	.....	206,197
	Sept.	25,431	196,421	.....	196,421

was passed during 1911; namely the Mines and Works Act, 1911, which came into operation on Oct. 1. This act deals with the control and supervision of mining operations, and, among other things, restricts work on Sundays. Underground work on Sundays is confined to such operations as pumping, ventilation, and repairs, and, on the surface, to such as are in their nature contin-

uous. As regards milling, the ban on Sunday work refers only to such mills as may be erected after the date when the act came into force. The hours of occupation underground are also limited by the act to eight per day, excluding the time occupied in going to or from the working place.

DIAMOND MINING

The principal producer of diamonds is the Premier mine. There was a small number of other producers, but the total output from them was so small as to be practically negligible. Table VI gives the production of Premier Mine from the inception of the company to date:

The total yield in carats for 1911 decreased by approximately 370,000c. or 17 per cent. when compared with the yield for 1910, but in compensation the value per carat steadily increased the average for 1911 being 15s. as against 13s. 11d. for the previous financial year. Notwithstanding the increase in value per carat, the total value of the output decreased by approximately £175,000. Figures of the number of loads washed, and of costs, have not yet been published. The increase in the valuation of the diamonds is in all probability due more to the increased demand for diamonds generally, and the class of diamonds produced by the Premier Co. in particular, than to any improvement in the actual quality of the goods.

TIN AND OTHER METALS

Tin production was of record dimensions during 1911 the total value being estimated at £410,000. Previous production has been by fiscal years ending

June 30, 1906-7, £27,180; 1907-8, £81,700; 1908-9, £148,340; 1909-10, £303,210. For the half year to Dec. 31, 1910, the value was £147,530. The high price of tin naturally gave a great stimulus to its production.

The recent advance in the market price of zinc served to direct attention to the ore to be found in the Transvaal, and, although the production is at present very small, it is anticipated that the output will be increased to some extent in the near future.

Silver is produced in the Transvaal only so far as it is obtained in the gold ores. It amounted in 1911 to 892,000 oz., the highest previous amount for any year having been the 830,000 oz. in 1910.

The quantity of copper produced in the Transvaal is small, the total value of the production for the year 1911 being estimated at about £61,000 as against £71,914 for the previous fiscal year.

COAL MINING

Twenty-nine collieries were producers in 1911, and roughly 5,550,000 tons were mined from the Transvaal coal mines during the year. From this quantity an average of 20 per cent. was sorted, and approximately 4,440,000 tons of coal were sold, at an average price at pit's mouth of 4s. 9d. per ton. The total sales of coal in previous years have been for the fiscal years ending with June: 2,912,000 tons in 1906-7; 2,892,000 in 1907-8; 3,312,000 in 1908-9; 3,876,000 in 1909-10. For the half-year from July 1 to Dec. 31, 1910, the total was 1,984,000 tons, indicating an output of nearly 4,000,000 tons for the full year.

Mining in Rhodesia in 1911

By H. F. Marriott*

Gold mining is, in Rhodesia as in the Transvaal, by far the most important of the mining activities of the country. The number of gold producers increased from 145 in 1910 to 163 in 1911. As in previous years, a large proportion of these were very small units working with 5 stamps and under. There were in fact only five concerns which crush regularly 5000 tons a month or more.

The total tonnage crushed during the year, as will be seen from Table 1, was slightly less than 1910, which in turn showed a decrease on the two previous years. Notwithstanding this, however, the total yield was estimated to be more than

£200,000 in excess of the 1910 figures, and the yield per ton has increased from 30.84s. to 35.66s. per ton. This is a most satisfactory feature, as this figure is higher than any that has been attained since 1903.

Table II shows the tonnage crushed and yield for the quarter ended Sept 30, 1911 of the mines which are crushing over 5000 tons a month, with one other (The Lonely) which produces over £10,000 in gold monthly

The total ore crushed by all producers during those three months was 420,795 tons, and the total yield £707,006. The six companies whose results are tabulated above were therefore responsible for 37½ per cent. of the total tonnage

milled and for no less than 43 per cent. of the combined yield.

NEW MINES

Considerable activity in prospecting operations was observable during the last year, many of the leading Transvaal mining houses having emissaries in the field.

Early in the year the Consolidated Gold Fields of South Africa, Ltd., floated a company with a capital of £2,000,000 to take over its assets and interests in Rhodesia. The working capital provided was £500,000. Negotiations were on foot in December last to consolidate this company's interests with those of

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another Rhodesian company, the Rhodesian Exploration & Development Co., Ltd. Details of this proposition have not yet been published, but should the

TABLE I. GOLD PRODUCTION OF RHODESIA.

	Tons Milled.	Value of Gold Won, £	Value per Ton, s.
Prior to Sept. 1, 1898...	*	23,456	.....
Sept. 1, 1898 to June 30, 1899	81,841	177,072	43.26
July 1, 1899 to June 30, 1900	104,746	208,877	39.88
July 1, 1900 to March 31, 1901	140,716	329,457	45.54
Year ended Mar. 31, 1902	249,667	640,661	51.32
Year ended Mar. 31, 1903	338,156	709,461	41.96
Year ended Mar. 31, 1904	516,747	845,359	32.71
Year ended Mar. 31, 1905	787,936	1,113,068	28.25
Year ended Mar. 31, 1906	1,100,609	1,556,741	28.28
April 1, 1906 to Dec. 31, 1906	1,051,908	1,531,481	29.10
Year 1907	1,610,875	2,178,886	27.05
Year 1908	1,819,230	2,526,006	27.77
Year 1909	1,807,771	2,623,785	29.00
Year 1910	1,666,223	2,569,201	30.84
Year 1911 (Estimate) ..	1,620,000	2,880,000	35.66

*No details available.

fusion be carried out the amalgamated concern will be an extremely strong one with great resources in mining interests, land, and cash.

The Shamva Mines, Ltd., a low-grade operation of great width, from which great things were prophesied on its formation in 1910, had developed by the end of September, 1911 over \$1,500,000 tons of ore of an average value of 20.27s. This valuation was made after reducing abnormally high assays. It was officially stated that the cost of developing this tonnage has averaged just over 6d. per ton. Plans for the erection of a mill are being discussed, and it is believed

that, owing to the width of the orebody, working costs will be well below 10s. per ton.

COPPER AND OTHER METALS

The Tanganyika Concessions, Ltd., the major portion of whose interests are in the Congo, has also a large copper deposit at Kansanshi in Rhodesia, near the Congo border, where it has a smelting plant. It is understood that it is at present smelting ore from the Star of Congo mine, which is, as its name implies, situated in the Congo State.

The output of silver fell from 217,000 oz. in 1910 to 188,000 oz. in 1911. About 650 tons of lead were produced, compared with 750 in 1910. The output of chrome ore was estimated roughly at 50,000 tons as against 44,000 tons in the preceding year.

Although so far there have been no diamond discoveries of any importance in Rhodesia, considerable interest attaches to the final result of the litigation which has long been proceeding between the De Beers Consolidated Mines, Ltd., and the British South Africa Co. The latter, under charter, has vested in it the right to all minerals in the country, and, in 1892, it entered into a contract with De Beers whereby it agreed, in consideration of a loan, to grant that company an exclusive license to work all diamondiferous ground in its territory. The British South Africa Co. claimed that, the loan having been paid off, the clause giving the monopoly ceased to be effective, and that in any case, it was incapable of enforcement in law as creating a clog in the equity of redemption. This contention was upheld by the Chancery Court and confirmed by the

TABLE II. STATISTICS OF SIX IMPORTANT MINES, QUARTER ENDED SEPT. 30, 1911.

Name of Company.	Reduction Plant.	Tons Crushed	Yield	Yield per ton.
Globe & Phoenix	40 Stamps 10 Pans.	18,761	£117,041	124s. 9d.
Wanderer	4 Gates Rolls	54,600	24,471	9
Giant Mines	30 Stamps 2 Tubes.	35,536	59,611	33 7
Eldorado	20 Stamps 2 Chileans	22,188	53,916	48 7
Penhalonga .....	.....	17,400	13,984	16 1
Lonely	15 Stamps 2 Tubes.	9,862	39,874	80 10
Total		158,347	£308,864	39s. —

The output of coal increased from 180,000 tons in 1910 to approximately 210,000 tons in 1911, all from the Wankie district.

Court of Appeal. The case has, however, finally been won by the De Beers company on appeal to the House of Lords.

Mining in Australasia

By F. S. Mance*

The mineral production of Australasia in the year 1910 was valued at £27,525,000, and it is expected that, when the final returns for 1911 come to hand, this total will again be closely approached. It is true that the gold yield of all the states exhibits a falling off, but against this both New South Wales and Queensland show compensating advances in the value of the production of the industrial metals. The year was not devoid of labor troubles, and operations were checked for a time at many centers, but, taken generally, work proceeded on steady and systematic lines. The same degree of attention was certainly not given to the mineral industry as in previous years, due, no doubt, to the series of favorable

seasons causing a diversion of energies into other channels. There was a noticeable scarcity of labor followed as a consequence with a good advance in wages. It demanded the effecting of all the improvements and economies practicable to enable these higher wages to be met without increasing working costs above profitable limits. The conditions, therefore, had been against the carrying out of prospecting operations, but with such evidence existing of the capability of the industry at least to maintain the present rate of production, there was scarcely occasion for any anxiety on this score.

GOLD

The accompanying table is a comparative statement of the gold yield of Australasia for the years 1910 and 1911; the

figures for 1911 were estimated from the production for the first ten months of that year; the figures are in fine ounces. The estimated decrease for the year 1911 was thus 220,703 oz., fine.

