TILDEN MINE
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7. OPEN PIT OPERATIONS (Continued)

f. Drilling, Blasting & Explosives (Cont'd)

Statement of Drill Bits Sharpened (Cont'd)

	Number of Bits Sharpened	Feet of Holes Drilled	Feet of Hole Per Bit Used
West Tilden	1,213	6,700	5.52
East Tilden	87	1,220	14.00

Distribution of Explosives Used

PRIMARY BLASTING

Kind	Quantity	Price	Amount 1931.	AMOUNT 1930.
No. 2 Gelamite				4,975.38
Gelamite "A"	6,000	12.75	765.00	
40% Gelatin				174.00
60% Gelatin				1,140.00
80% Gelatin	6,900	17.75	1,224.75	5,840.30
90% Gelatin	2,100	20.25	425.25	518.75
Total Powder	15,000	16.10	2,415.00	12,648.43
Blasting Supplies				
	Feet			
Dbl.Count.Cord.Bick.Fuse	3,029	48.87	148.04	403.12
Plain Cordeau-Bick. Fuse	1,009	42.50	42.88	134.26
No.2 WC Cord.-Bick. Fuse				344.42
Connecting Wire				3.28
Total Fuse, Caps, etc.	4,038		190.92	885.08
Total All Explosives,			2,605.92	13,533.51

SECONDARY BLASTING

	Lbs.			
60% Gelatin	2,700	13.75	371.25	1,430.74
Blasting Supplies	Ft.	Per M		
No. 6 Caps	2,800	11.55	32.35	52.75
Crescent Fuse	12,650	6.24	79.56	130.12
No. 6 Electric Caps	50	64.00	3.20	9.16
Connecting Wire				4.18
Total fuse, caps, etc.			115.11	202.21
Total Secondary Blasting			486.36	1,632.96
Grand Total Primary & Secondary,			3,092.28	16,166.46

EXPLORING

60% Gelatin				28.50
No. 6 Electric Caps				5.81
Connecting Wire				9.90
Total Explosives,				44.21
Total " Per Cost Sheet,			3,092.28	$15,210.67

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7. OPEN PIT OPERATION (CONTINUED)

f. Explosives, Drilling & Blasting (Cont'd)

Statement of Explosives Used

Kind	Quantity	Average Price	Total 1931	Total 1930
No.4 Hercomite	0		0	0
40% Gelatin				174.00
60% Gelatin	2,700	13.75	371.25	2599.24
80% Gelatin	6,900	17.75	1224.75	5840.30
90% Gelatin	2,100	20.25	425.25	518.75
Gelamite 2			0	4975.38
Gelamite A	6,000	12.75	765.00	0
Total Powder	17,700	15.74	2786.25	14,107.67
Blasting Supplies.				
No. 6 Caps	2,800	11.55	32.35	52.75
Crescent Fuse	12,750	6.24	79.56	136.12
Dbl.Count.Cord.Bick Fuse	3,029	48.87	148.04	403.12
Sgl.Count.Cord.Bick Fuse	1,009	42.50	42.88	134.26
No.2 WG. C-B Safety Fuse				344.42
Electric Blasting Caps	50	64.00	3.20	14.97
Connecting Wire				17.38
Total Fuse,etc.,			306.03	1,103.00
Total All Explosives,			3,092.28	15,210.67
Product			137,010	287,043
Lbs. Powder Per Ton of Ore			.129	.032
Cost Per Ton for Powder			.023	.049
Cost Per Ton, Fuse, Caps,etc.,			.002	.004
Cost Per Ton, All Explosives,			.025	.053
Average Price per Lb. for Powder			.157	.1537

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8. COST OF OPERATING

a. Comparative Mining Costs

	1931	1930	Incr.	Decr.
PRODUCTION:	137,010	287,043		150,033
Average Daily Product	1,651	2,295		644
Tons Per Man Per Day	40.56	53.79		13.23
Number of Days Operating	83	125		42
Number Shifts and Hours	1-9	1-9		
Budget-Estimated Production	300,000	600,000		300,000
Budget-Est. Cost at Mine	.538	.405	.133	
COSTS:				
Pit Operating Accounts	.390	.357	.033	
Pit General Accounts	.089	.055	.028	
Cost at Mine Per Cost Sheet	.479	.412	.067	
DEPRECIATION:				
Plant and Equipment	.077	.077		
Movable Equipment	.006	.006		
Taxes	.106	.074	.032	
Stripping	.016	.016		
Supply Inventory	.000	.000		
Total Cost at Mine	.684	.585	.099	
EXPENSE BEYOND MINE:				
Rail Freight	.640	.640		
Lake Freight	.760	.760		
Cargo Insurance & Analysis	.010	.010		
Shrinkage	.013	.012		
Total Cost Lower Lakes	2.107	2.007	.100	

b. Detailed Cost Comparison

1. Days & Shifts

The mine operated on a 1-9 hour shift three days per week as far as possible throughout the operating season of 1931. Operations were very intermittant, and it was necessary to operate the pit when boats were named for Tilden cargoes. We were able to operate the entire season without working overtime more than four or five shifts. It will be noted that the pit was only operated 83 days during 1931, as compared with 125 days in 1930.

2. Production

While the pit and equipment were in shape for handling a large production during the past season, the product was less than one half of that of 1930, which was due to the general condition of the ore market. Out daily average while loading with two shovels from the West Pit was about the same as that secured in 1930, but the low average secured while working one shovel in the East Pit, broke down the average for the year.

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8. COST OF OPERATING

b. Detailed Cost Comparison (Cont'd)

2. Production

The average daily production from the East Pit was little better than 900 tons per day. Only one shovel was operated in this pit, and loading conditions were not favorable, as the cut here is not a hillside cut, but into the hill, making it difficult to load more than one or two cars at a time. Further, considerable time was lost in sorting the rock from the ore in order to secure a good product.

3. Cost of Production

The Cost of Production of .479 per ton compared with .412 for 1930, an increase of .067 per ton. Operating conditions were very satisfactory, and if we had had a normal year, there is no reason why we would not have shown a decrease in the cost of production rather than an increase. The increases will be found in the following items: Drilling & Blasting, General Open Pit Expense and Waste Pile Expense.

The Cost on Cars of .684 compared with .585 for 1930, a further increase of .099, and is due to Taxes which were .032 higher in 1931 than in 1930.

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YEAR 1931.

8. COST OF OPERATING: (Continued)

b. Detailed Cost Comparison: (Continued)

4. Open Pit Costs:

	1931	1930
Days per Week	3	6-5
Shifts and Hours	1-9	1-9
Production, Tons	137,010	287,043
Average Daily Production	1,651	2,295
Number of Days Worked	83	125

	1931		1930		Increase		Decrease	
	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
PIT OPERATING:								
Direct Ore:								
1. Drilling & Blasting	21487.74	.157	39685.29	.138		.019	18197.55	
2. Electric Shovels Operating	2956.14	.021	7018.72	.025			4062.58	.004
3. Electric Shovels Maintenance	3900.96	.028	11707.76	.040			7806.80	.012
4. Locos. & Cars Operating	3198.71	.023	5267.74	.018		.005	2069.03	
5. Locos. & Cars Maintenance	1806.09	.013	7706.23	.027			5900.14	.014
6. Track Expense	1829.67	.014	3619.86	.013		.001	1790.19	
TOTAL (Direct Ore)	35179.31	.256	75005.60	.261			40826.29	.015
GEN. PIT EXPENSE:								
9. Water Supply	732.87	.005	377.85	.001	355.02	.004		
11. Crushing & Screening	6782.77	.049	19978.31	.070			13195.54	.021
12. General Open Pit Expense	4065.99	.029	3937.30	.014	128.83	.016		
13. Open Pit Superintendence	2740.00	.021	3000.00	.011		.010	260.00	
15. Waste Pile Expense	4066.82	.030	136.75	.000	3930.07	.030		
TOTAL GENERAL PIT EXPENSE	18388.45	.134	27430.21	.096		.038	9041.62	
TOTAL PIT OPERATING	53567.76	.390	102435.81	.357		.033	48867.91	

TILDEN MINE
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YEAR 1931.

8. COST OF OPERATING: (Continued)

b. Detailed Cost Comparison: (Continued)

4. Open Pit Costs:

	1931		1930		Increase		Decrease	
	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
GENERAL MINE EXPENSE:								
18. Insurance	163.81	.001	76.44	.000	87.37	.001		
19. Mining Engineering	517.43	.004	1248.67	.004			731.24	.000
20. Mech. & Elect. Engineering	1131.22	.008	1822.18	.006		.002	790.96	
21. Analysis & Grading	810.45	.006	4710.90	.016			3900.44	.010
22. Personal Injury	1635.37	.012	2598.23	.009		.003	962.86	
23. Geological	117.67	.001			117.67	.001		
24. Safety Department	162.70	.001	123.17	.001	39.53	.000		
25. Welfare Expense	459.20	.004	435.55	.002	23.65	.002		
26. Special Expense	844.50	.007	795.52	.003	48.98	.004		
27. Ishpeming Office	1133.08	.008	1127.85	.004	5.23	.004		
29. Mine Office	5000.82	.037	4380.12	.015	620.70	.022		
TOTAL GEN. EXP.	11976.26	.089	17318.63	.060		.029	5342.37	
COST OF PRODUCTION	65544.02	.479	119754.44	.417		.062	54210.42	
30. Taxes	14534.86	.106	21146.08	.074		.032	6611.22	
TOTAL COST	80078.88	.585	140900.52	.491		.094	60821.64	
BUDGET								
Tons and Cost	300,000	.538	600,000	.405		.133	300,000	

TILDEN MINE
ANNUAL REPORT
YEAR 1931

8. COST OF OPERATING (Continued)

b. Detailed Cost Comparison (Cont'd)

4. Open Pit Costs

1. Drilling & Blasting
The Drilling and Blasting costs are carried in a Deferred Account and charged on a tonnage basis as the ore is loaded and shipped. The smaller tonnage shipped this year explains the decrease in total amount. The increased cost per ton for 1931 is due to the blast made at the East Pit, which did not break as large a tonnage per foot of hole and per pound of powder as in previous blasts at the West Pit, where we have a high bank to blast.

2. Electric Shovels Operating
The small difference in cost per ton for operating the shovels is due to a smaller labor charge. During the past season when the mine was idle, all men were laid off, including the shovel runners. During 1930 the shovel men were employed regardless of whether we were loading or not.

3. Electric Shovels Maintenance.
The maintenance for shovels was considerably lower than for 1930, due to better operating conditions and a smaller tonnage handled during the past season.

4. Locomotives and Cars Operating
The increased cost per ton for operating locomotives and cars is explained by the smaller average daily production.

5. Locomotives and Cars Maintenance.
The maintenance of locomotives and cars shows a decided decrease, and is explained by the thorough overhauling given the locomotives during the winter of 1930-31.

11. Crushing & Screening
The charge to this account include both the costs for operating and maintenance. The decrease is due to the smaller tonnage handled and less repairs made throughout the plant.

12. General Open Pit Expense
The charge to this account was about the same each year, with 42 less operating days for 1931. The increased cost per ton is due to our having to maintain a certain number of men on our track crew for shifting of tracks when necessary. During the past season a large part of the track crews time was spent on general improvement, which explains the large increased cost against this account.

13. Open Pit Superintendence.
The increase here is due to a smaller tonnage handled.

15. Waste Pile Expense.
The charge against Waste Pile Expense in 1930 was for laying a track to the waste pile at the extreme west end of the West Pit. The charge in 1931 is the cost of handling some 15,000 to 20,000 tons of waste material from the East Pit.

TILDEN MINE
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8. COST OF OPERATING (Continued)

b. Detailed Cost Comparison (Cont'd)

4. Open Pit Costs.

19. Mining Engineering. 20. Mechanical & Electrical Engineering
There was less mining and mechanical engineering required during 1931 due to the curtailed operations.

21. Analysis & Grading.
Due to the large decrease in shipments from the Tilden Mine in 1931 over the previous year, there was less sampling and fewer determinations made.

22. Personal Injury Expense
This charge is on a payroll basis, and due to our curtailed operation during the season 1931, our payrolls were considerably less.

