THE
CLEVELAND-CLIFFS IRON CO.
MINING DEPARTMENT

ANNUAL REPORT OF GENERAL MANAGER

FOR

YEAR ENDING

DEC. 31ST. 1921

#1992

LAKE MINE:

CLIFFS SHAFT MINE:

1923

152

SALISBURY MINE:

Ba-4
12816

ANGELINE MINE:

HOLMES MINE:

NEGAUNEE MINE:

MAAS MINE:

ATHENS MINE:

SOUTH JACKSON MINE:

MORRIS-LLOYD MINE:

BARNES-HECKER MINE:

MORRIS-LLOYD:

GWINN DISTRICT:

AUSTIN MINE:

STEPHENSON MINE:

PRINCETON MINE:

GWINN MINE:

FRANCIS MINE:

GARDNER-MACKINAW MINE:

GWINN DISTRICT GENERAL:

REPUBLIC MINE:

SPIES MINE:

CROSBY MINE:

MEADOW-FOWLER MINE:

HILL-TRUMBULL MINE:

BOEING MINE:

WADE-HELMER MINE:

ENGINEERING DEPARTMENT:

GEOLOGICAL DEPARTMENT:

MECHANICAL DEPARTMENT:

MECHANICAL DEPARTMENT CONT'D:

SAFETY DEPARTMENT:

PENSION DEPARTMENT:

TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS [SUBJECT TO REVISION]

No. 1157-M. Issued with MINING AND METALLURGY, May, 1922.

Effect of Rate of Mining on Ton Cost and Total Value of Mine

By W. O. Hotchkiss,* Madison, Wis.

(New York Meeting, February, 1922)

In considering the question of mining methods the possible rate of production deserves much more attention than it often receives. Hoover's theorem that, in order to show the greatest profit, an orebody should be worked out in the shortest practicable time, should be better known. The author recently obtained detailed statements of costs from iron-mine superintendents of the Lake Superior district. In discussing these, the effect of rate of mining on cost of production was considered and detailed estimates were made. The methods by which these estimates were made and the way in which they were presented are here described to illustrate the importance of this factor in mining operations.

The saving due to lower costs is not the only factor that should be considered. The greater profit per ton is of much importance but of equal importance are the greater profit per ton that will be made on a greater number of tons per year, and the fact that the total profit will be received in a shorter period. This last makes a great difference in the present value of a property, by shortening the period of discount on future profits.

Another item of importance to those operating a number of mines is that the tonnage needed to supply the market can be obtained most profitably by operating the smallest number of mines that will supply the amount required when each is worked to maximum capacity.

In the Lake Superior iron district there are many grades of ore, and the requirements for each are known. If the demand for a certain grade can be supplied from mines now operating, the development and mining of a new orebody of the same grade must result in lower rates of production and lower profits to all mines producing this grade. If a company is mining the same grade of ore from three mines when it can supply its needs by operating only two, by operating only two it can obtain the greatest profit. Royalty rates, lease terms, and other considerations modify this general statement, but if all three properties

* State Geologist of Wisconsin.

were operating under the same conditions the statement would hold. If the properties differ in profit per ton, the better plan, on an even market, would be to mine first the deposits giving the greatest profit per ton, as then the greatest present value would be realized.

In making estimates of the savings possible by increasing the rate of production at each mine considered, the detailed cost sheet was studied with much care. Such items as general mine expense and pumping were assumed to be constant without regard to the tonnage mined and so the cost per ton decreased as the production increased; these items are left unmarked in Table 1. Other items, such as development in ore and breaking ore, were assumed to be practically the same per ton whether much or little is mined; these are marked with an asterisk(*). Such items as hoisting, stocking ore, and general surface expense were assumed to increase somewhat as production increased, because of the need of extra landers and motor men, and extra power consumed, but it was estimated

TABLE 1.—*Estimated Cost per Ton*

Monthly production	20,000	25,000	30,000	35,000	40,000
Exploring in mines	$0.110				
Development in rock	0.048				
Development in ore	0.270*				
Breaking ore	0.520*				
Ventilation	0.020*				
Timbering, specific	0.154*				
Timbering, development in rock	0.003†				
Timbering, development in ore	0.073*				
Timbering, breaking ore	0.025*				
Tramming, specific	0.199†				
Pumping	0.192				
Underground superintendence	0.055†				
General underground expense	0.027†				
Hoisting	0.228†				
Stocking ore	0.040†				
Loading from pockets	0.050				
General surface expense	0.070†				
Stockpile loading	0.040*				
General mine expense	0.035				
Engineering	0.018*				
Assaying	0.035†				
Personal injury expense	0.035*				
Contingent expense	0.003†				
Insurance (fire)	0.007				
Taxes	0.201†				
Total depreciation	0.125				
Total	$2.583				

that the increase was not to be in direct ratio to the production. Consequently these increases permit a saving with larger production. These items are marked with a dagger(†).

In the cost statement given, the actual costs were recomputed to remove the effect of certain abnormal conditions that existed during the year taken; some items were increased and others decreased to an estimated normal amount. After this was done each item was considered separately as to the change due to an increased production. The estimated cost per ton was then entered in the column under the particular production rate considered. The manner of treatment of each item would vary with the particular mine and the character of the orebodies.

The year for which costs were taken was one in which two shifts had been employed throughout. In changing cost items, it was assumed that two shifts was the constant basis. While for low rates of production a lower ton cost can often be obtained by working only one shift instead of two, such a case is abnormal and should not enter into this present consideration.

From tables like this, curves of estimated total cost per ton were made. To avoid disclosing cost figures, the curve shown in Fig. 1 is drawn as a hypothetical savings curve and shows the number of cents per ton that would be saved as the production is increased above a moderate normal rate. This curve is purely hypothetical, and is used to illustrate the method rather than fact. The curve is entirely possible, however, and does not show an exaggerated case.

The curve in Fig. 1 shows that savings increase from a normal profit at 13,000 tons per month to a maximum $0.70 per ton greater. In terms of mine cost, this means that if it were possible to increase the monthly production from 13,000 to 35,000 or 40,000 tons the cost of mining would decrease about $0.70 per ton. It will be noted that the curve gradually becomes parallel to the base line of the diagram as the tonnage increases. This indicates that there would be a certain rate of production beyond which the cost of producing a ton of ore would not decrease.

EFFECT OF INCREASED PRODUCTION ON PRESENT VALUE OF MINE

In the case of the hypothetical mine, of which the savings are shown in Fig. 1, assume that this property will produce 5,000,000 tons before it is worked out, and that the profit per ton, when producing 13,000 tons per month is $0.35 per ton. Then, according to the curve, increasing the rate of production to 25,000 tons will increase profits by $0.50 per ton, and make the total profit $0.85 per ton. The total annual profit on the 13,000-ton rate would be $54,600, and on the 25,000-ton rate $255,000. The total profits derived from mining the 5,000,000 tons of ore would be $1,750,000 at $0.35 per ton and $4,250,000 at $0.85 per ton. Multiplying

the rate of mining by 2, in other words, would multiply the total profits by 2.4. The $4,250,000 profit would be received in 16.6 years, while it would take 32 years to recover the profit of $1,750,000. Computing present values of these future profits, in order to get figures that are properly comparable, we find the following, using 8 and 4 per cent. sinking-fund rate:

Present value of $1,750,000 in 32 years (factor 2872)	$570,000
Present value of $4,250,000 in 16.6 years (factor 4865)	2,065,000

Hence, while the increase in rate of mining would increase the total profits from the mine only 2.4 times, it would increase the actual present value of the property nearly four times.

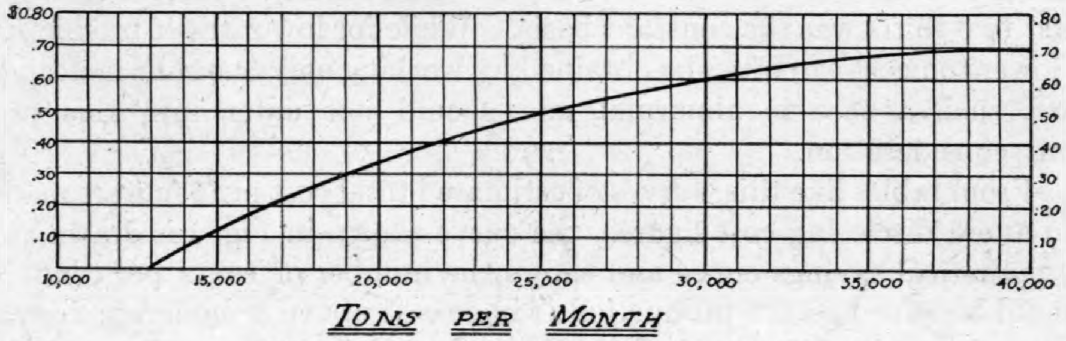

FIG. 1.—HYPOTHETICAL SAVINGS CURVE.

The following tabulation of these results makes a comparison of the results easy:

	PRODUCTION PER MONTH 13,000 TONS	25,000 TONS
Profits per ton	$0.35	$0.85
Profits per year	$54,600	$255,000
Life of mine in years	32	16.6
Total profits	$1,750,000	$4,250,000
Present value at 8 and 4 per cent. S. F.	$ 570,000	$2,065,000

The example is striking, but the profit range is not abnormal, and the saving in profits assumed is well within the bounds of reason. Numerous mines at which such a saving per ton has been exceeded for a similar increase in production are probably well known. The most striking thing is the way in which the present value of a mine can be increased many times by a reasonable increase in the rate of production.

January 1, 1922.

Mr. Wm. G. Mather, Pres.,

Cleveland, Ohio.

Dear Sir:-

I beg to submit the following report of the operations of the Mining Department for the year 1921. The inventories, maps, and statements relating to this report have gone forward to you under separate cover. The colored portions of the maps show the work for the year. The reports of the different mines of the Company were made by the Superintendents in Charge and the reports of the Mechanical, Engineering, Geological, Safety, and Welfare Departments by the heads of these departments.

The operating conditions during the year have been very unsatisfactory, due to putting the mines on part time, thus materially decreasing the output and increasing the cost. A statement accompanies this report showing the mines in operation January 1, 1921, with shifts and hours worked and changes during the year. The Lake and Angeline Mines were exhausted and have been permanently closed, and the lease to the Meadow-Fowler surrendered. The Salisbury, Gwinn, Princeton, Spies, Wade-Helmer and Crosby Mines were closed down, while the balance of the properties are now operating on a four hour six day basis.

There were three reductions in wages during the year - 14.02% February 1st, 11.35% August 1st, and 8% October 1st, the present scale corresponding to that of October 1,1917. This still leaves the wages 59% above 1913, and it would be necessary to make a reduction of 37% in the present schedule to bring them to the 1913 basis. In spite of the

reduced output, we have been able to bring the cost per ton for labor over the last three months of this year very close to that of 1917, as you will note from the figures given below.

COMPARATIVE COST OF PRODUCTION
LAST THREE MONTHS OF 1921 WITH LAST THREE MONTHS OF 1917.

		LABOR		SUPPLIES		TOTAL	
		AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PER TON
MAAS MINE.	1921. Ore Produced - - - - - - - - - - - - - - - - - 37,876 tons						
	No.Shifts & Days Operated - - 1-4hr - - - - - 76						
	Avg. Daily Product - - - - - - - - - - - - - - - 498						
Cost Production		39,989.47	1.052	30,333.15	.801	70,172.62	1.853
Percent		57		43		100	
	1917. Ore Produced - - - - - - - - - - - - - - - - - 95,228 tons						
	No.Shifts & Days Operated - 1-8hr - - - - - 76						
	Avg.Daily Product - - - - - - - - - - - - - - - 1,253						
Cost Production		96,654.57	1.015	46,069.17	.484	142,723.74	1.499
Percent		68		32		100	
NEGAUNEE MINE.	1921. Ore Produced - - - - - - - - - - - - - - - - 45,131 tons						
	No.Shifts & Days Operated - 1-4hr - - - - 76						
	Avg.Daily Product - - - - - - - - - - - - - - 594						
Cost Production		39,482.09	.875	33,363.94	.739	72,846.03	1.614
Percent		54		46		100	
	1917. Ore Produced - - - - - - - - - - - - - - - - 132,812 tons						
	No.Shifts & Days Operated -1-8hr - - - - 76						
	Avg.Daily Product - - - - - - - - - - - - - - 1,748						
Cost Production		112,330.04	.846	57,175.85	.430	169,505.89	1.276
Percent		66		34		100	
MORRIS-LLOYD MINE.	1921. Ore Produced - - - - - - - - - - - - - - - - 35,520 tons						
	No.Shifts & Days Operated - 1-4hr - - - - 76						
	Avg.Daily Product - - - - - - - - - - - - - - 467						
Cost Production		44,787.88	1.261	37,307.13	1.050	82,095.01	2.311
Percent		55		45		100	
	1917. Ore Produced - - - - - - - - - - - - - - - - 50,099 tons						
	No.Shifts & Days Operated - 2-8hr - - - - 76						
	Avg.Daily Product - - - - - - - - - - - - - - 778						
Cost Production		73,369.99	1.241	33,330.03	.564	106,700.02	1.805
Percent		69		31		100	

This is very satisfactory in view of the fact that there is a certain amount of non-productive labor which could not be reduced in proportion to the reduced output.