It will be seen that Western Australia continues to furnish the largest proportion of the gold, but in comparison with that of nine years ago, there was a drop of over £2,750,000 in value. The mines which gave such good yields from the upper levels have failed to maintain their grade with increasing depth. Thus the value of the ore mined in this state in 1903 was 77s. per ton, and in 1910 it had fallen to 42s. a ton, while a still lower figure will be recorded for the year under review. There have been some recent developments of promise, but not of such extent as to warrant the opinion that

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the supplies of ore which will be forthcoming are likely to be sufficient to arrest the downward tendency of the yield.

Victoria ranks next in importance for its gold production, but in this state, also, developments at the deeper levels have shown declining grade, and the yields from the old established fields, such as Bendigo and Ballarat, fall far short of the average for the past six years.

In the state of Queensland the decrease is likewise noticeable, but fortunately the deficiency was more than made up by the increased production of the industrial metals. The diminishing yields from fields such as Charters Towers and Gympie have had a depressing effect on prospecting, attention being given to the search for other minerals, and any immediate improvement in the gold yield cannot be hoped for under existing conditions.

The yield from New South Wales is not of large dimensions, and, as in Queensland, the mining for silver, copper and tin commands most attention. The Cobar district is the chief center of gold-mining operations, and now that the Great Cobar,

lead mines of New South Wales for the year 1911 is likely to constitute a record. The chief contribution is supplied by the mines at Broken Hill, and operations on that field have been attended with most gratifying results.

The accompanying statement shows the output of silver and lead from the mines of New South Wales during the three years 1908-1910:

Year	IN BULLION		IN CONCENTRATES EXPORTED	
	Silver	Lead	Silver	Lead
	Oz.	Tons	Oz.	Tons
1908. . . .	6,484,288	103,371	5,499,381	63,501
1909. . . .	3,717,016	64,821	6,867,775	90,307
1910. . . .	5,196,323	94,818	7,608,336	85,035

The value of the output for the first nine months of 1911 exhibited an increase of £561,872, compared with the same period in 1910, and this gives some indication of the headway which had been made. Each year witnesses the attainment of greater excellence in milling

Extended Co. gives promise of a successful future for the mine. It is estimated that the ore reserves at Broken Hill in sight at present are sufficient for nine years, and the indications are thus in favor of a continued period of activity. From the Yerranderie field, N.S.W., high-grade silver-lead ore had been supplied in considerable quantity.

In Tasmania the cessation of smelting operations by the Tasmanian Smelting Co. affected the output from the mines at Zeehan during the first half of the year, but owing to the timely intervention of the government, the smelteries were again put into commission, and during the second half of the year operations proceeded with marked energy. The success of the exploratory work carried on at the North Mount Farrell mine at depth has given a fillip to mining at this center.

In Queensland the Mungana mines were still the chief producers of silver-lead ore, the bulk of the output being drawn from the Girofla mine. Operations at the Lady Jane mine have been considerably retarded by the condition of the workings which were affected by the creep and the fire.

GOLD PRODUCTION OF AUSTRALASIA

State	1910	1911	Changes
Western Australia.	1,470,632	1,398,500	D. 72,132
New South Wales.	188,857	181,150	D. 7,707
Victoria.	570,383	511,600	D. 58,783
Queensland.	441,400	383,900	D. 57,500
South Australia and Northern Territory.	6,600	5,500	D. 1,100
Tasmania.	37,043	30,500	D. 6,543
Papua.	13,990	13,990	.....
Total Commonwealth.	2,728,910	2,525,140	D. 203,770
New Zealand.	446,433	429,500	D. 16,933
Total Australasia.	3,175,343	2,954,640	D. 220,703
Value.	£13,653,975	£12,704,952	D. £949,023

Ltd., has acquired the Cobar gold mines, a good increase has to be looked for from the treatment of the auriferous-copper ores. The yields from the other fields and from the dredges were disappointing.

From the other states of Tasmania and South Australia, as also from the Northern Territory and Papua, the total output contrasts unfavorably with that of previous years.

The Dominion of New Zealand also added to the depressing record. The decrease was mainly due to the restriction of the output from the Waihi mine. Recent developments in the lower levels of this mine have gone to confirm the previous evidence of decreasing assays as depth is attained. This mine has now produced gold to the value of about £10,000,000, and returned £4,300,000 to shareholders. Other important contributors are the Talisman and Waihi Grand Junction mines, while there were over 100 dredging plants which supplied a good quota of the production.

SILVER AND LEAD

The preliminary returns indicate that the value of the output from the silver-

practice, with a corresponding improvement in recoveries, and a reduction in working costs, and this despite the fact that the ore is being mined from deeper levels, and is of poorer grade, while wages have been materially increased. The output would have been still greater if more skilled labor could have been obtained.

Touching upon developments underground, the lode in the bottom levels of the South mine is maintaining its great size, although at the 1070-ft. level the work so far done showed that the ore-body is more irregular than at the 970-ft. level. In the North mine a fine body of ore is being followed at the 1100-ft. level. Owing to the relocation of the lode which was previously missed, the British mine has been given a new lease of life. In the parent mine, the Proprietary, there were no new developments in the lower levels; the old fire area in blocks 13 and 12 is being attacked at the 300- to 500-ft. levels. The Central mine (Sulphide Corporation) possesses good ore reserves, and has furnished a splendid output. The large low-grade lode which is being opened up by the South

ZINC

The spelter plant of the Proprietary company, at the Port Pirie works, was completed at considerable cost during the year, and put into commission, but in the absence of the company's report at date, it cannot be stated whether the project has so far proved a commercial success. This plant is only of sufficient capacity to deal with a portion of the tailing produced by the Proprietary company, so that the quantity of zinc concentrates exported is not likely to be greatly affected.

The accompanying statement shows the quantity and value of the zinc concentrates exported during the three years 1908-1910, the figures being in tons.

EXPORTS OF ZINC CONCENTRATES

Year	Concentrates, Tons	Zinc Contents, Tons (By Assay)	Value of Concentrates
1908	258,898	113,853	£926,610
1909	321,173	144,018	1,530,128
1910	403,220	184,897	1,801,143

The production for 1911 has been on an increased scale, and the figures when available should show a good advance over those for 1910.

As regards the several processes in use, the Zinc Corporation has installed a Minerals Separation plant in lieu of the Elmore. It would seem that, judged by actual results, the Mineral Separation plant is capable of dealing satisfactorily with tailings of variable grade, such as the Corporation has to handle, while the Elmore process is more adapted for tailings of uniform grade. The British

company has an Elmore plant in operation, and it is doing good work. The De Bavay plant is also giving gratifying results. The tendency all round is to simplify the zinc processes. Little oil (some eucalyptus) is now used, and the plant is of the simplest kind. An interesting experiment is being made by the Junction North Co., and a new plant is being installed by which it is proposed to eliminate the ordinary lead concentration mill, as after a preliminary extraction of from 12 to 15 per cent. lead by jigs, the crude ore is to be submitted direct to the flotation—a lead concentrate and a zinc concentrate resulting.

COPPER

It was estimated that for the year 1911 the mines in Australasia produced 42,000 long tons of copper, of which about 16,000 tons were shipped as refined copper; the balance was made up of blister, matte and high-grade ore. The copper-mining industry made no great strides, and the position remains much the same as in the preceding years, while, looking ahead, it cannot be said there is any probability of a material increase in 1912. However, it must not be thought that Australia is failing to open up new supplies of ore, for in point of fact the number of producing mines has been materially added to, but these new mines were merely compensating for the shortage created by the decreased production from some of the older ones, and for the interruption of operations at the established mines by labor troubles, etc.

Of the total output the mines in the state of Queensland supplied probably 50 per cent. The principal centers were Mount Morgan and the Cloncurry fields.

The production from the Mount Morgan mine during the last three financial years is given in the accompanying table.

MOUNT MORGAN PRODUCTION		
Year Ending May	Gold, Oz.	Copper, Tons
1909	138,341	5,799
1910	178,867	7,062
1911	142,449	6,973

The decreased output in 1911 was occasioned by unavoidable delays in effecting the necessary additions to the copper reduction works rendered necessary by the substitution of the basic ore from the Many Peaks mine for the barren ironstone formerly used. With the new plant in full operation the lost ground will soon be made up. The reserves of auriferous copper ore in this mine have been revalued, and, after allowing for the year's depletion, a slight increase in the former estimate is disclosed. The reserves are estimated as in the table herewith.

The extension of the railway to the Cloncurry field has been responsible for

a large increase in the copper production of Queensland. This field is remarkable for the extent of its oxidized deposits, an area of 250 by 80 miles being studded with holes from which the working miner has removed parcels of ores; but, as yet, only in a few instances have sulphide bodies of any extent been found. Consequently it has yet to be demonstrated

ORE RESERVES, MOUNT MORGAN		
Quantity of Ore, Tons	Copper, Per Cent.	Gold per Ton, Dwt.
1,543,000	3.5	8.0
2,070,500	3.0	2.5

that the life of the field is likely to extend for any lengthy term. The two largest mines in this field are the Mount Elliott and the Hampden Cloncurry, and during the latter part of the year they contributed between them a monthly output of about 1200 tons of blister copper.

COPPER IN NEW SOUTH WALES

In New South Wales the bulk of the copper produced was obtained from the Great Cobar, Ltd., the Kyloe, and the Grafton copper mines. There were few fresh developments to record, and the rate of production during 1910—8900 tons—was just about maintained. There are numerous deposits of copper ore in this state, but their exploitation and development are hampered owing to the failure of the legislature to sanction the necessary lines of railway communication. The Great Cobar, Ltd., has purchased the Cobar gold mines, and with the large quantity of auriferous copper ore now available, a steady increase in the output should result. The output by this company for the year was about 7000 tons of copper.