24. Safety Department
There was more First Aid training given during 1931.

25. Welfare Expense.
26. Special Expense.
27. Ishpeming Office
There was only a comparitively small increase against these items.

29. Mine Office Expense
This increase is explained by a larger proportion of the Superintendent's time being charged to the Tilden during 1931. In 1930 his time was distributed to the Holmes Mine as well as the Tilden and Spies-Virgil Mines.

10. TAXES

Tilden Township
Tilden Mine

	1931 VALUATION	1931 TAXES	1930 VALUATION	1930 TAXES
N½ of NW¼ Sec.26-47-27	$300,000	11,158.62	$400,000	17,009.25
SE¼ of SW¼ Sec.23-47-27	4,000	148.78	4,000	153.13
Supplies and Equipment	80,000	2,975.64	80,000	3,082.60
Summit Mountain Mine				
N½ of NE¼ Sec. 26-47-27 (A)	1,400	52.07	1,400	53.60
S½ of NE¼ Sec. 26-47-27	900	33.46	900	34.46
Ogden Mine				
Lot 3,Sec.13-47-27	150	5.60	150	5.74
Part Lot 4,Sec.13-47-27	100	3.72	100	3.83
Lot 5 Sec. 13-47-27	150	5.60	1.50	5.74
SE¼ of SW¼ Sec. 13-47-27	200	7.44	200	7.66
Total Tilden-Ogden	386,900	14,390.95	548,900	20,936.71
Collection Fees.....		143.91		209.37
Total Tilden-Ogden.....		14,534.86		21,146.08

TILDEN MINE
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11. PERSONAL INJURIES

There were no lost time accidents at the Tilden Mine during the year 1931, and only two minor accidents of "no lost time." On December 14th 1931, the Tilden Mine completed two years without any lost time accidents. It was the first one of the Companys' properties to make such a record. During May the employees of this property were presented with Safety Buttons for having gone one year without any lost time accidents. At Christmas time they were presented with turkeys in appreciation of their two-year record without a lost time accident. We are proud of this record, and will make renewed efforts to maintain it during 1932.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

E & A No. 592, A & B, Opening & Equipping Tilden Mine

a. Stripping

Stripping of the rough overburden at the East Tilden Pit with a 50 H.P. scraper hoist was continued through the first three months of the year until March 31st. At this time it was decided that this deposit would not be opened up during 1931, and further work of developing was discontinued. The Stripping with the scraper hoist proved very satisfactory, and we secured good costs, which have been tabulated under "Stripping" and showing a comparison with that obtained from washing.

The overburden at the West end of the East deposit is very heavy, averaging from four to six feet in depth. There is considerable hardpan and large bowlders which would be expensive, if not impossible to move by washing. An area as far north as Diamond Drill Hole No. 18, and 50 ft. to the East, has been cleared of the rough surface. It will be necessary to wash this area before blasting, to keep the ore clean.

In September when it was decided to mine a small tonnage of low phosphorous ore from the East Pit, work on extending the track from the Crushing Plant to the point of loading, was started. The track and the siding was laid, and all charges to this E & A closed as of December 31st, 1931. Any additional track work will be in the nature of extensions and charged to "Operating."

14. MAINTENANCE AND REPAIRS

1. Shovels.

Both No. 29 and 31 shovels were gone over thoroughly and all moving parts cleaned. There were very few replacements, as the service during the season of 1930 was not as severe as in the previous year. The motor generator sets were taken to the Shops and thoroughly cleaned and replaced during January. The base and boom of both shovels were gone over and all rivets and bolts tightened or replaced.

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14. MAINTENANCE AND REPAIRS (Continued)

1. Shovels, (Continued)

This is the first time that it has been necessary to do this. Several hundred rivets were replaced on No. 29 shovel, while on No. 31, only a few had to be renewed.

Last season the dipper sticks on the No. 31 shovel broke, and new ones that were built at the Hard Ore Shops were put on. These dipper sticks were two feet shorter than the original ones, which makes a considerable difference when digging along the bank. New dipper sticks were built during the winter at the General Shops, and these were put on No. 31 shovel, the short ones being kept as a spare set.

The dippers for both shovels were rebuilt, using a new designed front which will have 5 teeth instead of four. The outside teeth are located on the corners of the dipper front and prevent wear on the swinging lugs of the dipper. The new front is very much heavier and smooth, making it easy to attach wearing plates. The wearing plates were placed between the dipper teeth to within 18 inches of the bottom, where old concaves from the large crusher were riveted. These concaves are manganese steel and work out very successfully as wearing plates.

2. Locomotives

The tanks of locomotives Nos. 2 and 3 were lifted from the truck bodies, and the frame work of the trucks rebuilt. The cabs of Nos. 2, 3 and 4 were repaired and painted, and changes made in the coal hopper of No. 4 locomotive. The boilers of the three locomotives were scraped and painted. The running gear of these locomotives were overhauled after the close of the season of 1930.

3. Cars

Very few repairs were made to the cars during the early part of 1931, these repairs consisting mainly of straightening steps and brake riggings.

4. Crushing Plant

The two small crushers were overhauled during the latter months of 1930. During January of 1931, work was started on the large 42 inch crusher. The bottom was taken down and working parts inspected and cleaned, and new concaves were installed in the bottom row. These concaves were ordered one inch thicker than those previously used, to make up for some of the wear on the head. With the head lower and the new concaves in place, the opening was less than 5 inches, the smallest size to which this crusher can be set.

The steel frame carrying the dumping outfit was re-inforced by the addition of a ten-inch I-beam and several channels. A permanent ladderway and platform were constructed from the track grade to the top of the crusher building where the hoist motor is located.

TILDEN MINE.
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14. MAINTENANCE AND REPAIRS (Continued)

4. Crushing Plant (Cont'd)

New lining plates were put in the railroad loading pocket and chute gates repaired. The conveyor motor was re-installed during February, after being completely overhauled at the General Shops at Ishpeming. Several coils burned out during the previous season, and repairs at the time were only temporary.

Cast iron wearing plates made at the Lake Shore Engine Works, were installed on the spider of the small crusher, which was showing extensive wear due to the abrasion of the hard silicious ore.

The conveyor belt which was installed during the winter of 1930, has now handled a larger tonnage than the original belt, and from all appearances will handle a like tonnage. This conveyor belt is put on top of the old belt, which is used as a power belt. The conveyor is the Duplex System of the Boston Woven Hose and Rubber Company.

The pocket feeding into the 42 in. crusher, which was rebuilt during 1930, shows little or no wear, and has not required any repairs.

5. General

No repair work has been done since the mine was closed in October, at which time the entire crew was laid off.

18. NATIONALITY REPORT

	American Born	Foreign Born	Total
English	9	5	14
Swedish.....	5	1	6
Finnish.....	4	5	9
French Canadian..	2	1	3
Irish.....	5	0	5
Norwegian.....	1	0	1
Total...	26	12	38

NEGAUNEE MINE
ANNUAL REPORT
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1. GENERAL:

The mine operated four days per week from January 1st to April 13th, three days per week from April 13th to November 16th, and two days per week from November 16th to December 31st.

When the schedule of three days per week was first put into operation, the mine worked on Monday, Wednesday, and Friday, until August 17th, when it was decided to operate on the first three days of the week to increase efficiency. This latter plan proved very satisfactory as the working places were operated three days straight and then propped where necessary before leaving them on Wednesday. This plan increased the repair cost for the levels and travelling roads but this was more than offset by better operating conditions in the working places due to less repairing.

When the two day schedule went into effect it was decided to operate on Monday and Wednesday and have the night shift hoisting crew come out on Tuesday and Thursday day shift rather than on Monday and Wednesday night. All operations are now on the day shift, which allows better supervision of the work, as the Captain is able to be underground with the men. Another change that became imperative on the two-day schedule was to double up most of the contracts and have one crew of men work four days one week, then lay off, and another crew come on the next week. The average slice is 80 ft. long and if the maximum of one cut per shift was obtained it would take 16 days to complete a slice, which at two days per week would take two months. Long before this time the first part of the slice would be crushed due to the heavy pressure, also the top of the raise and the travelling and timber road would be lost or else considerable time would be wasted while retimbering. With the contracts doubled up the slice will be completed in one month and there will not be so many idle days, during which time crushing would occur with no miners working to catch up the caps with props before they came down and closed the drift.

The working force was maintained at practically a constant figure during the year. On account of the large number of unemployed men in the district some single and married men have worked part time to allow more men to obtain employment.

The use of wire fencing on top of poles in covering down the sub levels to make a better mat, introduced last year, was continued and except in cases where there was excessive pressures proved very satisfactory in holding back runs of loose rock from the gob above. Where the fencing has been used for two or three sub levels and a good mat established, its use has been discontinued, but as mining progresses in areas under new hanging the wire will be used until the loose rock no longer filters through the mat.

The five transfer systems operated in 1930 have been reduced to three as the area above one of them has been mined out and in another case the workings have reached the sub above the transfer and it is no longer possible to maintain the transfer drift due to the heavy pressure. This latter area, which is on the South foot between No. 1 and 2 dikes 40' below the 10th level, has become so small due to the receding of the footwall that it will be possible to mine the remaining ore from a few short rock raises. These transfer systems save a lot of rock development and prove very satisfactory where little or no water is encountered.

All the ore mined in 1931 was handled by scrapers to the raises. Ten new electric scraper hoists (1-20 h.p., 4-15 h.p., and 5-10 h.p.) have been purchased to replace some of the obsolete air and smaller electric units and these have made possible the use of larger scrapers and a corresponding increase in tons per man. The balance of the small hoists will be replaced as soon as economic conditions warrant the expenditure.

NEGAUNEE MINE
ANNUAL REPORT
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1. GENERAL: (Cont)

The decrease in stockpile shipments this year made it necessary to erect about 1000 ft. of wood trestle, as the steel trestles are practically full. This wood trestle was erected in the area prepared last Fall to the North of the East steel trestle.

Stoping was continued in the areas on the North and South footwall below the 10th level, approximately 15 contracts being employed in these two areas. Some of the ore on the South footwall has been handled through a transfer system.

In the area just above the 11th level on the North footwall in which mining was delayed due to the crushing of the 11th level, two transfer systems were put into use late in 1930 and stoping has been in progress the entire year. There is considerable pressure here and a fairly large amount of water which makes it exceedingly difficult to mine efficiently, especially with the curtailed operating schedule.

Mining has been completed in the central part of the ore body on the 11th level and the first sub level under the level is about half mined between the East footwall and the Maas boundary.

A few contracts have been stoping in the area under the hanging in the Southwest part of the ore body and as soon as the present sub level, three subs below the 11th level, is finished these contracts will be moved to the central area where they will be doubled up with contracts, as it is impractical to keep so many areas open under the present operating schedule.

The only development work in 1931 has been the sinking of No. 3 shaft 85 ft. below the 13th level for a storage and measuring pocket and the opening of a skip pit clean out drift at the bottom of the shaft. Sinking was started March 18th of this year and was completed on June 18th, the men working on the days when the mine was idle. The skip pit pocket has been installed and the storage pocket excavated and partly concreted. Work on this pocket, which will be of steel and concrete construction, will be completed early in 1932, after which the 13th level will be advanced to the ore body, approximately 1000 ft. to the North.

The grade of the ore produced in 1931 was similar to that produced in 1930. No Bessemer ore was produced in 1931 as the phosphorus was not uniform in the small areas mined under the hanging where Bessemer grade ore is obtained.

The present operating schedule makes it necessary to maintain a large force of men repairing in order to keep the levels and raises open and even then certain sections will have to be abandoned and reopened later at an increased cost, hence the mine will not be in shape to immediately resume a full production of 650,000 tons a year when economic conditions are normal.

Early in the Spring it was found that No. 2 shaft which is used for ventilation only was badly in need of repairs, the ice which forms in the winter in this downcast shaft having torn out the sets in several sections. A crew of shaft men have been repairing this shaft nearly all summer on the idle days as they could not work when the ventilating fan was in operation. This work has entailed considerable expense but as the shaft passes through jasper, which might slack and thus enlarge the opening, it was essential that new sets be put in and the old ones blocked and braced. Several attempts have been made to cut off the water, but without much success, as it seeps out at numerous places and the only way to completely seal it off would be to concrete the shaft. This would be a very costly proceeding and it has been decided to reverse the fan as much as necessary on the idle days to bring the warm air up and thus melt any ice that may form.

