THE
CLEVELAND - CLIFFS IRON CO.
MINING DEPARTMENT

AGENT'S ANNUAL REPORT
FOR
YEAR ENDING
DECEMBER 31ST, 1915

THE CLEVELAND-CLIFFS IRON COMPANY.

MINING DEPARTMENT.

AGENT'S ANNUAL REPORT.

FOR

YEAR ENDING DECEMBER 31, 1915.

#2107

I N D E X.

MORO MINE:

LAKE MINE:

CLIFFS SHAFT MINE:

SALISBURY MINE:

MAAS MINE:

ATHENS MINE:

ATHENS MINE CONT'D:

SOUTH JACKSON AND CRUSHER:

MORRIS-LLYOD MINE:

MORRIS MINE:

LLOYD MINE:

PRINCETON MINE:

GWINN MINE:

GWINN DISTRICT GENERAL:

REPUBLIC MINE:

REPUBLIC MINE - CONT'D:

IMPERIAL MINE:

CROSBY MINE:

ENGINEERING DEPARTMENT:

GEOLOGICAL DEPARTMENT:

MECHANICAL DEPARTMENT:

MECHANICAL DEPARTMENT (CONT'D):

SAFETY DEPARTMENT:

PENSION DEPARTMENT:

THE CLEVELAND-CLIFFS IRON COMPANY.

Ishpeming, Michigan,

January 1, 1916.

Mr. Wm. G. Mather, Pres.,

Cleveland, Ohio.

Dear Sir:-

I beg to submit the following report of the operations of the Mining Department of this Company. The inventories, maps, and statements relating to this report go forward to you under separate cover.

The tinted portions of the maps show the extensions for the year, and the location of each contract is indicated by the corresponding number.

The reports on the different mines of the Company were made by the Superintendents in charge, and the reports of the Mechanical, Engineering, Geological, Pension, Educational, and Safety Departments by the heads of these departments.

ANNUAL REPORT

(1915)

OF THE

MORO MINE.

Production and Shipments.

The Moro Mine remained closed throughout the year 1915. 3479 tons of Scotch Ore were shipped from the stock-pile in October to be used in the Cliffs Shaft mixture.

There are now on hand at the Mine 36,649 tons of Scotch Ore and 86,875 tons of Scotch Silica.

Surface.

A new roof was put on the oil-house in August.

MORO MINE

ORE STATEMENT AND SHIPMENTS FOR YEAR-1915.

	SCOTCH	SCOTCH SILICA	TOTAL	TOTAL LAST YEAR	
On Hand Jany. 1st, 1915	40,128	86,875	127,003	127,003	
Shipments,	3,479	0	3,479		
Balance on Hand,	36,649	86,875	123,524	127,003	

ANNUAL REPORT

(1915)

OF THE

LAKE MINE.

Production.

The Lake Mine worked one single shift throughout the year. The mine worked 304 days, and produced 335,700 tons of ore, an average of 1104 tons per day. The average tons per man per day for the year was 4.21. This was low on account of the stock-pile loaders employed during the summer.

23,485 tons of rock were hoisted during the year.

Table I.

Comparison of Production for 1914 and 1915.

Year	Days Worked	Ore Tons	Rock Tons	Ore & Rock Tons	Ore Per Day Tons	Rock Per Day Tons	Ore & Rock Per Day Tons
1914	299	326,506	20,788	347,294	1092	69	1,161
1915	304	335,700	23,485	359,185	1104	77	1,181

Table II.

Distribution of Production by Levels.

Above 4th. Level.	Ore Tons	Rock Tons	Ore & Rock. Tons
364 Foot Sub-Level,	28,870	1,000	29,870
383 " "	49,348	1,521	50,869
398 " "	64,790	2,296	67,086
415 " "	91,069	1,594	92,663
425 " "	81,575	3,511	85,086
Fourth Level.	11,414	5,548	16,962
Total,	327,066	15,470	342,536
Between 4th. and 5th. Levels.			
480 Foot Sub-Level,	6,714	3,770	10,484
Fifth Level,	1,920	4,245	6,165
Total,	8,634	8,015	16,649
Grand Total.	335,700	23,485	359,185

Table III.

Distribution of Production by Months.

Month.	Days Worked	Ore Per Day Tons	Total Ore Tons	Total Rock Tons	Total Ore And Rock Tons
January,	25	1,051	26,280	1,685	27,965
February,	24	1,055	25,321	1,825	27,146
March,	27	1,040	28,070	1,875	29,945
April,	24	1,102	26,449	1,980	28,429
May,	25	1,041	26,020	2,100	28,120
June,	25	1,118	27,956	2,200	30,156
July,	26	1,116	29,020	1,540	30,560
August,	26	1,169	30,409	1,935	32,344
September,	25	1,200	29,999	2,140	32,139
October,	26	1,127	29,294	2,120	31,414
November,	25	1,078	26,943	2,345	29,288
December,	26	1,151	29,939	1,740	31,679
Total	304	1,104	335,700	23,485	359,185

Table IV.

Shipments.

From Pocket, - - - - - - - - - 199,225 Tons.

From Stock-pile, - - - - - - - 117,677 Tons

From Stock-pile at Presque Isle. -

Total, 316,902 Tons

Table V.

Ore in Stock December 31, 1915.

At Mine, - - - - - - - - - - - 61,592 Tons

At Presque Isle, - - - - - - - 102,227 Tons

Total, 163,819 Tons.

Table VI.

Delays.

DATE	HOURS	TONS LOST	CAUSE	COST OF REPAIRS
March 15,	1	100	Broken friction on top-tram engine,	$ 7.47
April 21,	2¾	300	No current. Main line trouble,	
May 12,	8	1100	Lightning struck the motor-generator in the engine-house,	20.23
" 17,	1½	200	Under-ground haulage motor burned out,	11.45
" 18,	4	550	Chas. Asplund's funeral,	
" 24,	1	175	No current. Main line trouble,	
June 12,	½	100	No current. Main line trouble,	
" 21,	4	550	Oscar Hantila's funeral,	
July 13,	¾	100	No electric current. Main line trouble,	
" 17,	6½	975	Skip tore out shaft timber,)	
			)	259.44
" 19,	2	185	Skip tore out shaft timber,)	
Sept. 13,	2	300	No electric current and motor burned out,	14.15
" 14,	1	50	No electric current. Main line trouble,	
	35	4685		$ 312.74

Table VII.

Delays caused by Lack of Current on account of Main Line Trouble.

DATE	HOURS	TONS LOST	CAUSE
April 21,	2¾	300	No current. Main line trouble.
May 24,	1	175	No current. Main line trouble.
June 12,	½	100	No current. Main line trouble.
July 13,	¾	100	No current. Main line trouble.
Sept. 13,	1	150	No current. Main line trouble.
" 14,	1	50	No current. Main line trouble.
Total,	7	875	

Table VIII.

Distribution of Rock Drifting.

	Motor Drifts Feet	Timber Roads Feet	Air Ways Feet	Incident to Mining Feet	Exploratory Feet	Total. Feet
Third Level,			293			293
364 Foot Sub-Level,				186		186
383 Foot Sub-Level,		55		250		305
398 Foot Sub-Level,		94		378		472
415 Foot Sub-Level,		102		226		328
425 Foot Sub-Level,		85	62	576		723
Fourth Level,	115		110	333		558
480 Foot Sub-Level,			775			775
Fifth Level,	115			759		874
Total,	230	336	1240	2708		4514

Table IX.

Estimate of Ore Reserves.

383 Foot Sub-Level,	11,000 Tons.
398 Foot Sub-Level,	45,000 "
412 Foot Sub-Level,	163,000 "
425 Foot Sub-Level,	208,000 "
Fourth Level,	466,000 "
Total above Fourth Level,	893,000 Tons
Between 4th and 5th Levels,	1,190,000 "
Total Ore,	2,083,000 Tons
Less 10% Rock & 10% Loss in Mining,	417,000 "
Net Total,	1,666,000 Tons.

In making this estimate a factor of 10 Cu. Ft. per ton was used above the Fourth level, where the outlines of the ore-body are well defined, and a factor of 11 Cu. Ft. per ton was used below the fourth level.

Fatal Accidents.

Chas. Asplund.

About 2:30 P. M. on Friday, May 14th, Chas. Asplund, a Swedish miner working in No. 18 contract on the 398 foot sub-level in North-West, was killed by a fall of ground which broke down the timber under which he was working. His head was crushed against the side of the car. The mine was closed on the afternoon of the 18th for the men to attend the funeral.

Oscar Antilla.

At 4:20 P. M. on Friday, June 18th, Oscar Antilla, a Finnish miner working in the air-shaft above the third level, was over-come by gas when climbing up the raise, and died without re-gaining consciousness. 120 sticks of powder had been blasted at the top of the raise at 3:55 P. M. and Antilla did not wait long enough for the fumes to be driven out by the fan.

Ventilation.

A 45,000 foot fan belted to a 40 H. P. motor was installed on the third level, drawing the air out of the workings and discharging it into the shaft. Air-locks were installed on the third, fourth and fifth levels to control the air-current and a big raise was put up to surface from the South Side cross-cut on the third level to serve as an air-shaft. The ventilation sub-level, 35 feet below the fourth level, was extended east and west a total distance of 870 feet and was connected to the bottom of the air-shaft by a large rock raise. The incoming air is distributed through this sub-level to the working-places near the east and west limits of the ore-body, and finds its way back through the timber-roads to the shaft at the third level. The fan was started on March 27th, and has been in successful operation ever since. The humidity has been materially reduced, and the temperature of the out-going air has fallen from 79° to 63°.

Accidents to Equipment.

Early on the morning of Wednesday, May 12th, lightning struck the 2200 - Volt power-line between the engine-house and the Hard Ore sub-station, and burned out the motor that drives the generator for the under-ground haulage. The mine was idle on that day.

On the morning of Saturday, July 17th, a loaded skip, which was being hoisted in the south compartment, over-turned about 200 feet from surface, and tore out guides, dividings, and end-plates for about 20 feet. The mine was idle until ten o'clock Monday morning, the 19th, while repairs were being made. The loss of product was 1160 tons.

New Construction.

E & A No. 281.

A No. 6 gyratory crusher was bought from the Imperial Mine in May and set up on a concrete foundation on the north side of the north pocket-track directly opposite the shaft-house. Low phosphorus ore for charcoal furnaces is loaded on this track. The ore passes over a bar-screen in the shaft-house, the over-size going to the crusher and the fine dirt falling into the shaft-house pocket. 96,344 tons have been crushed since the crusher was started on June 11.

The crusher is driven by a 25 H. P. motor, and is entirely enclosed. The cost of installation is shown in the following table:-

Cost of Installing No. 6 Crusher.

No.	Account	Cost	Estimate
1	Cost of Crusher,	2,287.50	2,287.50
2	Freight and handling,	85.32	200.00
3	Foundation,	287.16	250.00
4	Electric Equipment,	476.15	1,100.00
5	Housing,	118.63	100.00
6	Screen,	87.05	100.00
7	Chutes and erection charges,	414.02	400.00
	Total,	3,746.83	4,437.50

Surface.

Repairs to Buildings.

The engine-house roof was recovered with asbestos roofing in June and July.

The inclined trestle for the coal-tram was partly rebuilt in August and September.

The coal-dock was repaired in May, June and July.

The big launder was repaired in February and March where it passes under the shops of the Angeline Mine. It was repaired again in November where it enters the tunnel.

Repairs to Machinery.

A new brake-rim and spider were put on the cage-hoist on New Year's Day.

The boilers and boiler-settings were repaired in September.

Stock-piles.

Neither the east nor west stock-piles was completely shipped. The east trestle was erected in September. In September and October 18,454 tons of ore were loaded from the west stock-pile by hand to avoid crushing. The trestle was erected in December.

Underground.

In the same way as was done last year, in order to facilitate the description of the work, the raises on the different levels have been lettered. All the raises on the fourth level were lettered in 1911, and the same system has been maintained. Beginning at the farthest west in the north drift on this level and going east, the raises have been lettered NA, NB, NC, etc. Where an interval has been left without a raise, the proper letter has been reserved for it. When a raise crushes or when for any other reason another raise has to be put up, the new raise is sub-lettered:- e.g. if the raise NC crushes, the new raise is called NC_1. On the fifth level the raises are lettered, beginning at the cross-cut south of the shaft, EA, EB, EC, etc., going east in the east drift, and WA, WB, WC, etc., going west in the west drift.

There have been no new developments during the year, work being confined to three different operations; namely: (1) Stoping generally above the fourth level, a pillar being left below the 398 foot sub-level all across the vein opposite the shaft; (2) putting up the new air-shaft and extending the ventilation sub-level and raises; (3) extending the fifth level drift east and west and putting up raises to the fourth level. The latter two operations have entailed an unusually large amount of drifting and raising both in ore and rock. Most of the work has been completed.

The increasing pressure of the loose ground above the workings has caused an increase in the amount of timber used in mining, and an increase in the work of repairing. In addition to the regular force of timbermen making repairs fully one-fourth of the contracts are doing repair-work all the time.

Since the Cage-Shaft of the Lake Superior Hematite Mine was closed in May the water pumped has increased from less than 90 gallons a minute to 362 gallons.

364 Foot Sub-Level.

North-East.

On the first of the year there remained on the sub-level, a pillar about 110 feet square on the foot-wall south of the shaft between Dike B and Dike C, and a series of pillars on both sides of the timber-drift extending east from a point 100 feet north of raise NK to raise NQ, a distance of 380 feet. This ore has all

been mined. Twelve contracts worked on this sub-level for the first six months of the year, and from that time on the number decreased until the last contract moved down to the next sub-level in October.

383 Foot Sub-Level.

North East.