In Tasmania the Mount Lyell Co. was practically the only producer, and the output of the company was adversely affected by labor troubles, the smelters being idle for about seven weeks. During the financial year ending September the company produced 7411 tons of blister copper. The exploratory work undertaken during the year has resulted in substantial additions to the ore reserves; the lode opened up at the 1100-ft. level of the North Lyell was of good dimensions, and showed a higher percentage of copper.

In South Australia operations proceeded at the Wallaroo & Moonta mines at the same steady pace as in former years. Little work was done at the outside mines, so that practically no custom ores were available for purchase. The yield from all sources was estimated at 5900 tons, the quantity of material treated being 158,000 tons.

In Western Australia small supplies of ore continued to be drawn from the Phillips River, and from the Whim Well mine.

TIN

A review of the tin mining industry disclosed the fact that while the aggregate value of the yield was well ahead of that of 1910, as a result of the higher prices ruling, little, if any, improvement was shown in the quantity won.

In Queensland the production for the first nine months of the year was 2306 tons of tin oxide valued at £229,914, which is 142 tons and £57,456 in value in excess of the corresponding months of 1910. In the Herberton district the exploitation of the various deposits has resulted in good additions to the supplies of ores, and a corresponding stimulus to operations. Regarding the established mines the most important developments had occurred at the Vulcan mine at Irvinebank and from the 600 ft. and lower levels good quantities of high-grade ore were won. The group of mines at Koorboora contributed an output of importance, while lode-tin in quantity was also obtained from Herberton and Watsonville. The yield of aluvial tin was won principally from the Herberton, Cooktown and Stanthorpe districts.

In New South Wales the output has apparently fallen below that of the previous year, although there is an increase in the value. As in the preceding year, the dredges furnished the bulk of the yield, and are the mainstay of the industry. In the Tingha district the dredges are rapidly working out the available deposits, and the returns from this center were on a decreased scale, but on the other hand, the plants in the Emmaville division have furnished an output well in advance of that of the preceding year. Little attention has been given to lode mining, and with the rapid exhaustion of the alluvial deposits the outlook of the industry in this state is anything but promising.

In Tasmania the Mount Bischoff mine is still pursuing its profitable career, and up to the end of September this company had paid £2,271,000 in dividends. The various faces are showing well, but each year's work brings home the fact that the problem of the treatment of the low-grade sulphides has yet to be solved. Other important contributors were the Pioneer and Briseis mines.

In Western Australia the Greenbushes and Pilbarra fields were estimated to have supplied about 420 tons of tin ore.

COAL

The output of coal from New South Wales was estimated at 8,250,000 tons. In Queensland the coal-mining industry was showing a steady advance concurrent with the growth of industrial enterprises, and some of the seams opened up were of exceptional size. In Victoria the output from the State coal mine was being well maintained, and amounts to about 300,000 tons per annum.

The Russian Empire in 1911

By John Power Hutchins*

The year 1911 was one of general progress in precious-metals mining in the Russian Empire, particularly was the mining of platinum stimulated and aided by the high price which averaged about twice as much as for gold.

Copper mining, protected as it is against foreign competition by a duty of about 7c. per lb., had a good year; copper sold for about 17c. per lb. during 1911.

Although the harvests of several years, except that of 1911, have been good, the iron and coal industries have not prospered for several years, as is usually the case in times of good harvest.

TOTAL GOLD PRODUCTION EXCEEDS THAT OF SOUTH AFRICA

The gold production of Russia and Siberia for 1911 was about \$40,600,000. Of the total gold production in the empire since the beginning of the XIX. century, Russia produced about 25 and Siberia about 75%. In total gold production, Russia and Siberia rank third, being surpassed by the United States and Australasia, but still remaining ahead of South Africa. This may surprise many, but, when one pauses to remember the huge size of Russia and Siberia, and to note the wide distribution of gold, one may well be surprised, not that they have produced so much, but rather, that they have produced so little.

The gold producing region in the Urals is farthest west; thence, easterly across Siberia, are scattered gold deposits to the east coast, about 4000 miles, while a journey from the south Urals, through the Altai Mountains, and southern Siberia, thence to the upper Amur, down the Amur, thence overland to Anadir, opposite Nome, all of which would be in gold-producing regions, would be about 6000 miles long. This is the greatest length of auriferous series in an east and west direction in the world, and is only exceeded by the length of the north and south deposits of the Cordillera, continuing as they do from Tierra del Fuego, the southernmost part of South America, to the Arctic Ocean.

GOLD EXPLOITED IN THE LAST CENTURY

The question naturally arises as to the reason of the small production with such a wide distribution. It would at first seem that the poorness of the deposits must be the cause, but this is not the reason. The gold deposits of Russia have been worked only about 100

years and the richest deposits, which occur in the inaccessible regions of Siberia, have been exploited only during the last 50 years.

In agriculture, with a fertile soil extending from the Baltic Sea, practically without interruption, to Vladivostok, about 6000 miles away, there is an inconsiderable amount of agricultural products as compared to smaller regions elsewhere. So with gold there is a small output that seems capable of large expansion, as the present producing regions are more thoroughly exploited by improved methods and intensive working, helped by the extension of transportation systems. New auriferous districts will be discovered and worked and a slow but steady expansion will occur. As in other industries, gold mining is largely handicapped by a lack of capital and the most successful mining companies are those which have had the help of foreign capital to develop, equip, and operate them. This is not only true of gold, but of copper, iron, platinum and zinc mines as well.

FOREIGN CAPITAL INVESTED IN MINING

There is an increasing interest in Russian and Siberian enterprises, largely due to the success of English, German and French capital in gold, copper, zinc and platinum mining. While London is at present manifesting a considerable interest in Russia and Siberia, it is probable, that, as the Alaskan placers near Nome shall become exhausted, those of East Siberia may be exploited by Americans. Unfortunately, some of the Russian regulations not only do not encourage the ingress of American or other foreign miners into East Siberia, but discourage this with restrictions preventing mining within 66 miles of the coast by foreigners without permission, which is difficult to obtain. Then, too, there are the difficulties of transportation, a language hard to learn and a rigorous climate. It is thought that there will be a change of policy that will open East Siberia, which would probably attract experienced miners from the Klondike and Alaska and result in a more intensive exploration and exploitation, particularly of the more accessible coastal regions. Russia and Siberia, with their large distribution of gold, and other metals, have large possibilities that it will take years even to investigate.

More gold is produced by drift mining than by either dredging or opencutting; quartz mining is, as yet, insignificant.

METHOD OF OPENING DRIFT MINES

As an operation typical of the present state of mining technique in Russia and Siberia, the following description of a drift-mining operation is given. Shafts, 14x14 ft. are sunk 100 to 150 ft. to bed-rock, about the middle of the gravel channel, and 300 to 500 ft. apart. Two corridors, one a drift and the other a crosscut, are run at right angles to each other, the drifts, to the distance of 150 to 250 ft. from the shaft, and the crosscuts to the limit of the pay gravel on the sides of the channel. These corridors are 14 ft. wide and 7 to 14 ft. high, depending upon the depth of the pay gravel.

As soon as these corridors have been started and extended 14 ft. from the shaft, drifts or crosscuts 14 ft. wide are started from these four points in opposite directions and at right angles to the corridors. When these drifts and crosscuts have been advanced 14 ft., other drifts and crosscuts are started, as above described, and this is continued until the limits are reached, at which time, the ground tributary to the shaft is one-half worked out. The mine plans, with the worked parts blacked, look like a chess-board.

Then the unworked ground is mined by beginning at the corners most distant from the shaft and robbing the 14-ft. pillars. Close timbering is used, even in frozen ground, in all corridors, crosscuts and drifts with poles four to six inches thick and 7 to 14 ft. long. As a drift is advanced 14 ft., heavy timbers, 14 ft. long, are inserted inside the caps and at right angles to them, with heavy posts at the ends, sometimes with a third post in the middle.

Ground is thawed by wood or charcoal fires. The latter are preferred in some places as they make less smoke, the great danger of carbonic acid gas being overlooked. Gravel is shoveled into poor, home-made wheelbarrows and wheeled to the shaft, frequently over rough boards, and dumped direct into the skip, there being no pockets or loading chutes. Much time is lost while loading the skip.

The skip is hoisted to the surface, 100 to 150 ft., by two or four horses, and the bottom of the skip, which is hinged into two doors, is knocked loose, by driving out two wedges, and the gravel falls on to an inclined door on the top of the shaft, sliding down a chute into a horse cart or, often, on the ground, as there is no bin. Later it is shoveled

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into a cart for transport to the washing plant, if in summer, or to the pay dump, if in winter.

The capacity of the horse hoist governs the rate of mining through each shaft and so, to mine an extensive area rapidly, many shafts are needed. As only about 25 men are needed to break and tram all the ground a horse whim can hoist, and these men do not work fast, it takes several years to mine the ground tapped by one shaft, and all the ground must be kept open until robbing the 14-ft. pillars is commenced. Thus, timbers must often be renewed before such time, and pillars are robbed so slowly that they must be timbered while being robbed. Thus timbering is expensive, as little or none is pulled and the cost for timbering alone is 30 to 40c. per cu.yd. even when timber is plentiful.

OPERATIONS IN OPENCUT MINES

It can be readily understood that such mining as described above must be costly; this operation with labor at 50c. per 12-hr. shift, and wood and timber at the rate of \$2.25 per cord, cost about \$2.50 per cu.yd. of which 44% was working cost, and 56% administration cost. So where ground is even as much as 30 to 50 or more feet deep, it is considered cheaper to work by opencutting, even where the pay gravel comprises only about one-tenth or less of the total gravel section or about two to five feet. Opencutting can be done by contract for 6 to 10c. per cu.yd. with hand shoveling into horse carts. These figures will seem low to many, but they are not unusual. As a matter of fact in one operation I observed, overburden was stripped by hand shoveling into horse sleighs in winter with minimum temperatures of -40° F., cheaper than the gravel underneath was dredged in summer; the respective costs being 6 and 9c. per cu.yd.