NEGAUNEE MINE
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YEAR 1931

1. GENERAL: (Cont)

Effective September 1st the Negaunee Mine laboratory took over the analysis work for all of the Company mines in Marquette County. The laboratories at Ishpeming and the Morris-Lloyd Mine were closed. A reorganization of the personnel was effected, only the best men being retained. The number of determinations from each mine was also reduced by eliminating a few of the daily stope analysis. A large saving in cost has been effected by the consolidation.

Monthly meetings of foremen have been continued throughout the year and while standardization of all operations has been part of the program, safety and the elimination of waste have also been taken up with very satisfactory results as shown in the decreased supply costs and the improved safety records. Purchases have been drastically reduced and standardization of supplies, methods of handling, rules for warehouse men, etc. are part of the program now under way to further reduce waste and operating costs.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

	1931	1930	Increase	Decrease
Negaunee Bessemer Ore	-	24,428		24,428
Negaunee Ore	338,696	555,312		216,616
Total Ore	338,696	579,740		241,044
Rock	7,872	16,760		8,888
Total Hoist	346,568	596,500		249,932

The product decreased in 1931 due to the reduced working schedule.

b. Shipments:

Grade of Ore	Pocket Tons	Stockpile Tons	Total Tons	Total Last Year
Negaunee Bessemer	-	24,913	24,913	2,498
Negaunee Ore	97,854	36,682	134,536	414,878
Total	97,854	61,595	159,449	417,376
Total Last Year	314,591	102,785	417,376	
Decrease	216,737	41,190	257,927	

Shipments decreased 62% in 1931 and were only 47% of the product.

c. Stockpile Inventories:

Grade of Ore	Dec.31,1931	Dec.31,1930	Increase	Decrease
Negaunee Bessemer	-	31,490		31,490
Negaunee Ore	401,789	188,910	212,879	
Total	401,789	220,400	181,389	

Ore in stock increased 181,389 tons; the increase in 1930 was 162,364 tons.

d. Division of Product by Levels:

The ore hoisted from the various levels was as follows:

	1931		1930	
10th Level	1,288	.4%	50,143	8.5%
11th "	173,471	51.2%	408,580	70.5%
12th "	163,937	48.4%	121,017	21.0%
Total	338,696	100.0%	579,740	100.0%

The product from the 12th level increased materially in 1931 and amounted to nearly 50% of the output as compared with 21% in 1930.

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2. PRODUCTION, SHIPMENTS & INVENTORIES:

e. Production by Months:

The production by months is as follows:

Month	Bessemer	Negaunee	Total	Rock
January	-	34,695	34,695	960
February	-	32,572	32,572	1,020
March	-	38,024	38,024	760
April	-	28,830	28,830	588
May	-	26,526	26,526	816
June	-	26,324	26,324	732
July	-	29,245	29,245	316
August	-	26,569	26,569	544
September	-	29,015	29,015	220
October	-	26,751	26,751	720
November	-	22,526	22,526	612
December	-	17,619	17,619	584
Total	-	338,696	338,696	7,872
Transferred from	-	-	-	
Stockpile Overrun	2,142		2,142	
Total	2,142	338,696	340,838	7,872
Total 1930	24,428	555,312	579,740	16,760
Decrease	22,286	216,616	238,902	8,888

The product by leases was distributed as follows:

	1931	1930	Increase	Decrease
Negaunee Mine	323,424	569,656		246,232
American Mining Co.	15,272	10,084	4,188	
Total	338,696	579,740		241,044

f. Ore Statement:

	Negaunee Bessemer		Negaunee	Total	Total Last Year
On Hand Jan. 1, 1931	31,490		188,910	220,400	58,036
Product for Year	-		338,696	338,696	579,740
Overrun	2,142		-	2,142	-
Transferred from	8,719	to	8,719	-	-
Total	24,913		536,325	561,238	637,776
Shipments	24,913		134,536	159,449	417,376
Balance on Hand	-		401,789	401,789	220,400
Decrease in Output				238,902	
Increase in ore on hand				181,389	

1931 - 1 8-hour shift, 4 days per week, January 1st to April 13th
3 " " " April 13th to November 16th
2 " " " November 16th to December 31st

1930 - 1 8-hour shift, 6 days per week, January 1st to July 1st
5 " " " July 1st to December 11th
4 " " " December 11th to December 31st.

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2. PRODUCTION, SHIPMENTS & INVENTORIES:

g. Delays:
There were no delays during 1931.

h. Delays from Lack of Current:
There were no delays during 1931.

3. ANALYSIS:

a. Average Mine Analysis on Output:

Grade	1931 Iron	1931 Phos.	1931 Silica	1930 Iron	1930 Phos.	1930 Silica
Negaunee Bessemer	-	-	-	61.70	.049	6.08
Negaunee	60.29	.101	6.79	60.20	.093	7.08

The average mine analysis on output was slightly higher in iron and phosphorus but a little lower in silica

b. Average Analysis on Straight Cargoes

Grade	Mine Iron	Mine Phos.	Lake Erie Iron	Lake Erie Moist
Negaunee Bessemer	61.90	.049	None	
Negaunee	60.82	.097	"	

The average analysis on straight cargoes averaged slightly lower in the Bessemer grade, but .73 higher in iron for the Negaunee grade.

c. High Sulphur Ore
There was no high sulphur ore encountered in mining or developing in 1931. When No. 3 shaft was sunk to the 13th level some high sulphur ore was cut but when sinking was resumed this year the material in the shaft and the plat was so low in iron content that it could not be classed as ore. Apparently the high sulphur ore encountered in the shaft when it was sunk to the 13th level several years ago was merely a rich seam in the jasper.

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore
Assumption: 12 cubic feet equals one ton
10% deducted for rock
10% deducted for loss in mining
Percentage of Bessemer equals 5%
Above 9th Level:

No. 1 Shaft Pillar	1,148,681	tons
No. 2 Shaft Pillar	113,906	"
Total above 9th level	1,262,587	"
Between 10th and 11th levels	796,654	"
" 11th " 12th "	1,789,771	"
Total developed ore above 12th level 11-30-31	3,849,012	"
Mined in December 1931	17,619	"
Total developed ore above 12th level 12-31-31	3,831,393	"

There was a decrease of 328,696 tons in the ore reserves from last year while the product was 340,838 tons, giving a total of only 12,142 tons increase in developed ore.

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4. ESTIMATE OF ORE RESERVES: (Cont)

a. Developed Ore: (Cont)

Statement showing ore reserves and new ore development for the following years:

	1927	1928	1929	1930	1931
Ore in Mine January 1st	5,452,481	5,290,042	5,046,197	4,702,191	4,160,089
Production	487,880	454,563	552,417	579,740	340,838
Balance	4,964,601	4,835,479	4,493,780	4,122,451	3,819,251
Ore in Mine Dec. 31st	5,290,042	5,046,197	4,702,191	4,160,089	3,831,393
New Ore Developed	325,441	210,718	208,411	37,638	12,142

The large increases in developed ore shown in 1927 - 1929 were due to further development on the 12th level.

b. Prospective Ore:

There is no prospective ore shown in this estimate. The ore below the 12th level will be included as developed ore as soon as the 13th level is opened and the outline of the ore body determined.

c. Estimated Analysis:

Ore Reserves: Approximate Expected Natural Analysis.

	Iron	Phos.	Silica	Mang.	Alum	Lime	Mag.	Sul.	Igni	Moist
Bessemer	52.80	.044	5.80	.220	2.30	.90	.290	.008	1.50	12.00
Negaunee	52.50	.095	6.50	.210	2.60	1.20	.360	.009	2.10	12.00

Ore in Stock: Average Natural Analysis:

	Iron	Phos.	Silica	Mang.	Alum	Lime	Mag.	Sul.	Igni	Moist
Bessemer	54.50	.044	5.60	.210	2.20	.95	.280	.008	1.35	11.50
Negaunee	52.40	.080	7.00	.200	2.55	1.10	.380	.010	1.94	12.00

The above analysis are the same as last year as no change seemed advisable.

5. LABOR AND WAGES:

a. Comments

(1) Labor

There was an excess of labor available the entire year due to the general unemployment situation with so many men returning to this vicinity from the industrial centers. Most of the single men and some of the married men have had to work alternately with each other so as to give some employment to as large a number as possible.

(2) New Construction

The following is a list of the E & A's on which work was done in 1931:

E. & A. #574 - Rocker Dump Cars. Completed last year but 18 of the 36 cars were charged out on the regular cost sheet this year at the rate of two cars per month. This completes the charging out of all the rocker dump cars.

E. & A. #611 - Electric Scraper Hoists.

The E. & A's will be taken up in detail under heading #12 - "New Construction and Proposed New Construction".

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5. LABOR AND WAGES:

b. Comparative Statement of Wages and Product:

	1931	1930	Increase	Decrease
PRODUCT	338,696	579,740		241,044
No. Shifts and Hours	1-8-hr	1-8-hr		
AVERAGE NO. MEN WORKING:				
Surface	51	52		1
Underground	222	216	6	
Total	273	268	5	
AVERAGE WAGES PER DAY:				
Surface	4.39	4.36	.03	
Underground	4.71	5.20		.49
Total	4.98	5.03		.05
AVERAGE WAGES PER MONTH:	13.8 days	23 days		9.2
Surface	65.84	100.28		34.44
Underground	66.15	119.60		53.60
Total	66.09	115.69		49.60
PRODUCT PER MAN PER DAY:				
Surface	32.08	36.65		4.57
Underground	8.58	9.34		.76
Total	6.77	7.44		.67
LABOR COST PER TON:				
Surface	.137	.119	.018	
Underground	.598	.557	.041	
Total	.735	.676	.059	
AVERAGE PRODUCT MINING:				
Stoping	21.80	22.61		1.19
Ore Development	6.85	9.31		2.46
Total	21.24	21.69		.45
AVERAGE WAGES CONT. LABOR	5.70	5.82		.12
TOTAL NUMBER OF DAYS:				
Surface	10,559¼	15,819		5,259¾
Underground	39,460	62,041		22,581
Total	50,019¼	77,860		27,840¾
AMOUNT FOR LABOR:				
Surface	46,338.39	68,982.60		22,644.21
Underground	202,658.80	322,793.73		120,134.93
Total	248,997.19	391,776.33		142,779.14

AVERAGE WAGES PER MONTH BASED ON MEN CARRIED ON MINE PAYROLL:

	18 days per Mo.	13 days per Mo.	9 days per Mo.*
Surface	76.68	56.68	35.37
Underground	91.44	67.34	41.31
Total	87.84	65.13	39.96

* 10% Reduction in Wages

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5. LABOR AND WAGES: (Cont)

b. Comparative Statement of Wages and Product: (Cont)

Proportion of Surface to Underground Men:

1931 - 1 to 4.35	1 8-hr	shift	4	days	per	week,	Jan. 1st to April 13th
	1 8-hr	"	3	"	"	"	Apr. 13th to Nov. 16th
	1 8-hr	"	2	"	"	"	Nov. 16th to Dec. 31st
1930 - 1 to 4.30	1 8-hr	"	6	"	"	"	Jan. 1st to July 1st
	1 8-hr	"	5	"	"	"	July 1st to Dec. 11th
	1 8-hr	"	4	"	"	"	Dec. 11th to Dec. 31st
1929 - 1 to 4.31	1 8-hr	"	6	"	"	"	
1928 - 1 to 4.79	1 8-hr	"	6	"	"	"	Jan. 1st to April 9th
	1 8-hr	"	5	"	"	"	Apr. 9th to Oct. 1st
	1 8-hr	"	6	"	"	"	Oct. 1st to Dec. 31st
1927 - 1 to 4.81	1 8-hr	"	5	"	"	"	Jan. 1st to March 12th
	1 8-hr	"	6	"	"	"	March 12th to Dec. 31st

6. SURFACE:

a. Buildings, Repairs:

The roofs on the engine house and fan station at No. 2 shaft were given a coat of asphalt which sealed all the leaks.