On the first of the year there remained on this sub-level a pillar about 600 feet long and 100 feet wide on the foot-wall extending from the cross-cut south of the shaft east to raise NQ. Most of this pillar has been mined. Practically all that part of it west of Dike C has been finished, one contract only working now near the foot-wall 100 feet north of raise NK. East of Dike C all the ore on the foot-wall has been mined except a small pillar between raises NO and NP. The ore remaining between Dike C and Dike D is in a series of pillars on both sides of the timber-road between the raises. There are eight contracts working on this ore. East of Dike D the ore has all been mined, the pillar being about 120 feet long and 80 feet wide.

There were thirteen contracts working on this sub-level in January, and the number remained practically constant until December, when it was reduced to nine.

398 Foot Sub-Level.

North-East.

At the beginning of the year all the ore left on this sub-level was in a pillar nearly 900 feet long, varying in width from 100 feet to 160 feet, extending from raise NF_1 in North-West to raise NU in North-East. Both the east and west ends of this pillar have been vigorously attacked, and work is now being concentrated in the middle portion. There remains at the end of the year a pillar 90 feet long and 60 feet wide on the foot-wall between Dike B and Dike C, a pillar 330 feet long and 100 feet wide on the foot-wall between Dike C and Dike D, and a few small pillars on both sides of the timber-road between Dike D and Dike E. All the ore east of Dike E has been mined.

Two contracts finished the ore south of raise NS and west of raise NU early in the year, and moved down to the 425 foot sub-level.

There are three contracts working south of the timber-drift south of raises NP and NQ stoping back towards the north. They came down from the 383 foot sub-level during the summer, and have mined the ore between Dike D and Dike E from the old workings on the south to a point within 30 feet of the timber-road on the north. Two other contracts have drifted along the foot-wall between raise NO and raise NR, and have stoped out some of the ore. Cross-cuts have been driven north from raises NK, NL, and NM to the foot-wall, and a cross-cut is being started south 15 feet west of raise NM. Two contracts are stoping south of raises NJ and NL, and two are stoping west of raise NI. Another contract is stoping near the foot-wall 40 feet east of raise NH. There have been three or four contracts working throughout the year on the big pillar between raises NG, NH and NS, but this ore is now practically finished.

North-West.

The ore on both sides of the timber -road between raises NF_1 and NH and as far south as raise NG was finished, and the contracts working there moved down to the next sub-level in the fall.

415 Foot Sub-Level.

North-East.

The ore on the foot-wall as far east as Dike E remains practically intact, the only work in North-East done during the year being the driving of three timber-roads. One was driven from the end of the cross-cut north of raise SK 150 feet north to a point 50 feet east of raise NH, where a raise was put up to the next sub-level. From this cross-cut a drift was driven west to the main cross-cut near raise NG, and another drift is being driven south-east. It is now in 130 feet south-east of raise NJ.

The ore east of Dike E is being mined on the 425 foot sub-level.

South-East.

The ore east of raise SS is being mined on the 425 foot sub-level. The contracts working in this part of the mine have remained practically unchanged throughout the year. There are nine working. They have mined the ore north of raises SL,SM,SN, SO and SP for a length of 300 feet and an average width of 70 feet

and have mined about half the ore on the foot-wall south of raises SQ and SR. A new cross-cut has also been driven north-east from raise SJ for 120 feet.

South-West.

Three contracts mined the ore near raises SE and SF as far south as the foot-wall, as far west as Dike A and as far north as Dike B. They moved down to the next sub-level in the fall. A small pillar was also mined between raises SB and SC, and two contracts mined the pillar left along the west boundary, starting in May.

North-West.

There were five contracts working here in January. Some of them moved down to the next sub-level early in the year, and were replaced by contracts coming down from the 398 foot sub-level. All the ore between the foot-wall and Dike B has been mined from a point 30 feet west of raise NH west to raise NE over a distance of 220 feet and a width of 100 feet. The last contracts went down to the next sub-level in November.

425 Foot Sub-Level.

North-East.

No work has been done west of Dike E. There are four contracts working in this part of the mine, dumping into raises NS, NU_1 and NV_1. The ore near the foot-wall is badly cut up by dikes, and most of the mining has been done along the north side of Dike F. The ore between Dike E and the foot-wall has been mined for a distance of 100 feet east of raise NU_1, and the ore south of the dike has been mined west from the foot-wall to a point 20 feet east of raise NV_1. A pillar 100 feet long and 60 feet wide has been mined in the middle of the ore-body on the north side of Dike F, leaving a pillar 40 feet wide on the east side of Dike E, through which a timber-road has been driven.

South-East.

There are six contracts working here. Four of them have driven the necessary drifts between the raises and have mined the ore on the east foot-wall for a length of 150 feet and a width of 40 feet, and on the south foot-wall for a length of 80 feet and a width of 35 feet. Two other contracts have been stoping near the foot-wall south of raises SS and ST.

South-West.

The stopes west of Dike A were started last year. Four contracts worked here constantly until late in fall, the last two moving down to the fourth level in December. Two other contracts are finishing the pillar left along the west boundary. All the ore west of Dike A has been mined. East of Dike A three contracts are opening up the ore adjacent to raises SE and SF. One gang is stoping between Dike A and Dike B, 40 feet north-west of raise SE. The other two gangs have drifted between the raises and cross-cut south to Dike C.

North-West.

What little ore remained west of Dike A has been mined. East of Dike A there are seven contracts working between Dike B and the foot-wall. They have mined the ore along the foot-wall north of raises ND_1, NE, NE_1, NF and NF_1, and south of raise ND_1 and NF. Four are now stoping along the foot-wall and three south along Dike B. This ore will soon be exhausted.

Fourth Level.

South-East.

A new motor-drift has been driven north-east across the ore-body from raise SO to the foot-wall drift between raises NP and NQ, a distance of nearly 400 feet. The old motor-drift between raises SS and SW has been re-timbered twice.

Three raises have been holed from the fifth level and two from the ventilation sub-level.

South-West.

A new motor-drift has been driven across the pillar between raises SC and NE, and three raises have been holed from the fifth level.

Three contracts have started mining the ore between the foot-wall and the motor-drift. One of them drifted south-west through Dike A, 60 feet to the foot-wall, and followed the contact west for 80 feet. Another is cross-cutting north from this drift towards raise SC, and the third is cross-cutting south from the main drift 30 feet west of raise SC.

Cross-cuts have also been driven north and south from raise WJ, put up from the

fifth level 15 feet west of raise SA.

North-West.

Raises NE_1, NF_1 and NF_2 have been put up to the 415 foot sub-level.

A cross-cut was driven north from raise WJ to the old motor-drift at raise NB, the old drift was followed west 35 feet, and a cross-cut driven north to the foot-wall. Two contracts are now mining the ore north of raise NB. A drift was driven west from the cross-cut 30 feet north of raise WJ 80 feet to the foot-wall, and the contact followed west to the boundary line, connecting here with a drift driven west from raise NA. The contract that did this work is now stoping north of raise NB.

480 Foot Sub-Level.

South-East.

The east drift has been advanced 500 feet and two raises put up to the fourth level. The cross-cut towards the air-shaft was driven ahead 65 feet south-west in rock, and a raise put up to the fourth level.

South-West.

The main drift was driven west 140 feet to the end of the drift 30 feet east of raise WE, and was extended to the west 230 feet to a point 70 feet north-west of raise WJ, where a raise was put up to the fourth level.

Fifth Level.

South-East.

The main drift was extended to the north-east 115 feet in rock, and raises EG, EK and EL put up to the fourth level. Raises EH and EM are nearly up to the fourth level.

South-West.

Raises WE, WH and WJ were put up to the fourth level, and raises WI and WK to the 480 foot sub-level. Raise WD is nearly up to the fourth level.

LAKE MINE.

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COMPARISON OF COST SHEETS.

For 1914 and 1915.

In both 1914 and 1915 the Lake Mine worked on single shift. The total tons per man decreased in 1915 on account of the stock-pile loaders employed during the summer. Wages were reduced 10% on October 1, 1914 and increased to the previous rates on August 1, 1915.

Production.

Year 1914,		326,504 Tons.	1,092 Tons per Day.
Year 1915,		335,700 "	1,104 " " "
	Increase	9,196 Tons.	12 Tons per Day.

Labor.

	1914	1915
Average number of men,	246	260
Average rate per day,	$ 2.81	$ 2.70

Tons Per Man Per Day.

	1914	1915
Surface,	18.74	17.98
Underground,	5.49	5.50
Total,	4.24	4.21

Cost of Production.

	1914	1915.
Labor,	.663	.640
Supplies,	.224	.251
Total,	.887	.891

GENERAL EXPENSE.

No. 26 - Insurance.

1914,	$ 208.94	.001
1915,	188.70	.001
Decrease,	20.24	.000

No. 27 - Engineering.

1914,	$ 661.65	.002
1915,	808.13	.002
	146.48	.000

The increase is on account of special surveys, especially those made in connection with the installation of the ventilation system.

No. 28 - Analysis.

1914	$ 5,677.93	.017
1915	5,727.75	.017
Increase,	50.82	.000

No. 30 - Personal Injury Expense.

1914	$ 103.19	.000
1915	7,214.93	.022
Increase,	7,111.74	.022

In 1915 there were two fatal accidents and all out-standing claims for compensation were charged off, whether incurred in 1915 or not.

No. 30a - Mine Office.

1914	$ 7,670.52	.024
1915	7,012.57	.021
Decrease,	657.95	.003

There were only two men in the mine office during the first half of 1915, and reduction in wages decreased labor cost also.

MAINTENANCE.

No. 125 - Tracks and Yards.

1914	$ 937.84	.003
1915	749.19	.002
Decrease,	188.65	.001

The bills for maintenance in 1914 amounted to $380.53 and to 289.46 in 1915. There were practically no charges in 1915 for raising the track at No. 1 Shaft, which has heretofore given much trouble.

No. 126 - Docks, Trestles and Pockets.

1914	$ 1,099.51	.003
1915	667.97	.002
Decrease,	431.54	.001

In 1914 labor for repairing the rock-dump was high; two bents of the permanent trestle were re-built, and the old pocket west of the shaft was torn down.

No. 127 - Buildings.

1914	$ 1,837.64	.006
1915	2,700.15	.008
Increase,	862.51	.002

In 1914 the principle items were:-

Repairs to coal-dock,	$973.43
Motor shop and engineers dry,	208.42
Dry-house repairs,	154.92
Painting shaft-house,	237.52
Engine-house roof,	201.85

In 1915 the principle items were:-

Repairing coal-dock & tunnel,	1,154.53
Engine-house roof,	440.12
Re-wiring engine-house,	117.42
Boiler-house roof,	315.57
Piping dry for hot & cold water	305.67
Repairs to shaft-house,	130.99

No. 128 - Shop Machinery.

1914	$ 99.34	.000
1915	29.42	.000
Decrease,	69.92	.000

No. 129 - Boiler Plant.

1914	$1,773.39	.005
1915	949.49	.003
Decrease,	823.90	.002

In 1914 the brick-work of all the boilers was thoroughly repaired.

LAKE MINE.

No. 130 - Hoisting Machinery.

1914	$ 970.86	.003
1915	434.27	.001
Decrease,	536.59	.002

In 1914 the new spider for the cage-hoist cost $ 358.94, and new ropes cost $354.71. In 1915 the cost of new ropes was $190.29

No. 131 - Compressors and Power Drills.

1914	$2,801.95	.009
1915	1,061.51	.003
Decrease,	1,740.44	.006

In 1914 16 drills cost $1570, and re-building the cooling tower cost $1062.52 In 1915 10 drills cost $1043.

No. 132 - Pumping Machinery.

1914	$1,520. 83	.005
1915	297.87	.001
Decrease,	1,222.96	.004

In 1914 the new discharge pipe on surface cost $1015.00, and ordinary items were lower. in 1915.

No. 133 - Top Tram Engines and Cars.

1914	$ 655.61	.002
1915	889.32	.003
Increase,	233.71	.001

A new rock-car was built in 1915 at a cost of $187.34

No. 134 - Skips and Skip-Roads.

1914	$1,113.86	.003
1915	1,381.13	.004
Increase,	267.27	.001

The principle item in 1915 was for repairs in the skip-road and on the skips on account of the wreck in the shaft in May.

No. 135 - Underground Tracks and Cars.

1914	$1,545.59	.005
1915	1,303.55	.004
Decrease,	242.04	.001

The decrease was mostly underground, in labor $220.59

No. 136 - Electric Tram Plant.

1914	$8,911.62	.027
1915	6,340.71	.019
Decrease,	2,570.91	.008

Charges were high in 1914 on account of laying new tracks and extending the trolley-lines on the fifth level. The fifth level was extended only 115 feet in 1915.

No. 137 - Telephones and Safety Devices.

1914	$1,676.75	.005
1915	1,188.39	.003
Decrease,	488.36	.002

In 1914 guards on the pulley-stands cost $189.69; new telephones cost $128.58 and safety devices in the engine-house and boiler-house cost $305.05

No. 139 - Lake Angeline Drainage.

1914	$ 525.13	.002
1915	699.48	.002
Increase,	174.35	.000

The increase is in charges for repairs to the big launder in 1915. In 1914 the discharge-pipe from the electric pumps was moved.

No. 140 - Fire Expense and Damage.

1914	$ 79.78	.000
1915	289.87	.001
Increase,	210.09	.001

Charges in both years are for a fire in the coal-dock.

No. 141 - Ventilation.

1914	$ 143.04	.001
1915	3169.60	.010
Increase,	3026.56	.009

The installation of the new ventilation system was started in 1914 and completed in 1915. It was all charged out against cost of production.

MINING EXPENSE.

No. 150 - Air-pipes.

1914	$1297.43	.004
1915	1267.58	.004
Decrease,	29.85	.000

No. 151 - Compressors.

1914	$9565.41	.029
1915	9130.11	.027
Decrease,	435.30	.002

Of the decrease in charges, $258 was on account of less air used after the ventilation fan was started, less boiler-house expense, and the lower rate of wages, and $167.30 on account of fuel adjustment.