The same transporting of ore underground in wheelbarrows and hoisting by horses, is seen in many vein mines. Close timbering is also used, even where there is no heavy ground.

EXCESSIVE TIMBERING A RESULT OF LAWS

One who has seen large untimbered workings in other countries and, particularly, those in the frozen gravel of Alaska and Klondike, wonders at such timbering especially in frozen gravel, until he ascertains that it is largely due to the mining regulations. In the paternal efforts to protect the workmen, there is a system of inspection of mining works by mining engineers in the government service. In case of accident to a miner, the responsibility must be fastened upon someone and, in case of fatal accident, even though the miner may

have been himself to blame, someone else may be made responsible and punished, even to the extent of imprisonment. Thus the mine foreman, or the mine superintendent, or the government inspector may be judged responsible for the accident by the judge before whom the matter is adjudicated, who must thus decide technical mining questions. This leads to great caution and the use of an excessive and unnecessary amount of timbering.

There is only an inconsiderable amount of gold vein-mining in Russia and Siberia. The Chilean mill is generally used, being preferred because of its supposed simpler construction requirements and cheaper operation on the generally soft oxidized ores now being worked. Quartz mining is as yet comparatively shallow. The metallurgical difficulties encountered when sulphide zones are reached have caused the cessation of mining in numerous instances. Most of the quartz mining has been done in the Urals where geological conditions are in many respects like those of the Appalachian Mountains and the outlook for quartz mining is thought to be rather unfavorable. Much of Siberia, except the Altai region and that in the mountains paralleling the east coast of Siberia from Vladivostok to and beyond the Kamchatka Peninsula, is like the Urals, where the mountains are of considerable age, geologically speaking. The railroad crosses the continental divide at an altitude of only about 1000 ft. The Altai in South Siberia and the mountains in East Siberia are seemingly recent and there is present volcanism near Kamchatka. It is thought that more intensive investigation may find quartz veins of value in them, but up to the present there is no quartz mining of importance in either of these regions.

Quartz mining, by foreign companies, has been generally unsuccessful in Russia and Siberia. The only mine of this kind, operated by foreigners east of Lake Baikal has, during 1911, been shut down after a disastrous career of about 10 years. It is noteworthy that in this region that has produced more than \$500,000,000 worth of placer gold, there is not one really successful vein mine.

THE POSSIBILITIES OF COPPER PRODUCTION

Copper mining during 1911 continued to demonstrate that there are deposits of this metal that can be worked profitably. The production increased rapidly and it is probable that Russia will soon become an exporter instead of remaining an importer of copper. The increase of production is due to the successful exploitations by English capital of several important and extensive deposits in the Ural and central Siberian regions. Other copper deposits, under control of Eng-

lish capital, are soon to become producers.

The Caucasus region has been investigated for copper, but, as yet, efforts have not been rewarded by commensurate success. Copper mining in the Caucasus has been in difficulties. There seem to be large low-grade pyrite deposits, but metallurgical difficulties, due to the ore being too silicious for smelting, hinder their profitable working. It is thought that these problems can be solved.

East Siberia has no copper mines although copper is known to exist in the region between Vladivostok and Nicolaievsk, at a city at the mouth of the Amur River. This region awaits further investigation to determine whether there are orebodies of economic importance.

At present there is a protective duty on copper of five rubles per pood or about 7c. per lb. It is said that this is likely to be reduced which procedure is being opposed, particularly by Russian producers whose copper, being more expensive than that made by foreigners, would be more seriously affected in case of reduction of the tariff. It is said that without the protective duty to help them nearly all the Russian copper mines cannot produce copper at a profit.

The production of copper for the first seven months of 1911 was about 13,600 long tons and the importation of copper in the same period was about 5400 long tons. It is probable that the production for 1911 will be about 26,000 tons as there was an increased rate of production in the last half of the year.

URAL IRON BUSINESS THREATENED

The iron works of south Russia have been able to control the iron business because of the accessible supplies of good coking coal. The Ural Iron works have suffered severely from competition of the south Russia works and though making an excellent grade of iron, using charcoal, they have lost ground and the last year has been one of loss for most of the Ural iron producers. The future of the Ural iron business is uncertain.

The iron production for the first six months of 1911 was 1,710,000 long tons, of which south Russia produced about 70%; Ural, 22%; Poland, 8%. Coming as it has after a period of enthusiastic buying of oil businesses in London, the petroleum business of 1911 was not as good as expected. Maikop, which was hoped to be a second Baku, has not as yet fulfilled these hopes, although good results were obtained in some instances. The production for nine months was about 400,000,000 poods.

PRODUCTION OF PLATINUM

Russia and Siberia are the largest producers of platinum. Most of this metal is found in the Urals, where it is mined

by dredging, by opencutting and by drifting. The price of this metal has been very high during 1911 and it has stimulated an active search as well as the working of deposits that were impossible of profitable exploitation before the reign of the present high prices. The reserves of platinum bearing gravel seem to be rather limited and it is not thought that the rate of production can be greatly increased. French capital is largely interested in platinum mining and has achieved success with dredges.

It is worth noting that some of the foreign companies interested in platinum mining in Russia and Siberia are scouring North and South America for deposits of this metal. The estimated production for 1911 is 400,000 ounces.

Dredging is having a varied result. There are 63 dredges in Russia and Siberia, but most of these have not been successes. In many instances dredges have been installed where only failure could result. Bad design and weak construction have contributed to similar results. A general lack of capital for mining enterprises has resulted in installing cheap machinery. The last year witnessed the successful operation of a drag-line excavator in conjunction with a floating washing-plant containing, in addition to the trommel, tables and belt stacker of the California type of dredge, a large disintegrator of the log-washer type, to free the gold from an extremely clayey gravel. A second trommel was used to screen out large stones before the material passed to the disintegrator. This plant worked in material so clayey that it would be considered by most dredge operators to be impossible for dredging and in a climate almost as severe as that of Klondike, but without perennially frozen ground with a working cost, not including administration, of about 17c. per cu.yd.

DREDGES OPERATED IN CLAYEY GROUND

There are several floating dredges in the Russian Empire having clay-disintegrating devices for there is a wide distribution of clay. The common form of disintegrator is the *chashka*, which resembles an arrastre, but has a stirring, instead of crushing action. Whether this, or the modified log-washer, is the better machine has not been determined, but it would appear that the application to some clayey areas in America, heretofore considered impossible for dredging, of one or the other of these devices, might permit successful operation of ground now thought impossible for successful exploitation.

The first American-built dredge was installed during the year. This dredge has 8 cu.ft. close-connected buckets, steel hull, and is operated by electricity, generated at a steam-electric plant about 10

miles away. The electric plant was placed on a lake to allow easy wood transport to it from the forests surrounding the lake, and, possibly, to use coal, later, should it prove cheaper, as the lake is navigable and only about 50 miles from where sea-going vessels, drawing 16 ft. of water, can anchor in a river and unload coal on to barges.

LABOR CONDITIONS

It is extremely difficult to find good hard-rock miners in Russia or, indeed, to get an adequate force of any kind of miners who constitute a mining population such as is had in American mining regions. In many districts, the men work as miners only when their agricultural pursuits need no attention. Thus, during the harvests, there may be a shortage. While the Russian miner is not paid much, in many instances, only about 30 to 50c. per day, he is not a cheap miner, when the cost per ton of ore is considered. He works well with pick and shovel on the surface, but in rock or underground he lacks skill. Many holidays with much drunkenness interfere.

In eastern Siberia there is considerable difficulty in getting enough laborers. The Russian government discourages the employment of Chinamen and Koreans, some of whom are good miners, and the present policy seems to point to their eventual exclusion. This policy tends to retard production, for there is the need for laborers in east Siberia. Many believe that Chinamen and Koreans are as good or better and cheaper laborers than Russians, they are more sober and law-abiding and have not the numerous holidays that are such a disadvantage. It is interesting to note that in some mining districts, nearly one-half of the year is spent in celebrating holidays, usually accompanied by drunkenness, and many of the days, immediately subsequent to the more important holidays, are devoted to recuperation from alcoholic excess.

IMMIGRATION ENCOURAGED

The Russian policy is to encourage immigration to east Siberia, which is only sparsely populated, from the more populous regions of Russia. About \$30,000,000 per year is spent for this purpose. The Chinese government has tried to populate the rich Manchurian country with the surplus population of its southern regions. Both these attempts are meeting with difficulties, for both the Russians and Chinamen have not the enterprising and colonizing spirit that shows itself in the present rapid immigration into North and South America. The climate of east Siberia and Manchuria is severe, with long cold winters which tends to discourage the emigrant from warmer climate.

A FAMINE IMMINENT

With the largest and probably richest agricultural possibilities in the world, there will be severe famine this winter in the south Ural and about \$80,000,000 is thought to be necessary to keep the people alive until the next harvest.

By comparing Siberian and Alaskan mining costs in similar ground with Siberian labor at one-tenth as much per day as that in Klondike, it will be found in many instances that the Alaska labor cost, per cu.yd., is less. This seems paradoxical, but, when one pauses to remember, that close timbering, wood-fire thawing, wheel-barrow-transport underground, and horse hoists are in vogue, it is not difficult to account for the high costs in Siberia, even with cheap labor.

The mining laws of the Russian Empire are rather complex and it is difficult, particularly for the foreigner, whose knowledge of Russian is only acquired after much time and painful effort, to get even a working familiarity with the laws. There is not a universal law for all parts, and troublesome restrictions are encountered in east Siberia and along the coast and southern boundaries. These restrictions are for strategic purposes.