You will note, however, that the Supplies per ton are considerably higher than in 1917. This increase is principally in two items - timber and power. At the Negaunee Mine the timber has increased from .055 to .124¢ per ton; at the Maas from .064 to .141; at North Lake from .110 to .127. The power at the Negaunee Mine has increased from .092 to .270; Maas from .148 to .336, and North Lake from .092 to .270. Part of this increase is due to the price of current, which was raised from 1¢ to 1½¢ per K.W.H. January 1, 1918, and the balance to the pumping, which is as high with a small as a large output. During 1922 the cost of timber will be lower, as the inventory has been depreciated to a cost basis. This, however, is 35% higher than in 1917.

Most of our married employees have been retained, and those for whom places could not be provided have found employment in road construction. The average earnings of our men on the present basis of work is approximately $50.00 per month. We anticipated that with this small income there would be a large demand for assistance, but so far this has not developed. It will probably become more acute, however, as time goes on.

I call your attention to the large increase in the estimate of tonnage at the Athens and Morris-Lloyd Mines, due to developments during the past year. This may increase the valuation of these mines for tax purposes, although it should not, as our total estimate for the Morris-Lloyd is 3,038,514 against the Tax Commission 1921 estimate of 3,793,831. In case of the Athens our estimate is 7,467,941 against the Tax Commission estimate of 8,886,849. However, our estimates are based on 12 cu.ft. per ton, with a reduction of 19% for rock and loss in mining. Last year the Tax Appraiser, Mr. Barrett, refused to permit this reduction, claiming

that 12 cu.ft. was so large a factor that it would take care of both these items. As a matter of fact the Steel Corporation uses a straight 10 cu.ft. per ton, so that there is some justification for the position taken by Mr. Barrett.

During the year the charge for locomotive service for spotting cars at steam shovels was discontinued by all the railroads. In December we were notified by the Chicago & North Western that the charge for the maintenance of stockpile tracks had been discontinued and would be made retroactive to the date upon which the roads were returned to the owners by the Government. In pursuance of this a check was sent us to cover all payments made on this account. The other railroads serving us have not yet followed the example of the North Western, but will undoubtedly do so in the near future.

The only outstanding lease is to the Empire Iron Company, covering the E½ of the SW¼ and the W½ of the SW¼ of Section 19-47-26.

W. W. Duncan
Vice Pres. & Gen. Mgr.

ANNUAL REPORT

OF THE

LAKE MINE (1921)

Production and Shipments.

The Lake Mine worked 124 days in 1921, and produced 34,497 tons of ore, an average of 278 tons per day. No ore was shipped from the pocket and only a small tonnage from the stock-pile. The mine was closed on June 1st.

2,275 tons of rock were mined, an average of 18 tons per day.

Table I.

Production by Grades.

	Total for Year		Average per Day	
Grade	1921 Tons	1920 Tons	1921 Tons	1920 Tons
Lake		100,972		338
Lakedale	34,497	55,028	278	184
Total Ore	34,497	156,000	278	522
Rock	2,275	11,565	18	39
Total Ore and Rock	36,772	167,565	296	561

Table II.

Shipments.

6,553 tons of Lake ore were shipped from stock-pile at the mine, and 6,536 tons were loaded by the Furnace Department from the stock-pile at Presqu' Isle and shipped to Pioneer No. 2 Furnace.

Table III.

Stock-Pile Balances, Dec. 31st, 1921.

Grade	At Mine Tons	At Presqu' Isle Tons	Total Tons
Lake	12,354		12,354
Lakedale	185,655	22,963	208,618
Total	198,009	22,963	220,972

Table IV.

Division of Product by Levels.

Level	Lakedale Tons	Rock Tons	Total Ore and Rock Tons
1280 Sub-Level	4,224		4,224
1256 Sub-Level	5,622	237	5,859
1240 Sub-Level	10,560	248	10,808
1224 Sub-Level	6,336	240	6,576
Second Level	4,939	410	5,349
1142 Sub-Level	1,418		1,418
1130 Sub-Level	1,398		1,398
Third Level		1,140	1,140
Total	34,497	2,275	36,772

Table V.

Production by Months.

Month	Days	Ore Per Day Tons	Lakedale Tons	Rock Tons	Total Ore and Rock Tons
January	25	264	6,590	190	6,780
February	23	269	6,179	155	6,334
March	26	289	7,520	605	8,125
April	25	288	7,200	1,010	8,210
May	25	280	7,008	315	7,323
Year	124	278	34,497	2,275	36,772

Table VI.

Delays.

There were no delays during the five months that the mine was operating.

Table VII.

Estimate of Ore Reserves.

Level	Gross Ore Tons	Deductions for Rock and Timber	Net Ore Tons
Second Level	15,000	33%	10,000
1142 Foot Sub-Level	10,000	60%	4,000
Third Level	10,000	60%	4,000
Total	35,000		18,000

A factor of 15 cu. ft. per ton was used.

This ore cannot be mined at a profit.

General.

The mine was closed on June 1st, and, after the underground equipment had been removed, no work was carried on except pumping, which was continued from June 9th to the end of the year at the expense of the Oliver Iron Mining Co.

Some of the employees were put on the pension-list, and some were transferred to other mines. Work on the county road was also obtained for some of the men who were laid off.

Wages were decreased 15% on February 1st, 12½% on August 1st and 10% on October 1st.

Surface.

Additional stock-pile trestle was built in January and May to take care of the output. All of this, except the legs, and nearly all of the other trestle east of the shaft was torn down and shipped to the Holmes, Morris-Lloyd and Austin Mines.

The two 2000-gallon turbine pumps, handling the surface-water from the dam at the east end of the Lake bottom, have been sold to the Oliver Iron Mining Co. The three smaller centrifugal pumps were taken up from the caves, and the smallest, having a capacity of 100 gallons, was sold to the Salisbury Mine. The 300-gallon pump was stored at the Hard Ore ware-house, and the largest, a 5-inch, two-stage, Alberger pump of 600-gallon capacity, was sold to the Oliver Iron Mining Co. for use at the Section 16 Mine on surface.

The mine-buildings were boarded up, the machinery being left in place till required elsewhere, and practically all supplies on hand were shipped to the General Storehouse or to other mines. All the mine-timber and lagging was shipped to the Holmes Mine.

The No. 6 gyratory crusher has been sold to the Athens Mine.

Underground.

The ore on the 1280 and 1256 foot sub-levels and practically everything above the 1224 foot sub-level was mined before the mine closed. Both the 1224 foot sub-level and the second level were extended to the east and some ore found, but it is badly cut up and mixed with rock from the effects of caving. The third level was also extended 150 feet to the east in rock and a raise put up to the second level, but the mine closed before this was used. Some ore was mined at the west end of the 1142 and 1130 foot sub-levels, between the second and third levels.

There is no clean ore left in the mine, and what ore is left in the old workings is of such poor grade and so expensive to mine that it is valueless.

Owing to a shortage of electric power, pumping was done with steam from January 13th until the middle of March, so that coal consumption was unusually heavy during the winter months. The compressor was shut down on March 18th, and thereafter compressed-air was received from the Holmes Mine.

After the mine closed all rail, cars, locomotives, trolley-wire and fittings, ventilating doors, hoists, winches, drills, drill-steel and tools, and all ladders in good condition, were removed from underground, leaving only the main pumps in the pump-houses on the fourth and fifth levels, which have been operated for the Oliver Iron Mining Co. since June 9th.

The rail was shipped to the Cliffs Shaft, Holmes and Morris-Lloyd Mines, and some was later sold to the County Road Commission. The mine-locomotives were stored in the Hard Ore Yard. Eight large steel cars were shipped to the Morris-Lloyd Mine, and the large fan and motor, and all the iron-work for six ventilation doors went to the Athens Mine.

LAKE MINE.

COMPARISON OF COST SHEETS FOR 1920 AND 1921.

The Lake Mine worked on double-shift in 1921 until it was closed on June 1st. All the ore mined was taken from the old workings on the foot-wall above the third level, and the proportion of rock handled was large. The average number of contracts working was 12, compared with an average of 17 in 1920.

On account of the short period of operations in 1921 and the changes in the form of the cost sheet, it is impossible to make a comparison of the cost sheets for the two years that is of any value.

Wages were decreased 15% on February 1st, 12½% on August 1st, and 10% on October 1st.

Production.

	1920	1921
Days Worked	299	124
	Tons	Tons
Ore	156,000	34,497
Rock	11,565	2,275
Ore and Rock	167,565	36,772
Ore Per Day	522	278
Rock Per Day	39	18
Ore and Rock Per Day	561	296

Labor.

	1920	1921
Average number of men	154	108
Average rate per day	$ 6.26	$ 5.48

Tons Per Man Per Day.

	1920	1921
Surface	11.77	9.44
Underground	4.72	3.53
Total	3.37	2.57

Cost of Production.

	1920	1921
Labor	$ 1.848	$ 2.170
Supplies	.598	1.021
Total	$ 2.446	$ 3.191

LAKE MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1921.

GRADE	IRON	PHOS.	SILICA
Lakedale,	56.89	.087	9.54
Lake,	(No Production)		

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1921.

GRADE	Mine IRON	PHOS.	
Lakedale,	(No Shipments)		
Lake,	60.86	.117	-(This means 3 cargoes all crushed and consigned to Michigan Ports for Charcoal Furnaces).

ORE STATEMENT - DECEMBER 31ST, 1921.

	LAKE ORE AT MINE	LAKEDALE AT MINE	LAKE ORE STOCKED AT PRESQUE ISLE	TOTAL	TOTAL LAST YEAR
On hand January 1, 1921,	18,907	151,158	29,499	199,564	231,313
Output for Year,	0	34,497	0	34,497	156,000
Total,	18,907	185,655	29,499	234,061	387,313
Shipments,	6,553	0	6,536	13,089	187,749
Balance on Hand,	12,354	185,655	22,963	220,972	199,564
Decrease in Output,				121,503	
Increase in Ore on Hand,				21,408	

1921 -- 1-8 Hour Shift Jan. 1st to June 1st, 1921.
Mine closed May 31st, 1921.

1920 -- 2-8 Hour Shifts Jan. 1st to Nov. 1st, 1920.
1-8 Hour Shift Nov. 1st to Dec. 31st, 1920.

LAKE MINE

SHIPMENTS FOR YEAR-1921

GRADE	POCKET	STOCKPILE	PRESQUE ISLE STOCKPILE	TOTAL	TOTAL LAST YEAR
Lake,	0	6,553	6,536	13,089	155,600
Lakedale,	0	0	0	0	32,149
Total,	0	6,553	6,536	13,089	187,749
Total Last Year,	95,855	73,167	18,727	187,749	
Decrease,				174,660	

LAKE MINE

COMPARATIVE MINING COST FOR YEAR

	1921	1920	INCREASE	DECREASE
Product	34,497	156,000		121,503
Underground Costs	2.392	1.862	.530	
Surface Costs	.626	.419	.207	
General Mine Accounts	.181	.165	.016	
Cost of Production	3.199	2.446	.753	
Original Cost		.212		.212
Plant Account	.018		.018	
Equipment	.002	.003		.001
Taxes	.188	.193		.005
Central Office	.097	.090	.007	
Contingent Expense	.046		.046	
Idle Expense	.602		.602	
Cost Adjustment	.029	.004	.025	
Cost on Stockpile	4.181	2.948	1.233	
Loading & Shipping	.103	.167		.064
Total Cost on Cars	4.284	3.115	1.169	
No. Days Operating	124	299		175
No. Shifts & Hours	1-8	2-8-251 1-8 48		
Avg. Daily Product	278	522		244
COST OF PRODUCTION				
Labor	2.170	1.848	.322	
Supplies	1.029	.598	.431	
Total	3.199	2.446	.753	

1-8 hr. 6 days a week to May 31;
Mine abandoned June 1, 1921.