No. 152 - Hoisting.

1914	$8973.42	.028
1915	8438.31	.025
Decrease,	535.11	.003

Of the decrease in charges $399.28 was on account of less boiler-house expense and lower rate of wages and $135.83 on account of fuel adjustment.

No. 153 - Pumping.

1914	$3154.43	.010
1915	3480.28	.010
Increase,	325.85	.000

In 1914 water pumped was 45,925,949 gallons.
In 1915 water pumped was 96,375,565 gallons.
50,449,616 Increase.

No. 154 - Sinking and Shaft Repairs.

1914	$ 655.12	.002
1915	000.00	.000
Decrease,	655.12	.002

Charges in 1914 were for completing pockets at shaft and changes at the plat.

No. 155 - Rock Drifting.

1914	$17,651.09	.054
1915	20,850.30	.062
Increase,	3,199.21	.008

In 1914 4139 feet of drifting and raising cost $4.26 a foot. In 1915 4514 feet of drifting and raising cost $4.62 a foot, the increase in cost per foot being due to the hard rock in air-shaft and at the east end of the fifth level.

No. 156 - Breaking Ore.

1914	$121,293.90	.371
1915	117,120.57	.349
Decrease,	4,173.33	.022

The decrease is due to the reduction in wages being in effect for four months longer in 1915 than in 1914 and to improved working conditions on account of ventilation.

No. 157 - Tramming.

1914	$ 17,333.97	.053
1915	17,390.98	.052
Increase,	67.01	
Decrease,		.001

The greater number of days worked in 1915 compensated for the lower average wages, and the greater tonnage trammed reduced the cost per ton.

No. 158 - Filling.

1914	$ 942.47	.003
1915	853.76	.003
Decrease,	88.71	.000

No. 159 - Timbering.

1914	$ 47,993.45	.147
1915	55,293.01	.165
Increase,	7,389.56	.018

The cost of timbering increased with the tonnage produced and also with increasing pressure underground.

No. 160 - Captain and Bosses.

1914	$ 7,229.92	.022
1915	6,751.45	.020
Decrease,	478.47	.002

The decrease is due to the decrease in wages.

No. 161 - Dry-house.

1914	$ 3,300.80	.010
1915	3,118.12	.009
Decrease,	182.68	.001

The decrease is due to the decrease in wages.

No. 162 - Top Landing. and Tramming.

1914	$ 4,056.08	.013
1915	4,722.52	.014
Increase,	666.44	.001

The increase is due to extra men at night during the second half-year on account of hoisting rock at night.

No. 163 - Stocking Ore.

1914	$ 3,722.02	.011
1915	3,320.24	.010
Decrease,	401.78	.001

The decrease is on account of the reduction in wages and the lower cost of the trestles in 1915.

No. 164 - Sorting Ore.

1914	$ 137.92	.000
1915	216.46	.001
Increase,	78.54	.001

No. 165 - Cave-in

This charge is for pumping the water from the Lake Bottom. It was higher in 1915 on account of the wet summer.

1914	$1,898.01	.006
1915	2,093.57	.006
Increase,	195.56	.000

No. 167 - Stocking Ore at Presque Isle.

The Presque Isle stocking plant was dismantled late in 1914, and some of the charges did not come in until 1915.

1914	$ 393.25	.001
1915	137.86	.000
Decrease,	255.39	.001

No. 168 - Ventilation.

The ventilation fan was started March 27, 1915.

1914	$ 000.00	.000
1915	1,796.32	.005
	1,796.32	.005

RECAPITULATION.

Account	1914 Total	1914 Per Ton	1915 Total	1915 Per Ton	Increase Total	Increase Per Ton	Decrease Total	Decrease Per Ton
General Expense,	14,322.23	.044	20,952.08	.063	6,629.85	.019		
Maintenance,	25,692.74	.079	22,151.92	.066			3,540.82	.013
Mining Expense,	249,598.69	.764	255,981.44	.762	6,382.75			.002
Cost or Production,	289,613.66	.887	299,085.44	.891	9,471.78	.004		

LAKE MINE

AVERAGE MINE ANALYSIS OF OUTPUT FOR YEAR-1915.

GRADE	IRON	PHOS.
Lake Ore,	58.75	.127

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR-1915.

	Mine		Lake Erie	
GRADE	IRON	PHOS.	IRON	MOIST.
Lake Ore,	58.76	.133	58.62	13.32

ORE STATEMENT - DECEMBER 31ST, 1915.

	LAKE ORE AT MINE	LAKE ORE STOCKED AT P.I.	TOTAL	TOTAL LAST YEAR.
On Hand Jany. 1st, 1915	42,794	102,227	145,021	135,626
Output for Year,	335,700		335,700	326,506
Other ores dumped on Lake				
Stockpile at Presque Isle,	0	0	0	0
Total,	378,494	102,227	480,721	462,132
Shipments,	316,902		316,902	317,111
Balance on Hand,	61,592	102,227	163,819	145,021
Increase in Output-3%			9,194	
Increase in Ore on Hand,			18,798	

1-8 Hr. Shift during 1914 & 1915.

SHIPMENTS FOR YEAR--1915

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR.
Lake Ore,	199,225	117,677	316,902	317,111
Total Last Year,	192,847	124,264	317,111	
Decrease,			209	

LAKE MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 5.	1 9 1 4.	INCREASE	DECREASE
PRODUCT	335,700	326,506	9,194	
General Expense	.063	.044	.019	
Maintenance	.066	.079		.013
Mining Expense	.762	.764		.002
Cost of Production	.891	.887	.004	
DEPRECIATIONS.				
Original Purchase	.200	.134	.066	
Plant Account	.006	.004	.002	
Uncompleted Construction	.001	.006		.005
Total Depreciation	.207	.144	.063	
Taxes	.154	.148	.006	
Central Office	.050	.060		.010
Miscellaneous	.001	.005	.004	
Sundry Expense	.058	.042	.016	
COST ON STOCKPILE	1.359	1.276	.083	
Loading and Shipping	.026	.018	.008	
Total Cost on Cars	1.385	1.294	.091	
No. Days Operating	304	299	5	
No. Shifts and Hours	1-8hr	1-8hr		
Avg.Daily Product	1104	1092	12	
COST OF PRODUCTION.				
Labor	.634	.663		.029
Supplies	.257	.224	.033	
Total	.891	.887	.004	

LAKE MINE.

COMPARATIVE WAGES AND PRODUCT.

	1915.	1914.	INCREASE.	DECREASE.
PRODUCT	335,700	326,506	9,194	
No.Shifts and Hours	1-8hr	1-8hr		
AVERAGE NO.MEN WORKING				
Surface	61	56	5	
Underground	199	190	9	
Total	260	246	14	
AVERAGE WAGES PER DAY				
Surface	2.30	2.40		.10(4.17%)
Underground	2.82	2.92		.10(3.42%)
Total	2.70	2.81		.11(3.91%)
WAGES PER MONTH OF 25 DAYS				
Surface	56.00	60.00		4.00
Underground	70.50	73.00		2.50
Total	67.50	70.25		2.75
PRODUCT PER MAN PER DAY				
Surface	17.98	18.74		.76
Underground	5.50	5.49	.01	
Total	4.21	4.24		.03
LABOR COST PER TON				
Surface	.128	.128		
Underground	.512	.533		.011
Total	.640	.661		.021
Avg.PRODUCT BREAKING & TRAMMING	9.33	8.94	.39	
" WAGES CONTRACT MINERS	2.91	3.01		.10
" " " LABOR	2.91	3.01		.10
TOTAL NUMBER OF DAYS				
Surface	18,677¾	17,425¼	1,252½	
Underground	60,992	59,501¼	1,490¾	
Total	79,669¾	76,926½	2,743¼	
AMOUNT FOR LABOR				
Surface	43,039.77	41,855.48	1,184.29	
Underground	171,794.50	173,959.64		2,165.14
Total	214,834.27	215,815.12		980.85

Proportion - Surface to Underground Men:
1915 - 1 to 3.26
1914 - 1 to 3.42
1913 - 1 to 4.10
1912 - 1 to 3.38
1911 - 1 to 3.17

NOTE: Oct.1,1914. Wage rates reduced 10% from schedule adopted Feb.1,1913.
Aug.1,1915. Wages restored to scale in effect prior to Oct.1,1914.

Avg.wages 9 Mos.from Jan.1-Sept.30/14- 2.89
" " 10 " " Oct.1/14-Aug.1/15-2.58
Decrease during 10 month period .31
Percent " " 10.73

LAKE MINE.

TIMBER STATEMENT FOR YEAR ENDING DECEMBER 31, 1915.

K I N D .	LINEAL FT.	AVG.PRICE PER FT.	AMOUNT.	LAST YEAR.
6" to 8" Timber	121,218	.02	2,424.36	1,204.72
8" to 10" "	106,708	.04	4,268.32	5,830.34
10" to 12" "	106,821	.06	6,409.26	5,181.72
12" to 14" "	26,135	.08½	2,151.67	1,457.86
14" to 16" "				245.10
Total Timber 1915	360,882	.0423	15,253.61	
Total Timber 1914	312,307	.0446		13,919.74
(850' to the cord)	LINEAL FT.	PER 100'		
5' Lagging	1,238,025	.4657	5,765.66	3,712.00
9' "	62,800	.55	345.40	
7' "	16,979	.55	93.39	195.25
8' "	32,102	.55	176.56	189.25
Total Lagging	1,349,906	.0473	6,381.01	4,096.50
Poles	15,871	.918	145.77	390.43
1915- Total Lagging & Poles	1,365,777	.4727	6,526.78	
1914- " " "	900,018	0.50		4,486.93

	1915.	1914.
Product for Year	335,700	326,506
Feet Timber per ton of Ore	1.075	.956
Feet of Lagging " " "	4.02	2.76
Feet of lagging per foot of Timber	3.74	2.75
Cost per ton for Timber	.0454	.0426
" " Lagging	.0191	.0125
" " Poles	.0004	.0012
" " Timber,Lagging & Poles	.065	.056
Equivalent of stull timber to Board measure	649,053	559,096
Feet of Board Measure per ton of ore	1.93	1.71

Total Cost for Timber,Lagging & Poles,	1915	21,780.39
"	1914	18,406.67
"	1913	24,128.99
"	1912	21,525.33
"	1911	19,916.58
"	1910	26,717.90
"	1909	21,927.42
"	1908	17,499.22
"	1907	21,989.00

LAKE MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	1915 AMOUNT.	1914 AMOUNT.
50% Powder - 1½ L.F.Standard Anna	4,650	.105	488.25	
50% " - 1½" N.G.Dynamite	61,350	.115	7,055.25	6,468.75
Total Powder	66,000	.1143	7,543.50	6,468.75
Fuse	208,175	4.22M	878.67	564.06
Caps	57,300	8.00M	458.30	219.92
Cap Crimpers	27	.25 ea.	6.75	3.50
Electric Exploders	300	33.30M	9.99	3.03
Connecting Wire	6	.28-1/3#	1.70	.60
Total Fuse,Etc.			1,355.41	791.11
Total All Explosives			8,898.91	7,259.86
Product			335,700	326,506
Pounds Powder per Ton Ore			.197	.172
Cost per ton for Powder			.0225	.020
Cost per ton for Fuse,Caps,Etc.			.004	.002
Cost per ton for All Explosives			.027	.022
Avg.Price per Lb. for Powder			.1143	.115

ANNUAL REPORT

(1915)

OF THE

CLIFFS SHAFT MINE

Production and Shipments.

The Cliffs Shaft Mine worked 304 days in 1915, and produced 326,500 tons of ore, an average of 1074 tons per day. Practically all of the product was screened. The production by grades is shown in Table I.

Table I.

Production by Grades.

Lump, - - - - - - - - - - - - - - 138,500 Tons.

Crushed, - - - - - - - - - - - - 188,000 "

Total, 326,500 Tons.

21,455 tons of rock were produced during the year, all of which was dumped under-ground.

One eight-hour shift was worked until October 18th, at which time hoisting on two shifts was started. Most of the ore hoisted on night shift came from "A" Shaft. Practically all breaking ore and hand-tramming was done on the day shift, the product hoisted at night being trammed by the motor haulage on the 10th and 15th levels. The increase in product was accomplished by the purchase of thirty new Leyner drills, replacing most of the old piston-drills, and by the addition of eight contracts, bringing the total number of contracts up to fifty-six.

Table II.

Comparison of Product for 1914 and 1915.

Year	Days	Ore Tons	Rock Tons	Ore & Rock Tons	Ore per Day Tons	Rock per Day Tons	Ore & Rock per day. Tons
1914	299	300,771	20,122	320,893	1006	67	1073
1915	304	326,500	21,455	347,955	1074	70	1144

Table III.

Distribution of Product.

Level	"A" Shaft Ore Tons	"A" Shaft Rock Tons	"A" Shaft Total Tons	"B" Shaft Ore Tons	"B" Shaft Rock Tons	"B" Shaft Total Tons	Total Ore Tons	Total Rock Tons	Total Ore & Rock Tons
1	9,062		9,062	18,382	800	19,182	27,444	800	28,244
2	5,940		5,940				5,940		5,940
3	7,970	210	8,180	7,565		7,565	15,535	210	15,745
4	6,713		6,713	1,459		1,459	8,172		8,172
5	6,394	320	6,714		230	230	6,394	550	6,944
6	30,094	560	30,654	36,909	415	37,324	67,003	975	67,978
7	20,621	220	20,841	17,407	500	17,907	38,028	720	38,748
8	37,534	812	38,346	12,384	1,070	13,454	49,918	1,882	51,800
9	33,213	1,006	34,219	6,211	350	6,561	39,424	1,356	40,780
10	26,006	798	26,804	23,758	658	24,416	49,764	1,456	51,220
11				18,878		18,878	18,878		18,878
12								300	300
15		5,410	5,410					13,206	13,206
	183,547	9,336	192,883	142,953	4,023	146,976	326,500	21,455	347,955

Table IV.