The iron house near the blacksmith shop, started last year, was completed and covered with toncan metal. The old iron house, which was too far away from the blacksmith shop, was made over into an electrician's repair building and will have a direct connection to the tunnel for the handling of motors, etc.

b. Stockpiles:

Stocking on the new stockpile grounds prepared in the Fall of 1930 started in March of this year and on December 31st there has been approximately 150,000 tons stocked on this new trestle which only has room for about 20,000 more tons, after which time the space formerly occupied by the Bessemer grade on the steel trestle will be filled and then some additional wooden bents will have to be added to the East of the steel trestle.

c. Tracks, Roads, etc.

There has been considerable saving effected in the amount of water consumed by the installation of a hot well to collect the water from the condensed steam and from which it is pumped directly into the boilers. The following table shows the cost by quarters for 1929 - 1931:

	1929	1930	1931
1st Quarter	257.57	180.01	104.72
2nd "	279.79	175.71	57.41
3rd "	305.55	219.47	26.31
4th "	173.39	147.36	46.55
Total	1,016.30	722.55	234.99

e. Grounds:

There was considerable rearrangement of the shrubbery around the engine house and tunnel approach to the dry and this has improved the appearance of the grounds. The installation of the pipes for the return of the condensed water to the hot well was completed in the Spring and the lawn leveled and resodded over the ditches.

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7. UNDERGROUND:

a. Shaft Sinking:

On March 18th the sinking of No. 3 shaft below the 13th level was started; two shifts worked two days per week when the mine was idle and completed the 85 ft. necessary for storage and measuring pockets and skip pit clean out drift on June 18th. The material encountered was jasper.

b. Development:

The skip pit clean out drift was excavated 85 ft. below the 13th level for some 75 ft. to the North and about 10 ft. wide along the East side of the shaft. A small pumphouse and sump for the installation of a small electrical pump was also excavated.

The excavation of the storage and measuring pockets below the 13th level was started in September by raising on the foot of the pocket and then stripping the sides. This pocket, which will be entirely of steel and concrete, will be completed early in 1932 and then work will start in the main 13th level motor drift to the ore body some 1000 ft. to the North.

The only other development for the year was the completion in February of the drift on the 11th level between No. 1 dike and the footwall which was started in June of last year. Two raises have been put up from this drift to the 485 ft. sub level.

Four additional raises were put up during the year from the drift between No. 1 and No. 2 dikes to the 500 ft. sub level.

Two raises are now under way from the East footwall drift between No. 1 and 2 dikes. These latter raises are to take the place of the transfer drift on the 450 ft. sub which has crushed due to mining on the 475 ft. sub. They will be put up to the 475 ft. sub.

There was no development on the 12th level except a few raises, one in a crosscut to the 370 ft. sub level, and two in the drift parallel to the Maas boundary to the 395 ft. sub to facilitate mining near the Maas boundary.

The summary of development work for the year is as follows:

	Drifting		Raising			Total
	Ore	Rock	Ore	Rock	Total	1930
10th Level	-	-	-	-	-	55'
11th Level	-	40'	544'	136'	720'	1948'
Transfer System & Subs	-	-	-	-	-	631'
12th Level	-	-	239'	53'	292'	1840'
13th Level	-	60'	-	-	60'	-
Skip Pit Clean Out	-	100'	-	-	100'	-
Sinking	-	85'	-	-	85'	-
Total	-	285'	783'	189'	1257'	4474'

There was an average of four contracts on development work during 1931 as compared with six in 1930.

c. Stoping:

(1) General Remarks:

In 1931 mining extended from the first sub level below the 10th level on the North and South footwalls to the third sub below the 11th level in the extreme Southwest end of the mine under the hanging.

In the North footwall area near the Maas Mine one and one-half subs have been mined with an average of six contracts working as compared to two and one-half subs mined in 1930 with increased operating schedule.

On the South footwall, where there have been two transfer systems in operation, one and one-quarter sub levels have been mined with an average of twelve contracts.

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7. UNDERGROUND:

c. Stoping: (Cont)

(1) General Remarks: (Cont)

On the North footwall just above the 11th level there have been an average of six contracts mining in an area that was temporarily abandoned in 1929 on account of the crushing of Nos. 8 and 9 crosscuts on the 11th level. Late in 1930 two transfer drifts were started here about 60 ft. above the 12th level and raises put up to the 425 ft. sub where mining has continued through the year.

The major part of the contracts have been concentrated in the central part of the ore body where they have completed mining on the 11th level and have the first sub below the 11th level about one-half mined above Nos. 6 and 7 crosscuts on the 12th level.

In the area under the hanging above the 12th level, the third sub below the 11th level, which was started last year, has been nearly mined out with about four gangs working in this territory.

There has been continual repairs on main level drifts especially those on the 11th level as these drifts are very heavy. A portion of the drift between Nos. 1 and 2 dikes and some of the raises put up to the 500 ft. sub crushed before they were ever used. Toward the latter part of this year the pressure seemed to slack off and it may be that there will be less trouble here in the future. The area above this drift is very wet as well as heavy and it has been decided to mine the West end first for a sub or two and thus drain off the water from the remainder. One contract has worked the entire year in this area mining out one small sub level and opening up another below. Toward the latter part of the year two contracts were started on the East end of this pillar.

Scrapers have been used entirely to handle the ore and with the addition of ten larger electrical units and the introduction of more 42" scrapers, much better results have been obtained in the working places and if there had not been the decrease in operating schedule and subsequent crushing of working places before they could be finished, causing delay and extra cost for repairing, there would have been a substantial increase in the tons per man for stoping.

There was an average of 49 contracts stoping during 1931, 3 of which were on double shift, as compared with 50 contracts with 3½ on double shift in 1930.

(2) Detail of Stoping:

10th Level - North footwall:

Mining at this elevation near the Maas boundary started in March 1930 and was completed in January of this year.

Subs between the 10th and 11th Levels:

500' Sub Level - North footwall:

Mining was started in this area in October of last year and was completed in November of this year with six contracts working here most of the year.

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7. UNDERGROUND:

c. Stoping: (Cont)

500' Sub Level - South footwall:

In the area South of No. 1 dike, opened up for mining in May 1930, mining has been in progress the entire year and in December one contract was working double shift mining the last small pillar remaining on this sub level.

The territory to the West of the old winze crosscut on the 11th level has given considerable trouble due to water and exceedingly heavy pressure. The last previous mining in this territory was done in 1929 on the 10th level elevation, after which no mining was attempted until a new drift had been driven on the 11th level and raises put up. As soon as this work was completed and before mining could be resumed here the new drift crushed and several of the raises squeezed together. In March 1931 it was possible to place one contract in this area at No. 1111 raise and a small pillar under the hanging adjoining No. 1 dike was taken out under very difficult conditions. There was a large amount of water that washed down rock from above and also got into the ore chute and caused trouble on the level when loading the cars. Toward the latter part of the year the contract working here completed mining all the ore they could safely reach from 1111 raise and then cut out on the sub below. This drained off the water from the 500 ft. sub and in September one other contract was started in 1110 raise to the North and in December two contracts were mining on double shift in a comparatively dry territory. It is planned to keep the Southwest corner of this area one sub in advance to control the water.

488' Sub Level - North footwall:

The territory adjacent to the Maas boundary at this elevation was opened up for mining in June of this year and in December there were six contracts stoping here.

488' Sub Level - South footwall:

Mining in the area between No. 1 and No. 2 dikes and East of the mining limit was started in March of last year and was completed in August of this year. Most of the ore mined on this sub level was handled through transfer raises to the 450 ft. transfer sub level.

The territory to the South of No. 1 dike was opened up for stoping in February of this year and two contracts have been mining here through the year.

475' Sub Level - South footwall:

This sub level was opened between Nos. 1 and 2 dikes in January of this year and mining has been continued throughout the year. Part of the ore mined here was handled through four raises connecting with the 11th level while the remainder of the ore is handled through transfer raises to the 450 ft. transfer sub. In December five contracts were stoping here.

425' Sub Level:

Mining on this sub level was first started in January 1928 in the central portion and at the end of this year there only remained the North and South footwall pillars that are being left to protect the workings above, except a few pillars on the North central foot where mining is now in progress. This latter area was opened up in the Fall of 1930 from transfer raises put up from the 385 ft. transfer sub. This system was put in as the foot is very flat and would have required a prohibitory amount of rock drifting and rock raising on the 12th level to reach the ore on the footwall in the regular system of mining. Six contracts were stoping here in December.

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7. UNDERGROUND:

c. Stoping: (Cont)

11th Level:

The drift South of No. 1 dike, which was started last year, was completed in January after advancing 135 ft. in the footwall rock to hole to the North-South footwall drift just South of the winze. Two raises have been put up to the 488 ft. sub level from this drift.

Four raises were also put up from the drift between Nos. 1 and 2 dikes to the 500 ft. sub level. This drift has been very hard to maintain both on account of heavy pressure and also to the fact that there is so much water draining from surface in this area. It has been necessary to keep a repair gang working here constantly.

Two raises have been started from the East footwall drift between Nos. 1 and 2 dikes to take the place of the transfer drift on the 450 ft. sub which has crushed due to mining being close above it. Two contracts were raising here in December. There was also some stoping on this level during the year in the central part of the ore body between the East footwall and the Maas boundary. With the exception of one pillar just North of 1298 raise, mining in the 1290, 1272, and 1208 system of raises was completed in June of this year, the contract North of 1298 raise finishing in October.

395' Sub Level:

This sub level was opened in June 1929 in the Southwest part of the ore body under the hanging and during 1931 the mining operations consisted of stoping in the areas controlled by the 1260, 1290, and 1207 system of raises. In the vicinity of 1207 and 1208 raises the footwall has receded very fast, reducing the size of the ore body to such an extent that these raises will not be used on the next sub level below. In December there were three contracts stoping from the 1260 system of raises in the two pillars remaining in this area. There were seven contracts in the 1270 system and ten contracts in the 1290 system where the ore body has extended under the hanging to the Maas boundary line.

385' Sub Level:

Mining in the Southwest end of the deposit under the hanging was started in January 1930 and continued until June of this year when the area developed by the 1250 system of raises was completed. Owing to the curtailed production and the necessity of keeping as few drifts and raises in operation as possible, it was decided not to open up this territory for mining at a lower elevation at this time.

370' Sub Level:

This sub level was opened up under the hanging in the extreme Southwest end of the ore body in September of last year and mining has been continued throughout the year. In December three contracts were mining the few small pillars remaining in the area controlled by the 1240 system of raises. As soon as these contracts have completed mining here they will be moved to another area where they will be doubled up with contracts so that slicing will be continued for four days per week instead of two and, therefore, be completed before the slice and drifts have crushed.

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7. UNDERGROUND:

c. Stoping: (Cont)

12th Level:

The only work done during the year on the 12th level was that of putting up two additional raises from the drift parallel to the Maas boundary to the 395 ft. sub.

In December one contract started to repair that part of No. 4 crosscut that parallels the Maas boundary preparatory to finishing the connection of this crosscut with the main drift parallel to the Maas boundary at a point between Nos. 5 and 6 crosscuts. This will provide a better air circulation and also make provision for additional raises near the Maas boundary.

13th Level:

Work was started on this level in November 1930 preparatory to sinking the shaft 85 ft. for a storage and measuring pocket and skip pit pocket as the 13th level had been the skip pit clean out drift heretofore. January and February of this year were spent in excavating the ground on the main level above the pocket and making a small temporary sump. On March 18th sinking was started and completed to a depth of 85 ft. on June 18th. This work was carried on at the rate of two days per week on the days the mine was not operating. In December the crew was concreting the storage pocket which will be entirely of steel and concrete. The work on the pocket will be finished early in 1932, after which time drifting on the 13th level will be started to the ore body some 1000 ft. to the North.

Skip Pit Clean Out Drift:

This drift is 85 ft. below the 13th level which makes the sea elevation +100 or 1283 ft. below the collar of No. 3 shaft. This drift was advanced 72 ft. to the South of the shaft, together with a 10 ft. excavation to the East of the shaft to make room for the cars to be loaded from the skip pit pocket. This work was done in June, July, and August, and the skip pit pocket was installed in September.