LAKE MINE

COMPARATIVE WAGES AND PRODUCT

	1 9 2 1	1 9 2 0	INCREASE	DECREASE
PRODUCT	34,497	156,000		121,503
No. Shifts & Hours	1-8hr	2-8-251 1-8- 48		
AVERAGE NO. MEN WORKING				
Surface	14	44		30
Underground	33	110		77
Total	47	154		107
AVERAGE WAGES PER DAY				
Surface	5.12	5.48		.36
Underground	5.66	6.57		.91
Total	5.50	6.26		.76
WAGES PER MONTH OF 25 DAYS				
Surface	128.00	137.00		9.00
Underground	141.50	164.25		22.75
Total	137.50	156.50		19.00
PRODUCT PER MAN PER DAY				
Surface	8.54	11.77		3.23
Underground	3.47	4.72		1.25
Total	2.47	3.37		.90
LABOR COST PER TON				
Surface	.599	.466	.133	
Underground	1.630	1.391	.239	
Total	2.229	1.857	.372	
AVG. PRODUCT BRK&G & TRM'G	6.86	.8.16		1.30
" WAGES CONTRACT MINERS	5.69	6.73		1.04
" " " TRAMMERS	5.69			
" " " LABOR	5.69	6.73		1.04
TOTAL NUMBER OF DAYS				
Surface	4,037¾	13,253¾		9,216
Underground	9,935½	33,062¾		23,127¼
Total	13,973¼	46,316½		32,343¼
AMOUNT FOR LABOR				
Surface	20660.02	72654.29		51994.27
Underground	56223.20	217064.39		160841.19
Total	76883.22	289718.68		212835.46

Proportion Surface to Underground Men;

1921 - 1 to 2.40
1920 - 1 to 2.27
1919 - 1 to 2.59
1918 - 1 to 3.09
1917 - 1 to 3.32

1-8hr 6 days a week to May 31;
Abandoned June 1, 1921.

LAKE MINE

TIMBER STATEMENT FOR THE YEAR ENDING DECEMBER 31, 1921.

KIND	LINEAL FEET	AVG. PRICE PER FOOT	AMOUNT 1921	AMOUNT 1920
6" to 8" Timber	26,676	.0600	1,601.84	1,165.39
8" to 10" "	14,292	.109	1,557.95	3,962.89
10 to 12 "	7,716	.154	1,188.72	2,653.73
12 to 14 "	1,792	.198	354.64	631.26
Total - 1921	50,476	.093	4,703.15	
Total - 1920	137,297	.0613		8,413.27
	LINEAL FEET	PER 100'		
5' Lagging	117,300	1.04	1,221.71	5,284.51
7'-8'-9'				279.90
Poles	7,980	1.088	86.78	136.70
Total - 1921	125,280	1.04	1,308.49	
Total - 1920	660,309	.863		5,701.11

Product	34,497	156,000
Feet timber per ton of ore	1.463	.880
Feet lagging "	3.400	4.158
Feet lagging per foot of timber	2.482	4.724
Cost per ton for Timber	.136	.0539
" " Lagging	.035	.0357
" " Poles	.002	.0009
" " Timber, Lagging & Poles	.174	.0905
Equivalent of still timber to board measure	87,878	257,912
Ft. Board measure per ton of ore	2.55	1.65

Total cost for timber, lagging & poles -	1921	6011.64
	1920	14114.38
	1919	27040.59
	1918	30668.00
	1917	28753.10
	1916	25050.94

LAKE MINE. - - Mine closed June 1st.

LAKE MINE

STATEMENT OF EXPLOSIVES USED FOR STOPING & DEVELOPING IN ORE (BREAKING ORE)

KIND	QUANTITY	AVERAGE PRICES	AMOUNT 1921	AMOUNT 1920
50% Powder - - - - - - -	7,800	.1850	1,443.00	4,844.05
Total Powder -	7,800	.1850	1,443.00	4,844.05
Fuse - - - - - - - - - -	24,500	8.28	202.86	724.59
Caps - - - - - - - - - -	6,800	13.645	94.23	343.85
Crimpers - - - - - - - -	-	-	-	2.17
Connecting Wire - - - -	-	-	-	1.02
Total Fuse, Etc. -			297.09	1,071.63
Total All Explosives-			1,740.09	5,915.68
Product - - - - - - --- -			34,497	156,000
Pounds Powder per ton of Ore			.226	.172
Cost per ton for Powder			.0418	.0310
" " " " Fuse, Etc.			.0086	.0069
" " " " All Explosives			.0505	.0379
Avg. Price per Lb. for Powder			.1850	.1801

For operating conditions see "Comparative Wages & Product".

ANNUAL REPORT

OF THE

CLIFFS SHAFT MINE (1921)

Production and Shipments.

The Cliffs Shaft Mine worked 114 days in 1921, and produced 66,470 tons of ore, an average of 583 tons per day. Shipments from pocket and stock-pile were not large.

984 tons of rock were produced, all of which was dumped underground.

The mine worked on single shift six days a week until March 26th, and thereafter worked only five days a week until June 1st. On that date the mine was closed, and thereafter no hoisting was done, although a few men were employed underground for three months. During the time the mine was operated only 24 contracts were working and the number of men was kept at approximately 150.

Table I.

Production by Grades.

	Year 1921		Year 1920	
Grade	Tons	Per Cent	Tons	Per Cent
Lump	42,279	63.6	198,836	62.3
Crushed	24,191	36.4	120,315	37.7
Total	66,470	100.0	319,151	100.0

Table II.

Shipments.

Grade	Pocket Tons	Stock-Pile Tons	Total Tons
Lump	6,387	63,473	69,860
Crushed	252	87	339
Total	6,639	63,560	70,199

Table III.

Ore in Stock, Dec. 31st, 1921.

Cliffs Shaft Lump	170,836 Tons
Cliffs Shaft Crushed	148,652 "
Total	319,488 "

Table IV.

Division of Product by Levels.

	"A" Shaft			"B" Shaft			Both Shafts		
Level	Ore Tons	Rock Tons	Total Tons	Ore Tons	Rock Tons	Total Tons	Ore Tons	Rock Tons	Total Tons
1st				7,346		7,346	7,346		7,346
5th	2,451		2,451				2,451		2,451
6th	6,047		6,047	2,489	37	2,526	8,536	37	8,573
7th	7,562	85	7,647	6,412		6,412	13,974	85	14,059
8th	4,235	323	4,558				4,235	323	4,558
9th	7,913		7,913				7,913		7,913
10th	1,913	193	2,106	137		137	2,050	193	2,243
11th	4,393		4,393	4,429	14	4,443	8,822	14	8,836
12th	2,987		2,987	7,625	14	7,639	10,612	14	10,626
13th				471	318	789	471	318	789
14th				60		60	60		60
Total	37,501	601	38,102	28,969	383	29,352	66,470	984	67,454

Table V.

Production by Months.

Month	Days	Ore Per Day Tons	Lump Tons	Crushed Tons	Total Ore Tons	Rock Tons	Total Ore and Rock Tons
January	25	574	9,302	5,051	14,353	318	14,671
February	23	520	7,757	4,193	11,950	160	12,110
March	25	609	9,911	5,315	15,226	146	15,372
April	20	608	7,904	4,259	12,163	218	12,381
May	21	608	7,405	5,373	12,778	142	12,920
Year	114	583	42,279	24,191	66,470	984	67,454

Table VI.

Delays.

Date	Hours	Tons Lost	Cause	Repair Cost
Jan. 20	4	100	Putting in new runners in "A" shaft.	$ 16.58
Jan. 20	2	100	No electric current.	
Feb. 9	1½	75	Cleaning "A" shaft skip-pit.	
Feb. 11	1½	150	Cleaning "A" shaft skip-pit.	
May 26	1	100	Lump stocking-engine house burned.	28.12
Year	10	525		$ 44.70

Table VII.

Delays Due to Lack of Current.

Date	Hours	Tons Lost
Jan. 20	2	100

Table VIII.

Estimate of Ore Reserves.

	"A" Shaft Tons	"B" Shaft Tons	Total Tons
Pillars	981,000	640,000	1,621,000
Floors	1,559,000	1,039,000	2,598,000
Partly Developed	417,000	16,000	433,000
Total	2,957,000	1,695,000	4,652,000
Less 10% Rock	295,000	170,000	465,000
Net Total	2,662,000	1,525,000	4,187,000
To Support Surface	1,476,000	978,000	2,454,000
Available Ore	1,186,000	547,000	1,733,000
Less 10% Rock & 10% Loss in Mining	238,000	109,000	347,000
Net Available Ore Jan. 1, 1922.	948,000	438,000	1,386,000

Recapitulation.

	Developed Tons	Prospective Tons	Total Tons
Available Ore	1,481,000	252,000	1,733,000
Less 10% Rock & 10% Loss in Mining	296,000	51,000	347,000
Net Available Ore	1,185,000	201,000	1,386,000

Factors used:- 8, 9 and 10 cu. ft. per ton.

Table IX.

Ore mined from C.I.M. Co.'s land, - 3,111 Tons

GENERAL.

Labor.

The mine was closed on Saturdays from March 26th to June 1st, and was then closed entirely. A few men were retained for three months making a connection with No. 3 Mine and removing equipment. Some of the older men were put on the pension-roll and places for many of the others were found at other mines and on the county-road, but it was impossible to place all of the old employees.

Wages were decreased 15% on February 1st, 12½% on August 1st, and 10% on October 1st.

New Construction.

After the mine closed, a 50 H.P. boiler and stack were installed in the south room of the dry, and connections were made to the general office and engine-house. A small boiler was also set up in the basement of the laboratory. All other steam and water-connections were shut off and drained.

In March a 2500-gallon oil-storage tank was set up in the basement of the shops, and filled with fuel-oil.

A new double-decked cage for "B" shaft was completed in February.

Fatal Accident.

Oscar Kivinen, a miner, was killed by a fall of ground on January 27th. He and his partner were working on a sub-level in the North Vein between the sixth and seventh levels, taking up the floor of the sixth level to a depth of about fifteen feet. They had returned to their place after blasting, and, while preparing to blast some large chunks, Kivinen was hit on the head by a small piece of ore which apparently fell from the back. No loose pieces were found in the back after the accident.

Kivinen was a Finn, 43 years old, unmarried, and had worked at the mine over fifteen years.

Accidents to Equipment.

On May 26th fire of unknown origin destroyed the engine-house containing the haulage-engine used for stocking lump ore. The sheaves and motor were badly damaged, but not totally destroyed. The entire product was crushed until the mine was closed on June 1st.

On May 28th a strand broke on "A" shaft hoisting-rope, and a new rope was put on.

Power.

On account of shortage of electric power the steam-compressor and steam-pumps were run from January 13th to the middle of March.

The boiler-plant was run until August 29th, and was then closed down and drained.

SURFACE.

Buildings.

The south room in the dry was converted into a boiler-room after the mine closed, the lockers being removed and stored in the next room.

All the mine-buildings except "A" shaft-house, one end of the dry, the laboratory, and the engine-house were closed and locked, and all water-and steam-connections shut off. The office was closed in September, and the superintendent's office moved to the Holmes Mine.

Stock-Piles.

The south-west corner of the lump stock-pile has been loaded and shipped, so that there is now room to erect a trestle, if it should be needed. A platform and chute have been erected on the south side of the crushed ore pocket-track, near the west end of the lump stock-pile, and lump ore is being loaded here with a scraper for all-rail shipments.

Both pocket-tracks have been moved out from the building so that an engine can pass.

UNDERGROUND.

Development.