Production by Months.

Month	Days Worked	Ore per Day Tons	Crushed Tons	Lump Tons	Total Tons	Rock Tons	Total Ore and Rock Tons.
January	25	979	13,362	11,134	24,496	1,300	25,796
February	24	1,018	13,300	11,132	24,432	1,192	25,624
March	27	1,020	15,056	12,416	27,472	2,027	29,499
April	24	1,029	13,220	11,230	24,450	2,244	26,694
May	25	1,023	14,958	10,611	25,569	1,780	27,349
June	25	1,026	15,603	10,038	25,641	1,440	27,081
July	26	1,039	15,969	11,047	27,016	1,786	28,802
August	26	1,008	15,655	10,541	26,196	1,978	28,174
September	25	1,030	15,087	10,675	25,762	1,950	27,712
October	26	1,161	16,953	13,156	30,109	2,214	32,323
November	25	1,298	19,366	13,098	32,464	1,758	34,222
December	26	1,265	19,471	13,422	32,983	1,786	34,679
	304	11,074	188,000	138,500	326,500	21,455	347,955

Table V.

Shipments.

Crushed,	209,331 Tons.
Lump,	95,560 "
Total,	304,891 Tons.

Table VI.

Ore in Stock, January 1st, 1915.

Crushed,	42,393 Tons.
Lump,	56,290 "
Total,	98,683 Tons.

Table VII.

DELAYS.

DATE	HOURS	TONS LOST	CAUSE	COST OF REPAIRS
January 20,	1½	150	Hoist-motor brushes burned out.	$ 1.27
28,	½	50	Locomotive off the track.	.35
29,	1	100	Lower tram car off the track.	1.26
February 24,	1	100	Motor train off track, 10th level "A" Shaft.	.80
March 16,	1	100	Counter-weight jammed in "B" Shaft.	5.12
19,	1½	100	"B" Shaft skip stuck in the dump.	3.33
24,	½	50	Isaac Keskimaki injured at 10th level, "B" Sh.	
April 7,	2	100	"A" Shaft skip caught in the dump.	2.10
8,	2½	150	"A" " " " at first level pkt.	6.03
12,	2	200	No current. Main line repairs.	
21,	2½	250	No current. Main line trouble.	
27,	1½	150	No current. Main line trouble.	
May 5,	2½	150	"B" Shaft runners loose.	5.54
25,	1	100	Electric hoist bearings hot.	.60

DELAYS, (CONTINUED.)

DATE	HOURS	TONS LOST	CAUSE	COST OF REPAIRS
June 10,	1	125	Pocket blocked at "A" Shaft.	$ .50
12,	2	250	Rail jammed in crusher.	5.00
19,	6¼	800	Hoist motor burned out.	6.50
23,	1½	50	Broken horn on skip.	3.00
July 3,	1	40	Main air-line broken in "B" Shaft.	10.08
13,	1½	100	No current. Main line trouble.	
20,	1½	200	Tenth level "A" Shaft pocket door stuck.	2.00
30,	3	400	Hoist motor burned out.	3.00
August 10,	2	140	Motor off the track on 10th level "A" Shaft.	1.60
September 13,	2½	250	No electric current. Main line trouble.	
14,	3	250	No electric current. Main line trouble.	
25,	4	400	"B" Shaft idle all day. Changing sheave.	387.26
October 7,	1	100	Top tram counter-weight rope broke.	
25,	3	100	Skip caught chute in "A" Shaft.	1.75
30,	7	800	Top-tram motor out of order.	28.58
November 9,	2½	100	Changing from pocket to stockpile.	3.50
13,	1	150	" " " " "	1.40
December 20,	3	200	Top-tram car axle broke, lower tram car off Track.	3.75
Total,	67¾	6205		484.32

Table VIII

Delays caused by lack of electric current on Main line.

DATE	HOURS	TONS LOST
April 12,	2	200
21,	2½	250
27,	1½	150
July 13,	1½	100
September 13,	2½	250
14,	3	250
Total,	13	1,200

Table IX.

Estimate of ore reserves.

	"A" Shaft Tons	"B" Shaft Tons	Total Tons
Pillars,	910,000	528,000	1,438,000
Floors,	1,755,000	1,143,000	2,898,000
Partly Developed,	589,000	111,000	700,000
Total,	3,254,000	1,782,000	5,036,000
Less 10% for Rock,	325,000	178,000	503,000
Net Total,	2,929,000	1,604,000	4,533,000
To support surface,	1,518,000	886,000	2,404,000
Available Ore,	1,411,000	718,000	2,129,000
Less 10% for Rock and 10% for loss in Mining,	282,000	144,000	426,000
Net Available Ore, January 1st, 1916.	1,129,000	574,000	1,703,000

SURFACE.

Crusher Building.

In February an arc-chute on the pocket below the No. 5 crusher was replaced by fingers, increasing the capacity of the plant about 100 tons a shift, and with the employment of one less man than previously.

A new head and concaves were put in the West No. 5 crusher during the summer.

Stockpiles.

The production was 21,609 tons more than the shipments, all of this excess being in lump ore, & the balance of crushed ore at the end of shipping season being less than in 1914. The trestle for crushed ore was completed in October. No trestle was necessary for the lump ore. Crushed ore was stocked after November 1st, and lump ore after November 15th.

Repairs to Buildings.

The coal-dock was thoroughly repaired in April, May and June, most of the corbels, and more than half of the caps being replaced by new timber.

A new concrete top was put on the West smoke-stack of the boiler-house in July.

Hoisting.

The counter-weight in "B" Shaft was jammed in the guides on January 25, and there was a short delay, but no other damage was done.

"B" shaft was shut down on September 25, while a new head-sheave and new stringers were put in the shaft-house. A new head-sheave, the duplicate of those in "A" and "B" Shaft-houses, was received in November.

Fires.

A small fire occurred in "A" Shaft on April 29th, but the damage was slight.

Air-Compressor.

A 1200-foot, electric air-compressor was received from the Chase Mine and set up in the engine-house, replacing one of the old Rand compressors. This work was completed in September, and after the compressor was started, no more air was bought from North Lake.

UNDER-GROUND.

Ore Bodies in "A" shaft.

The names given the ore bodies in "A" shaft are the same as were used in the last three reports. They are as follows:-

1. North Deposit. The North Deposit is a rather flat ore body, or series of ore bodies, that lies north of the great east and west fault.

2. Main Vein. The Main Vein extends east and west from the shaft, dipping to the south and pitching to the east. It is developed for 1940 feet east of the shaft.

3. Small Body. This is an isolated body, practically exhausted, 300 feet north-east of the shaft. There has been no work done in it this year.

4. South Lens. This is not really a lens of ore, but a "U"-shaped deposit lying in the bottom of a trough. It extends 300 to 1300 feet south-east of the shaft.

5. South-East Deposit. This ore has been opened on the 9th and 10th levels. It is apparently the continuation of the ore in the old Incline Mine.

Ore Bodies In "B" shaft.

The same names have been used this year as last for the ore bodies in "B" shaft. They are as follows:-

1. Main Vein. This vein strikes north-east and south-west, and has been developed from a point 400 feet north-east of the shaft on the upper levels to a point approximately 1500 feet south-west of the shaft on the tenth level.

2. North Deposit. This ore extends from 500 feet north-east of the shaft to 800 feet north-west of the shaft, and lies on the north side of the main east and west fault.

3. Fault Vein. The main east and west fault has been found to carry ore of varying width in its western part, where it swings to the south-west, below the fifth level, and this ore has been developed on the sixth, seventh, eighth, ninth and tenth levels from 700 to 1400 feet south-west of the shaft.

UNDER-GROUND.

General Development.

Efforts were made as in previous years to clean up the available ore on the upper levels and in the isolated deposits, concentrating the reserves as much as possible on the lower levels and in the larger and better defined ore-bodies. The necessity of meeting the high guarantee of analysis hindered work in the North Vein most of the year, but when production was increased in October, new gangs were started here. The ore in the North Deposit has been cut off on the east, and the limit of the ore-body seems to have been reached in this direction.

The Main Vein in "A" shaft is still being followed east on the 8th level, and the 7th level is being opened in this vein near the east end from raises from the 8th level. During the last two months there has been a considerable flow of water from this place which is now 625 feet from the nearest stope of the Incline Mine.

The most important new developments in "A" shaft are in the south-east Deposit. There are two gangs working on the 10th level, three on the 9th, and one on the 8th level, following this ore. Three diamond drill-holes were also drilled to the south from the 5th level. The best prospects for new ore are in this direction, and the next year should show important developments. In order that the mine may maintain its present ore-reserves it is necessary that ore be found to take the place of the ore-bodies in the North Deposit which have been cut off. The most likely place to develop this new ore is in this territory to the south-east.

The 15th level was advanced 755 feet in rock, and is in almost far enough to start a raise to the 10th level.

In "B" shaft the western limit of the Fault Vein has been reached on the 6th, 7th and 10th levels, and probably will soon be reached on the 8th level. This has, however, been off-set to a certain extent by the development of ore in the west end of the Main Vein on the 7th level by diamond-drilling. It is probable that similar ore will be found on the 8th and possibly on the 6th level. The 11th level has shown up pretty well, and looks

promising to the north and north-west, but the ore has been cut off by jasper on the south-west. New raises have been put up from the 15th level to the elevation of the 11th 12th, 13th and 14th levels, and the 12th level has been started. Each level will have one raise for ore, and one for rock.

Discription of Work.

"A" Shaft.

First Level.

Main Vein.

One contract worked all the year mining floors to the depth of 12 feet from 480 to 650 feet north-east of the shaft. It will probably be one year before this ore is exhausted.

Second Level.

South Lens.

One contract working from the top of the riase from the 3rd level has been stoping 250 feet south of the shaft. They have driven a stope for 150 feet and put up one raise about 40 feet, and are now starting a new raise 240 feet south of the shaft. Including the floors that will have to be mined there is probably ore for this contract for another year in this place.

Third Level.

South Lens.

One contract has mined floors 240 feet south of the shaft, taking the floors of an old stope. The bench is 10 feet high with rock in thebottom. They started in October.

Main Vein.

One contract has worked nine months mining floors from 800 feet to 930 feet east of the shaft. The bench is 15 feet high.

Fourth Level.

North Deposit.

One contract started in February drifting east from the raise from the

5th level 450 feet north-west of the shaft, and have followed the ore 160 feet. THe ore is narrow but good, and is getting wider. Another gang was started in October on the west side of the chute, and has stoped west 40 feet in good ore.

Main Vein.

One contract mined floors for three months, 800 feet east of the shaft, and moved to the third level.

South Lens.

One contract is mining floors 200 feet south-east of the shaft. They started in October.

Fifth Level.

North Deposit.

There are three contracts working in this deposit. One has been mining floors for the last six months, 850 feet to 950 feet north-east of the shaft. One has been taking down the back 810 feet north-east of the shaft for the last two months. The third contract has been mining floors 1200 feet north-east of the shaft, during the whole year.

South Lens.

One contract cross-cut south-east 85 feet in rock, and opened a stope 600 feet south-east of the shaft. The ore was cut off on the east and south, but the stope is going ahead to the west. There have been two machines in this stope during the latter part of the year. This contract also cross-cut south-east through 25 feet of rock on the south side of the stope just mentioned, and found a small body of ore. From this stope three diamond drill holes have been drilled toward the south.

Sixth Level.

North Deposit.

Two contracts are now working in this deposit. One cross-cut north-east 100 feet to the raise from the 7th level 1570 feet north-east of the shaft and stoped near the boundary. They moved south-west 100 feet and stoped for three months, blocking out a pillar 1500 feet north-east of the shaft, and are now cross-cutting south 1480 feet north-east of the shaft. The other contract is raising in the back of the old stope 1220 feet north-east of the shaft, and have quite a pile of ore broken. They have worked one month, but no ore has been

trammed from their place.

One contract raised for five months near the west end of the deposit in two places, 720 feet and 870 feet north-east of the shaft, and then moved to the 5th level.

Seventh Level.

North Deposit.

There have been two contracts working in this deposit most of the year. One stoped west along the boundary for 110 feet to the end of the ore, 1230 feet north-east of the shaft, and then moved back 75 feet, and cross-cut south 120 feet to the jasper. They have now moved to the sixth level. The other contract joined them here, and stoped west from their south cross-cut for 40 feet. Early in the year they drove a stope west 50 feet and put up two short raises, 1330 feet east of the shaft.

South Lens.

One contract mined floors for two months 650 feet south-east of the shaft, and moved to the 4th level.

Main Vein.

T wo contracts opened stopes on this level in November from raises put up from the 8th level 1820 feet and 1880 feet east of the shaft. They holed together in December. One contract is now stoping east and the other west.

Eighth Level.

North Deposit.

One contract stoped north-west 30 feet to the foot-wall, and drifted north-west 70 feet in rock, 1400 feet north-east of the shaft. They then raised to the seventh level 1425 feet north-east of the shaft, and moved to the south lens.

Another contract have stoped west 150 feet between walls of jasper, and are now 1290 feet north-east of the shaft. They have worked in this place throughout the year. The third contract stoped west 100 feet from 1500 to 1400 feet east of the shaft, and raised to the 7th level on the north side of the stope, 1500 feet east of the shaft.

Main Vein.

One contract stoped east 150 feet along the foot-wall, and are now 2040 feet east of the shaft. There has been a good deal of water in the breast during the last three months. The breast is 625 feet from the nearest stope in the Incline Mine, and further than that from No. 3 Mine. From this stope two raises have been put up in ore on the foot-wall 1820 and 1880 feet east of the shaft.

South Lens.