Mining machinery enters Siberia for the region east of Lake Backal duty free. That for western Siberia and Russia must pay a duty, steam engines and pumps about 5c., boilers and structural steel about 3c., electrical machinery about 12c., smelting machinery about 6c. per pound.

The production of coal for seven months in the Don region was as follows:—Soft coal—9,000,000 long tons; anthracite—1,500,000 long tons; coke—1,900,000 long tons, and briquettes—38,000 long tons. In Poland, the production for nine months was 4,000,000 long tons of soft coal.

The Ural region produced 240,000, the Caucasus region 20,000 and the Moscow district 80,000 long tons of coal in the first nine months of the year.

Mining on the Gold Coast

The operations at the mines of the Gold Coast on the west coast of Africa were greatly hampered during 1911 by shortage of unskilled labor. To this were ascribed the comparatively high costs of mining; Abosso \$8 and Taquah \$11.50, as compared with an average of \$4.10 on the Rand. An association was organized to recruit savages from the outlying country, but it was deemed unwise to make any such attempt without government sanction, which was withheld. The production in 1910 was 189,443 oz. of unrefined bullion, it is expected that returns will show that the 1911 yield exceeded 265,000 oz. of crude bullion.

Petroleum in the United States

The accompanying table shows the production of crude petroleum in the United States for the year 1910 and an estimate of the production for 1911. The most significant figures are those for the Mid-continental field which produced four million barrels, or 7½% more than in 1910, and those for Texas with an increase of two million barrels or 25%.

The California figures show an increase in production though not nearly so large as the increase of 1910 over 1909 production. As in the previous year, the production for 1911 will exceed in value the gold production of the state. The demand for oil is expected to gradually increase as the Alaskan demand will be greater and the use of

PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES

(In barrels of 42 gal.)

Field	1910	1911
California	74,327,150	77,224,359
Colorado	239,794	(a) 207,000
Gulf { Texas	8,181,580	13,000,000
Louisiana	6,841,395	7,000,000
Illinois	33,143,362	30,000,000
Lima { Indiana	2,159,725	4,656,000
Ohio	5,094,136	
Mid-continental (b)	53,613,030	57,911,525
Kentucky-Tennessee	468,774	(a) 300,000
Appalachian (c)	26,089,900	22,275,000
Wyoming (d)	115,430	(a) 360,000
Others	() 5,000	(a) 5,000
Total	210,279,276	209,931,884

(a) Estimated. (b) Kansas and Oklahoma. (c) Pennsylvania, New York, West Virginia and eastern Ohio. (d) Includes Utah.

oil for fuel is rapidly extending along the Pacific Coast, but in spite of this increase the production was much greater

than the demand. Although there were no gushers like the Lake View producing, the increased number of small wells counter-balanced the effect of the cessation of the Lake View gusher.

The decline in the Illinois field was about equal to the increase in California, while the decline in the Appalachian was nearly equal to the increase in the Mid-continental field. The production from Colorado has shown a steady decline for the last few years. The increase in production of the Gulf fields, notably those of Texas, about balances the decrease in the Lima fields so that the total production of the United States in 1911 about equaled that of the previous year.

Petroleum in California in 1911

By Mark L. Requa *

Conditions in the California oil field in 1911 fulfilled the prognostications made in the autumn of 1910. Production outran consumption and the surplus that began to manifest itself in the summer of 1910 continued more or less unabated throughout the last year.

OVERPRODUCTION DETERRED DRILLING

While it is true that the great Lake View gusher ceased to produce, the bringing in of which created the first signs of over-production, it is also a fact that apparently this decline in output was more than counter-balanced by other wells that were brought in in the Midway district, so that, notwithstanding the entire cessation of the Lake View gusher, California is still confronted with a surplus production.

It is not probable, however, that this condition can continue over any long period for the reason that under existing conditions there is no incentive for the drilling of additional wells and unless additional wells are drilled there must inevitably be a decrease in production and in consequence more nearly a balance between consumption and production.

While conditions remained about stationary in 1911, so far as over-production was concerned, yet indications point toward a hardening of prices in 1912, and it would not be surprising if in the latter part of the year prices ad-

vanced sharply with material gains in the early part of 1913. On the whole it is impossible for the producers of oil in California to market their product at the existing price of 30c. for fuel oil and 45c. for refining oil with satisfactory profit. This was brought home in 1911 to many of the producers, and it was not only because of the inability to

CALIFORNIA OIL PRODUCTION, 1911, Less Fuel Used*

District	Bbl.
Midway	20,821,669
Coalinga	17,793,221
Kern River	12,225,273
Santa Maria	6,259,766
Fullerton	5,887,069
McKittrick	5,339,364
Maricopa	4,468,087
Salt Lake	2,815,097
Whittier-Coyote	1,106,966
Ventura	453,764
Los Angeles	436,200
Newhall	139,508
Summerland	64,875
Lost Hills	63,500
Less loss and overestimates.	650,000
Net for year	77,224,359
Shipments, 1911	66,665,000
Surplus	10,559,359

*Fuel used in the fields is estimated at 425,000 bbl. per month.

raise capital that drilling materially declined, but also because operating companies have realized the futility of drilling against a 30-cent price for oil.

The speculative fever that was so acutely manifest during the summer and autumn of 1910 entirely subsided and there were practically no new flotations in 1911. Capital declined to come forward and purchase stocks under existing conditions, and the state as a

whole, and in a lesser degree other Pacific Coast states and the United States, learned a lesson that will not be forgotten during the next year or two.

SURPLUS PRODUCTION, 10,559,000 BBL.

At present there is above ground in storage a total of approximately 39,000,000 bbl. of oil, as compared with 28,000,000 at the end of 1910. The total production for the year approximated 77,224,000, as compared with 77,000,000 in 1910, an insignificant increase. The surplus for 1911 approximated 10,559,000 bbl. Assuming production as above and surplus as 10,559,000, consumption was 66,665,000, a figure probably not far from correct.

The Midway field did not entirely fulfill the hopes of its most ardent supporters, but developed an important and rich field the limits of which are now fairly well outlined; in the other developed fields of the State there were no material changes, and the new fields of Lost Hills and Bell Ridge are yet too young to hazard any estimate of their ultimate capabilities. Both of these fields, however, developed oil at comparatively shallow depths, and there seems to have been a complete upsetting of certain geological prognostications regarding this territory. The developments here indicated interesting possibilities for a large section of country between Coalinga and McKittrick which has not yet been proved or disproved, except in certain isolated areas.

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The Kettleman Hills more than fulfilled geological prophecy as to the depth at which the oil would be encountered, one well at present being over 4000 ft. in depth without any showing of oil. On the whole, the proved oil area was not increased to any large extent. It is also true that certain areas that were looked upon as extremely promising did not on development prove of value.

Considerable territory in the Santa Maria field is showing a constantly increasing volume of water, and development in areas presumed to be oil-bearing indicated that the oil was at such depth as to be unprofitable at prices now prevailing, or at prices that are likely to prevail for several years to come.

The Kern River field did not materially alter its position. Coalinga continued a reliable and steady producer, and the fields in the southern part of the state, as a whole, more than held their own.

The gas field developed in the Buena Vista Hills gave promise of large production, although there was not any effort made to pipe this gas to other parts of the state. The proposed pipe-line to Los Angeles, which was much discussed, is as yet unconstructed. In fact, save for some construction by the Standard Oil Co., there was no new pipe-line construction in 1911.

STANDARD REFINERY AT EL SEGUNDO

Invasion of Southern California by the Standard, with a refinery at El Segundo, near Los Angeles, was the most important happening in the refining industry for the year.

Nowhere throughout the state was there any well that in any way approached the Lake View, and all of the drilling done in the vicinity of the Lake View was productive of nothing comparable with this famous gusher.

There were numerous wells in the Midway field coming in with a production of from one to 5000 bbl., but their decline was rapid and a few months apparently served to bring their yield down to at most a few hundred barrels.

The extension of the Coalinga field to the south was not productive of any commercial results. Whatever may be found there was demonstrated as being at great depth and will have no part in unsettling market conditions. To the north of Coalinga there was nothing discovered of commercial importance. Some work was done in the Vallecitos country, north of Coalinga, but so far as is known results to date were negative.

Aside from the Lost Hills and the Bell Ridge areas, there have been no new developments in improved areas, although there are certain places that are believed to offer attractive possibilities and will probably be developed as soon as the price of oil justifies.

ACTIVITY OF SOUTHERN PACIFIC

As compared with a year ago, there is a marked decrease in the number of strings of tools running, notwithstanding a very large increase in drilling on the part of the Southern Pacific. The activity of the Southern Pacific dates from midsummer, at which time it appeared to have adopted a policy of line drilling against other producing wells, although it is understood that it will not drill lines until work has been started upon adjoining property.

It is unfortunate for the industry as a whole that some equitable arrangement cannot be perfected whereby the Southern Pacific could keep its oil for future requirements. If it continues its campaign with unabated activity, it must, in the near future, have a very large volume of oil with which it will supply its needs and supplant oil now being purchased by it from the producers of the state through the Associated Oil Co. A conservation of its resources would not only give it a supply for future needs, but would give a market for independently produced oil and would create a volume of paying freight and passenger traffic that would materially add to the revenues of the Southern Pacific Co. It can hardly be believed that it would willingly adopt a drilling policy that would so materially affect freight revenue.

On the other hand the draining of oil territory by independent producers unquestionably deprives it of oil beneath its territory. To just what distance a well will drain adjoining territory is an interesting problem which has not been satisfactorily solved and, from data available, unquestionably varies from field to field.