The most important piece of development-work carried on was the drift and raise at the east end of the eighth level, where connection was made to the bottom of the Incline Mine. This drift was extended east 80 feet, passing through 40 feet of good ore, and a raise was then put up at 50° inclination to the east to the elevation of the bottom level of the Incline Mine, which is 90 feet above the eighth level. Most of this raise, with the exception of the last 30 feet, was in ore. From the top of this raise a drift was driven east 135 feet to the Incline Mine drift, passing through one vein of good ore 47 feet wide and smaller veins of poorer ore. Connection was made on July 26th. The bottom level of the Incline Mine was then cleaned out, a dam built, and a 6-inch siphon-pipe laid through the drift and raise and down to the ninth level in the South-East Deposit of the Cliffs Shaft Mine.

In the North Vein in "A" shaft a raise was completed from the tenth to the ninth levels, 1800 feet east of the shaft, and another raise started above this one to the eighth level. Another contract drifted east on the sixth level in the same vein to a point over these raises.

In "B" shaft a rock-raise was put up from the thirteenth level to the sub-level above the north side of the twelfth level, to eliminate transferring broken ore, and the ore was followed up on the foot-wall from the thirteenth to the twelfth level, 1420 feet west of the shaft. This is important as it shows that there are two veins on the twelfth level.

The Main Vein on the eleventh and twelfth levels was followed west until it narrowed down to drift-size about 1600 feet west of the shaft.

Raises were also put up from the seventh level to the sixth level in the North Deposit in "A" shaft for mining floors.

Stoping.

In "A" shaft three contracts worked on the fifth, sixth and seventh levels in the South-East Deposit, and two more on the ninth level, developing the two limbs of this deposit by breast-stoping. In the Main Vein and North

Deposit the highest workings were on the sixth level, where one gang was stoping in the back 1400 feet east of the shaft. Another gang followed the ore east on the foot-wall of the Main Vein on the seventh level, and two more drove stopes east on the eleventh and twelfth levels. These places were all in ore when the mine closed. One contract mined the floor of the seventh level in the South Lens, milling it into a chute on the eighth level.

In "B" shaft three gangs worked on the sub-levels above the first level. Two of them stoped east on the 1190 foot sub-level in the Main Vein, and the other finished the ore in the bottom of the 1165 foot sub-level in the South Lens close to the south boundary. Three other gangs mined floors in the Main Vein and North Deposit above the sixth, seventh and eleventh levels, and another stoped north-west and south-east on the sub-level above the twelfth level. In this place the limits of the ore have apparently been reached. There was no work in the Fault Vein, except part of one month for one gang on the thirteenth level.

The following table shows the average number of contracts and their occupation up to June 1st.

	"A" Shaft	"B" Shaft	Total
Breast-Stopes	9	5	14
Mining Backs	½	0	½
Mining Floors	½	3	3½
Drifts and Raises in Ore	2	1	3
Drifts and Raises in Rock	2	1	3
Total	14	10	24
Mining Known Reserves	2	5	7
Developing New Ore	10	4	14
Total in Ore	12	9	21

Incline and No. 3 Mines.

Pumping in No. 3 Mine was continued until August. As soon as the siphon-pipe from the bottom of the Incline Mine to the ninth level of the Cliffs Shaft Mine was completed, the pumps were stopped and removed. All the piping

and machinery, except the electric hoist on surface, were removed and stored at the Hard Ore Yard and at the Cliffs Shaft Mine.

The water from No. 3 and the Incline amounts to about 350 gallons per minute, of which approximately 60 gallons is leakage from the Saw-Mill Pit. This increase brings the amount of water handled by the Cliffs Shaft Mine up to about 900 gallons per minute, which is about the same as was handled before pumping was started in the old pits.

There is a strong draft down the Incline Mine, which can probably be controlled so as to make both "A" shaft and "B" shaft upcast, and thereby prevent ice-troubles during the winter months.

CLIFFS SHAFT MINE.

COMPARISON OF COST SHEETS FOR 1920 AND 1921.

In 1921 the Cliffs Shaft Mine worked on single shift six days a week until March 26th, and thereafter five days a week, closing down on Saturdays, until June 1st. On that date the mine was closed, a few men only being retained until some necessary work was completed underground. In 1920 the mine worked with a full crew, hoisting being done on both shifts, until December 1st, and on that date 200 men were laid off and the number of contracts was reduced to 25. This rate of operation was continued until June 1st, 1921.

Wages were decreased 15% on February 1st, 1921, 12½% on August 1st, and again 10% on October 1st.

Pumping was continued in No. 3 Mine until connection was made with the Cliffs Shaft Mine. This was a heavy charge against the small production maintained.

On account of the different rates of production and the changes in the form of the cost sheet it is impossible to make a comparison of the various accounts, that is of any value.

Production.

	1920	1921
Days Worked	298	114
	Tons	Tons
Ore	319,151	66,470
Rock	15,196	984
Ore and Rock	334,347	67,454
Ore Per Day	1,071	583
Rock Per Day	51	9
Ore and Rock Per Day	1,122	592

Labor.

	1920	1921
Average number of men	320	151
Average rate per day	$ 6.38	$ 5.70

Tons Per Man Per Day.

	1920	1921
Surface	11.52	11.63
Underground	4.71	5.63
Total	3.34	3.79

Cost of Production.

	1920	1921
Labor	$ 1.890	$ 1.542
Supplies	.766	.801
Total	$ 2.656	$ 2.343

CLIFFS SHAFT MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1921.

GRADE	IRON	PHOS.	SILICA
Cliffs Shaft Lump,	59.49	.097	5.32
Cliffs Shaft Crushed,	58.62	.094	6.63

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1921.

	Mine		Lake Erie	
GRADE	IRON	PHOS.	IRON	MOIST.
Cliffs Shaft Lump,	59.27	.098	59.52	.35

ORE STATEMENT - DECEMBER 31ST, 1921.

	CL. SHAFT LUMP	CL. SHAFT CRUSHED	TOTAL	TOTAL LAST YEAR
On hand January 1, 1921,	198,417	124,800	323,217	371,401
Output for Year,	42,279	24,191	66,470	319,151
Total,	240,696	148,991	389,687	690,552
Shipments,	69,860	339	70,199	367,335
Balance on Hand,	170,836	148,652	319,488	323,217
Decrease in Output,			252,681	
Decrease in Ore on Hand,			3,729	

1921 -- 1-8 Hour Shift, 6 days per week, Jan. 1st to May 1st, 1921.
1-8 Hour Shift, 5 days per week, May 1st to June 1st, 1921.
Mine closed May 31st, 1921.

1920 -- 1-8 Hour Shift for Year.

CLIFFS SHAFT MINE

SHIPMENTS FOR YEAR 1921

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Lump Cliffs Shaft,	6,387	63,473	69,860	190,611
Crushed Cliffs Shaft,	252	87	339	176,724
Total,	6,639	63,560	70,199	367,335
Total Last Year,	182,588	184,747	367,335	
Decrease,	175,949	121,187	297,136	

CLIFFS SHAFT MINE

COMPARATIVE MINING COST FOR YEAR

	1 9 2 1	1 9 2 0	INCREASE	DECREASE
Product	66,470	319,151		252,681
Underground Costs	1.919	2.197		.278
Surface Costs	.431	.381	.050	
General Mine Accounts	.119	.098	.021	
Cost of Production	2.469	2.676		.207
Original Cost		.157		.157
Plant Account	.063	.027	.035	
Equipment	.016	.008	.008	
Taxes	.632	.321	.311	
Central Office	.072	.093		.021
Contingent Expense	.033		.033	
Idle Expense	1.655		1.655	
Cost Adjustment	.037	.036	.001	
Cost on Stockpile	4.977	3.318	1.659	
Loading & Shipping	.084	.093		.009
Total Cost on Cars	5.061	3.411	1.650	
No.Days Operating	114	298		184
No.Shifts & Hours	1-8hr	1-8hr		
Avg.Daily Product	583	1,071		488
COST OF PRODUCTION				
Labor	1.579	1.901		.322
Supplies	.890	.775	.115	
Total	2.469	2.676		..207

1-8 hr. 6 days a week to March 26;
1-8 hr. 6 " " Mar. 28 to May 31;
Closed June 1, 1921.

CLIFFS SHAFT MINE

COMPARATIVE WAGES AND PRODUCT

	1921	1920	INCREASE	DECREASE
PRODUCT	66,470	319,151		252,681
No.Shifts and Hours	1-8hr	1-8hr		
AVERAGE NO.MEN WORKING				
Surface	27	93		66
Underground	55	227		172
Total	82	320		238
AVERAGE WAGES PER DAY				
Surface	4.75	5.42		.67
Underground	5.87	6.78		.91
Total	5.50	6.38		.88
WAGES PER MONTH OF 25 DAYS				
Surface	118.75	135.50		16.75
Underground	146.75	169.50		22.75
Total	137.50	159.50		22.00
PRODUCT PER MAN PER DAY				
Surface	9.29	11.52		2.23
Underground	4.73	4.71	.02	
Total	3.13	3.34		.21
LABOR COST PER TON				
Surface	.511	.471	.040	
Underground	1.241	1.438		.197
Total	1.752	1.909		.157
AVG.PRODUCT BRK'G & TRM'G	8.69	6.53	2.16	
" WAGES CONTRACT MINERS	6.32	6.82		.50
" " " TRAMMERS	6.62	8.01		1.39
" " " LABOR	6.44	7.26		.82
TOTAL NUMBER OF DAYS				
Surface	7,154½	27,702¾		20,548¼
Underground	14,050½	67,724¾		53,674¼
Total	21,205	95,427½		74,222½
AMOUNT FOR LABOR				
Surface	33986.78	150264.43		116277.65
Underground	82479.36	458929.75		376450.39
Total	116466.14	609194.18		492728.04

Proportion Surface to Underground Men:

1921 - 1 to 2.04
1920 - 1 to 2.44
1919 - 1 to 2.30
1918 - 1 to 3.14
1917 - 1 to 3.25

1-8hr 6 days a week to Mar.26;
1-8hr 6 " " Mar.28 to May 31;
Closed June 1,1921.

CLIFFS SHAFT MINE

STATEMENT OF EXPLOSIVES USED FOR STOPING & DEVELOPING IN ORE (BREAKING ORE)

KIND	QUANTITY	AVERAGE PRICES	AMOUNT 1921	AMOUNT 1920
50% Powder - - - - - - -	52,100	.1849	9,635.50	50,799.92
80% " - - - - - - -	200	.250	50.00	-
Total Powder -	52,300	.1852	9,685.50	50,799.92
Fuse - - - - - - - - - -	78,200	8.21	642.06	3,381.18
Caps - - - - - - - - - -	17,900	14.61	261.59	1,118.53
Crimpers - - - - - - - -	2	1.00	2.00	15.40
Total Fuse, Etc.-			905.65	4,515.11
Total All Explosives-			10,591.15	55,315.03
Product - - - - - - - - -			66,470	319,151
Pounds Powder per ton of Ore			.7868	.8791
Cost per ton for Powder -			.1457	.1591
" " " " Fuse, Caps, Etc.			.0136	.0141
" " " " All Explosives			.1593	.1732
Avg. Price per Lb. for Powder			.1852	.18105

Forces were reduced Dec. 1st, 1920, and mine closed down June 1st, 1921.

ANNUAL REPORT

OF THE

SALISBURY MINE (1921)

Production and Shipments.

The Salisbury Mine worked 53 days in 1921, and produced 20,106 tons of ore of all grades, an average of 379 tons per day. 1,122 tons of rock were hoisted, an average of 21 tons per day.

Some of the Clinton Silica stock-pile was shipped. The Bessemer and Clinton piles were untouched.

The mine was closed on the night of Saturday March 5th, but the pumps were kept running.

Table I.

Production by Grades.

Grade	Year 1921 Total Tons	Year 1921 Per Day Tons	Year 1920 Total Tons	Year 1920 Per Day Tons
Bessemer			162	1
Clinton	10,736	202	54,374	181
Clinton Silica	9,370	177	53,721	179
Total Ore	20,106	379	108,257	361
Rock	1,122	21	4,336	14
Total Ore and Rock	21,228	400	112,593	375

Table II.

Shipments.

20,872 tons of Silica ore were shipped from stock-pile. There were no other shipments.

Table III.

Stock-Pile Balances, December 31st, 1921.

Grade	1921 Tons	1920 Tons
Bessemer	918	918
Clinton	23,193	12,457
Clinton Silica	36,902	48,404
Total	61,013	61,779

Table IV.