One contract mined floors to the depth of 14 feet all the year, from 690 feet to 830 feet south-east of the shaft. Another contract drifted south-east 220 feet in rock to a point 1160 feet south-east of the shaft. There is now ore in the breast of this drift, but it is impossible to say what it will amount too.

Ninth Level.

North Deposit.

One contract stoped west 190 feet following a narrow vein until the ore pinched out, 1230 feet north-east of the shaft. They are now cross-cutting north-east 1580 feet east of the shaft, and are in 40 feet in rock, but they have ore in the breast.

Main Vein.

One contract stoped north 30 feet in the big pillar, and holed to an old stope 1420 feet east of the shaft; and then stoped west 150 feet in the middle of the pillar to a point 1250 feet east of the shaft.

South Lens.

One contract cross-cut south 10 feet in rock from the old stope to the foot-wall drift, 930 feet south-east of the shaft, and then cross-cut south 50 feet in rock from the end of the foot-wall drift, to the ore found in diamond drill hole No. 232. They have opened a stope here, 1130 feet south-east of the shaft and are now stoping east and west with two machines.

South-East Deposit.

The south cross-cut from the Main Vein 1950 feet east of the shaft

was continued 250 feet, 220 feet in rock, and 30 feet in ore. One contract has stoped east 80 feet in this ore, and another has drifted west 150 feet partly in rock and partly in ore, and have also cross-cut north 40 feet from this drift to the top of the raise put up last year from the 10th level 1900 feet south-east of the shaft. They are now drifting west in ore.

Tenth Level.

Main Vein.

The main east drift was advanced 40 feet in jasper and a stope opened 2050 feet east of the shaft. The ore was very small, however, and soon pinched out on all sides. This contract then moved to the South-East Deposit.

Another contract drove a short drift west to the main haulage-way, 1500 feet east of the shaft to straighten the track, and then drove a stope east 120 feet on the north side of the main east drift from 1730 feet to 1850 feet east of the shaft. In December they started a cross-cut in jasper to the north-east from the main drift 1310 feet east of the shaft.

South Lens.

One contract continued their stope south-west 120 feet from No. 4 cross-cut 1200 feet east of the shaft to the foot-wall and followed the contact west 90 feet. They are now starting another stope north-west from this stope 1140 feet south-east of the shaft. From this stope a raise was put up to the south in rock to the ninth level, 1150 feet south-east of the shaft.

South-East Deposit.

The two raises put up last year from the south-east drift have been continued to the ninth level 1850 feet and 1900 feet south-east of the shaft.

The south cross-cut following diamond drill hole No. 195 was continued 60 feet in jasper and a stope was opened in ore. This stope has been driven west 30 feet and south-east 100 feet. 100 feet further east another stope has been driven to the east 60 feet. Both of these stopes are now being driven to the east with two machines in each.

Fifteenth Level.

One contract has worked on this level all the year. The east drift has been advanced 755 feet in rock, and a siding 80 feet long has been cut. The

breast is in nearly far enough to start a raise to the 10th level.

"B" Shaft.

First Level.

1200 Foot Sub-Level.

Main Vein.

Three contracts have worked on this sub-level all the year. One contract drifted west in ore 70 feet on the foot-wall from the west end of the sub-level and cross-cut south 30 feet in jasper under diamond drill-hole No. 18. They cross-cut south also 45 feet in jasper to diamond drill-hole No. 17 and mined the ore in the back of two cross-cut stopes 470 feet south-west of the shaft. They are now stoping just above the back of the end of the cross-cut to diamond drill-hole No. 17. Another contract drove a stope west and south around a pillar 490 feet south of the shaft, and drove a cross-cut north 60 feet to the hanging-wall 380 feet south-east of the shaft. The third contract stoped 600 feet south of the shaft and cross-cut south 80 feet in rock toward diamond drill-hole No. 15. They have 60 feet to go.

Main Level.

One contract is raising to the 1200 foot sub-level for a new chute 350 feet south-east of the shaft. They are now up 40 feet in ore from the 1150 foot sub-level.

Second Level.

North Deposit.

One contract mined the floor of the old stope all the year, from 120 feet north to 220 feet north-east of the shaft. They have finished the floor, but have a little ore in the back to take down.

Third Level.

Main Vein.

One contract has mined floors for three months 1250 feet south-west of the shaft.

Fifth Level.

Main Vein.

One contract mined floors all year, 1010 feet to 1220 feet south-west of the shaft and 900 feet to 980 feet west of the shaft.

North Deposit.

In August one contract mined a little ore found in diamond drill-hole No. 235, but it pinched out, and they moved to the sixth level.

One contract has been mining floors 530 feet north of the shaft for five months.

Sixth Level.

North Deposit.

Three contracts worked in this deposit all the year. One contract mined floors 700 feet north-west of the shaft for six months, and then raised ffom the seventh level, 610 feet north-west of the shaft, in the middle of the pillar. They drove a cross-cut stope south in this pillar 40 feet to this raise, and are now mining the floor. One contract mined the back of the east-west stopes for 150 feet to a point 400 feet north-west to the shaft, working here throughout the year. The third contract drove the south stope east for 70 feet, and holed to the foot-wall stope 500 feet north-east of the shaft. They also cross-cut north twice in the pillar between the stopes.

Main Vein.

One contract is working in the pillar 350 feet north-west of the shaft. They have been here and fifty feet further west for three and one-half months. During May, June and July they were mining the floors of the stope 300 feet north of the shaft, and then went to the fifth level.

Fault Vein.

One contract drifted west 260 feet in the fault vein, the last 80 feet being in jasper. The breast of the drift is 1620 feet south-west of the shaft. They are now back-stoping 1400 feet south-west of the shaft.

Seventh Level.

North Deposit.

One contract stoped for two months, 350 feet north of the shaft and

raised to the sixth level. They moved to the sixth level in April. Another contract raised to the sixth level 610 feet north-west of the shaft in July and August, and then moved to the sixth level.

Main Vein.

One contract has been following the hanging-wall west for 130 feet. They started in September, and had rock for 50 feet, but now have good ore. The breast is 1480 feet south-west of the shaft.

Fault Vein.

One contract stoped west in the Fault Vein for 140 feet, until the ore pinched out, 1570 feet south-west of the shaft. They are now back-stoping, 1500 feet south-west of the shaft, but have very little ore.

Eighth Level.

Main Vein.

One contract drifted north-east 280 feet in rock to get under some ore on the seventh level, 350 feet north of the shaft. They are now raising from the end of this drift. They started this drift in April after spending the previous three months at the west end of the vein, mining a little ore 1200 feet and 1310 feet west of the shaft.

Fault Vein.

One contract has continued its stope west 180 feet, 1570 feet south-west of the shaft. The ore is not as good as it has been, being mixed with spots of jasper, and it is likely that in the near future it will be cut off entirely.

Ninth Level.

Main Vein.

In December one contract holed a raise from the 10th level 620 feet north-west to the shaft, and are now mining the floor.

Fault Vein.

The main stope has been advanced 170 feet, and the breast is wider than it has been, and the ore is good. The breast is now 1250 feet south-west of the shaft. A raise has been put up from this stope to the eighth and seventh levels, 1080 feet south-west of the shaft.

Tenth Level.

Main Vein.

One contract has been stoping in the back of two stopes, 150 feet and 50 feet north of the main drift from 600 to 800 feet north-west of the shaft. They have just raised to the ninth level, 620 feet north-west of the shaft, and have a large pile of ore broken.

The west drift along the hanging-wall has been advanced 150 feet, partly in rock. The breast is now in ore, 1650 feet west of the shaft. A rock-drift has also been driven 50 feet south-west from the main drift to reach the ore found in diamond drill-hole No. 245. The breast is now in ore, 1450 feet west of the shaft. Another contract has been back-stoping for four months, south of the main drift, 800 feet west of the shaft.

Fault Vein.

The stope in this vein was continued west for 75 feet, until the ore was cut off, 1230 feet south-west of the shaft. The ore has been followed east 185 feet, and the breast is now in fine ore 1000 feet west of the shaft. From this stope a raise was put up to the ninth level early in the year, 1100 feet south-west of the shaft.

Eleventh Level.

Main Vein.

Two contracts have worked on this level throughout the year. One stoped south and south-west 160 feet along the hanging-wall. Their ore has been cut off on the west, but they are now stoping east, 1030 feet west of the shaft. The other contract drove a cross-cut stope south 80 feet from the main drift to the foot-wall, 970 feet west of the shaft, and stoped east 30 feet to the jasper and west 30 feet through the pillar. They are now stoping north-west, 1010 feet north-west of the shaft. Another contract put up a raise from the 15th level, and cross-cut south-east to the stope last mentioned, in October and November, holing to the stope at a point 1030 feet north-west of the shaft. They moved to the 12th level.

Twelfth Level.

Main Vein.

In December one contract started a drift south-east from the big raise

from the 15th level, 1050 feet north-west of the shaft, and are now in 35 feet in slate.

Fifteenth Level.

The main drift was advanced 60 feet in jasper at the beginning of the year.

Three raises have been put up on the north side of the main drift. One went up at an inclination of 55 degrees to the north-east to the elevation of the 11th level, starting at a point 1220 feet north-west of the shaft. It was in rock most of the way, but struck ore just below the 11th level. The 12th level is being turned off from this raise. Another raise was put up to the west at the same inclination and starting from the same chute. It went up to the 13th level in rock, and 15 feet above the level in ore. The third raise has been put up almost to the 13th level in jasper. It was started from the main drift 1320 feet north-west of the shaft, and is inclined to the north-east.

CLIFFS SHAFT MINE.

COMPARISON OF COST SHEETS.

For 1914 and 1915.

The Cliffs Shaft Mine worked on single-shaft in 1914, but in 1915 hoisting was started on double-shift in October, the mining operations, however, being carried on on single-shift. About $15,000 worth of new equipment was charged out in four months in the fall.

Wages were reduced 10% on October 1, 1914, and increased to the previous rates on August 1, 1915.

Production.

	Total	Per Day.
Year 1914,	300,771 Tons,	1,006 Tons,
Year 1915,	326,500 "	1,074 "
Increase,	25,729 Tons,	68 Tons,

Labor.

	Year 1914	Year 1915
Average number of men,	285	300
Average rate per day,	$2.71	$2.61

Tons per Man per Day.

	Year 1914	Year 1915
Surface,	16.13	17.09
Underground,	4.49	4.54
Total,	3.51	3.59

Cost of Production.

	Year 1914	Year 1915
Labor,	.779	.728
Supplies,	.335	.355
Total,	1.114	1.083

GENERAL EXPENSE.

No. 26 - Insurance.

1914	$ 168.91	.001
1915	149.59	.000
Decrease,	19.32	.001

No. 27 - Engineering.

1914	$1,616.11	.005
1915	1,177.64	.003
Decrease,	438.47	.002

The decrease has been mostly in office work and geological mapping.

No. 28 - Analysis.

1914	$1,970.23	.007
1915	1,907.34	.006
	62.89	.001

No. 30 - Personal Injury Expense.

1914		
1915	$2,280.46	.007
Increase,	2,280.46	.007

In 1915 all out-standing claims for compensation were charged against the mine, whether incurred during this year or not.

No. 30a - Mine Office.

1914	$7,036.61	.023
1915	6,495.55	.020
Decrease,	541.06	.003

The decrease is mostly due to the decrease in salaries.

MAINTENANCE.

No. 125 - Tracks and Yards.

1914	$1,061.98	.004
1915	537.74	.001
Decrease,	524.24	.003

Charges against this account were high in 1914 because of repairs to the retaining-wall south of "A" Shaft.

No. 126 - Docks, Trestles and Pockets.

1914	$ 402.88	.001
1915	292.11	.001
Decrease,	110.77	.000

The decrease is in charges for repairs to shaft-house pockets.

No. 127 - Buildings.

1914	$4,702.18	.016
1915	2,471.89	.008
Decrease,	2,230.29	.008

The principal charges in 1914 were for new roofs for the engine-house and boiler-house, and for repairing the coal-dock. In 1915 the coal-dock was thoroughly repaired.

No. 128 - Shop Machinery.

1914	$ 985.48	.003
1915	61.57	.000
Decrease,	923.91	.003

In 1914 a No. 5 Leyner drill-sharpener was purchased, costing $859.00

No. 129 - Boiler Plant.

1914	$1,088.24	.004
1915	1,115.03	.003
Decrease,		.001
Increase,	27.79	

No. 130 - Hoisting Machinery.

1914	$1,943.56	.006
1915	1,468.25	.005
Decrease,	475.31	.001

In 1914 the principal supply items were two new ropes, $745.50; reversing panels for electric-hoist, $150.80; resistance grids, $100.80; general repair parts, $130.00; turn sheave for "B" Shaft, $101.05.

In 1915 the principal items were:-

New ropes,	$540.65
New sheave for "B" Shaft	254.10
Motor bearings for hoist	43.20

The labor charges were about the same for the two years.

No. 131 - Compressors and Power-drills.

1914	$3,406.40	.011
1915	9,880.32	.030
Increase,	6,473.92	.019

In 1914, 13 new drills cost $3119.37. In 1915 30 new drills and tripods cost $8193.00. Installing new compressor cost $900.00

No. 132 - Pumping Machinery.

1914	$7,224.77	.024
1915	1,844.76	.006
Decrease,	5,380.01	.018

In 1914 the excavation of the sump and pump-house cost $6080.39. In 1915 it cost $248.08.

No. 133 - Top Tram Engines, and Cars.

1914	$1,498.36	.005
1915	1,067.57	.003
Decrease,	430.79	.002

In 1914 a new rotor and field-coils for the top-tram motor, and labor for repairs cost $703.48. No new parts were bought in 1915.

No. 134 - Skips and Skip-Roads.

1914	$1,493.65	.005
1915	1,556.60	.005
Increase,	62.95	.000

No. 135 - Underground Tracks and Cars.