A small pumphouse and sump were then excavated, which completes the work that has to be done at the bottom of the shaft with the exception of installation of a small electric pump.

d. Timbering:

The cost per ton for all timber was slightly higher in 1931, due to use of larger timber and to use of more poles and wire fencing in covering down floors of sub levels. The larger size timber was used on account of the reduced working schedule which made it necessary to try to keep the working places open a longer time, also to the use of more 9 ft. legs and caps than in the previous year. The total cost per ton for all timber increased .008 in 1931; it was .01 higher than the average cost for the period 1926-1931 inclusive. During the past two years much more care has been taken in covering down floors of sub levels to increase safety and to avoid dilution of the ore by runs of rock. The results have more than justified the extra cost as accidents have decreased and there has been an improvement in the grade of the output.

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7. UNDERGROUND:

d. Timbering: (Cont)

Statement of Timber Used:

	LINEAR FEET	AVG. PRICE PER FOOT	AMOUNT 1931	AMOUNT 1930
6 to 8" Cribbing	67,643	.0408	2,763.85	7,228.53
8 to 10" Stulls	55,707	..0637	3,550.40	7,839.16
10 " 12" "	58,817	.09	5,294.08	5,992.47
12 " 14" "	27,973	.1177	3,292.27	3,753.70
14 " 16" "	5,753	.1431	823.00	475.02
16 " 18" "	681	.1431	96.94	-
Athens Treated Timber				628.56
Total - 1931	216,574	.0731	15,820.54	
Total - 1930				25,917.44
Lagging - 7 ft.	838,425	.7096	5,949.66	11,383.27
Poles - 9½ ft.	719,025	1.416	10,181.08	13,389.42
Covering Boards - 1"				221.87
Total - 1931	1,557,450		16,130.74	
Total - 1930				24,994.56
*Wire Fencing (1795 rds)			1,457.42	1,588.62
Grand Total - 1931			33,408.70	
Grand Total - 1930				52,500.62

*In use only 6 months in 1930

Product	338,696	579,740
Feet of timber per ton of ore	.6396	.7214
Feet of lagging per ton of ore	2.4760	2.5670
Feet of lagging per foot of timber	3.8720	3.5560
Feet of wire fencing per ton	.3640	.5424
Cost per ton for timber	.0467	.0447
" " " " lagging	.0176	.0196
" " " " poles	.0300	.0232
" " " " covering boards	-	.0004
" " " " wire fencing	.0043	.0027
Total Cost per Ton	.0986	.0906
Equivalent of stull timber to board measure	474,110	769,027
Feet of board measure per ton of ore	1.40	1.327

Total Cost for Timber, Lagging, Poles, etc.	Amount	Cost per ton
1931	33,408.70	.0986
1930	52,500.62	.0906
1929	45,512.75	.0899
1928	40,882.06	.0738
1927	36,003.44	.0868
1926	31,579.36	.0844

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7. UNDERGROUND:

e. Drifting and Raising:

There was a large decrease in the amount of development work done in 1931 as compared with the previous year. This was due to sinking the shaft 85 ft. below the 13th level for pocket and skip pit, during which time no other development work was undertaken. There was, however, less work necessary as the development of the 12th level was well advanced in 1930.

The following is a statement of drifting and raising for the years 1931 and 1930:

	Drifting		Raising		
Year	Ore	Rock	Ore	Rock	Total
1931	-	110'	783'	189'	1,082'
1930	228'	1,100'	2,586'	560'	4,474'
Decrease	228'	990'	1,803'	371'	3,392'

f. Explosives, Drilling and Blasting:

The explosive cost per ton increased .0028 or practically one quarter of a cent in 1931. A careful study of blasting practice was made late in the year, as a result of which it is hoped to effect a slight reduction in cost in 1932.

Statement of Explosives Used: (Ore Development and Stoping)

	Quantity	Average Price	1931 Amount	1930 Amount
40% Gelatin Powder - lbs	100	11.50	11.50	
50% " " "	112,150	12.50	14,019.00	15,929.98
60% " " "	23,050	13.54	3,129.51	6,539.47
2-x " " "	100	12.50	12.50	981.75
1-x " " "	100	12.50	12.50	5,371.65
60% Gelamite "A" "	800	12.75	102.00	
Total Powder - 1931	136,300	12.68	17,287.01	
Total Powder - 1930	226,350	12.73		28,822.85
Fuse - feet	400,897	5.61M	2,251.74	3,430.09
Caps - No. 6	62,786	11.61M	729.58	991.15
Connecting Wire				.82
Tamping Bags	34,500	2.28M	79.68	43.58
Fuse Lighters	3,700	8.82M	32.67	-
Total Fuse, etc. - 1931			3,093.67	
Total Fuse, etc. - 1930				4,465.64
Total all explosives - 1931			20,380.68	
Total all explosives - 1930				33,288.49
Product			338,696	579,740
Lbs. of powder per ton of ore			.4025	.3904
Cost per ton - powder			.0510	.0497
" " " - fuse, caps, etc.			.0091	.0077
" " " - all explosives			.0602	.0574

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7. UNDERGROUND:

f. Explosives, Drilling and Blasting: (Cont)

Statement of Explosives Used: (Cont)

Sinking, Rock Development, etc.

	Quantity	Average Price	1931 Amount	1930 Amount
Total Powder - 1931	7,800		1,062.77	
Total Powder - 1930	13,850			1,915.25
Total Fuse, etc. - 1931			191.88	
Total Fuse, etc. - 1930				470.09
Total All Explosives - 1931			1,254.65	
Total All Explosives - 1930				2,385.34
Total Explosives used in mine			21,635.33	35,673.83
Average price per lb. for powder			.1273	.1279

21.7% of all powder used in 1931 was 60%
24.4% " " " " " 1930 " 60%

Comparison of cost of all explosives for period 1927 to 1931 inclusive:

Year	Cost per Ton	Product
1927	.0629	338,696
1928	.0676	579,740
1929	.0571	555,919
1930	.0574	454,563
1931	.0602	487,880

The average cost for the 5-year period is .0610 per ton. The last three years the average cost was .0582 per ton. The decrease in cost in last three years was due to use of more 60% powder and 1½" powder in hard, tough, ground instead of 1¼".

g. Mining & Loading:

For the last two years all the ore mined has been handled with scrapers. Additional electric scraper units in 10, 15, and 20 h.p. sizes have been purchased and larger size scrapers are being used with these larger hoists. The maintenance cost of the larger electric hoists is quite low and they also decrease the time required to scrape the ore.

More 9 ft. legs and 9 ft. caps have been used on the sub levels in 1931, thus increasing the tonnage from a cut with very little extra expense, as practically the same amount of powder will bring out the larger cut and the time required for timbering is the same.

i. Ventilation:

The cost for ventilation was quite high in 1931 on account of extensive repairs to No. 2 shaft. Early in June it was noted that there was not sufficient air entering the mine for ventilation purposes through No. 2 shaft where the 120,000 cu. ft. ventilating fan is located. Examination of the shaft disclosed that ice in the shaft during the winter had fallen away and broken a number of sets of timber between the ledge and the 3rd level and that the debris had partially plugged the shaft at several places. Work was immediately started

NEGAUNEE MINE
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7. UNDERGROUND:

i. Ventilation: (Cont)

to repair these sets and remove the obstructions. Several raises from the 9th level to the 6½ and 4th levels were opened to provide additional air passages to the 9th level. This work could only be done when the mine was idle as the fan had to be shut down and therefore it took several months at 8 days per month to repair the shaft for a distance of 480 ft. or to the 3rd level. The cage road has been cased tight and it is hoped that with this new feature and constant inspection of the shaft during the winter a repetition of similar trouble can be avoided.

In the Spring several concrete bulkheads will be put in on the 3rd and 4th level to keep the air from escaping into the old No. 1 shaft workings..

There have been only two booster fans needed in the mine to ventilate certain isolated sections as the volume of air controlled by the ventilation doors is usually sufficient to clear out the smoke from blasting and keep the working places fairly cool.

j. Pumping:

The number of gallons pumped per minute during 1931, 1930, and 1929, are shown below:

Month	1931	1930	1929
January	990	1,118	1,285
February	914	1,183	1,226
March	891	1,095	1,153
April	878	1,058	1,155
May	847	958	1,179
June	960	1,087	1,303
July	972	1,073	1,223
August	923	1,071	1,274
September	953	1,063	1,279
October	931	1,075	1,231
November	839	934	1,202
December	875	1,011	1,250
Total Average	914	1,060	1,230

The amount of water pumped at the Negaunee Mine decreased again in 1931, the decrease amounting to 146 gallons per minute, as compared with 170 gallons in the previous year. There was only a slight increase at the Maas so that it is assumed the decrease at the Negaunee indicates a lowering of the ground water level in the area adjacent to the mine.

The average number of gallons pumped per minute for the past seven years is as follows:

Year	Gals per minute
1931	914
1930	1,060
1929	1,230
1928	1,198
1927	1,144
1926	819
1925	705

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7. UNDERGROUND:

k. Underground in General:

During 1931 on account of the curtailed operations with the subsequent idle days there has been much more repairing than formerly and several schemes have been tried out to offset this as far as possible. When operations were cut to two days per week it was at once apparent that the places could not be kept open long enough to remove the ore adjacent to a raise and, therefore, in the latter part of December approximately one-half of the working places where conditions were the best as far as crushing was concerned, were propped and temporarily abandoned. The miners were combined into two shifts whereby one-half the working places will be worked by one set of men four days each week and then the alternate crew of men will work the same place four days in the following week. Thus, while the men will only work 8 or 9 days per month the place itself will be in operation 16 or 17 days and there will be more chance of getting out the ore before crushing interferes. Some repairing will have to be done from time to time on the main levels and sub levels in the abandoned territory so that there will not be too great a delay when it is desired to put the mine on full operating schedule again.

The use of wire fencing has been continued in the areas where there is not a good mat and also in all areas near jasper and dike and under new hanging.

Larger electric scraper hoists have been purchased and larger scrapers put into service with these more powerful hoists which has decreased the time required for scraping the ore to the raise.

There has been very little development work done this year except the sinking of No. 3 shaft 85 ft. below the 13th level for loading pocket and skip pit. The work of concreting the pocket was in progress at the end of the year. The pocket is of steel and concrete construction and will last the life of the mine with practically no repairs.

8. COST OF OPERATING:

a. Comparative Mining Costs:

	1931	1930	Increase	Decrease
PRODUCT	338,696	579,740		241,044
Underground Costs	1.102	.997	.105	
Surface Costs	.175	.128	.047	
General Mine Expenses	.238	.155	.083	
Cost of Production	1.515	1.280	.235	
Depletion - Original Cost	.099	.092	.007	
Increment	.338	.314	.024	
Depreciation - Plant & Equipt.	.031	.031		
Taxes	.541	.329	.212	
Taxes - Franchise	.003	.002	.001	
Loading and Shipping	.011	.014		.003
Total Cost at Mine	2.538	2.062	.476	
Administrative & General Expense	.024	.018	.006	
Miscellaneous Income	-.014	-.008	-.006	
TOTAL COST	2.548	2.072	.476	
No. of Days Operated	166	276		110
No. Shifts & Hours	1 8-hr	1 8-hr		
Average Daily Product	2,040	2,100		60

COST OF PRODUCTION:

	1931	%	1930	%	Increase	
Labor	.756	49.9	.687	53.7	.069	3.5%
Supplies	.759	50.1	.593	46.3	.166	3.5%
Total	1.515	100.0	1.280	100.0	.235	

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8. COST OF OPERATING:

b. Detailed Cost Comparison:

(1) Days and Shifts:

Year	Days Worked	Shifts & Hours	Men Employed	Total Days Worked
1931	166	1 8-hr	273	50,019¼
1930	276	1 8-hr	268	77,860
Increase			5	
Decrease	110			27,841¾

(2) Wages:

The mine operated on the same wage schedule in 1931 as in 1930 until the first of October when a 10% reduction in wages became effective. The salaried employees received a curtailment in working time of one day per week with a corresponding reduction in salary effective June 16th.