Division of Product by Levels.

Level	Clinton Tons	Clinton Silica Tons	Total Ore Tons	Rock Tons	Total Ore and Rock Tons
5th	1,070	3,344	4,414	184	4,598
8th	1,606	4,014	5,620	610	6,230
10th	536	2,012	2,548	164	2,712
12th	1,084		1,084	122	1,206
13th	6,440		6,440	42	6,482
Total	10,736	9,370	20,106	1,122	21,228

Table V.

Production by Months.

Month	Days	Ore Per Day Tons	Clinton Tons	Clinton Silica Tons	Total Ore Tons	Rock Tons	Total Ore and Rock Tons
January	25	386	5,282	4,370	9,652	574	10,226
February	23	380	4,626	4,110	8,736	490	9,226
March	5	344	828	890	1,718	58	1,776
Year	53	379	10,736	9,370	20,106	1,122	21,228

Table VI.

Delays.

There were no delays up to March 5th, the date of closing the mine.

Table VII.

Delays Due to Lack of Current.

There were no delays due to lack of current in 1921.

Table VIII.

Estimate of Ore Reserves.

Developed Ore.

Level	Bessemer Tons	Clinton Tons	Clinton Silica Tons	Total Tons
4th			4,000	4,000
5th			4,000	4,000
8th		3,500	16,500	20,000
9th		2,500	9,000	11,500
10th		5,500	14,500	20,000
11th		4,500	11,000	15,500
12th		7,000	7,000	14,000
13th		8,500		8,500
14th	5,000	22,500		27,500
16th	3,000	11,000	9,000	23,000
Total	8,000	65,000	75,000	148,000
Less 10% Rock and 10% Loss in Mining	1,500	13,000	15,000	29,500
Net Total	6,500	52,000	60,000	118,500

Factors Used:-

Bessemer and Clinton in Place:- 12 cu. ft. per ton.

Silica:- 13 - 15 cu. ft. per ton.

GENERAL.

Labor.

The mine was closed on the night of March 5th. About 80 of the 120 men laid off were sent to the Angeline Mine, where the two crews doubled up, each crew working half-time. A few men were pensioned, a few went to the Holmes Mine and a few to the Morris-Lloyd Mine.

Wages were decreased 15% on February 1st and 12½% on August 1st. A third cut of 10% went into effect on October 1st.

New Construction.

After the boiler-plant was shut down a 100-gallon electrically driven centrifugal pump was set up in the pump-house on the hill to furnish water in case of fire and to supply the Terrace Street houses. This pump came from the Lake Mine.

Surface.

The water-tank at the boiler-house was repaired and filled, and the boiler shut down and cleaned. The air-compressor was laid up and painted, and all water-pipes and steam-pipes drained.

Supplies on hand, except coal, were shipped to other mines or the General Storehouse, as far as practicable. Some mine timber and lagging have been sent to the Holmes Mine.

The four mules were taken up from the fourteenth level when the mine closed. Two of them were in use all summer, and the other two were put in the pasture. The mine-team was sold to the Athens Mine.

UNDERGROUND.

There was no new development during the short time the mine was running.

There were six gangs stoping in the South-East Deposit, and eleven in the Old Mine, nine being in the North Vein and two in the South Vein.

In the South-East Deposit all the ore on the 905 and 895 foot sub-levels, except a little around Raise "EH," was finished, and stoping was started on the 890 foot sub-level and on the thirteenth level. The raises on the 890, 895 and 905 foot sub-levels were covered over, and no attempt made to keep open the workings on these sub-levels, after the mine was closed.

Above the fifth level two gangs scrammed around the old workings east of No. 2 shaft pillar, working on the 1334 and 1240 foot sub-levels, and further east two more gangs finished the ore above the level in the raising stopes 700 and 800 feet south-east of the shaft.

Below the fifth level two gangs were stoping on the 1205 and 1185 foot sub-levels near the hanging-wall, about 800 feet south-east of the shaft, and a third mined back part of their drift west of No. 2 shaft.

Below the eighth level one gang continued stoping in the old caved room at the east end of the North Vein on the 1100 foot sub-level, and another opened out in the same raise 15 feet lower down.

In the South Vein one gang stoped most of the ore remaining on the east foot-wall on the ninth level, and another put up a raise from the 1000 foot sub-level on the south foot-wall, and started to mine the ore found last year near the old workings.

The changes in the workings since the last annual report were very slight.

SALISBURY MINE.

COMPARISON OF COST SHEETS FOR 1920 AND 1921.

As the Salisbury Mine worked only 53 days in 1921 no satisfactory comparison of costs with 1920 can be made. The average tons per man and daily production were slightly higher in 1921 during the working period.

Wages were decreased 15% on February 1st, 1921; 12½% on August 1st; and 10% on October 1st.

Production.

	1920	1921
Days Worked	300	53
	Tons	Tons
Ore	108,257	20,106
Rock	4,336	1,122
Ore and Rock	112,593	21,228
Ore Per Day	361	379
Rock Per Day	14	21
Ore and Rock Per Day	375	400

Labor.

	1920	1921
Average number of men	129	125
Average rate per day	$ 6.08	$ 5.70

Tons Per Man Per Day.

	1920	1921
Surface	12.45	12.57
Underground	3.69	3.85
Total	2.82	2.95

Cost of Production.

	1920	1921
Labor	$ 2.162	$ 1.961
Supplies	.599	.668
Total	$ 2.761	$ 2.629

SALISBURY MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1921.

GRADE	IRON	PHOS.	SILICA
Salisbury Bessemer,	(No Production)		
Clinton,	59.07	.111	8.61
Clinton Silica,	50.41	.085	21.72

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1921.

GRADE	Mine IRON	Mine PHOS.	Mine SILICA	Lake Erie IRON	Lake Erie MOIST.
Salisbury Bessemer,	(No Shipments)				
Clinton,	(No Shipments)				
Clinton Silica,	50.26	.081	22.60	50.55	10.53

ORE STATEMENT - DECEMBER 31ST, 1921.

	SALISBURY BESSEMER	CLINTON	CLINTON SILICA	TOTAL	TOTAL LAST YEAR
On hand January 1, 1921,	918	12,457	48,404	61,759	48,662
Output for Year,	0	10,736	9,370	20,106	108,257
Total,	918	23,193	57,774	81,865	156,919
Shipments,	0	0	20,872	20,872	95,140
Balance on Hand,	918	23,193	36,902	60,993	61,759
Decrease in Output,				88,151	
Decrease in Ore on Hand,				766	

1921 -- 2-8 Hour Shifts Jan. 1st to March 6th, 1921.
Mine closed March 5th, 1921.

1920 -- 2-8 Hour Shifts for Year.

SALISBURY MINE

SHIPMENTS FOR YEAR-1921

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Salisbury Bessemer,	0	0	0	0
Clinton,	0	0	0	48,667
Clinton Silica,	0	20,872	20,872	46,473
Total,	0	20,872	20,872	95,140
Total Last Year,	32,593	62,547	95,140	
Decrease,			74,268	

SALISBURY MINE

COMPARATIVE MINING COST FOR YEAR

	1921	1920	INCREASE	DECREASE
Product	20,106	108,257		88,151
Underground Costs	2.120	2.266		.146
Surface Costs	.347	.363		.016
General Mine Accounts	.170	.153	.017	
Cost of Production	2.637	2.782		.145
Plant Account	.014		.014	
Equipment	.011	.003	.008	
Taxes	.067	.052	.015	
Central Office	.112	.100	.012	
Contingent Expense	.041		.041	
Idle Expense	1.666		1.666	
Cost Adjustment	.058	.023	.035	
Cost on Stockpile	4.606	2.960	1.646	
Loading & Shipping	.047	.088		.041
Total Cost on Cars	4.653	3.048	1.605	
No.Days Operating	53	300		247
No.Shifts & Hours	2-8hr	2-8hr		
Average Daily Product	379	361		18
COST OF PRODUCTION				
Labor	1.961	2.175		.214
Supplies	.676	.607	.609	
Total	2.637	2.782		.145

2-8 hr. 6 days a week to March 5th;
Closed March 6, 1921.

SALISBURY MINE

COMPARATIVE WAGES AND PRODUCT

	1 9 2 1	1 9 2 0	INCREASE	DECREASE
PRODUCT	20,106	108,257		88,151
No.Shifts and Hours	2-8	2-8		
AVERAGE NO.MEN WORKING				
Surface	9	29		20
Underground	23	100		77
Total	32	129		97
AVERAGE WAGES PER DAY				
Surface	4.99	5.44		.45
Underground	5.68	6.26		.58
Total	5.49	5.08		.59
WAGES PER MONTH OF 25 DAYS				
Surface	124.75	136.00		12.25
Underground	142.00	156.50		14.50
Total	137.25	152.00		14,75
PRODUCT PER MAN PER DAY				
Surface	8.05	12.45		4.61
Underground	3.09	3.61		.52
Total	2.23	2.80		.58
LABOR COST PER TON				
Surface	.610	.437	.183	
Underground	1.839	1.733	.106	
Total	2.459	2.170	.289	
AVG.PRODUCT BRK'G ' TRM'G	5.36	5.14	.22	
" WAGES CONTRACT MINERS	6.20	6.56		.36
" " " TRAMMERS	4.90	5.24		.34
" " " LABOR	5.91	6.25		.34
TOTAL NUMBER OF DAYS				
Surface	2,498¼	8,693¼		6,195
Underground	6,506½	29,957¼		23,450¾
Total	9,004¾	38,650½		29,645¾
AMOUNT FOR LABOR				
Surface	12457.72	47317.27		34859.55
Underground	36972.68	187639.04		150666.36
Total	49430.40	234956.31		185525.91

Proportion Surface to Underground Men:

1921 - 1 to 2.55
1920 - 1 to 3.7
1919 - 1 to 3.23
1918 - 1 to 3.13
1917 - 1 to 2.68

2-8hr 6 days a week to March 5th.
Closed March 6, 1921.

SALISBURY MINE.

TIMBER STATEMENT FOR THE YEAR ENDING DECEMBER 31, 1921.

KIND	LINEAL FEET	AVG. PRICE PER FOOT	AMOUNT 1921	AMOUNT 1920
6" to 8" Timber	2,922	.0364	106.24	924.51
8" to 10" "	5,136	.0782	401.52	1,238.18
10 to 12 "	5,590	.0958	535.68	647.50
12 to 14 "	160	.121	19.36	85.81
Total - 1921	13,808	.0769	1,062.80	
Total - 1920	52,772	.0550		2,913.50
	LINEAL FEET	PER 100'		
5' Lagging	70,337	.978	688.10	2,887.83
7' "	27,467	.867	237.17	956.28
Total Lagging	97,804	.946	925.27	3,844.11
Poles	27,950	1.18	329.66	1,416.25
Total - 1921	125,754	1.005	1,264.93	
Total - 1920	507,702	1.0361		5,260.36

Product	20,106	106,642
Feet timber per ton of ore	.686	.495
Feet lagging "	4.864	3.660
Feet lagging per foot of timber	7.083	7.397
Cost per ton for timber	.0528	.02732
" " lagging	.0460	.03604
" " poles	.0164	.01328
" " timber, lagging & poles	.1152	.07664
Equivalent of still timber to board measure	28,189	78,467
Ft. board measure per ton of ore	1.402	.0736

Total cost for timber, lagging & poles -	1921	2327.73
	1920	8173.86
	1919	9212.36
	1918	8615.93
	1917	8213.84
	1916	6932.89

SALISBURY MINE

STATEMENT OF EXPLOSIVES USED FOR STOPING & DEVELOPING IN ORE (BREAKING ORE)

KIND	QUANTITY	AVERAGE PRICES	AMOUNT 1921	AMOUNT 1920
40% Powder - - - - - - - -	2,250	.169	381.96	2,247.47
50% " - - - - - - - -	4,300	.175	753.30	7,191.29
Total Powder -	6,550	.173	1,135.26	9,438.76
Fuse - - - - - - - - - - -	20,800	8.21	170.70	1,336.89
Caps - - - - - - - - - - -	5,100	14.62	74.58	516.58
Crimpers - - - - - - - - -	-	-	-	3.60
Total Fuse, Etc.-			245.28	1,857.07
Total All Explosives -			1,380.54	11,295.83
Product - - - - - - - - -			20,106	106,642
Pounds Powder per ton of Ore			.326	.203
Cost per ton for Powder			.056	.088
" " " " Fuse, Caps, Etc.			.012	.017
" " " " All Explosives			.068	.105
Avg. Price per Lb. for Powder			.173	.1798

Production ceased March 5th, 1921.