1914	$5,466.45	.018
1915	6,059.28	.019
Increase,	592.83	.001

The increase is in 20 lb. rail used, 10 sets of roller-bearing wheels having been purchased in each year.

No. 136 - Electric Tram Plant.

1914	$4,049.39	.014
1915	4,017.45	.012
Decrease,	31.94	.002

No. 137 - Telephones and Safety Devices.

1914	$2,077.55	.007
1915	905.98	.003
Decrease,	1,171.57	.004

In 1914 charges were high on account of safety devices in the engine-house, central station equipment and livery expense, oxygen tanks, stretchers etc.

No. 138 - Crushing and Screening.

1914	$3,064.25	.010
1915	2,924.88	.009
Decrease,	139.37	.001

In 1914 both No. 5 crushers were re-lined with concaves, and in 1915 only one crusher was so repaired.

No. 140 - Fire Expense and Damage.

1914	$ 71.47	.000
1915	21.03	.000
Decrease,	50.44	.000

MINING EXPENSE.

No. 150 - Air-pipes.

1914	$2,283.05	.008
1915	3,153.70	.010
Increase,	870.65	.002

New hoses in 1915 cost $707.81. The extension of water-lines to the new drills also increased charges against this account.

No. 151 - Compressors.

1914	$15,477.24	.051
1915	17,153.66	.053
Increase,	1,676.42	.002

There were more drills in use in 1915 than in 1914, and more working days. The cost of operating the steam-compressor increased $1071.07; charges from North Lake were about the same for both years, and the new compressor in 1915 cost $747.91

No. 152 - Hoisting.

1914	$8,623.09	.029
1915	9,707.09	.030
Increase,	1,184.00	.001

The increase is due to hoisting at night in the fall.

No. 153 - Pumping.

1914	$12,907.11	.043
1915	14,540.92	.045
Increase,	1,633.81	.002

In 1915 the number of gallons of water pumped was 283,489,900. The increase in cost is due to pumping by electricity.

No. 154 - Sinking and Shaft Repairs.

1914	1,781.41	.006
1915	532.04	.001
Decrease,	1,249.37	.005

Charges in 1914 for getting ready the plat at the 15th level, "A" Shaft, were $692.50 and for new air-lifts $104.93. The balance is for putting in new pockets and repairing those in use.

No. 155 - Rock Drifting.

1914	$37,133.81	.124
1915	36,874.82	.113
Decrease,	258.99	.011

In 1914, 3348 feet @ $11.09
In 1915, 3676 feet @ $10.03
The higher cost per foot in 1914 was due to the rock raise from the 15th level to the 10th level in "B" Shaft.

No. 156 - Breaking Ore.

1914	$107,593.36	.358
1915	116,783.87	.358
Increase,	9,190.51	.000

The increase is on account of the larger tonnage produced. The new drill-steel charged out off-set the lower rate of wages.

No. 157 - Tramming.

1914	$70,659.54	.235
1915	76,785.72	.235
Increase,	6,126.18	.000

The increase is due to the greater tonnage mined.

No. 158 - Filling.

1914	$1,592.85	.005
1915	1,754.81	.005
Increase,	161.96	.000

In 1914, 20,122 tons of rock were hoisted and dumped underground. In 1915 the amount was 21,427 tons.

No. 159 - Timbering.

1914	$2,151.34	.007
1915	4,042.70	.012
Increase,	1,891.36	.005

The increase is mostly in charges for new chutes underground made necessary by mining isolated ore-bodies.

No. 160 - Captain & Bosses.

1914	$8,214.58	.027
1915	8,453.91	.026
Increase,	239.33	
Decrease,		.001

There were only four bosses until May 1914. There were five throughout the year 1915.

No. 161 - Dry-house.

1914	$1,926.44	.006
1915	1,925.50	.006
Decrease,	.94	.000

No. 162 - Top Landing and Tramming.

1914	$2,637.16	.009
1915	3,029.34	.009
Increase,	392.18	.000

The increase is on account of hoisting at night in the last three months of 1915.

No. 163 - Stocking Ore.

1914	$4,198.64	.014
1915	3,564.23	.011
Decrease,	634.41	.003

In 1914 two trestles were built, much of the material being new.
In 1915 only one trestle was built, most of the material having been left over from 1914.

No. 164 - Sorting Ore.

1914	$4,481.10	.015
1915	4,296.26	.013
Decrease,	184.84	.002

The decrease in wages accounts for the decrease in charges.

No. 168 - Crushing Ore.

1914	$ 671.55	.002
1915	17.01	.000
Decrease,	654.54	.002

In 1914, 40,827 tons were crushed at $.016 per ton.
In 1915, 646 tons were crushed at $.026 per ton.

No. 169 - Screening Ore.

1914	$3,415.33	.011
1915	4,801.16	.015
Decrease,	1,385.83	.004

In 1914, 259,944 tons were screened at $.013 per ton.
In 1915, 325,854 tons were screened at $.014 per ton.

RECAPITULATION.

Account	1914 Total	1914 Per Ton	1915 Total	1915 Per Ton	Increase Total	Increase Per Ton	Decrease Total	Decrease Per Ton
General Expense,	10,791.86	.036	12,010.58	.036	1,218.72			
Maintenance,	38,536.61	.128	34,224.46	.105			4,312.15	.023
Mining Expense,	285,747.60	.950	307,416.74	.942	21,669.14			.008
Cost of Production.	335,076.07	1.114	353,651.78	1.083	18,575.71			.031

CLIFFS SHAFT MINE

AVERAGE MINE ANALYSIS OF OUTPUT FOR YEAR-1915.

GRADE	IRON	PHOS.	SILICA
Cliffs Shaft Lump,	59.42	.098	5.84
Cliffs Shaft Crushed,	59.00	.100	6.17

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR-1915.

	Mine		Lake Erie	
GRADE	IRON	PHOS.	IRON	MOIST.
Cliffs Shaft Lump,	59.72	.100	59.81	.50
Cliffs Shaft Crushed,	59.32	.102	59.57	1.37

ORE STATEMENT - DECEMBER 31ST, 1915.

	LUMP C. SHAFT	CRUSHED C. SHAFT	TOTAL	TOTAL LAST YEAR
On Hand Jany. 1st, 1915,	13,350	63,724	77,074	62,530
Output for Year,	138,500	188,000	326,500	300,771
Total,	151,850	251,724	403,574	363,301
Shipments,	95,560.	209,331	304,891	286,227
Balance on Hand,	56,290	42,393	98,683	77,074
Increase in Output-8.5%			25,729	
Increase in Ore on Hand,			21,609	

1-8 Hr. Shift during 1914 & 1915.

Tonnage mined from the former Cleveland Iron Mining Company's property through the Cliffs Shaft Mine;

1914.....9,574 Tons

1915.....17,886 "

CLIFFS SHAFT MINE

SHIPMENTS FOR YEAR--1915.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR	
Lump Cliffs Shaft,	67,978	27,582	95,560	107,472	
Crushed Cliffs Shaft,	83,080	126,251	209,331	178,755	
Total,	151,058	153,833	304,891	286,227	
Total Last Year,	138,982	147,245	286,227		
Increase - 6%			18,664		

CLIFFS SHAFT MINE.

COMPARATIVE MINING COST FOR YEAR.

	1 9 1 5	1 9 1 4	INCREASE	DECREASE
PRODUCT	326,500	300,771	25,729	
General Expense	.036	.036		
Maintenance	.105	.128		.023
Mining Expense	.942	.950		.008
Cost of Production	1.083	1.114		.031
Exploratory	.016	.009	.007	
DEPRECIATIONS.				
Original Purchase	.200	.134	.066	
Plant Account	.051	.052		.001
Encompleted Construction		.005		.005
Total Depreciation	.251	.191	.060	
Taxes	.159	.154	.005	
Central Office	.056	.067		.011
Sundry Expense	.057	/040	.017	
Cost on Stockpile	1.622	1.575	.047	
Loading and Shipping	.018	.019		.001
Total Cost on Cars	1,640	1.594	.046	
No.days operating	304	299	5	
No.Shifts & Hours	1-8hr.	1-8hr		
Avg.Daily Product	1074	1006	.68	
COST OF PRODUCTION.				
Labor	.727	.779		.052
Supplies	.356	.335	.021	
Total	1.083	1.114		.031

NOTE:

Increase Cost on Cars		.046
Less Exploratory	.007	
Less Original Purchase	.066	.073
Decrease excluding above		.027

CLIFFS SHAFT MINE.

COMPARATIVE WAGES AND PRODUCT.

	1 9 1 5.	1 9 1 4.	INCREASE.	DECREASE.
PRODUCT	326,500	300,771	25,729	
No.Shifts and Hours	1-8hr	1-8hr		
AVERAGE NO.MEN WORKING				
Surface	63	62	1	
Underground	237	223	14	
Total	300	285	15	
AVERAGE WAGES PER DAY				
Surface	2.36	2.40		.04(1.67%)
Underground	2.68	2.80		.12(4.29%)
Total	2.61	2.71		.10(3.69%)
WAGES PER MONTH OF 25 DAYS.				
Surface	59.00	60.00		1.00
Underground	67.00	70.00		3.00
Total	65.25	67.75		2.50
PRODUCT PER MAN PER DAY				
Surface	17.09	16.13	.96	
Underground	4.54	4.49	.05	
Total	3.59	3.51	.08	
LABOR COST PER TON				
Surface	.138	.149		.011
Underground	.590	.623		.033
Total	.728	.772		.044
AVG.PRODUCT BREAKING & TRAMMING	6.30	6.64		.34
" WAGES CONTRACT MINERS	2.72	2.82		.10
" " " TRAMMERS	2.73	2.85		.12
" " " LABOR	2.72	2.83		.11
TOTAL NUMBER OF DAYS				
Surface	19,102	18,648	454	
Underground	71,896¼	66,978	4,918¼	
Total	90,998¼	85,626	5,372¼	
AMOUNT FOR LABOR				
Surface	45,098.00	44,749.17	348.83	
Underground	192,510.81	187,499.96	5,010.85	
Total	237,608.81	232,249.13	5,359.68	

Proportion - Surface to Underground Men:
1915 - 1 to 3.76
1914 - 1 to 3.59
1913 - 1 to 3.40
1912 - 1 to 4.20
1911 - 1 to 3.35

NOTE: Oct.1,1914, Wage rates reduced 10% from schedule adopted Feb.1,1913.
Aug.1,1915, Wages restored to scale in effect prior to Oct.1,1914.

Avg.wages 9 mos. Jan.1-Sept.30,1914 - 2.79
" " 10 " Oct,1-Aug.1,1915, - 2.50
Decrease during, 10 month period - .29
PerCent " " " -10.4%

CLIFFS SHAFT MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1915.	AMOUNT 1914.
50% Red Cross Powder	249,150	.105042	26,151.25	22,678.55
60% " " "				559.62
80% Gelatin	400	.14	56.00	
Total Powder	249,550	.1050	26,207.25	23,238.17
Fuse	310,300	4.32	1,341.48	1,108.33
Caps	65,200	7,956	518.73	349.63
Cap Crimpers	29	.25	7.45	
Total Fuse,Etc.			1,867.66	1,457.96
Grand Total			28,074.91	24,696.13
Product			326,500	300,771
Pounds Powder per ton ore			.7643	.737
Cost per ton for powder			.0802	.077
Cost per ton for fuse,caps,etc.			.0112	.005
Cost per ton for all explosives			.0914	.082
Avg.price per lb.for powder			.1050	.1048

ANNUAL REPORT

(1915)

OF THE

SALISBURY MINE.

Production and Shipments.

The Salisbury Mine remained closed from the first of the year until October 15th., the only work under-ground being drifting and raising to reach the new ore-body 2,200 feet south-east of the shaft, and the repairs to No. 5 shaft.

On October 15th. three contracts were started in the old mine, and more were added as fast as places could be opened for them in good ore. The mine is now producing a kittle over 6,000 tons a month. The following tables show the production by grades, levels, and months, and the shipments and stock-pile balances.

Table I.

Production by Grades.

Grade	Total for 2 Months Tons	Total for Year 1915 Tons	Average per day 2 Months, 1915. Tons	Average per day 9 Months 1914 Tons
Bessemer	8,748	9,262	172	130
Clinton & Salis.	2,200	3,038	43	12
Clinton Silica	556	600	11	245
Total Ore	11,559	12,900	226	387
Rock	2,380	14,250	46	39
Total Ore &R.	13,939	27,150	272	426

Of the Clinton stock-pile, 4,681 tons were shipped. 1,929 tons of Clinton Silica were loaded by hand, and shipped. Some Clinton, Salisbury, and bessemer was shipped from the pocket.

Table II.

Shipments.

Bessemer	2,679 Tons
Clinton	4,819 "
Salisbury	138 "
Clinton Silica	1,929 "
Total	9,565 Tons

Table III.

Stock-pile balances, December 31, 1915.

Bessemer	6,583 Tons
Salisbury	3,665 "
Clinton Silica	172,782 "
Total	183,030 Tons

What was left of the Clinton stock-pile, when the steam-shovel finished loading, was not very high in phosphorus, and the ore dumped on top of it has been running so low in phosphorus that the whole grade has been changed to Salisbury.

Table IV.

Division of Product by Levels.

Level	Bessemer	Salisbury	Clinton	Silica	Total Ore	Rock	Total Ore and Rock
	Tons	Tons	Tons	Tons	Tons	Tons	Tons
5	3,528	516	422	90	4,556	96	4,652
8	3,290	394	504	188	4,376	20	4,396
14	2,444	590	612	322	3,968	14,134	18,102
Total	9,262	1,500	1,538	600	12,900	14,250	27,150

Table V.

Production of Ore from Old and New Deposits.