CORPORATE AFFAIRS

The recent agitation that brought about the dissolution of the Standard Oil Co. effected no change in the dominating position of the Standard in California, and the oil producers of the state are asking themselves what real benefit was derived from this dissolution, and whether it would not have been much better if some form of regulation had been attempted that would have permitted agreements as to production and price. Certainly from a financial standpoint there was nothing gained by independent producers.

The much discussed agreement between the Independents, the Union Oil Co. and the Associated Oil Co., whereby it was hoped that prices would be steadied, was apparently a complete failure. The hoped-for increased consumption which was to have benefited the Union-Independents was not forthcoming; on the contrary, there was a marked tendency to declining consumption during some of the autumn months.

Consumption by the Northern Pacific, Great Northern, and the Canadian Pacific did not materially affect the sales of the Union-Independent Agency, although it is believed that, during 1912, these roads will greatly increase present consumption.

NEW CONSUMERS OF OIL

The most noticeable invasion of new territory in 1911 was at the plant of the Nevada Consolidated Copper Co. at Ely, Nev. This plant had been burning Utah and Wyoming coal, and had been presumed to be within the coal zone.

The extension of the burning of oil on the Southern Pacific from Sparks to Carlin was also accomplished in 1911, and there are rumors of this being pushed still farther to Montello and possibly as far east as Ogden. It is, however, improbable that California oil can maintain a foothold in this field at the price at which producers can profitably afford to sell their production, and rather than further increase in this direction it is probable a decline would take place in the event of oil reaching the price hoped for by producers, that is, a minimum of 50c. at the well, which seems now to be the base price hoped for.

Owing to a rapid increase in production and the unpreparedness of the companies to tank their oil, there was enormous waste during the year. It is entirely out of the question accurately to calculate this loss, although well informed producers agree that 4,000,000 bbl. would be a minimum, and many believe that double this amount was lost.

POSSIBILITIES OF DOMESTIC USE

The use of California oil as a fuel for domestic purposes is attracting considerable thought and attention at present. While as yet no means has been developed whereby it can be successfully burned for domestic use, it is hoped that some simple device will soon be perfected for this purpose. There is, of course, no difficulty in burning oil for domestic purposes by the installation of an electrically driven pump and blower. The cost of this installation, however, precludes its adoption in any general way, although it is being used in several private houses, being in principle the same system as is being used by hotels, apartment houses and restaurants in the larger cities. The incentive for some such apparatus is great for the reason that coal delivered at private dwellings in San Francisco approximates from \$12 to \$16 per ton. Should there be devised some cheap means of burning oil for domestic purposes there would be a considerable additional demand and the coal trade of the state would suffer a still further decline.

Oil and Gas in Mid-Continental Field

By Erasmus Haworth*

The production of oil in 1911 by the Mid-Continental field was the greatest since its development began, the total aggregating 57,911,525 bbl., as shown by the accompanying tables. The Prairie Oil & Gas Co. was again the greatest purchaser of oil, its total purchase reaching over 34,500,000 bbl. The Texas Oil Co. and the Gulf Oil & Pipe Line Co. were the next two largest purchasers, the former reaching almost 9,000,000, and the latter more than 8,500,000 bbl. The independent refineries did not consume as much as they did in 1910, their total being about 5,500,000 bbl. Compared with 1910 each of the three large purchasers handled a little more, raising the grand total to a small fraction under 58,000,000 bbl., which is by far the largest ever produced in the Mid-Continental field in one year. The Prairie Oil & Gas Co. increased its storage about 1,250,000 bbl., although during a number of different months it delivered considerably more than it bought.

1911 OIL PRODUCTION, MID-CONTINENTAL FIELD

Company	Bbl.
Prairie Oil & Gas	34,691,298
Texas Oil	8,934,800
Gulf Oil & Pipe Line	8,669,827
Independent refineries	5,365,600
Fuel oil, crude	250,000
Total	57,911,525

NEW DEVELOPMENTS IN TEXAS

No developments of a startling character were made within the limits of the Mid-Continental field proper, but to the southwest just across the line in Texas, about Electra, great interest arose. Drilling was pretty well kept up during the year throughout the entire field. A new pool was discovered north of Cleveland in Oklahoma, commonly known as the West Osage field. Here a number of strong wells were obtained, a few of which rivaled the big wells in the Glenn Pool years ago. At present, however, the field seems to be fairly well circumscribed. Considerable oil was also found about Jenks, near the north end of the Glenn Pool which at the present time is attracting a number of drillers. It seems that the oil will be developed on both sides of the river. Recently, the Prairie Oil & Gas Co. brought in a good well reported at about 600 bbl. natural, situated near the northern edge of its tank farm at Jenks. Beyond these comparatively new pools development has been confined almost entirely to drilling here and there

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throughout the areas already exploited at the beginning of the year. Every area received considerable attention, with fairly good success, showing that the oil supply is by no means exhausted.

The Electra field is in Wichita County, Tex., just south of the Red River, between the 98th and 99th meridians. A promising oil field has been developed here, and also much gas a little to the east of the oil fields, closer to Henrietta, from which gas already has been piped into Wichita Falls. It seems probable that the productive area will reach north and northeast across the river into Oklahoma. With the development in Oklahoma migrating southward continuously, it is quite possible the Mid-Continental field proper may yet connect with this Texas field.

Almost no developments of pipe lines were made during the year. The National Refining Co. at Coffeyville, offices at Cleveland, Ohio, extended a line into the shallow field from Coffeyville. The term "shallow field" now includes all of the old time shallow field around Alluwe and Coody's Bluff, and also the northeastward extension commonly known as the Delaware field lying principally to the west of Delaware. The Gulf Pipe Line Co. and the Texas Pipe Line Co. extended their lines into this shallow pool area early in the year. Each of the purchasing companies continuously extended its gathering lines, so that oil could be marketed from all the wells throughout the entire year.

GAS OUTLOOK DISMAL

No startling developments of gas were made during the year. Drilling was kept up reasonably well both in Kansas and Oklahoma, and many new wells were found, but no distinctly new pools. A number of gas wells were obtained in Oklahoma both north and south of Cleveland, particularly in the neighborhood of the West Osage oil field, already mentioned. Likewise throughout the well known gas territory in the aggregate many new wells were obtained. The gas pressure over the entire area is seriously reduced. The Kansas Natural Gas Co. extended its pipe lines into the Hogshooter gas field early in the winter of 1910 and 1911. During the latter part of the summer months the Kansas Natural Gas Co. applied to Kansas City for the privilege of increasing the retail price of gas from 25c. per 1000 cu. ft. to 35c. No action has been taken upon the subject yet. The Kansas

Natural also gave notice of an increase in the price of gas to consumers in a number of towns in Kansas.

Early in September the Public Utilities Commission of Kansas City, Mo., employed me to investigate the gas situation. The conclusions reached were substantially:

(1) That all the companies are now drawing gas from substantially the same areas. These are the Kansas Natural Gas Co.; the Oklahoma City Pipe Line Co.; the Quapaw Pipe Line Co. carrying gas to the Joplin mining district; the Caney River Pipe Line Co., carrying gas to Wagner and Muskogee; and the Wichita Pipe Line Co., carrying gas to Winfield, Wichita, Hutchinson and Newton, Kan., and the Portland Gas Company.

(2) That more than 1,000,000 people are now being supplied for heating, lighting and manufacturing purposes with natural gas from the Mid-Continental field, about 45% of which is used by factories. (3) That at the present rate of consumption, Kansas City need not hope for a supply of gas sufficient to meet its wants longer than two or three more years. (4) It seems probable that towns and villages within the gas fields may reasonably expect to have their supply continued for a decade or more after the big pipe lines practically have gone out of existence.

SOME OKLAHOMA WELLS ALREADY WATERLOGGED

Barring a small supply which may yet be obtained from the Vilas field, and the Independence field, Kansas can no longer supply the pipe lines with any material amount. Across the line in Oklahoma the pressure is low and most of the wells are waterlogged within 10 miles of the Kansas line excepting some new developments in the Osage. The area around the erstwhile famous burning Caney well is substantially exhausted. Southward in some places where the gas sands are irregular many new wells come in about as strong as ever, but throughout the great Hogshooter area, one of the most remarkable gas fields in the country, the pressure is reduced from an average of about 470 lbs. to about 350 lbs., and the volume from an original average of about 15,000,000 cu. ft. per well to 8,500,000 cu. ft. per well. The Hogshooter pool occupies a nicely marked anticlinal area and a number of wells along the limbs of the anticline are already waterlogged, which certainly looks bad for the field.

Petroleum in Illinois in 1911

By Raymond S. Blatchley*

Illinois suffered a relapse in oil production in 1911. The estimated production for the year is 30,000,000 bbl., as against 33,143,362² in 1910. An accompanying table gives the total production of oil in Illinois from 1905 to 1911. The decline in 1911 is the second in the brief history of the oil business in Illinois. The first came in 1909 and was due to disturbed market conditions. Recovery was immediate in 1910 but the imminent decline of the early fields and the lack of new development in later pools in 1911 caused a second reversal. Unless new fields are discovered the decline must continue. The basis of estimating the production, since only 11 months returns are available, is to assume the December runs of the Ohio Oil Co. and the Tidewater Pipe Line Co. equivalent to those of November and the

SOUTHEASTERN ILLINOIS OIL FIELDS

The combined daily output of the Clark, Cumberland, and Edgar County wells was about 8000 bbl., as against 9000 bbl. in 1910. Crawford County showed the first step of a rapid decline in 1910. The average daily output of the county was about 18,000 bbl., as against 30,000 bbl., in 1910 and 100,000 bbl., in 1907.