ANNUAL REPORT

OF THE

ANGELINE MINE (1921)

Production and Shipments.

The Angeline Mine worked 124 days in 1921, and produced 22,000 tons of ore of all grades, an average of 177 tons per day. All the ore came from "D" shaft.

The mine was closed down on June 1st.

No shipments were made from either pocket or stock-pile.

1,670 tons of rock were hoisted, an average of 13 tons per day.

Table I.

Production by Grades.

Grade	Year 1921 Total Tons	Year 1921 Per Day Tons	Year 1920 Total Tons	Year 1920 Per Day Tons
Angeline Bessemer	21,380	172	33,448	112
Angeline			7,630	26
Angeline Silica			5,771	19
Hard Bessemer	620	5	1,146	4
Total	22,000	177	47,995	161

Table II.

Stock-Pile Balances.

Grade	1921 Tons	1920 Tons
Angeline Bessemer	28,306	6,926
Angeline	3,810	3,810
Angeline Silica	6,432	6,432
Hard Bessemer	746	126
Total	39,294	17,294

Table III.

Production by Levels.

Level	Angeline Bessemer Tons	Hard Bessemer Tons	Total Ore Tons	Rock Tons	Total Ore and Rock Tons
Fourth	21,380		21,380	620	22,000
Seventh		620	620	1,050	1,670
Total	21,380	620	22,000	1,670	23,670

Table IV.

Production by Months.

Month	Days	Ore Tons Per Day	Angeline Bessemer Tons	Hard Bessemer Tons	Total Ore Tons	Rock Tons	Total Ore and Rock Tons
January	25	173	4,314		4,314	380	4,694
February	23	128	2,941		2,941	604	3,545
March	26	145	3,747	35	3,782	350	4,132
April	25	204	5,000	102	5,102	14	5,116
May	25	234	5,378	483	5,861	322	6,183
Year	124	177	21,380	620	22,000	1,670	23,670

Table V.

Delays.

Date	Hours	Tons Lost	Cause	Repair Cost
Jan. 22	4	100	Chute broken underground	$ 299.02
Mar. 16	8	100	Chute broken down.	180.86
Mar. 17	12	145	Chute broken down.	70.00
Apr. 13	4	50	Electric locomotive broken down.	7.23
May 9	6	80	Chute broken down.	163.32
Year	34	475		$ 720.43

Table VI.

Delays Due to Lack of Current.

There were no delays from lack of electric current in 1921.

Table VII.

Estimate of Ore Reserves.

Developed Ore.

Sub-Level	Angeline Bessemer Tons
1318	4,600
1310	5,300
1290	5,000
1274	1,500
1258	2,300
Total	18,700
Less 10% Mining Loss and 10% Rock	3,700
Net Total	15,000

A factor of 12 cu. ft. per ton was used. All the ore is near No. 56 raise above the fourth level. The prospective hard ore estimated last year was not included this year, because its situation and physical condition made it impossible to mine it at a profit.

The mine has been abandoned, and the amount of ore in sight is not sufficient to pay the cost of reopening.

General.

Beginning March 14th, the men previously employed at the Angeline Mine worked only half-time, their places being taken every other week by men from the Salisbury Mine.

The mine was closed down on June 1st, and all equipment was removed from underground, except the pumps and the track on the fourth level. Pumping was continued after June 10th for the remainder of the year at the request and expense of the Oliver Iron Mining Co.

The sub-level cars, one locomotive, and most of the tools and supplies were sent to the Holmes Mine. The other locomotive was sent to the Maas Mine, but the motor-cars were stored at the mine.

Shaft.

During the last three months of the year the Oliver Iron Mining Co. made some repairs in the shaft and built two concrete dams on the seventh level, in preparation for the installation of two Layne and Bowler pumps.

Underground.

In the Hard Ore Vein above the seventh level near the west boundary one contract worked on the 1178 foot sub-level drifting from Raise 7 F. to the open stopes further west. So many of the old stopes and raises have caved and are filled with rock that it will be impossible to mine this ore at a profit.

Nine contracts continued working in the pillar around No. 56 timber raise. They finished the 1328 foot sub-level and the south half of the 1318 foot sub-level, and opened and partly mined another sub-level at 1310 feet. This sub-level is under the south part of the 1318 foot sub-level and also west of Raise 4A. Here the ore opened up better than was expected, and there is a chance for more ore further west near the boundary. Ore was also opened on the 1274 and 1258 foot sub-levels east of Raise 4C, and there is a strong probability that more ore will be found to the east on the 1258 foot sub-level.

In January and in April there was trouble with water in the chutes in Raise 4A, causing considerable delay.

ANGELINE MINE.

COMPARISON OF COST SHEETS FOR 1920 AND 1921.

The Angeline Mine worked on double-shift in 1921, operations being confined entirely to "D" shaft. Drifting and raising in the Hard Ore Vein produced little ore in either 1920 or 1921, and the work in rock was expensive.

Wages were decreased 15% on February 1st.

On account of the short period of operation in 1921 it is impossible to make a satisfactory comparison of expenditures for the two years.

Production.

	1920	1921
Days Worked	298	124
	Tons	Tons
Ore	47,995	22,000
Rock	2,254	1,670
Ore and Rock	50,249	23,670
Ore Per Day	161	177
Rock Per Day	8	13
Ore and Rock Per Day	169	190

Labor.

	1920	1921
Average number of men	68	73
Average rate per day	$ 6.12	$ 5.30

Tons Per Man Per Day.

	1920	1921
Surface	9.78	10.00
Underground	2.57	3.18
Total	2.34	2.42

Cost of Production.

	1920	1921
Labor	$ 2.647	$ 2.229
Supplies	.770	.682
Total	$ 3.417	$ 2.911

ANGELINE MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1921.

GRADE	IRON	PHOS.	SILICA
Angeline "D" Shft. Bess.	62.96	.032	6.82
Angeline Hard Bessemer,	62.38	.040	7.21

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1921.

GRADE	Mine IRON	PHOS.
Angeline "D" Shft. Bess.	(No Shipments)	
Angeline Hard Bessemer,	(No Shipments)	

ORE STATEMENT - DECEMBER 31ST, 1921.

	"D" SHFT. BESSEMER	"D" SHFT. ANGELINE	ANG. SILICA	"D" SHFT. HARD BESSEMER	TOTAL	TOTAL LAST YEAR
On hand Jan. 1, 1921,	6,926	3,810	6,432	126	17,294	12,099
Output for Year,	21,380	0	0	620	22,000	47,995
Total,	28,306	3,810	6,432	746	39,294	60,094
Shipments,	0	0	0	0	0	42,799
Balance on Hand,	28,306	3,810	6,432	746	39,294	17,294
Decrease in Output,					25,995	
Increase in Ore on Hand,					22,000	

1921 -- 2-8 Hour Shifts Jan. 1st to June 1st, 1921.
Mine closed May 31st, 1921.

1920 -- 2-8 Hour Shifts for Year.

ANGELINE MINE

SHIPMENTS FOR YEAR 1921

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
"D" Shaft Bessemer,	0	0	0	29,560
"D" Shaft Angeline,	0	0	0	12,193
Angeline Silica,	0	0	0	0
"D" Shaft Hard Bessemer,	0	0	0	1,047
Total,	0	0	0	42,800
Total Last Year,	22,564	20,236	42,800	
Decrease,			42,800	

ANGELINE MINE

COMPARATIVE MINING COST FOR YEAR

	1921	1920	INCREASE	DECREASE
Product	22,000	47,995		25,995
Underground Costs	2.530	2.820		.290
Surface Costs	.316	.392		.076
General Mine Accounts	.176	.205		.029
Cost of Production	3.022	3.417		.395
Plant Account	.154	.430		.276
Equipment		.001		.001
Taxes	.068	.087		.019
Central Office	.104	.119		.005
Contingent Expense	.065		.065	
Idle Expense	.319		.319	
Cost Adjustment	.047	.048		.001
Cost on Stockpile	3.779	4.102		.323
Loading & Shipping		.082		.082
Total Cost on Cars	3.779	4.184		.405
No.Days Operating	124	299		175
No.Shifts & Hours	2-8hr	2-8hr		
Average Daily Product	177	161	16	
COST OF PRODUCTION				
Labor	2.229	2.647		.418
Supplies	.793	.770	.023	
Total	3.022	3.417		.395

2-8 hr. 6 days a week to May 31st.
Mineabandoned June 1, 1921.

ANGELINE MINE

COMPARATIVE WAGES AND PRODUCT

	1 9 2 1	1 9 2 0	INCREASE	DECREASE
PRODUCT	22,000	47,995		25,995
No.Shifts and Hours	2-8hr	2-8hr		
AVERAGE NO.MEN WORKING				
Surface	8	16		8
Underground	24	53		29
Total	32	69		37
AVERAGE WAGES PER DAY				
Surface	4.75	5.38		.63
Underground	5.46	6.34		.88
Total	5.27	6.12		.85
WAGES PER MONTH OF 25 DAYS				
Surface	118.75	134.50		15.75
Underground	136.50	158.50		22.00
Total	131.75	153.00		21.75
PRODUCT PER MAN PER DAY				
Surface	8.96	9.78		.82
Underground	3.16	2.57	.59	
Total	2.33	2.34		.01
LABOR COST PER TON				
Surface	.530	.551		.021
Underground	1.730	2.066		.336
Total	2.260	2.617		.357
AVG.PRODUCT BRK'G & TRM'G	4.13	4.92		.79
" WAGES CONTRACT MINERS	5.54	6.98		1.44
" " " TRAMMERS		Co.Acct		
" " " LABOR	5.54	6.98		1.44
TOTAL NO. OF DAYS				
Surface	2,454¾	4,906		2,451¼
Underground	6,972¾	15,638¼		8,665½
Total	9,427½	20,544¼		11,116¾
AMOUNT FOR LABOR				
Surface	11651.17	26428.07		14,776.90
Underground	38069.39	99194.36		61124.97
Total	49720.56	125622.43		75,901.87

Proportion Surface to Underground Men:

1921 - 1 to 3.
1920 - 1 to 3.3
1919 - 1 to 1.62
1918 - 1 to .88

2-8hr 6 days week to May 31st.
Abandoned June 1, 1921.

ANGELINE MINE

TIMBER STATEMENT FOR THE YEAR ENDING DECEMBER 31, 1921.

KIND	LINEAL FEET	AVG. PRICE PER FOOT	AMOUNT 1921	AMOUNT 1920
6" to 8" Timber	6,040	.058	351.28	894.90
8" to 10 "	5,266	.109	572.90	932.81
10 to 12 "	3,174	.124	394.01	1,065.26
12 to 14 "	1,746	.174	303.61	465.21
Total - 1921	16,226	.0999	1,621.80	
Total - 1920	54,668	.061		3,358.18
	LINEAL FEET	PER 100'		
5' Lagging	46,750	1.13	527.03	1,442.68
7' "				527.67
Total - Lagging	46,750	1.13	527.03	1,970.35
Poles	41,836	1.84	770.38	445.59
Total - 1921	88,586		1,297.41	
Total - 1920	246,629			2,415.94

Product	22,000	47,995
Feet timber per ton of ore	.738	1.14
Feet lagging "	2.125	4.41
Feet Lagging per ft. of timber	3.47	3.93
Cost per ton for timber	.0737	.069
" lagging	.0239	.041
" poles	.035	.009
" timber, lagging & poles	.1326	.119
Equivalent of stull timber to board measure	119,632	97,119
Feet board measure per ton of ore	5.44	2.02

Total cost per timber, lagging & poles - 1921 2919.21
1920 5774.12
1919 2514.53
1918

Mine closed May 31, 1921.

ANGELINE MINE.