(3) Comparison of Production:

Production - 1931	338,696 tons
Production - 1930	579,740 "
Decrease	241,044 "

(4) Comparison of Number of Men and Wages:

	No. Men	No. Days	Amount	Rate per day
1931	273	50,019¼	248,997.19	4.98
1930	268	77,860	391,776.33	5.03
Increase	5			
Decrease		27,841¾	142,779.14	.05

(5) Tons per man per day:

The tons of ore mined per man per day were as follows:

	1931	1930	Increase	Decrease
Surface	32.08	36.65		4.57
Underground	8.58	9.34		.76
Total	6.77	7.44		.67

(6) Cost of Production:

1931	$513,360.80	Cost per ton	$1.515
1930	742,148.15	" " "	1.280
Decrease	228,787.35	Increase	.235

	Total Cost				Cost per ton		
	Labor	%	Supplies	%	Labor	Supplies	Total
1931 -	$256,188.90	49.9	$257,171.90	50.1	$.756	$.759	$1.515
1930 -	398,430.45	53.7	343,717.70	46.3	.687	.593	1.280
Incr.				3.8	.069	.166	.235
Decr.	142,241.55	3.8	86,545.80				

NEGAUNEE MINE
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8. COST OF OPERATING:

b. Detailed Cost Comparison:

(7) Detail of Accounts

	1931		1930		Increase		Decrease	
Days per week	4-3-2		6-5-4					
Shifts and Hours	1 8-hr		1 8-hr					
Production, Tons	338,696		579,740				241,044	
Avg. Daily Prod. - Tons	2,040		2,100				60	
Number of Days Worked	166		276				110	
		Per		Per		Per		Per
Underground Costs	Amount	Ton	Amount	Ton	Amount	Ton	Amount	Ton
1. Exploring in Mine	417.50	.001	262.10	.001	155.40			
2. Sinking in Shaft	13857.79	.041	535.01	.001	13322.78	.030		
3. Development in Rock	2154.13	.006	11363.45	.020			9209.32	.014
4. Development in Ore	4468.42	.013	13697.17	.024			9228.75	.011
5. Stoping	141542.28	.418	225493.79	.389		.029	83951.51	
6. Timbering	89086.79	.263	143014.78	.247		.016	53927.99	
7. Tramming	28392.00	.084	50549.11	.087			22157.11	.003
8. Ventilation	4144.02	.012	4878.91	.008		.004	734.89	
9. Pumping	32661.54	.096	38428.71	.066		.030	5767.17	
10. Compressors & Air Pipes	25753.77	.076	42835.32	.074		.002	17081.55	
11. Back Filling			1941.35	.003			1941.35	.003
12. U. G. Superintendence	12467.65	.037	15634.88	.027		.010	3167.23	
13. Cave-In	.46		45.83				45.37	
14. Maint:Comp & Power Drls	1847.76	.005	3976.09	.007			2128.33	.002
16. Elec Tram Equipt	14698.93	.043	22076.90	.038		.005	7377.97	
17. Pumping Machy	1770.41	.005	3076.20	.005			1305.79	
Total U. G. Costs	373263.45	1.102	577809.60	.997		.105	204546.15	
Surface Costs								
18. Hoisting	19339.64	.057	29589.78	.051		.006	10250.14	
19. Stocking Ore	6286.03	.019	6921.62	.012		.007	635.59	
21. Dry House	5990.19	.018	9119.26	.016		.002	3129.07	
22. Gen. Surface Expense	4584.04	.014	7154.97	.012		.002	2570.93	
23. Maint: Hoisting Equipt.	4656.06	.014	8965.20	.016			4309.14	.002
24. Shaft	6105.88	.018	2689.74	.005	3416.14	.013		
25. Top Tram Equipt.	2101.84	.006	3095.29	.005		.001	993.45	
26. Docks,Tres.& Pkts	9208.06	.027	4110.74	.007	5097.32	.020		
27. Mine Buildings	1018.85	.003	2591.85	.004			1573.00	.001
Total Surface Costs	59290.59	.175	74238.45	.128		.047	14947.86	
General Mine Expenses:								
28. Insurance	76.75		54.86		21.89			
29. Mining Engineering	1934.03	.006	2533.09	.004		.002	599.06	
30. Mech. & Elec. Engng.	1950.26	.006	2704.46	.005		.001	754.20	
31. Analysis & Grading	8138.11	.024	12657.31	.022		.002	4519.20	
32. Personal Injury	14240.87	..042	17759.21	.030		.012	3518.34	
33. Safety Department	1412.58	.004	1507.54	.003		.001	94.96	
34. Telephones & Safety Dev.	1828.93	.005	2763.46	.005			934.53	
35. Local & Gen. Welfare	5480.33	.016	6025.59	.010		.006	545.26	
36. Spec.Exp.,Pens.& Allow.	17694.44	.052	12705.90	.022	4998.54	.030		
37. Ishpeming Office	16585.96	.049	17583.24	.030		.013	997.28	
39. Mine Office	11464.50	.034	13805.44	.024		.010	2340.94	
Total Gen. Mine Exp.	80806.76	.238	90100.10	.155		.083	9293.34	
COST OF PRODUCTION	513360.80	1.515	742148.15	1.280		.235	228787.35	
40. Taxes	184239.36	.544	191791.14	.331		.213	7551.78	
Total Cost	697600.16	2.059	933939.29	1.611		.448	236339.13	

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)
(7) Detail of Accounts:

General:
Decrease in expenditures in practically all the accounts is due to shorter working schedule.

2. Increase in this account is due to sinking shaft 85 ft. to provide skip pit and shaft pocket for the new 13th level.

3.

	Drifting	Raising	Total Feet	Cost per foot
1931	110'	189'	299'	7.21
1930	1100'	560'	1660'	6.85
Increase				.36
Decrease	990'	389'	1361'	

A decrease of .014 per ton is shown in this account due to the large decrease in footage.

4.

	Drifting	Raising	Total Feet	Cost per foot
1931	-	783'	783'	5.71
1930	228'	2586'	2814'	4.87
Increase				.84
Decrease	228'	1803'	2031'	

A decrease of .011 per ton is shown in this account due to decrease of 72% in total development for the year.

5.

	Labor		Supplies	
1931	95,924.67	67.8%	45,617.61	32.2%
1930	158,818.48	70.4%	66,675.31	29.6%

The following shows the scraper hoists purchased in 1931 and 1930:

1931	1930
4 - 15 h.p. Ingersoll Rand Hoists	2 - 15 h.p. Ingersoll Rand Hoists
5 - 10 " " " "	1 - 6 H.C. Tugger Hoist
1 - 20 " " " "	4 - 15 h.p. Sullivan Hoists
Total Cost - $9,495.50	Total Cost $7,827.38

Increase in cost per ton is due to the following reasons: $1628.12 increase in cost for scraper hoists; in 1931 71.1% of the total product was stocked as compared with 45.8% stocked in 1930; considerable overrun, which is in the stockpile, would have reduced the cost at least 1¢ per ton; due to the mine being on a shorter working schedule considerable repairing was necessary to keep the working places in proper condition and this caused a decrease in the tons per man per day. Tons per man per day for 1931 was 6.77 compared with 7.44 in 1930.

6. Increase of .016 in cost per ton is due to repairing timber broken down during days the mine was idle and to less product on account of less overrun due to less ore shipped from pocket. More timber and poles were necessary to keep the working places in proper condition for mining.

	Labor		Supplies	
1931	50,479.42	56.7%	38,607.37	43.3%
1930	80,390.84	56.2%	62,623.94	43.8%

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)
(7) Detail of Accounts: (Cont)

9.

	Gallons Pumped	Gallons per Minute	Cost for Power
1931	482,294,599	914	24,234.27
1930	557,227,893	1,060	29,263.90
Decrease	74,933,294	146	5,029.63

There were 146 gallons per minute less water pumped this year but due to the smaller product the cost per ton increased .030.

10.

	Operating Compr. Cost	Cost for Air Pipes	Cu. Ft. Air	Cu. Ft. Air Per Ton
1931	25,151.08	2,602.69	520,641,000	1,832
1930	37,312.01	5,523.31	1,044,240,000	1,801
Increase				31
Decrease	14,160.93	2,920.62	423,599,000	

Cost per ton increased .002 due to smaller production, also to running compressor on idle days on account of sinking shaft 85 ft. below the 13th level.

14.

	Compressors	Power Drills
1931	694.87	1,152.89
1930	2,253.96	1,722.13
Decrease	1,559.09	569.24

The cost for maintenance of compressors in 1931 was for new valves costing $359.35 and proportion of cost for spare cooler $147.78. The 1930 charge was for new feather valves on the Nordberg compressor.

In 1931 8 RB-12 Ingersoll Rand Drills and 4 Gardner Denver Sinking Machines were purchased, total cost $1,152.89. In 1930 10 RB-12 Ingersoll Rand drills costing $1700.00 were purchased.

16.

	Gen. & Motors	Locomotives	Wiring	Tracks	Cars
1931	201.23	1,755.81	329.08	3,168.59	9,244.22
1930	114.82	3,998.59	1,397.93	5,606.25	10,959.31
Increase	86.41				
Decrease		2,242.78	1,068.85	2,437.66	1,715.09

New brushes for converter accounts for increase in Generator & Motor expense; 18 new motor cars were also purchased this year - the same number as last year. The smaller tonnage increased the cost per ton.

18.

	Power Cost	Cost per ton for power
1931	14,380.20	.042
1930	22,315.30	.039
Increase		.003
Decrease	7,935.10	

Increase in cost per ton for power is due to sinking shaft and sending down timber needed for repairing on idle days, also more ore hoisted from the 12th level.

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)
(7) Detail of Accounts: (Cont)

19.

	Tons Stocked	
1931	240,842	71.1% of Total Product
1930	265,149	45.8% " " "
Decrease	24,307	

Increase in cost per ton is due to stocking 25.3% more of the product in 1931 than in 1930.

21.

Coal to Boiler House	Tons	Cost
1931	885-1100	4,470.26
1930	1254	6,596.56
Decrease	368- 900	2,126.30

Decrease is due to saving on account of putting in a return system and hot well for the heating plant and the reduced working time.

22. Increase in cost per ton is due to smaller production. The policeman on the day shift was discontinued on July 1st. This helped to reduce the expenditure in this account.

23.

	Sub Division			
	Sheaves	Wire Rope	Electric Hoists	Skips & Skip Roads
1931	21.69	1,461.33	1,263.45	1,909.59
1930	564.51	1,672.91	1,711.98	5,015.80
Decrease	542.82	211.58	448.53	3,106.21

This account shows a decrease of .002 per ton.

24. Large increase in this account due to extensive repairs to No. 2 shaft. The main ventilation fan of 120,000 cu. ft. capacity is located at the collar of this shaft; all air entering the mine is forced down this shaft.

25.

	General Repairs	Wire Rope
1931	1,429.15	672.69
1930	2,043.48	1,051.81
Decrease	614.33	379.12

26. Increase in this account due to building 34 bents of wooden trestle Northeast of the shaft house. This was necessary because of smaller shipments from stockpile.

27.

	Cost			
	1931	1930	Increase	Decrease
Office & Warehouse	24.42	234.32		209.90
Shops	18.74	129.44		110.70
Shaft House	187.14	627.79		440.65
Engine House	46.64	549.07		502.43
Dry House	169.27	648.29		479.02
Coal Dock	58.08	91.63		32.45
Miscellaneous	514.56	311.31	203.25	
	1018.85	2591.85		1573.00

Increase in miscellaneous buildings is due to building a new iron and steel storage shed. This was done to make it more convenient for the shop men and also to provide a room for the electricians in the former space occupied by the iron and steel in the main storage building.

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)
(7) Detail of Accounts: (Cont)

29. Decrease is due to the mine being on shorter working schedule and 10% decrease in wages October 1st.

30. Same as above.

31. This account includes proportion of district laboratory expense and sampling.

	Cost of Optg. Laboratory	No. of Determinations	Cost per Determination
1931	14,822.75	73,609	.20135
1930	17,714.47	115,438	.15350
Increase			.05215
Decrease	2,891.72	41,829	

The number of determinations for the Negaunee Mine in 1931 was 19.461 as compared with 38,972 in 1930.

32. Decrease in this account is due to smaller payroll on account of shorter working schedule. The rate for personal injury reserve is 2% of total labor cost and there is also .08 per $100.00 labor for catastrophe insurance.

33.

	1931	1930
Central Office Charge	1,077.36	1,386.37
Mine Office Charge	335.22	121.17
	1,412.58	1,507.54

Increase in charge from Mine Office is due to holding more safety meetings with foremen and bosses in 1931 than 1930.