	Old Mine Tons	New Deposit Tons	Total Tons
Bessemer	8,648	614	9,262
Clinton	1,282	256	1,538
Salisbury	1,144	356	1,500
Clinton Silica	596	4	600
Total Ore	11,670	1,230	12,900
Rock	1,192	13,058	14,250
Total Ore & Rock	12,862	14,288	27,150

Table VI.

Production by Months.

Month	Days	Ore per Day Tons	Bessemer Tons	Clinton and Salisb. Tons	Silica Tons	Total Ore Tons	Rock Tons	Total Ore and Rock. Tons
January	25						1206	1,206
February	24				2	2	1,316	1,318
March	27						1,072	1,072
April	24				2	2	1,004	1,006
May	25						914	914
June	25						846	846
July	26						928	928
August	26						1,720	1,720
September	25	9		226		226	1,616	1,842
October	26	45	514	612	40	1,166	1,248	2,414
November	25	219	4,371	822	290	5,483	1,270	6,753
December	26	232	4,377	1,378	266	6,021	1,110	7,131
Total	304	42	9,262	3,038	600	12,900	14,250	27,150

Delays.

There were no delays that caused a loss of product in 1915.

Table VII.

Estimate of Ore Reserves.

Level	Bessemer Tons	Clinton Tons	Salisbury Tons	Silica Tons	Total Tons
3				2,000	2,000
4				6,000	6,000
5	29,000	4,000		45,000	78,000
8	77,000	10,000	10,000	73,000	170,000
9	5,000	5,000	2,000	11,000	23,000
10		3,000	2,000	15,000	20,000
12		6,000	5,000	24,000	35,000
14	25,000		30,000	14,000	69,000
16	3,000	1,000		9,000	13,000
Total	139,000	29,000	49,000	199,000	416,000
Less 10% Rock & 10% Loss In Mining.	28,000	6,000	10,000	40,000	84,000
Net Total	111,000	23,000	39,000	159,000	332,000

Ore Reserves Jan. 1, 1915. - - - - - 308,000 Tons

Production, 1915. - - - - - - - - - 12,953 "

Balance 295,047 Tons

Ore Reserves Jan. 1, 1916. - - - - 332,000 "

Gain in 1915. 36,953 Tons

The factors used were as follows:-

Bessemer - - - - - - - - - - 10 Cu. Ft. per ton.

Clinton - - - - - - - - - - 10 " " " "

Salisbury - - - - - - - - - 10 " " " "

Silica - - - - - - - - - - 13 " " " "

SURFACE.

Stock-piles.

1929 tons of Clinton Silica were loaded by hand from the stock-piles during the summer.

4681 tons of Clinton ore were loaded by steam-shovel early in the season. There was no Bessemer on hand.

The trestle leading to the Clinton stock-pile was re-erected, and Salisbury ore dumped here. Bessemer ore has been stocked since October 15th.

Drainage.

The old dam on Section 16 just across the West boundary line near the South-west corner of Section 15 was removed, and the channel of the stream deepened four feet, in order to drain the big swamp South of the mine and prevent the water frpm backing up over the new deposit. It will be necessary next year to divert the stream that flows over the new deposit.

Timber Yard.

Nearly all of the timber left in the yard was shipped to other mines early in the year, and is now being replaced.

Accidents.

The air-pipe blew up in the engine-house on the night of April 23rd, causing a delay of two shifts.

UNDER-GROUND.

Exploration.

The South-east cross-cut on the fourteenth level was advanced 1026 feet in hard rock, and a drift driven east 200 feet and west 45 feet, 2120 feet from the shaft, following a narrow vein of ore. From the east drift three raises have been put up, one to the thirteenth level and two to the twelfth level, opening the ore found by surface diamond-drilling. About 50,000 tons of high grade ore have already been developed in the deposit.

Repairs to No. 5 Shaft.

No. 5 Shaft was re-timbered from the fourteenth level to a point about 40 feet below the eighth level. It is now in pretty good condition, and will probably not need any repairs for a year or two.

General Mining.

On October 15th the working force was increased and mining was started in the old mine, the work being confined as much as possible to Bessemer and Salisbury ore, Silica ore being mined only when incidental to mining the higher grades. There are now fourteen contracts working in the mine.

North Vein.

Bessemer Deposit.

Three contracts started work on the fourth level, or 1269 foot sub-level, on October 15th, 1220 to 1320 feet south-east of the shaft, and mined three pillars of Bessemer ore. One gang went down to the next sub-level in November, and the other two finished the ore on the fourth level at the end of the year.

On the 1258 foot sub-level the ore has been mined east of the big raise 1300 feet south-east of the shaft, and drifts have been driven west along foot and hanging to connect with the other two raises. There is one gang working on this sub-level.

South Vein.

There are four gangs working in the South vein above the eighth level. One gang finished the 1187 and 1177 foot sub-levels, 1470 feet south-east of the shaft, and are now starting to mine the ore in the back of the 1162 foot sub-level, 45 feet above the eighth level, 1400 feet south-east of the shaft.

The three other gangs are working on the 1152 foot sub-level, 35 feet above the eighth level. One gang is just finishing the ore at the west end of the sub-level; another has mined all the ore on the east and south sides of the raise 1300 feet south-east of the shaft, and the third is raising from the hanging wall drift 1380 feet south-east of the shaft. All these

gangs are working in "standing ground", i.e. ore that has never been caved.

One gang put up a raise 40 feet from the eighth level, 1140 feet south-east of the shaft, but found little ore.

South-West Deposit.

There are three contracts working above the fourteenth level in the South-West Deposit. One gang mined all the ore left on the 830 foot sub-level, at the east end of the deposit 650 feet south-east of the shaft, and are now working on the sill-floor of the level mining the same piece of ore. Another contract raised from the fourteenth level 540 feet south of the shaft, and have nearly finished the ore along the hanging-wall 18 feet above the level. The third contract cut a sump near the shaft, and are now enlarging the drift two hundred feet from the shaft.

New Deposit.

There are four gangs working in this deposit, and more will be put on as soon as places can be opened up for them.

The raises from the east drift 2200 feet south-east of the shaft have been lettered EA, EB, EC, and ED. Raise EA was put up 50 feet to the thirteenth level, or 878 foot sub-level, 20 feet East of the main cross-cut. It went up in mixed ore and paint-rock. Raise EB was put up only 10 feet in rock 40 feet inside of raise EA. Raise EC, 50 feet east of raise EB, was put up 50 feet in rock and struck the ore at the elevation of the thirteenth level. It was later continued 50 feet further in ore to the twelfth level, where one contract is opening out in ore. Raise ED, was put up 100 feet inclined to the east, starting 75 feet east of raise EC. It was in ore for 35 feet, but has since been in rock. A drift was turned off to the West from this raise on the thirteenth level, and another is being started at the top of the raise on the twelfth level.

On the thirteenth level a cross-cut was driven 20 feet north-east from raise EA in rock, and another 45 feet South to test the ore formation. Both were in rock. Starting 20 feet south of the raise a

drift was driven east 25 feet and south-east 25 feet in rock. At this point ore was found, and the drift has been continued 110 feet further in ore, following the south contract. A cross-cut was driven from this drift to raise EC, the ore being 25 feet wide at this point.

A cross-cut was driven north 15 feet in rock from the drift 18 feet west of raise ED, and another south-west from the opposite side of the drift. This cross-cut was in rock for one set, but is now in ore.

SALISBURY MINE

AVERAGE MINE ANALYSIS OF OUTPUT FOR YEAR-1915.

GRADE	IRON	PHOS.	SILICA
Salisbury Bessemer,	61.68	.047	5.50
Salisbury,	61.97	.051	4.80
Clinton,	61.14	.150	5.62
Clinton Silica,	53.08	.042	18.16

AVERAGE ANALYSIS ON STRAIGHT CARGOES FOR YEAR-1915.

GRADE	Mine IRON	Mine PHOS.	Mine SILICA	Lake Erie IRON	Lake Erie MOIST.
Salisbury Bessemer,	All mixed				
Salisbury,	"	"			
Clinton,	"	"			
Clinton Silica,	No Shipments				

ORE STATEMENT - DECEMBER 31ST, 1915.

	SALISBURY BESS.	CLINTON AND SALISBURY	CLINTON SILICA	TOTAL	TOTAL LAST YEAR
On Hand Jany. 1st, 1915		5,584	174,111	179,695	162,044
Output for Year,	9,262	3,038	600	12,900	86,741
Total,	9,262	8,622	174,711	192,595	248,785
Shipments,	2,679	4,957	1,929	9,565	69,090
Balance on Hand,	6,583	3,665	172,782	183,030	179,695
Decrease in Output,				73,841	
Increase in Ore on Hand				3,335	

1915-- Mine closed from Jany. 1st to Oct. 31st.
2-8 Hr. Shifts Nov. 1st to Dec. 31st.

1914-- 2-8 Hr. Shifts Jany. 1st to Sept. 30th,
Mine Closed from Oct. 1st to Dec. 31st.

SALISBURY MINE

SHIPMENTS FOR YEAR--1915.

GRADE	POCKET	STOCKPILE	TOTAL	TOTAL LAST YEAR	
Salisbury Bessemer,	2,679		2,679	31,864	
Clinton and Salisbury,	276	4,681	4,957	2,150	
Clinton Silica,		1,929	1,929	35,076	
Total,	2,955	6,610	9,565	69,090	
Total Last Year,	24,774	44,316	69,090		
Decrease - 86%			59,525		

SALISBURY MINE.

COMPARATIVE MINING COST PER YEAR.

Producing	1915. 2 Mos.	1914. 9 Mos.	INCREASE.	DECREASE.
PRODUCT	12,900	86,741		73,841
General Expense	.374	.082	.292	
Maintenance	.200	.141	.059	
Mining Expense	1.202	1.295		.093
Cost of Production	1.776	1.518	.258	
Exploratory	.080	.048	.032	
DEPRECIATIONS.				
Original Purchase	.200	.113	.087	
Equipment	.003	.001	.002	
Total Depreciation	.203	.114	.089	
Taxes	.030	.036		.006
Central Office	.105	.100	.005	
Supply Inventory	.047	.003	.044	
Miscellaneous	.048			.048
Idle Expense	1.654		1.654	
Sundry Expense	.039	.015	.024	
COST ON STOCKPILE	3,896	1.834	2.052	
Loading & Shipping	.021	.018	.003	
Total cost on cars	3.907	1.852	2.055	
Number of days operating	51	224		173
Number Shifts and Hours	2-8hr	2-8hr		
Average Daily Product	253	387		134
COST OF PRODUCTION				
Labor	.982	1.108		.126
Supplies	.794	.410	.384	
Total	1.776	1.518	.258	

SALISBURY MINE.

COMPARATIVE WAGES AND PRODUCT.

	1 9 1 5.	1 9 1 4.	INCREASE.	DECREASE.
PRODUCT	12,900	86,741		73,841
No.Shifts and Hours	2-8hr	2-8hr		
AVERAGE NUMBER MEN WORKING				
Surface	12	28		16
Underground	24	89		65
Total	36	117		81
AVERAGE WAGES PER DAY				
Surface	2.35	2.49		.14
Underground	2.83	2.82	.01	
Total	2.67	2.74		.07
WAGES PER MONTH OF 25 DAYS				
Surface	61.25	62.25		1.00
Underground	70.75	70.50	.25	
Total	66.75	68.50		1.75
PRODUCT PER MAN PER DAY				
Surface	3.57	10.17		6.60
Underground	1.79	3.26		1.47
Total	1.19	2.47		1.28
LABOR COST PER TON				
Surface	.659	.245	.414	
Underground	1.585	.865	.720	
Total	2.244	1.110	1.134	
AVG.PRODUCT BREAKING & TRAMMING	4.68	4.85		.17
" WAGES CONTRACT MINERS	2.90	2.85	.05	
" " " TRAMMERS	2.50	2.50		
" " " LABOR	2.82	2.80	.02	
TOTAL NUMBER OF DAYS				
Surface	3,614	8,529		4,915
Underground	7,217	26,642¼		19,425¼
Total	10,831	35,171¼		24,340¼
AMOUNT FOR LABOR				
Surface	8,503.74	21,279.96		12,776.22
Underground	20,442.03	75,017.29		54,575.26
Total	28,945.77	96,297.25		67,351.48

Producing	2 mos.	9 mos.
Development only	10 "	3 "

Prop.Surface to Underground Men.
1915 - 1 to 2.
1914 - 1 to 3.12
1913 - 1 to 3.49
1912 - 1 to 3.51
1911 - 1 to 3.21

AVERAGE WAGES PER DAY.

	DAYS.	AMOUNT.	RATE.
As per this statement	10,831	28,945.77	2.67
Exploratory (Constr.)	2,650¼	7,803.40	2.94
Total	13,481¼	36,749.17	2.73
Avg.rate last year			2.74
Decrease			.01

The actual decrease is, therefore, .01 instead of .07 as shown above (when all labor is considered).

SALISBURY MINE.

TIMBER STATEMENT FOR THE YEAR ENDING DECEMBER 31,1915.