ANGELINE MINE

STATEMENT OF EXPLOSIVES USED FOR STOPING & DEVELOPING IN ORE (BREAKING ORE)

KIND	QUANTITY	AVERAGE PRICES	AMOUNT 1921	AMOUNT 1920
40% Powder - - - - - - -	200	.1725	34.50	- -
50% " - - - - - - -	4,800	.181	914.28	3,391.54
60% " - - - - - - -	200	.2215	44.30	17.73
Total Powder -	5,200	.191	993.08	3,409.27
Fuse - - - - - - - - - -	22,200	8.308	184.45	394.80
Caps - - - - - - - - - -	5,900	14.70	86.77	178.65
Crimpers - - - - - - - -	21	1.02	21.40	12.75
Total, Fuse, Etc. -			292.62	586.20
Total All Explosives-			1,285.70	3,995.47
Product - - - - - - - -			22,000	47,995
Pounds Powder per ton of Ore			.203	.389
Cost per ton for Powder			.045	.071
" " " " Fuse, Etc.			.013	.012
" " " " All Explosives			.058	.083
Avg. Price per Lb. for Powder			.191	.183

For operating conditions see "Comparative Wages & Product".

ANNUAL REPORT

OF THE

HOLMES MINE (1921)

Production and Shipments.

The Holmes Mine worked 289 days in 1921, and produced 178,000 tons of ore, an average of 616 tons per day. The mine worked double-shift full time until March 5th, and from that date to June 1st worked five days a week. On June 1st the night-shift was discontinued, and two crews worked on day-shift on alternate weeks, six days a week.

Shipments during the season were very light and ore was stocked all summer, leaving a very large balance on hand at the end of the year. Additional room was provided for stocking the winter's output.

13,635 tons of rock were produced, an average of 47 tons per day.

Table I.

Production by Grades.

Grade	1921 Tons	1920 Tons
Holmes Bessemer	52,041	76,977
Holmes	7,813	21,738
Junction Bessemer	24,636	15,229
Junction	93,510	117,863
Total	178,000	231,807

Table II.

Shipments.

Grade	Pocket Tons	Stock-Pile Tons	Total Tons
Holmes	149	19,960	20,109
Junction Bessemer	4,111	12,236	16,347
Junction	1,403	4,084	5,487
Total	5,663	36,280	41,943

Table III.

Stock-Pile Balances, December 31st, 1921.

Grade	Tons
Holmes Bessemer	100,126
Holmes	46,072
Junction Bessemer	10,783
Junction	127,351
Total	284,332

Table IV.

Division of Product by Levels.

Level	Holmes Bessemer Tons	Holmes Tons	Junction Bessemer Tons	Junction Tons	Total Ore Tons	Rock Tons	Total Ore and Rock Tons
First				25,016	25,016	260	25,276
Second	43,266	1,786	19,103	54,944	119,099	6,120	125,219
Third	6,171	3,433	4,424	10,957	24,985	4,998	29,983
Fourth	2,604	2,594	1,109	2,593	8,900	2,257	11,157
Total	52,041	7,813	24,636	93,510	178,000	13,635	191,635

Table V.

Production by Months.

Month	Days	Ore Per Day Tons	Holmes Bessemer Tons	Holmes Tons	Junction Bessemer Tons	Junction Tons	Total Ore Tons	Rock Tons	Total Ore and Rock Tons
January	25	843	7,155	746	1,439	11,748	21,088	1,619	22,707
February	23	825	5,684	1,463	1,712	10,118	18,977	1,135	20,112
March	22	890	6,094	1,256	3,201	9,022	19,573	1,585	21,158
April	20	749	5,047	1,030	1,066	7,836	14,979	1,400	16,379
May	21	907	6,022	1,211	3,328	8,494	19,055	1,336	20,391
June	25	471	3,113	238	672	7,748	11,771	544	12,315
July	25	469	2,653	507	2,124	6,453	11,737	1,109	12,846
August	27	463	2,660	136	1,740	7,969	12,505	1,473	13,978
September	25	462	2,836	24	2,955	5,742	11,557	1,128	12,685
October	26	490	3,267	375	2,185	6,904	12,731	698	13,429
November	24	460	4,078	268	864	5,824	11,034	762	11,796
December	26	481	3,432	559	2,861	5,652	12,504	846	13,350
Year	289	614	52,041	7,813	24,147	93,510	177,511	13,635	191,146
Stock-Pile Overrun		2			489		489		489
Total	289	616	52,041	7,813	24,636	93,510	178,000	13,635	191,635

Table VI.

Delays.

Date	Hours	Tons Lost	Cause	Repair Cost
Apr. 20	3½	100	Compressor-motor burned out.	$ 46.23
Apr. 21	11½	650	No air. Compressor-motor burned out.	57.53
May 26	2¼	25	Repairing runners in skip-road.	12.48
June 1	3	175	No current. Coil on converter burnt out.	25.18
Total	20¼	950		$ 141.42

Table VII.

Estimate of Ore Reserves.

Developed Ore.

Level	Holmes Bessemer Tons	Holmes Tons	Junction Bessemer Tons	Junction Tons	Total Ore Tons
Second	27,000	2,000	20,000	147,000	196,000
Third	198,000	48,000	100,000	532,000	878,000
Fourth	91,000	90,000	130,000	701,000	1,012,000
Total	316,000	140,000	250,000	1,380,000	2,086,000
Less 10% Rock and 10% Loss in Mining	64,000	28,000	50,000	276,000	418,000
Net Total	252,000	112,000	200,000	1,104,000	1,668,000

Prospective Ore.

Level	Holmes Bessemer Tons	Holmes Tons	Junction Bessemer Tons	Junction Tons	Total Ore Tons
Fourth	6,000	10,000			16,000
Below Fourth	____	____	50,000	293,000	343,000
Total	6,000	10,000	50,000	293,000	359,000
Less 10% Rock and 10% Loss in Mining	1,000	2,000	10,000	59,000	72,000
Net Total	5,000	8,000	40,000	234,000	287,000
Total Ore	257,000	120,000	240,000	1,338,000	1,955,000

Factors Used:- Hard Ore - 9 cu. ft. per ton.

Soft Ore - 12 cu. ft. per ton.

The extent of the hard ore was pretty definitely determined by developments on the 340 and 240 foot sub-levels, and the soft ore areas were slightly increased on these sub-levels also.

GENERAL.

Labor.

When the Salisbury Mine closed on March 5th, some of the single men at the Holmes Mine were laid off to make places for older hands, and, when the Holmes Mine went on single shift on June 1st, all single men, except a few who were supporting families, and all married men employed less than four years were laid off, to make places for older hands from the other mines. During the remainder of the year two full crews were worked on alternate weeks on day-shift.

Wages were reduced 15% on February 1st, 12½% on August 1st and 10% on October 1st.

New Construction.

50,000 square feet of new stock-pile floor were graded and rolled south of Excelsior Street, and nearly as much more room was prepared at the south end of the Junction Bessemer and Holmes Bessemer stock-piles.

A transmission-line was built from the engine-house south to the cave on Section 16, where an electric pump was erected by the Oliver Iron Mining Co. for draining the swamp.

Exploration.

Underground Diamond Drilling.

On January 4th a drill was taken underground, and six holes were drilled from the west drift on the third level towards the foot-wall and hanging, and three from the west end of the west drift on the fourth level. None of these holes found any new ore.

Accidents to Equipment.

On April 20th in a thunder-storm lightning struck the transmission line between the Holmes and Cliffs Shaft Mines, and set the engine-house on fire. The switch-board and motor for the air-compressor were injured, causing a delay of fifteen hours. The switch-board was replaced later in the year.

Power.

Compressed air was furnished to the Angeline Mine up to June 1st and to the Lake Mine from March 18th to June 1st.

SURFACE.

Stock-Piles.

The Junction Bessemer stock-pile was shipped in May to make room for Junction ore, and a new place for stocking Junction Bessemer was prepared and a trestle erected south of the Holmes stock-pile. Additional room was prepared for Holmes Bessemer ore along the west side and on the south end of that pile, and a new floor and trestle were built south of the new Excelsior Street to make room for Junction ore. Only 4,000 tons of Junction ore and 20,000 tons of Holmes ore were shipped from stock-pile. The amount of ore in stock at the end of the year is the largest in the history of the mine.

UNDERGROUND.

Development.

The 340 and 240 foot sub-levels, half way between the second and third levels and between the third and fourth levels respectively, were nearly all opened up, and the outline of the ore determined. Nineteen new raises were also put up. The bottom of the hard ore was found on the south side of the 240 foot sub-level, but it extended below this elevation at the west end of the mine.

The only development above the second level was on the 445 foot sub-level, where some medium grade hematite was opened up between the hard ore and the foot-wall, 300 feet west of the east boundary line. Five new raises were put up from the second level in the soft ore.

Stoping.

All the ore remaining above the first level was mined. The 510 and 500 foot sub-levels were finished early in the year, and the ore along both sides of the foot-wall drift was robbed back.

The ore along the south boundary was mined down to the old shrinkage stope put up by the Oliver Iron Mining Co., and there are now two gangs working in this ore on the 420 foot sub-level. The soft ore along the south boundary has also been mined down to this sub-level. Going north and west the sub-levels in the soft ore are successively higher, and stoping is going on on the 420, 435, 440, 445, 450, 460 and 470 foot sub-levels.

The hard ore left in pillars between the shrinkage-stopes put up from the second level in the year production started has been mined down to the 410 foot sub-level at the west end, and down to the 435 foot sub-level further east.

One contract has been stoping in the hard ore above the third level at the west end of the mine, but the ore is very narrow here, and its extraction will not disturb the surface.

There have been twenty nine gangs working during most of the year, of which, on the average, sixteen have been stoping, eleven drifting and raising in ore, one repairing and one in rock. A large amount of rock had to be handled while stoping and drifting in ore, which is not included in the above. There are innumerable small dikes in the ore-body, especially above the second level, which make it impossible to lay out stoping operations on rectangular lines. The soft ore below the first level has also been very hard and tough, requiring more holes and more powder to break it than much of the hard ore, but this condition will be better below the second level. The average number of contracts for the year in hard ore was ten and in soft ore eighteen.

HOLMES MINE.

COMPARISON OF COST SHEETS FOR 1920 AND 1921.

The Holmes Mine worked on double-shift throughout 1920, but in 1921 it worked on double-shift six days a week until March 5th, then five days a week until June 1st, and thereafter on single-shift six days a week. The proportion of development to stoping was large, but there was not as much rock-work as in 1920.

Wages were decreased 15% on February 1st, 12½% on August 1st, and 10% on October 1st, making the average rate 20% less than in 1920.

On account of the change in the form of the cost sheet and the different rates of production in 1920 and 1921 no satisfactory comparison of the expenditures for the two years can be made.

Production.

	1920	1921
Days Worked	299	289
	Tons	Tons
Ore	231,807	178,000
Rock	29,157	13,635
Ore and Rock	260,964	191,635
Ore Per Day	775	616
Rock Per Day	98	47
Ore and Rock Per Day	873	663

Labor.

	1920	1921
Average number of men	232	164
Average rate per day	$ 6.09	$ 5.02

Tons Per Man Per Day.

	1920	1921
Surface	11.94	12.81
Underground	4.36	5.29
Total	3.20	3.74

Cost of Production.

	1920	1921
Labor	$ 1.854	$1.378
Supplies	.780	.737
Total	$ 2.634	$2.115

HOLMES MINE

AVERAGE MINE ANALYSIS ON OUTPUT FOR YEAR 1921

GRADE	IRON	PHOS.	SILICA
Holmes Bessemer,	62.07	.030	6.11
Holmes Crushed,	61.96	.065	6.38
Junction Bessemer,	62.61	.038	4.86
Junction,	57.61	.076	8.10

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR 1921

GRADE	Mine IRON	Mine PHOS.	Lake Erie IRON	Lake Erie PHOS.	Lake Erie MOIST.
Holmes Bessemer,	(No Shipments)				
Holmes Crushed,	61.65	.064	61.39		4.26
Junction Bessemer,	63.32	.038	63.11	.040	6.28
Junction,	(All Mixed)				

ORE STATEMENT - DECEMBER 31ST, 1921.