34. Decrease is due to shorter working schedule and smaller cost for lighting shafts and levels. 3 Phister fire extinguishers costing $202.50 were charged to this account this year.

39. Decrease is due to reduced working schedule and 16% reduction in salaries effective June 15th, 1931.

Supplies Purchased - 1931

Statement showing decrease in supplies purchased per operating day in last 7 months of the year as compared with first 5 months. This statement shows the saving due to economies instituted and elimination of waste. The most striking examples are in purchases of General Supplies, Iron and Steel, and Machinery Supplies. No fuel was purchased in the first five months of the year, but in this period most of the lumber and timber was bought.

	Jan. 1st to June 1st	June 1st to Dec. 31st	Cost per Day Increase	Cost per Day Decrease
Days mine operated	79	87		
General Cost per day	144.13	129.20		14.93
Iron & Steel " " "	41.41	19.75		21.66
Oil & Grease " " "	11.82	11.06		.76
Machinery " " "	198.21	84.89		113.32
Explosives " " "	127.63	126.51		1.12
Lumber & Timber" " "	423.29	67.53		355.76
Fuel " " "	-	39.33	39.33	
Elec. Power " " "	434.47	436.53	2.06	
Sundries " " "	19.10	19.19	.09	
Total	1,400.06	933.99		466.07

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9. EXPLORATIONS AND FUTURE EXPLORATIONS:

There were no explorations in 1931, nor is it expected there will be any for some time, as the limits of the Negaunee ore body, except for minor rolls in foot or hanging, are outlined above the 12th level.

10. TAXES:

A comparison of the taxes paid by the Negaunee Mine Company in 1931 and 1930 is as follows:

Description	1931		1930	
City of Negaunee	Valuation	Taxes	Valuation	Taxes
Realty - 213.19 acres	3,745,000	146,549.34	4,235,000	163,699.70
Personal-stockpile, equipt.	855,000	33,457.86	615,000	23,772.22
Total by Tax Commission	4,600,000	180,007.20	4,850,000	187,471.92
Collection Fee		1,800.07		1,874.72
Total Operating Negaunee Mine		181,807.27		189,346.64
Rented Buildings:				
C. C. I. Co. 1st Addition	35,700	1,397.14	34,400	1,329.85
Collection Fee		13.97		13.30
Total Negaunee Mine Co.		183,218.38	4,884,400	190,689.79
Tax Rate		3.9132		3.8654
Total City of Negaunee Tax		621,285.41		611,259.85
Negaunee Mine % of City Tax		29.5%		31.2%

The tax rate increased in 1931 but the valuation by the State Tax Commission decreased $250,000.00, making total taxes $7,471.41 less than in 1930.

11. ACCIDENTS AND PERSONAL INJURY:

The following table shows the number and classification of accidents for the years 1931, 1930, and 1929:

	1931	1930	1929
Fatal	-	1	1
Time Lost - over four months	1	2	2
" " - one to four months	4	5	4
" " - less than one month	-	3	2
Total Accidents	5	11	9
Number of cases paid compensation for accidents prior to January 1, 1931	12	12	7
Number of cases being paid difference in wages	5	4	3

The nature of the injuries occurring in 1931 is as follows:

The man who lost more than four months had the first three fingers of his left hand cut off while operating scraper hoist.

The four injuries causing lost time of from one to four months were a contused back and fractured rib, a fractured arm, an infection of the arm, and a dislocated knee.

The surface crew at the Negaunee Mine have made a very good record, having tone 634 days without a lost time accident on December 31st, 1931.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

(a) E. & A. #574 - Rocker Dump Haulage Cars

Total Estimate - 36 cars @ $485.00 each	$17,480.00
Total Expenditure	17,480.00
Total Unexpended Balance	-

This E. & A. was completed last year and 18 cars were charged out in 1930 and 18 in 1931 on the regular cost sheet.

E. & A. #611 - Electric Scraper Hoists

Total Estimate - 10 hoists	12,000.00
Total Expended in 1931	9,495.50
Total Unexpended Balance Jan. 1, 1932	2,504.50

All 10 hoists were purchased in 1931 but owing to a better price per hoist than was expected, and also to the fact that one hoist was charged direct to stoping in error, there is an unexpended balance of $2,504.50 which will not be required. These hoists have been charged out on the regular cost sheet at the rate of one hoist per month and this charge was completed at the end of the year.

13. EQUIPMENT AND PROPOSED EQUIPMENT:

a. Steam Shovels:

Two steam shovels were repaired at the Negaunee Mine shops during the winter.

b. Stockpile Trestles:

(2) Wooden Trestle:

On Account of decreased shipments in 1930, additional stocking ground was provided late in the Fall of 1930 by stripping on the North side of the East steel trestle. In January 1931 ten permanent wooden bents were erected on the curve from the shaft where this new trestle leaves the steel trestle. Stocking on this trestle started in March and has been more or less continuous throughout the year as the shipping was so light that ore was stocked in every month. There are now 34 bents erected, of which only the last four are available for additional stocking. When these are filled, together with the two empty bents on the steel trestle, there will have to be additional bents erected at the East end of the steel trestle, which will make the total length of the stocking grounds about one-quarter of a mile long on the East Steel trestle.

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13. EQUIPMENT AND PROPOSED EQUIPMENT: (Cont)

d. Scraper Hoists:

The mine is now supplied with the following scraper hoist equipment:

Company	On Hand 1/1/1931	Purchased 1931	On Hand 1/1/1932	Repair Cost Per Machine Per Year
Ingersoll-Rand 15 H.P. Elec.	4	2	6	8.80
" " 10 " "	-	5	5	8.04 *
" " Air	12	-	11	26.07
Sullivan 25 H.P. Electric	2	-	2	-
" 20 " "	-	1	1	-
" 15 " "	10	-	10	33.48
" 6½ " "	10	-	10	135.54
Gardner-Denver 15 H.P. Elec.	2	-	2)	
" " 10 " "	3	-	3)	48.50
" " 7½ " "	10	-	10	49.46
" " Air	8	-	4	65.40
Lake Shore Engine Works 25 H.P.Elec. Scraper Slide	1	-	1	-
Total	62	8	65	

Distribution: 5 on transfer subs, 1 on loader used in drifting, 59 in mining area.
1 Ingersoll-Rand air and 4 Denver air hoists were scrapped during the year.
* Cost based on use of 3 machines for 6 months.

e. Hoisting Equipment

While the work of sinking the shaft was in progress it was found necessary to use a sinking cage hung under the main cage and, therefore, additional counterweight was required to reduce the peak load on the cage hoist and thus cut down on the power cost. 2600 lbs. was added to the old counterweight, making the total weight 9062 lbs. This additional weight will be left in place as the previous weight was too light to properly balance the regular cage. The sinking cage was removed July 7th.

The steel slides for the hoisting rope in the engine house, partially installed last year, were completed early in the Spring of 1931.

14. MAINTENANCE AND REPAIRS:

There were no extraordinary maintenance or repairs in 1931. Installation of heating plant boiler and return system to hot well, together with the hot well, started in 1930, was completed in 1931.

Repairs to pump rotar, costing $773.00, were made in 1931.

15. POWER:

Electric power was supplied by the Cliffs Power & Light Company, a subsidiary of The Cleveland-Cliffs Iron Co. The rate charged for current was 1½¢ per k. w. hour, the same as last year.

The following statement shows a comparison in detail of the power cost for the years 1930 and 1931.

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15. POWER: (Cont)

Account	1931 K. W.	1931 Cost	1931 Per Ton	1930 K. W.	1930 Cost	1930 Per Ton
Stoping	114,000	1,710.00	.005	108,000	1,620.00	.003
Timbering	4,236	63.55		3,200	48.00	
* Ventilation	234,146	3,512.20	.010	254,702	3,820.53	.007
* Pumping	1,615,618	24,234.27	.072	1,950,926	29,263.90	.050
* Hoisting	958,680	14,380.20	.042	1,487,688	22,315.30	.039
* Stocking Ore	50,686	760.29	.002	53,528	802.93	.001
* Dry House Expense	8,887	133.31		17,750	266.25	
Telephone & Safety Devices	37,616	564.24	.002	40,000	600.00	.001
* Mine Office	684	10.26		992	14.88	
* Electric Haulage	116,312	1,744.68	.005	254,930	3,823.95	.007
* Shops	3,340	50.10		5,190	77.85	
* Operating Compressors	1,394,663	20,919.93	.061	2,322,423	34,836.35	.060
Total	4,538,868	68,083.03	.201	6,499,329	97,489.94	.168
Product		338,696			579,740	
K. W. per ton of ore		13.4			11.2	
Cost per K. W.		.015			.015	

* Metered Accounts

Increase in stoping is due to more electric scraper hoists in use in 1931 than in 1930.

Increase in ventilation in cost per ton is due to smaller product.

Increase in pumping " " " " " " " " "

Increase in hoisting in cost per ton is due to sending down timber for repairing while mine is idle.

17. CONDITION OF PREMISES:

The grounds were kept up to their usual high standard and the parking area for automobiles of employees just West of the office was covered with cinders and rolled to improve the appearance. Considerable shrubbery was moved and rearranged around the office yard and engine house.

18. NATIONALITY OF EMPLOYEES:

This report has been prepared under two statements. The first shows the nationality of the employees as to parentage; for instance, a man has been classified as a Finn when born in this country of Finnish parentage. This naturally shows only a few Americans employed. The second statement separates the nationalities into "Foreign born" and "American born".

As to parentage	1931	%	1930	%
English	64	23	67	23
Finnish	102	38	117	40
Italian	32	12	35	12
Swedish	37	13	29	10
French Canadians	21	8	24	9
Americans (mixed)	-	-	-	-
Germans	3	1	3	1
Austrians	4	1	4	1
Norwegians	4	1	3	1
Irish	3	1	4	1
Danish	6	2	7	2
Polish	-	-	1	-
	276	100	294	100

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18. NATIONALITY OF EMPLOYEES: (Cont)

	Total		American born		Foreign born	
As to birth	1931	1930	1931	1930	1931	1930
English	64	67	38	33	26	34
Finnish	102	117	36	39	66	78
Italian	32	35	6	5	26	30
Swedish	37	29	16	12	21	17
French Canadians	21	24	18	20	3	4
Germans	3	3	2	1	1	2
Austrians	4	4	2	2	2	2
Norwegians	4	3	2	1	2	2
Irish	3	4	3	4	-	-
Danish	6	7	5	5	1	2
Polish	-	1	-	1	-	-
Total	276	294	128	123	148	171
Percentage			46%	42%	54%	58%

MAAS MINE
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1. GENERAL:

The mine operated on one 8-hour shift 5 days per week from January 1st to May 1st, 4 days per week from May 1st to June 8th, 3 days per week from June 8th to November 16th, and 2 days per week from November 16th to December 31st.

The working force has been maintained at practically a constant figure during the year, except that due to curtailment of operations and to the fact that there were so many unemployed in the district the working time of the single men have been cut and their time filled in with married men who were out of work. Also in several occupations which require full time operation, such as engineers, pumpmen, watchmen, firemen, etc. the time has been split up among several men, thus giving more men work but keeping the man days the same.

Mining operations have continued in the two areas mined in 1930, i.e. the footwall pillar near the Negaunee boundary between the 2nd and 3rd levels where mining has now reached a point four subs below the 2nd level, and the large area above the 4th level extending from the Race Course property to the Negaunee boundary. In the 4th level area mining was carried on in several areas from the 200 ft. sub 90 ft. above the 4th level to the 140 ft. sub level 30 ft. above the 4th level. Development was continued in the Race Course footwall pillar above the 3rd level and the upward extent of this ore body has been practically located 150 ft. above the 3rd level where stoping will be started in 1932.

The development of the 5th level has been continued throughout the year with the extension of the shaft crosscut to the ore body, a raise put up to the 4th level in ore for ventilation, and the turning off of the first and second crosscuts in the Race Course from the Southwest footwall drift, also the pump house and sump have been nearly completed. The development of the 5th level in the ore body was stopped temporarily on account of the curtailment in operations, but will have to be resumed in 1932. The workings above the 4th level are approaching the level which with attendent crushing of the drifts will force the abandonment of these areas until new raises can be put up from the 5th level. As this territory furnishes the majority of the production and also includes the Race Course ore body which must be mined out as rapidly as possible to complete mining within the life of the lease, it is essential that the development of the 5th level be completed before the 4th level haulage drifts crush.