KIND.	LINEAL FEET.	AVG.PRICE PER FOOT.	AMOUNT 1915.	AMOUNT 1914.
6" to 8" Timber	19,404	.02	388.08	599.16
8" to 10" "	5,860	.04	234,40	1,310.00
10" to 12" "	4,716	.06	282.96	1,945.44
12" to 14" "	2,772	.08¼	227.04	858.00
Total 1915	32,752	.0346	1,132.48	
Total 1914	103,532	.045		4,672.60
	LINEAL FEET.	PER 100'		
5' Lagging	113,900	.47	536.00	1,633.00
6' "	24,550	.55	135.04	
7' "				525.75
Total Lagging	138,450	.485	671.04	2,158.75
Poles	31,310	.943	295.65	1,284.43
Trestle Timber				11.40
Total 1915	169,760	.57	966.69	
Total 1914	579,295	.596		3,454.58

	1915.	1914.
Product for Year	12,900	86,741
Feet of Timber per Ton of Ore	2.539	1.193
Feet of Lagging per ton of Ore	10.73	6.68
Feet of Lagging per Foot of Timber	4.23	4.28
Cost per Ton for Timber	.0878	.054
" " Lagging	.0520	.025
" " Poles	.0229	.015
" " Timber, Lagging & Poles	.1627	.094
Equivalent of stull timber to Board Measure	56,830	228,840
Feet of Board Measure per Ton of Ore	4.41	2.64
Total cost of timber, lagging, and poles 1915		2,099.17
" " " " 1914		8,127.18
" " " " 1913		7,058.47
" " " " 1912		6,787.05
" " " " 1911		7,228.23
" " " " 1910		7,065.06
" " " " 1909		7,756.19
" " " " 1908		7,089.14

Costs per ton,etc., high on account of mine producing ore but two months-November and December. Cost of timber includes that used for drifting and development also.

SALISBURY MINE.

STATEMENT OF EXPLOSIVES USED FOR BREAKING ORE.

KIND.	QUANTITY.	AVERAGE PRICES.	AMOUNT 1915.	AMOUNT 1914.
40% Powder				517.25
50% "	4,440	1,051	466.20	2,638.75
60% "	50	1,150	5.75	
Total Powder	4,490	1,051	471.95	3,156.00
Fuse	14,450	4,718	68.18	347.32
Caps	4,625	9,110	42.15	186.48
Cap Crimpers	1		.25	
Total Fuse, Etc.			110.58	533.80
Total All Explosives			582.53	3,689.80
Product			12,900	86,741
Pounds Powder per Ton Ore			.348	.353
Cost per Ton for Powder			.036	.036
" Fuse, Caps, Etc.			.009	.006
" All Explosives			.045	.042
Avg.Price per Lb. for Powder			.1051	.1031

ANNUAL REPORT

(1915)

OF THE

ANGELINE MINE.

General.

The Angeline Mine was purchased on September 15th from the Pittsburgh & Lake Angeline Iron Company. Two watchmen were immediately put on the property, one working by day, and one by night. All the mine-buildings have been turned over to the Cleveland-Cliffs Iron Company, except the office and barn, which the Jones & Laughlin Ore Company are still using.

"D" Shaft.

The shaft-house has been repaired so that mining operations could start at any time. New sills, many new braces, and a new floor have been put in, and several posts and girts have been spliced.

The shaft has been repaired down to the first set of bearers. Eight new sets were put in below the collar, close together, and from there down to the bearers, about 60 feet, cross-braces were put in at both ends and between the dividings, and new lathe and studdles were put in as needed. New ladders, sollars and casing-planks have been put in as needed almost to the fourth level. The runners for both the skip and cage have been straightened and connected to those in the shaft-house.

East End.

Happy Hollow.

A six inch pipe-line was started from the Lake Mine on December 11th to supply compressed air. It will be completed in a few days.

Ditches have been dug east and west to carry the water from the side-hill into the main launder that runs through the Lake Basin.

The tunnel driven by the Pittsburgh & Lake Angeline Iron Company, has been cleaned out and a track is being laid.

ANNUAL REPORT

(1915)

OF THE

HOLMES MINE.

Surface.

The shaft and railroad tracks have been located, and the grading has been started for the temporary buildings and for the shaft-house. One car of timber has been received.

A six-inch air pipe has been laid from the air pipe connecting the Cliffs Shaft and Morris-Lloyd Mines, for a distance of about 3,000 feet, and about 400 feet remains to be laid before the line reaches the shaft.

Exploration.

Several diamond drill holes have been put down to locate the best position for the shaft. Several drill holes were also drilled during the year, underground from the workings of the Section 16 Mine, and from the drift being driven on the 1050 foor sub-level of the Section 16 Mine across the S½ of the Forty. This drift has also been advanced about 250 feet. All the diamond drilling and drifting has been carried on under the direction of the Geological Department, and wil be given in the Chief Geologists Report.

NEGAUNEE MINE.

PUMPING PLANT - Acct. No. 82a.

In my previous report I described the serious trouble in the sump due to a large accumulation of mud. A detail description was given of the proposed method of removing this mud by bringing up two raises from a lower elevation and holing them in the bottom of the sump. As far as I know, this method is entirely new. It was believed by some that it would not be possible to draw off the mud by valves in the bulkheads in the bottoms of the raises. Mr. McClure and myself believed that practically all of the mud would continue to flow before the water in the sump would break through. In January the raise connecting with the settling basin part of the sump was holed. It was soon demonstrated that the method was perfectly practical and that by opening the valve in the bulkhead in the lower part of the raise the mud could be readily drawn off directly into the skip. In March a second raise, which was taken to within a short distance of the bottom of the sump at a point directly below the suctions, was connected with the sump. Before this could be done it was necessary to divert the coming water of the mine from the main part of the sump. This was sent into the settling basin and taken through a temporary 6 in. suction to the centrifugal pump. This made it possible to drain the main part of the sump and to connect the raise. The mud had accumulated to a depth varying from two to four feet in the various drifts. It had packed to such an extent that it would not flow. It was therefore necessary to put men into the sump to wheel the mud in barrows and dump it into the raise. Part of it was slushed into the raise by the use of water under pressure. In the north end of the sump the distance was so great that this was not practical and a large part of it had to be handled in wheelbarrows. This work was continued for a part of each day until the early part of June when it was completed. Each week since June about two cars of mud have been taken out of the raise which connects with the settling basin. From the

commencing of this work it was demonstrated that it had a great effect on the pumps and much less trouble was experienced in operating them. We have every reason to believe that there will not be any further serious trouble due to coarse material entering the pumps. This work cost considerable money but will pay for itself in a remarkably short time. It is an extremely difficult job to clean a sump as large as the one which we have and it is hard to design any means of removing the mud without delaying the operation of pumping. It should be remembered that we are continuing to remove the larger percentage of the mud without extra labor. This mud of course is iron ore and it is safe to say that we save each week at least ten tons which would ordinarily be lost.

PUMPING WITH STEAM.

Up to April 9th steam was kept in the boilers at No. 2 Shaft as it was not thought safe to abandon the steam pumps until we were sure that the electric pumps were reliable; further, there was not sufficient electric current, and therefore a part of the work had to be done by steam. On April 9th we received word that there was sufficient power and that it would be unnecessary to continue to run the steam pumps. The boiler plant at No. 2 was immediately shut down and since that time it has not been started.

REMOVING STEAM PUMPS.

In September it was found that the steam line going down No. 2 Shaft was broken. It was known that this line was extremely old and if it was allowed to cool that steam could never be sent through it again. It was decided to dismantle the steam pumps and hoist them to the surface. There was a delay in getting a hoist from North Lake as it was in use on Section 6. It was not received until the latter part of November. It was set up at a point about 250 feet to the south of No. 2 Shaft, placed on timbers which were weighted down with rock. Early in December a temporary 3 in. air line about 3,000 feet in length was connected between No. 3 Shaft and the hoist. One pump and a part of the second were hoisted to the surface and loaded on flat

cars and shipped to Ishpeming. Unfortunately, the temperature dropped; the shaft being downcast, it commenced to freeze rapidly. In a short time the roads became so small that it was impossible to hoist. Work had to be stopped. During December word was received to ship the hoist to the Spies Mine. In the spring, if it is possible to obtain another hoist, the remaining pump on the 6 1/2 and also the large Worthington pump and condenser on the 4th level will be pulled to the surface.

CRUSHER - E. & A. No. 282.

On the afternoon of May 6th I received word that the small crusher which was to be used in the preparation of ores for charcoal furnaces was authorized. On the morning of the 7th we started a force of men to excavate and build forms for the concrete. The base is 12 ft. 4 in. by 12 ft. 4 in. On account of the main discharge from the pumps passing directly through the base it was necessary to sink for four feet. The discharge pipe was inclosed in a launder. The crusher foundation itself is rectangular, being 8 ft. 4 in. east and west by 12 ft. 4 in. north and south. The top of the foundation is 20 feet above the rail. The south edge of the foundation is at the same distance from the center of the track as the center of the track is from the shaft house. The center of the foundation is directly opposite and north of the north pocket of the shaft house. On the 12th concreting was started on the main part of the foundation and completed on the 14th. The crusher was received on May 21st and entirely set up on the 23d. There was a small delay in receiving a pulley and belt for the motor. On the afternoon of June 1st the entire work was completed and the crusher put into operation.

From the north edge of the top landing to the bottom of the chute below the skips there is a grizzly with 2 1/2 in. openings. This part of the grizzly is hinged, making it possible to raise it whenever necessary to stock ore. From the edge of the shaft house to a point over the crusher there is another grizzly about 16 feet in length. Below this grizzly there is an apron which conveys the fine ore to a small pocket which is attached to the south side of the foundation of the crusher. The ore going through the crusher

also runs into this small pocket. The capacity of the pocket is only about eight tons but it is large enough to enable us to continue to crush during the period when cars are being dropped down without causing any delay in the hoist. The original grizzly had spreaders between the bars at intervals of 3 feet. These spreaders retarded the progress of the ore and had a great tendency to make the sticky material hang up. The interval between the bars in the old grizzly was 2 1/2 in., the bars being 1/2 by 5 inches. In August a new grizzly was put in. It was made of bars 3/4 by 8 inches. The opening in the upper part was 2 in. and the lower 2 1/2 inches. By using the heavier bars it was possible to get along with only one spreader in the center of the grizzly. It was soon demonstrated that this was a tremendous advantage and the sticky material was not so liable to hang up. This grizzly was put into use in the early part of August. Negaunee ore is extremely difficult to send through a gyratory crusher. A large part of it is of the consistency of putty. I have seen skips dumped on the grizzly and the entire mass slide down into the crusher. This sticky material will not go through the crusher and has to be picked out with bars. In order to get any results it is necessary to sort the ore underground, being very careful not to send sticky stuff to the crusher. Since this has been done we have had much better results. I am perfectly positive that no results could ever be obtained in crushing this sticky ore in gyratory crushers. For the larger part of the season the crusher has not worked to capacity. During December the orders have increased. The operating of the crusher causes some delay in the stocking of ore. The Negaunee and Bessemer which does not pass through the crusher must be handled by the south car. As the Bessemer ore is being stocked at a great distance from the shaft it often occurs that the skip reaches the dump before the car can be returned.

In the early part of December the temperature dropped and we commenced to have serious trouble due to freezing. This is particularly bad at the Negaunee mine on account of the north exposure. It was immediately seen that we would not be able to continue to crush unless sufficient heat could be

provided to keep the ore from freezing on the grizzlies and in the crusher. It was necessary to house in the entire structure and provide a number of large heaters. Since that time we have been able to continue without serious delay.

STOCKPILES.

During the shipping season of 1914 no ore was loaded from the west pile. We commenced the season with this trestle practically filled. Early in February it was necessary to commence to use side dump cars. The plate girders of the trestle are 4 ft. 6 in. in depth by 4 ft. in width. By using the saddle back car, as soon as the ore reaches the inside of the lower part of the girder it is necessary to stop dumping, for if this were continued, the weight of the ore on the inside would push the girders out. These girders were not designed to stand pressure at right angles to their length. By using a side dump car it is possible to greatly increase the capacity of the trestle as a layer of ore about 8 feet in thickness can be dumped for its entire length. Previous experience had shown that it was not practical to allow the ore to accumulate around the braces which extend from the girders to the piers. This left a considerable hole around each pier and decreased the capacity of the trestle. By using a side dump car the ore runs back towards the piers on an angle of 45 degrees. This makes the loss around each pier very small. It was found that by using the side dump car we could increase the capacity of the trestle about 25 per cent.

During the shipping season the old pile at No. 2 Shaft was finally cleaned up. This has been on hand for several years and it was particularly important to have it removed as it interfered with mining operations. In the previous year we had done considerable work preparatory to attacking the No. 2 Shaft pillar. This had to be stopped as the stockpile was not removed in 1914. In addition, the general mining operations were commencing to pull back closer to No. 2 Shaft. It was feared that if the pile was not shipped a part of it might commence to settle. The loading of this ore was extremely difficult on account of the poor tracks and also due to the fact that the

pile had settled into the swamp for four or five feet. For several cuts it was necessary to block up the shovel and the loading track for this height. In October, after the old stockpile was removed, we commenced to pick up the sollar plank. This was loaded on flat cars and shipped to No. 3 Shaft. A part of it was used to increase the width of the sollar at No. 3 stockpiles. The remainder will be taken into stock and used underground. A large part of this plank is in firstclass condition.

At No. 3 Shaft the Bessemer pile and the Negaunee on the east trestle was all shipped. In the west trestle two cuts were taken. On the end of the season there remained a large strip of ore for the entire length of the west trestle. With the estimated production for 1916 it is figured that we will just have enough capacity to stock the ore.

ROLLER BEARING CARS.

For two years we have been experimenting on the top tram with roller bearing wheels. These have been proven to be most satisfactory. On the start there was much trouble on account of the bearings not being designed correctly. The engineer from the Hyatt factory investigated the trouble and rectified it immediately. Since that time the bearings have stood up remarkably well. On account of the great success on the top tram we commenced to experiment underground. In September, 1914, a car was built and equipped with roller bearing wheels. It has been in use continually since that time with practically no trouble. It has been demonstrated that with one loose wheel, which is the common practice in roller bearing wheels, that the wheels do not become flat. With the ordinary bearing and two wheels pressed on the axle flat wheels are exceedingly common and often occur inside of a month or so. The replacing of these wheels is expensive. By using roller bearing trucks there should be a very large reduction in the upkeep for wheels. In addition, the cars should stand up better as the tremendous vibration due to flat wheels is eliminated. In October we put into operation eight roller bearing cars which had been built by the Lake Shore Engine Works. At about this time a new locomotive was received. This locomotive was stalled with five loaded cars