Lawrence County is the richest producing area in the state. There are seven sands from 750 to 1900 ft. that yield steadily. In order they are the Bridgeport Nos. 1, 2 and 3 lenses, 750 to 1000 ft.; the Buchanan sand, 1100 to 1400 ft.; the Kirkwood sand, 1350 to 1650 ft.; the Tracey sand, 1550 to 1750 ft.; and the McClosky lime, 1750 to 1900 ft. The

the year east of the Mississippi. The area was described by the State Geological Survey³ previous to opening the field.

The field is governed by an elongated dome on the western flank of the Illinois basin and has an areal extent of about 1½ square miles. The gravity of the oil is about 35° Bé. There are about 120 producing wells yielding about 4500 bbl. daily. The initial production of the first Carlyle wells was about 200 bbl.

In Macoupin County, two gas wells of about 100,000 cu.ft. daily, and two oil wells of 5- and 10-bbl., daily yield were completed about three miles south of Carlinville. The production comes from the base of the Pottsville rocks immediately overlying the massive St. Louis limestone. The structure, according to

ILLINOIS OIL PRODUCTION

Year	Bbl.
To 1905	6,576
1905	181,084
1906	4,397,050
1907	24,281,973
1908	33,686,238
1909	30,898,339
1910	33,143,362
1911 (estimated)	30,000,000
Total	156,594,622

tank-car shipments to be about 3,000,000 bbl. The accompanying table gives the pipe-line runs and the stock by months, according to the *Oil City Derrick*, of the Ohio Oil and the Tidewater Pipe Line Companies.

The tank-car shipments in the Illinois fields are those of the Sun Oil, Cornplanter Refining and Missouri-Illinois Oil Cos., and railroad shipments from Sandoval and Carlyle, Illinois. Dr. David T. Day gives 3,070,925 bbl. as the tank-car shipments for 1910.

The prices of the two general grades of oil remained steady from the previous year until May 2, 1911. Until this time oil of gravity over 30° Bé., commanded 60c. per bbl., and under 30° Bé., 52c. per bbl. The price increased in May for the two grades to 63 and 55c. per bbl. A second increase for the first grade to 65c. per bbl. took place June 14. A third increase for the first and a second increase for the second grade to 67 and 57c. took place on Sept. 15 and 19 respectively.

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²Figures by Dr. David T. Day, U. S. Geological Survey.

ILLINOIS OIL PRODUCTION FOR 1911

Month.	Runs, Bbl.		Stocks, Bbl.	
	Ohio Oil Co.	Tidewater Pipe Line Co.	Ohio Oil Co.	Tidewater Pipe Line Co.
January	2,169,879	124,783	26,243,015	3,860,578
February	1,994,231	113,489	25,635,245	3,998,278
March	2,589,635	124,746	23,997,496	3,941,079
April	2,173,939	117,003	24,005,010	3,141,490
May	2,299,881	139,925	24,129,388	3,193,449
June	2,208,358	132,833	23,195,749	3,744,088
July	2,292,927	131,641	22,714,183	4,076,403
August	2,340,877	126,921	22,265,928	3,986,160
September	2,179,591	114,807	21,904,719	3,558,641
October	2,195,408	114,752	21,359,482	2,444,909
November	1,996,321	109,719	20,211,934	.....

Kirkwood and McClosky sands, especially the latter are the richest developed in Illinois. The accumulation of oil and gas in these sands is governed by a long double plunging anticline. Lawrence County maintained her usual production without new additions to the field. The average daily yield of the field was about 42,000 bbl. Both sour and sweet oils were produced, which were handled separately.

The Sandoval field of Marion County was clearly defined in 1911, and was found to be limited to about three-fourths of a square mile. There are about 66 producing wells that have a daily yield of 1800 bbl. The oil comes from the Stein and Benoist sands in the basal portion of the Chester rocks of the Mississippian series of formations and is equivalent to the Kirkwood sand of Lawrence County. The Sandoval field lies along an irregular structural terrace upon the broad and gentle western flank of the Illinois basin. A new field was opened three miles northwest of Carlyle in Clinton County, in April, 1911, which proved to be the best new field for

F. C. Kay of the Survey, seems to be a small elongated dome. The Midvalley Oil Co. of St. Louis found a showing of oil in its prospect four miles east of Pinckneyville County, late in November. A conspicuous north and south anticline has been pointed out between Duquoin and Pinckneyville by the State Geological Survey, and much drilling is contemplated along this area.

The Carlyle development caused the average initial production to rise in April and July, to the highest point in two years. Of the 1256 wells drilled in 1911, Lawrence and Crawford Counties, with 479 and 449 respectively, headed the list. On Jan. 1, 1911 it was estimated that 18,618 wells had been drilled in Illinois. Of these 2847 or 15.2% were barren. In the first 11 months of 1911, 1256 wells were drilled, with 287 or 22.8% barren. The total up to Dec. 1, 1911 was 19,874 wells drilled with 3134 or 15.7% barren. The greatest number of wells were drilled in 1907, 4988, and in 1911, the smallest number.

³Ill. Geol. Surv., Bull. No. 16, pp. 87 and 167.

The Appalachian Oil Fields in 1911

By H. C. GEORGE*

The Appalachian oil field, comprising the oil pools of New York, Pennsylvania, Southeast Ohio, West Virginia and Kentucky, produces a high-grade petroleum with a paraffin base, rich in illuminating oil, benzine, and gasoline. In the last five or six years, nearly all of the oil pools in this district have shown a continuous decline in the number of wells drilled and the new production secured,

holes. In Pennsylvania, the question of drilling to greater depths in the Bradford pool in the northwest part of the state, and the finding of a few good wells at Canonsburg, Washington County, in the southwest part of the state, are the only new features for 1911.

In West Virginia, there were some good wells found in Wetzel County. There was considerable activity in Roane and Kanawha Counties with prospects of finding a large pool in the latter. But none of the large gushers, such as were secured in 1910, were found during the last year.

Almost the entire decline in the wells drilled and in the new production secured, is from the Indiana part of the field. In the Ohio part, the old gas end of the Finley pool in Hancock County furnished the best producers. Years ago this district was not worked, on account of the large amount of salt water associated with the oil. Years of pumping has reduced this, and has produced conditions which led to the developments of 1911.

There were a number of new wells in Wood County in northwestern Ohio in 1911, but there as in most other parts

PRODUCTION OF WELLS DRILLED IN THE APPALACHIAN OIL FIELD IN 1909, 1910 AND 1911.

	Number of Wells Drilled			Daily Production, Bbl.			Daily Production, Bbl. Per Well Drilled			Per Cent. of Dry Holes		
	1909	1910	1911	1909	1910	1911	1909	1910	1911	1909	1910	1911
Allegheny County, N. Y.....	468	303	201	838	446	201	1.8	1.4	1.0	7.6	16.2	33.3
Pennsylvania	3,958	2,056	1,646	10,361	5,936	4,349	2.6	2.8	2.7	15.6	23.7	27.3
West Virginia	1,810	1,735	1,228	35,872	35,347	10,556	19.1	20.4	8.6	36.9	40.6	48.4
Southeast Ohio	2,285	1,682	1,178	25,239	19,321	9,363	11.0	11.5	7.9	36.2	36.8	41.2
Kentucky	179	119	114	2,108	997	1,541	11.7	8.4	13.5	44.7	62.2	32.4
Totals	8,700	5,895	4,167	81,918	62,047	25,810	9.4	10.5	6.2	25.6	32.8	39.2

1911 to a greater extent than any previous year.

The total number of wells drilled in all pools of the Appalachian oil field in 1911, was 4167 as compared with 5895 in 1910 and 8700 in 1909. The decline in new production was still more noticeable. The daily production from new wells in 1911 was 23,810 bbl., as compared with 62,047 bbl. in 1910, and 81,918 bbl. in 1909. The number of dry-holes increased from 25.6% in 1909 to 32.8% in 1910 and 39.2% in 1911.

The total production for the Appalachian oil field in 1911 was 22,275,000 bbl., as compared with 26,089,000 bbl. in 1910, and 25,394,000 bbl. in 1909 and 24,240,000 bbl. in 1908. From 1908 to 1910, each year showed an increase in production, but 1911 showed a less total production than any of these years. No change in the price of petroleum of the grade production in this field took place during the year. The price in 1911 was \$1.30 per bbl., as compared with \$1.33

In southeast Ohio, as a result of the new operations of 1911, there are prospects of finding an extension to the deep-sand territory, to the south and east of its present limits. There were many failures in the shallow territory. In Harrison County the large gas companies were active in new operations.

In Kentucky and Tennessee there was much land leased, but no increase in the drilling operations. Most of the work done in 1911, was in Wayne County, Ky. Central Ohio, the old Clinton Sand gas district, has shown the most activity during the last year, resulting in the finding of many good wells.

of the Lima field, most of the wells drilled were on inner locations on old leases, which give a small but sure production.

Petroleum in Texas

By WILLIAM B. PHILLIPS†

The production of petroleum in Texas during 1911 is estimated as exceeding 10,000,000 bbl., a considerable increase over 1910 and preceding years. Activities in the older and better known fields, such as Spindle Top, Sour Lake, Saratoga, Batson, Humble and Corsicana were continued.

PRODUCTION FROM A NEW FIELD

The most noteworthy circumstance in connection with the production of petroleum was the opening of the Electra oil field, Wichita County, 140 miles northwest of Fort Worth. At the close of 1911 the production in this new field was close to 10,000 bbl. per day and a pipe-line was being laid to the refineries near Dallas, a distance of 160 miles. Two new oil refineries will be built at Fort Worth. The oil from the Electra field varies in gravity from 38 to 42 B, the general average being close to 41 B. It is, therefore, more like the Corsicana oil than the oils from the Gulf coast. The formations involved appear to be Carboniferous and Permian-Carboniferous. The deepest well in the region is now down 3985 ft., but is not productive. Most of the oil is now coming from a depth of 1000 to 1200 ft. although the deeper sands, 1700 to 1900 ft., are also good producers.