	BESS. CRUSHED	HOLMES CRUSHED	JUNCTION BESSEMER	JUNCTION	TOTAL	TOTAL LAST YEAR
On hand January 1, 1921,	48,085	58,368	2,494	39,328	148,275	103,754
Output for Year,	52,041	7,813	24,147	93,510	177,511	230,860
Stockpile Overrun,			489		489	947
Total,	100,126	66,181	27,130	132,838	326,275	335,561
Shipments,	0	20,109	16,347	5,487	41,933	187,286
Balance on Hand,	100,126	46,072	10,783	127,351	284,342	148,275
Decrease in Output,					53,807	
Increase in Ore on Hand,					136,067	

1921 -- 2-8 Hour Shifts Jan. 1st to March 5th, 1921.
2-8 Hour Shifts, 5 days per week, March 5th to June 1st, 1921.
1-8 Hour Shift, 6 days per week, June 1st to Dec. 31st, 1921.

1920 -- 2-8 Hour Shifts for Year.

HOLMES MINE

SHIPMENTS FOR YEAR 1921

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR
Holmes Bessemer Crushed,	0	0	0	49,258
Holmes Crushed,	149	19,960	20,109	3,806
Junction Bessemer,	4,111	12,236	16,347	13,153
Junction,	1,403	4,084	5,487	121,069
Total,	5,663	36,280	41,933	187,286
Total Last Year,	103,462	83,824	187,286	
Decrease,			145,353	

HOLMES MINE

COMPARATIVE MINING COST FOR YEAR

	1 9 2 1	1 9 2 0	INCREASE	DECREASE
PRODUCT	178,000	231,807		53,807
Underground Costs	1.667	2.158		.491
Surface Costs	.312	.307	.005	
General Mine Accounts	.136	.104	.032	
Cost of Production	2.115	2.569		.454
Original Cost	.002	.002		
Plant Account	.506	.500	.006	
Taxes	.267	.127	.140	
Central Office	.088	.085	.003	
Contingent Expense	.045		.045	
Cost Adjustment	.089	.097		.008
Cost on Stockpile	3.114	3.382		.268
Loading & Shipping	.013	.057		.044
Total Cost on Cars	3.127	3.439		.312
No.Days Operating	289	299		10
No.Shifts & Hours	2-8;1-8	2-8		
Avg.Daily Product	616	775		159
COST OF PRODUCTION				
Labor	1.378	1.854		.476
Supplies	.737,	.715	.022	
Total	2.115	2.569		.454

HOLMES MINE

COMPARATIVE WAGES AND PRODUCT

	1 9 2 1	1 9 2 0	INCREASE	DECREASE
PRODUCT	178,000	231,807		53,807
No.Shifts and Hours	2-8;1~~0~~8	2-8hr		
AVERAGE NUMBER MEN WORKING				
Surface	66	60	6	
Underground	166	172		6
Total	232	232		
AVERAGE WAGES PER DAY				
Surface	4.38	5.34		.96
Underground	5.28	6.36		1.08
Total	5.02	6.08		1.06
WAGES PER MONTH OF 25 DAYS				
Surface	109.50	133.50		24.00
Underground	132.00	159.00		27.00
Total	125.50	152.00		26.50
PRODUCT PER MAN PER DAY				
Surface	12.81	12.34	.47	
Underground	5.29	4.51	.78	
Total	3.74	3.30	.44	
LABOR COST PER TON				
Surface	.342	.433		.091
Underground	.999	1.410		.411
Total	1.341	1.843		.502
AVG.PRODUCT BRK'G & TRM'G	7.00	5.97	1.03	
" WAGES CONTRACT MINERS	5.43	6.73		1.30
" " " TRAMMERS		5.47		
" " " LABOR	5.43	6.66		1.23
TOTAL NUMBER OF DAYS				
Surface	13,898¾	18,795¼		4,896½
Underground	33,659¼	51,419¼		17,760
Total	47,558	70,214½		22,656½
AMOUNT FOR LABOR				
Surface	60877.07	100316.29		39439.22
Underground	177813.55	327077.85		149264.30
Total	238690.62	427394.14		188703.52

Proportion Surface to Underground Men;

1921 - 1 to 2.63
1920 - 1 to 2.87
1919 - 1 to 2.55
1917 - 1 to 2.5

2-8hr 6 days a week Mar.5;
2-8hr 5 days " Mar.6 to May 31st;
1-8hr 6 days " June 1 to Dec.31.

HOLMES MINE.

TIMBER STATEMENT FOR THE YEAR ENDING DECEMBER 31, 1921.

KIND.	LINEAL FEET	AVG.PRICE PER FOOT	AMOUNT 1921	AMOUNT 1920
6" to 8" Timber	115,659	.0553	6,398.71	3,687.93
8" to 10 "	61,834	.117	7,269.91	4,871.02
10 to 12 "	20,737	.132	2,742.74	2,805.02
12 to 14 "	4,981	.171	852.60	2,442.39
Total - 1921	203,211	.0849	17,263.96	
Total - 1920	224,102	.0635		14,239.30
	LINEAL FEET	PER 100'		
5' Lagging	814,300	1.04c'	8,468.85	4,441.69
7' "	8,500	1.26c'	107.00	486.85
Total - 1921	822,800	1.04c'	8,575.85	4,928.54
Poles	235,093	1.60c'	3,761.60	1,722.12
Total - 1921	1,057,893	1.166	12,337.45	
Total - 1920	892,100	.746		6,650.66

Product	178,000	231,807
Feet timber per ton of ore	1.141	.967
Feet lagging "	4.62	3.26
Feet Lagging per ft. of timber	4.04	3.38
Cost per ton for timber	.096	.061
" lagging	.048	.021
" poles	.021	.007
" timber, lagging & poles	.166	.09
Feet Bd.measure per ton of ore	1.80	2.04

Total cost for timber, lagging & poles - 1921 29601.41
1920 20889.96

Mine operated from Jan. to Mar.1 - 2-8hr shifts 6 days a week.
" " Mar.1 to June 1, 2-8hr " 5 "
" " June 1 to Dec.31st 1-8hr " 6 "

HOLMES MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY	AVERAGE PRICE.	AMOUNT 1921.	AMOUNT 1920.
50% L.F. Powder	47,795	.176	8,413.89	10,879.31
60% " "	24,200	.197	4,771.51	18,338.81
60% Gel. "	33,800	.212	7,164.28	
80% " "	10,450	.265	2,766.50	4,728.45
Total Powder	116,245	.1988	23,115.18	33,946.57
Fuse,	252,150	7.996	2,016.36	3,167.02
Caps,	61,938	13.91	861.84	1,136.88
Crimpers,	15	1.03	15.49	8.60
Total Fuse, Etc.			2,893.69	4,312.50
Total Explosives,			26,008.87	38,259.07
Product			178,000	231,807
Pounds Powder per Ton of Ore			.653	.724
Cost per ton for Powder			.129	.146
" " Fuse, Caps, Etc.			.0162	.0186
" " All Explosives.			.146	.165
Avg. Price per Pound for Powder.			.1988	.2024

Mine operated from Jan.1st to Mar. 1st 2-8hr shifts 6 days a week.
" " " Mar.1st to June 1st 2-8hr " 5 " "
" " " June 1st to Dec.31st 1-8hr " 6 " "

NEGAUNEE MINE - 1921.

The product by grades for the year was as follows:-

Bessemer,	28,373 tons,
Negaunee,	228,262 "
Total,	256,635 "
Rock,	2,320 "

This compared with the 1920 product of 554,609 tons, shows a falling off during the present year of 297,974 tons. This was caused by heavy curtailment throughout the year.

The first curtailment went into effect January 15th, the monthly basis being changed from 45,000 tons to 30,000 tons. The operations continued without interruption but with a reduced force. On March 26th a further curtailment went into effect when the working schedule was reduced to five days per week. On May 17th a further curtailment to 15,000 tons per month was made, and the mine has operated one-half shift per day six days per week since that time. The operating force has been reduced to married men and single men with dependents. A large number of old hands had to be laid off, some of whom were our best miners. The curtailment reduced the number of working places so that certain opened areas had to be abandoned temporarily and the present force concentrated as much as possible.

Although the product was reduced to about one-third of normal, certain costs remained as high as if the mine were operating at full capacity. These include items such as pumping, main level timber and track repairs, taxes, etc. These increased the cost per ton greatly, but were offset by three reductions in wages, the present wage being approximately 67% of what it was a year ago.

The operations in the mine were in the main ore body where work has been in progress a number of years; in the East end of the mine near #2 shaft, Northwest end near the Maas boundary and in the further development of the

eleventh level.

The main ore body was opened quite extensively to the Southwest North of #2 dike on the tenth level and the first sub level below. No exploratory work was done during the year.

UNDERGROUND.

NO. 2 SHAFT AREA

This section of the mine is the most isolated of any of our working areas. Work here was stopped as the sub levels which had been opened were completed. No work was done in this territory after May 30th.

810' SUB LEVEL.

This sub level located about 400' Northwest of #2 shaft was started in 1920 and completed in January.

795' SUB LEVEL.

This was started the latter part of 1920 directly beneath 810' sub level. It was worked for five months and completed in May of this year.

FOURTH LEVEL.

This old level was reopened to #2 shaft in 1920. The only work during the present year was in April and May. Work was stopped here on the completion of the 795' sub above. A bulkhead was placed in the drift between #17 raise and the dike to the North to protect the top of the raise at this elevation.

Bulkheads were also placed in the drifts at raises #12 and #13 to protect their tops. At regular intervals this territory is inspected.

SUBS ABOVE THE NINTH LEVEL.

The work here was in two areas, one in the Northwest end of the mine adjoining the Maas, in the American Mining Company strip and supporting pillar; the other above the South foot to the West of #1 shaft.

NORTHWEST END.

640' SUB LEVEL.

This sub level was opened the latter part of last year and the pillars stoped this year. A small pillar at #59 raise will be mined in January which

should complete the sub level.

620' SUB LEVEL.

This was opened in April at #58 raise and development work continued the balance of the year. In December eight contracts worked here, four driving crosscuts to the foot, two developing to the East and West from #32-A raise and two others to the South of #58 raise under the hanging.

SOUTH FOOT.

620' SUB LEVEL.

The work here was mining the pillars outlined last year between #148 and #12-A raises. The sub level was completed in July.

NINTH LEVEL.

The only work on this level was on the South foot to the West of #1 shaft. The area is cut by a dike which runs through the formation East and West. To the North, between this dike (#1 dike) and the hanging, an area was developed and partially mined in 1920. The mining was completed here in 1921.

The area between #1 dike and the foot was blocked out in 1920 and mining has been nearly completed during the present year. In December six contracts were stoping between #148 and #150 raises.

SUBS BETWEEN NINTH AND TENTH LEVELS.

588' SUB LEVEL.

The main ore body at this elevation was mined about five years ago. With the completion of the ninth level foot wall area, this sub level was opened immediately below, the development starting the latter part of 1920. During the present year the development was continued and mining started between #1 and #2 dikes, while to the South of #1 dike there was development only. In December fourteen gangs were developing and stoping between #1 and #2 dikes.

580' SUB LEVEL.

Mining at this elevation was in progress last year on the North foot, just East of the supporting pillar, between the two large East and West dikes. The sub level had been fully developed and partially mined. Operations were con-

tinued until May of this year when the sub level was completed.

565' SUB LEVEL.

This sub level was started in January immediately below the 580' sub mentioned above. A development drift was driven West from #26 raise during that month. With the January curtailment, all work on this sub level was abandoned.

545' SUB LEVEL.

Mining at this elevation was started in 1920 North of #1 dike, about 100' Northwest of the winze, in the extreme Western end of the mine. Work was continued during January and February of this year when this area was temporarily abandoned due to curtailment.

530' SUB LEVEL.

During the latter part of last year a development drift to the Southwest from #198 raise, North of #2 dike, proved quite an extent of ore under the hanging at this elevation. This area was completely mined out during the present year, the work being completed in May.

TENTH LEVEL.

In the main or central ore body on the tenth level the motor drifts were abandoned and the territory blocked out for mining and partially stoped in 1920. During the present year a few small pillars were taken out around #207 raise, completing the work on the foot wall side, East of the supporting pillar. The area North of #2 dike, extending to the West, is much larger on this level than on the 530' sub level above. This is due to the flattening of the hanging. Work has been in progress here during the entire year.

At the extreme end of the motor drift which parallels the Maas boundary, Southeast of #60 raise, a connection was made with #234 raise from the eleventh level, to drain off the water. This motor drift was down grade and acted as a sump, the water collecting on the tracks making loading difficult. In December three contracts were stoping the remaining pillars between #198 and #262 raises.