NATURAL GAS

There was a notable extension of the use of natural gas in the state. By far the greater production came from Clay

The Lima Oilfield in 1911

By H. C. GEORGE

The production of the Lima Oilfield of northwestern Ohio and eastern Indiana shows a continuation of the decline in production which has been noticed since 1907. The total production in

PRODUCTION OF WELLS DRILLED IN THE LIMA FIELD IN 1909, 1910 and 1911.

Year	Number of Wells Drilled			Daily Production Bbl.			Daily Production, Bbl. per Well Drilled			Per Cent. of Dry Holes		
	1909	1910	1911	1909	1910	1911	1909	1910	1911	1909	1910	1911
Northwest Ohio	917	573	561	7,771	6,344	9,471	8.4	11.1	11.3	9.6	13.4	9.0
Northeast Indiana	304	363	151	3,852	8,010	1,528	12.6	22.1	10.1	27.3	19.0	35.8
Total	1221	936	712	11,623	14,354	7,999	9.5	15.3	11.2	14.0	15.7	14.6

in 1910, \$1.62 in 1909 and \$1.78 in 1908.

The only pool in the field that did not show the general decline, was the small one of Kentucky, which had about the same number of wells drilled in 1911 as in 1910, but with a larger new production and a smaller percentage of dry

1911 was 4,656,000 bbl., as compared with 5,171,000 bbl. in 1910, 6,192,000 bbl. in 1909 and 7,287,000 bbl. in 1908. The average price paid for North Lima oil in 1911 was 82c. per bbl., as compared with 83c. per bbl. in 1910, 91c. per bbl. in 1909 and \$1.03 per bbl. in 1908. South Lima oil has constantly brought 5c. per bbl. less.

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County, 100 to 120 miles northwest of Fort Worth. Many cities and towns in north Texas are now supplied with this fuel. The price varies according to consumption and may be taken at about 25c. per 1000 cu.ft., on the average. On what appears to be reliable authority it is stated that the town of Wichita Falls, Wichita County, will offer natural gas to industrial establishments at 1½c. per

1000 cu.ft. This gas is also obtained from Clay County, the piping distance being from 15 to 20 miles.

The natural gas fields of Clay County are north of Henrietta and around a little station known as Petrolia. This area also produces oil, but not in such amounts as the Electra field. A considerable amount of natural gas is used in and around Corsicana, but is not piped to any

distance. On the Rio Grande the town of Laredo is supplied with natural gas from Webb County. Texarkana and Marshall get their gas from the Caddo field, Louisiana. There is some natural gas used at Pittsburg, Camp County, at Santa Anna, and Trickham, Coleman County, at Moran, Shackelford County, and south of San Antonio, in Bexar and McMullen Counties.

Coal and Coke in 1911

Notwithstanding the general complaints of dull business in many lines, it appears that the total production of coal in 1911 fell below the great output of 1910 by a small quantity only, and that the year will, therefore, be known as one of the best in the history of our coal industry, so far as output is concerned.

ANTHRACITE

The production and consumption of anthracite were alike the largest ever reported. The collieries in the anthracite region worked during the year with remarkable steadiness, and the shipments from the mines showed comparatively little variation from month to month—even less so than usual. Not only was this the case, but the storage yards of the large companies remained almost empty during the year, the shipments being readily taken into consumption.

The total shipments of anthracite from the mines, estimating the latter part of December only, were 69,838,872 long tons. Making the customary allowance for coal used at the mines, this would give a total mined of 77,521,148 long tons—equivalent to 86,823,686 short tons. The increase over the production for 1909 was 4,153,450 short tons.

The well known fact that the miners of the anthracite region have formulated demands for increased wages and other modifications of the agreement under which those mines have worked, practically ever since the settlement of the great strike in 1903, would naturally have led the companies to take some precautions against a stoppage of mining in April next, when the agreement will expire.

The demand for coal, however, was so great throughout the year that there has been little opportunity for preparing for this contingency. Doubtless there will be heavy storage of coal from now on, but up to the close of the year it was not possible.

The anthracite market remained very steady throughout the year. For the prepared or household sizes the schedule prices, as fixed by the large carrying companies, remained unchanged except for the discounts usually made in the summer months. For the small or steam sizes

prices were a little uncertain early in the year, but they soon steadied up and remained firm, while toward the close of the year this class of coal sold at tide-water at higher prices than have been known for seven or eight years. The returns to the companies must have been entirely satisfactory, both on account of the large quantity sold and the well maintained prices.

BITUMINOUS COAL

The production of bituminous coal is more difficult to ascertain at an early date than is that of anthracite, which is concentrated in a single district. The advance returns collected by *Coal Age*, however, point to a total output in 1911 of 396,296,823 short tons of bituminous coal, a decrease from 1910 of 14,829,585 tons. This decrease was rather generally distributed over most of the coal-producing states, although West Virginia probably increased its output, but at the expense of Ohio, Indiana and Illinois. In Illinois, which was until recently the second producing state, there was a considerable decrease, owing to the protracted disagreement between the operators and miners, which closed many collieries for several months.

TOTAL PRODUCTION

Adding the anthracite and the bituminous together, we find that the total production as closely estimated for 1911, was 483,192,888 short tons, that for 1910 having been 493,796,643 tons. There was, therefore, a decrease in 1911 of only 10,603,755 tons, or but little more than 2 per cent. This shows a surprisingly small difference in consumption; practically none at all, as it is the universal testimony that there has seldom been a time when consumers were carrying such small stocks as at the close of 1911. The almost universal practice during the greater part of the year was to buy supplies only as needed.

THE BITUMINOUS MARKET

The bituminous-coal markets generally were not by any means in as good condition as those for anthracite. Even early in the year, when there was much talk of a suspension of mining in the Central

West on the expiration of the old contract, prices remained at rather a low point. Later, when difficulties were quickly adjusted in all the states except Illinois, and when West Virginia continued to pour coal into both the seaboard and the western markets, prices became gradually weak. To an unusual degree large consumers failed to make yearly contracts for their supplies, preferring to depend upon the open market with the confidence that they could secure lower prices; and the result generally justified them in this course. For a brief time the stoppage of mining in Illinois raised prices at Chicago and St. Louis, but the shortage was quickly made good from West Virginia, Ohio and Indiana, and prices remained weak and uncertain for the greater part of the year.

Upon the whole, the bituminous markets were not favorable to producers, and the year 1911 will not be remembered by them with any wish to return to its general conditions.

COKE

The production of coke in 1911 is estimated by *Coal Age* at 29,338,214 short tons. This is a decrease of 6,717,845 tons from the output of 1910. The diminution was due chiefly to the comparative dullness in the iron trade and the smaller production of pig iron in the early part of the year; in a small degree also to the fact that there were large stocks of coke on hand unsold at the opening of the year. In the month of December business improved in a remarkable degree, and the year closes with much better prospects for the coming season.

LABOR CONDITIONS

Coal-mining labor at the close of the year is in a general state of unrest. In the Central West the miners' union is anxious for a restoration of the old tri-state agreement; the operators of Illinois and Indiana have agreed, but those of Ohio and the Pittsburg district will not consent, preferring to make their own agreements. West Virginia remains outside of all union contracts. The prospect is that the coming spring will see a prolonged struggle, both in the bituminous and the anthracite mines.

The Mining Index

A Classified Bibliography of the Current Literature of Mining and Metallurgy

COAL AND COKE

17,425—**ACCIDENT**—An Outburst of Coal and Fire-Damp at Valleyfield Colliery, Newmills, Fife. Henry Rowan. (Trans. Min. Inst. of Scotland, Vol. XXXIV, Part 1, 1911; 3 pp.)

17,426—**BITUMINOUS COAL INDUSTRY**, The Condition of the. A. J. Moorshead. (Proc. Am. Min. Congress, Oct. 24-28, 1911; 8 pp.)

17,427—**BREAKER**—Taylor Breaker near Scranton, Penn. M. A. Walker. (Coal Age, Dec. 23, 1911; 2 pp. illus.) 20c.

17,428—**BRIQUETS**—Zur Frage der Selbstentzündlichkeit von Braunkohlenbriketts. F. W. Hinrichsen and S. Taczak. (Glückauf, Oct. 21 and 28, 1911; 14 pp.) Concerning self-ignition of lignite briquets. 60c.

17,429—**COAL-CUTTING MACHINERY**. W. Bolton Shaw. (Iron and Coal Tr. Rev., Dec. 1, 1911; 4 pp., illus.) 40c.

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17,435—**COKE PLANT**—The World's Largest By-Product Coke Plant. (Iron Tr. Rev., Dec. 23, 1911; 4 pp., illus.) A description of electrical equipment of the Kopper's coke-oven installation at Gary, Ind. 20c.

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17,438—**ELECTRICITY** in the Service of the Brown Coal Industry. Alfred Strauss. (A E G Journ., Oct., 1911; 5½ pp., illus.)

17,439—**EXPLOSION**—The Adrian Mine Explosion. Pennsylvania. R. Dawson Hall. (Coal Age, Nov. 18, 1911; 3½ pp., illus.) 20c.

17,440—**EXPLOSIONS**—The Causes and the Prevention of Coal Mine Explosions. Edward K. Judd. (School of Mines Quart., Nov., 1911; 7 pp.) 60c.

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17,445—**LOW-GRADE FUEL**—Ausnutzung minderwertiger Brennstoffe auf Zechen des Oberbergamtsbezirks Dortmund. XII. Bütow und Döbelstein. (Glückauf, Nov. 11, 1911; 5½ pp., illus.) Utilization of low-grade fuel at collieries of Dortmund district. Experiments with gas producers. 40c.

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