Although the total shipments decreased, shipments from the stockpiles increased in 1931 over 1930 with the result that the stocking ground under the steel trestle is in shape to take care of the three grades of ore necessary to stock here. The percentage of Bessemer ore produced decreased 4% and the percentage of Race Course ore increased 5%. The percentage of both of these grades should increase in 1932 when mining starts above the 5th level and in the footwall pillar above the 3rd level.

All the ore has been handled with scrapers. The purchase of eight larger electric scraper units together with the introduction of larger scrapers has increased the output of the contracts, making it possible to handle the ore in a shorter time and thus leave more time for drilling and timbering in order to complete the cycle. This would have naturally increased the tons per man stoping had it not been offset by the curtailment in operations with its attendent crushing and delays due to retimbering.

The largest daily output ever obtained at the mine was in October 1931, when an average of 1,928 tons per day was hoisted. This demonstrated the possibilities of a much larger yearly product than had ever been obtained.

MAAS MINE
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1. GENERAL: (Cont)

I regret to report that a fatal accident occurred in January, when a timberman putting in lining plank in a raise above the 3rd level was struck in the head by a falling piece of ore, crushing his skull. This raise had just been completed and the chunk must have worked through the covering placed on top of the raise. This accident was classified as avoidable and was, therefore, unnecessary. It was due to violation of rules and lack of care on the part of the timber boss.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

	1931	1930	Increase	Decrease
Maas Bessemer	72,563	123,308		50,745
Race Course Bessemer	14,916	10,364	4,552	
Maas	201,960	269,269		67,309
Race Course	16,165	13,712	2,453	
Total	305,604	416,653		111,049
Rock	26,780	26,840		60
Total	332,384	443,493		111,109

b. Shipments:

Grade of Ore	Pocket Tons	Stockpile Tons	Total Tons	Total Last Year
Maas Bessemer	17,152	56,202	73,354	68,993
Race Course Bessemer	3,202	6,600	9,802	1,132
Maas	47,827	70,899	118,726	174,931
Race Course	3,481	28,004	31,485	8,796
Total	71,662	161,705	233,367	253,852
Total Last Year	154,125	99,727	253,852	
Decrease	82,463		20,485	
Increase		61,978		

c. Stockpile Inventories:

Grade of Ore	Dec.31,1931	Dec.31,1930	Increase	Decrease
Maas Bessemer	75,978	76,769		791
Race Course Bessemer	22,902	17,788	5,114	
Maas	241,246	158,012	83,234	
Race Course	1,428	13,176		11,748
Total	341,554	265,745	75,809	

Including the overrun of many years in the Maas stockpile there were nearly 500,000 tons in stock at the end of the year.

d. Division of Product by Levels:

	1931	%	1930	%
3rd Level	83,371	27.3	116,252	27.5
4th Level	220,297	72.1	300,401	72.5
5th Level	1,936	.6	-	-
Total	305,604	100.0	416,653	100.0

The percentage of ore removed from the 3rd and 4th levels was approximately the same for the two years, with a small amount from the 5th level in 1931.

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Cont)

e. Production by Months:

The production by months is as follows:

Month	Maas Bess.	Maas	R.C.Bess	Race Course	Total	Rock
January	6,248	21,936	1,708	1,976	31,868	3,000
February	8,332	17,476	2,116	2,124	30,048	3,192
March	7,660	24,332	2,568	1,336	35,896	4,220
April	10,768	21,060	1,872	2,112	35,812	2,880
May	8,779	14,892	1,216	1,128	26,015	1,944
June	6,387	14,064	1,032	1,104	22,587	1,580
July	6,155	13,387	910	1,224	21,676	1,692
August	5,814	14,259	1,091	1,236	22,400	1,984
September	7,706	14,541	1,009	1,277	24,533	2,120
October	7,354	16,168	1,243	301	25,066	1,616
November	4,553	10,254	692	313	15,812	1,580
December	3,476	8,922	378	1,115	13,891	972
Total	83,232	191,291	15,835	15,246	305,604	26,780
Transferred from	10,669	to 10,669	919	to 919		
Stockpile Overrun				3,572	3,572	
Total	72,563	201,960	14,916	19,737	309,176	26,780
Total 1930	123,308	269,269	10,364	13,712	416,653	26,840
Increase			4,552	6,025		
Decrease					107,477	60

The product was distributed as follows:

	1931	1930	Increase	Decrease
George Maas Lease	215,309	300,777		85,468
Catholic Cemetery	33,654	54,484		20,830
C. C. I. Co. (Right of Way)	14,179	20,500		6,321
American Mining Company	7,180	7,484		304
Race Course	34,653	24,064	10,589	-
City of Negaunee	4,201	9,344		5,143
Total	309,176	416,653		107,477

f. Ore Statement:

	Maas Bessemer	Maas	R.C. Bess	Race Course	Total	Total Last Year
On Hand Jan. 1, 1931	76,769	158,012	17,788	13,176	265,745	102,944
Product for Year	83,232	191,291	15,835	15,246	305,604	416,653
Overrun	-	-	-	3,572	3,572	-
Transferred from	10,669	to 10,669	919	to 919	-	-
Total	149,332	359,972	32,704	32,913	574,921	519,597
Shipments	73,354	118,726	9,802	31,485	233,367	253,852
Balance on Hand	75,978	241,246	22,902	1,428	341,554	265,745
Decrease in Output					107,477	
Increase in ore on hand					75,809	

1931 - 1 8-hour shift, 5 days per week, January 1st to May 1st
4 " " " May 1st to June 8th
3 " " " June 8th to November 16th
2 " " " November 16th to December 31st
1930 - 1 8-hour shift, 6 days per week, January 1st to July 16th
5 " " " July 16th to December 31st.

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2. PRODUCTION, SHIPMENTS & INVENTORIES: (Cont)

g. Delays:

Feb. 15th - 1 hour delay on account of panel board shorted across contactors on skip hoist. This was the only delay during the year as compared with 9 delays totaling 24 hours in 1930.

h. Delays from Lack of Current:

There were no delays on account of lack of current.

3. ANALYSIS:

a. Average Mine Analysis on Output:

	1931			1930		
Grade	Iron	Phos.	Silica	Iron	Phos.	Silica
Maas Bessemer	62.07	.040	6.64	61.38	.044	7.45
Maas	60.44	.074	7.76	60.01	.066	8.11
Race Course Bessemer	61.29	.042	7.95	61.38	.044	7.25
Race Course	59.98	.075	7.83	59.36	.061	8.82

The average mine analyses on output were higher in 1931 in all grades except Race Course Bessemer where there was a slight decrease.

b. Average Analysis on Straight Cargoes:

None.

c. High Sulphur Ore

There was no high sulphur ore encountered in mining or developing in 1931.

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption: 12 cubic feet equals one ton
10% deducted for rock
10% deducted for loss in mining
Percentage of Bessemer equals 10%.

Between 2nd and 3rd levels)		1,140,197 tons
" 3rd " 4th ")	Maas Lease	3,015,109 "
" 2nd " 4th "	Race Course Lease	486,013 "
Total above 4th level - Nov. 30, 1931		4,641,319 "
Mined in December 1931		13,891 "
Total developed ore above 4th level - Dec. 31, 1931		4,627,428 "

The estimate of ore reserves December 31, 1931, shows 23,934 tons less than that of 1930. Taking into account the product for the year there has been an increase of 285,242 tons, mostly due to proving up a larger area of ore in the Race Course ore body above the 3rd level.

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4. ESTIMATE OF ORE RESERVES: (Cont)

a. Developed Ore: (Cont)

Statement showing ore reserves and new ore development for the following years:

	1927	1928	1929	1930	1931
Ore in Mine Jan. 1st	4,660,105	4,502,460	4,787,424	5,975,050	4,651,362
Production	270,006	261,454	331,922	416,653	309,176
Balance	4,390,099	4,241,006	4,455,502	5,558,397	4,342,186
Ore in Mine Dec. 31st	4,502,460	4,787,424	5,975,050*	4,651,362#	4,627,428##
New Ore Developed	112,361	546,418	1,519,548	- 907,035	285,242

* Race Course ore body, estimated at 1,500,000 tons, included this year.
\# Decrease due to only showing ore above 4th level in Race Course estimate
Increase due to a larger outline of ore West of the dike above 3rd level.

b. Prospective Ore:

No estimate of prospective ore is shown in this estimate but as soon as the development of the 5th level shows the probable outline of the ore then the ore between the 4th and 5th levels will be included under developed ore.

c. Estimated Analysis:

Ore Reserves: Approximate Expected Natural Analysis.

	Iron	Phos.	Silica	Mang.	Alum	Lime	Mag.	Sul.	Igni	Moist
Maas & R. C. Bessemer	53.50	.040	6.40	.195	2.00	.80	.225	.008	1.10	12.00
Maas & Race Course	52.45	.060	6.63	.208	2.20	1.10	.320	.010	1.80	12.50

Ore in Stock: Average Natural Analysis:

	Iron	Phos.	Silica	Mang.	Alum	Lime	Mag.	Sul.	Igni	Moist
Maas Bessemer	54.12	.039	6.34	.194	2.02	.88	.224	.008	.98	11.50
Maas	52.67	.075	7.00	.200	2.10	1.20	.350	.011	1.80	11.75
R.C.Bessemer	53.85	.040	6.35	.180	2.00	.75	.220	.009	1.00	11.50
Race Course	52.60	.058	7.70	.183	2.20	1.00	.250	.010	1.70	11.75

5. LABOR AND WAGES:

a. Comments:

(1) Labor:

There was no shortage of surface or underground men during the year: in fact, the time of several of the monthly men such as engineers, firemen, pumpmen, watchmen, etc. was split up so that more men could work during the present curtailment. There was a 10% reduction in wages effective October 1st.

(2) New Construction:

The following is a list of the E. & A's on which work was done during 1931:

E. & A. #504 - Moving Race Course Houses to 1st Addition
E. & A. #548 - Sinking Shaft & Developing the 5th level
E. & A. #611 - Scraper Hoists
E. & A. #614 - C. C. I. Co. 2nd Addition

All E. & A's will be taken up in detail under #12 "New Construction and Proposed New Construction".

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5. LABOR AND WAGES:

b. Comparative Statement of Wages and Product:

	1931	1930	Increase	Decrease
PRODUCT	305,604	416,653		111,049
No. Shifts and Hours	1-8-hr	1-8-hr		
AVERAGE NO. MEN WORKING:				
Surface	42½	42½		
Underground	197	191	6	
Total	239½	233½	6	
AVERAGE WAGES PER DAY:				
Surface	4.38	4.47		.09
Underground	5.08	5.25		.17
Total	4.94	5.10		.16
AVERAGE WAGES PER MONTH:	15.9 days	23.2 days		7.3
Surface	69.64	103.70		34.06
Underground	80.77	121.80		41.03
Total	77.65	118.32		40.67
PRODUCT PER MAN PER DAY:				
Surface	30.59	30.82		.23
Underground	7.71	7.64	.07	
Total	6.16	6.12	.04	
LABOR COST PER TON:				
Surface	.143	.145		.002
Underground	.659	.687		.028
Total	.802	.832		.030
AVERAGE PRODUCT MINING:				
Stoping	20.17	20.45		.28
Ore Development	8.79	7.28	1.51	
Total	18.91	18.79	.12	
AVERAGE WAGES CONT. LABOR	5.54	5.80		.26
TOTAL NUMBER OF DAYS:				
Surface	9,990	13,520		3,530
Underground	39,633	54,541		14,908
Total	49,623	68,061		18,438
AMOUNT FOR LABOR:				
Surface	43,777.81	60,434.02		16,656.21
Underground	201,316.51	286,125.80		84,809.29
Total	245,094.32	346,559.82		101,465.50

AVERAGE WAGES PER MONTH BASED ON MEN CARRIED ON MINE PAYROLL:

	18 days per Mo.	13 days per Mo.	9 days per Mo.*
Surface	75.06	55.51	35.82
Underground	93.96	66.69	41.31
Total	87.12	62.79	40.14

* 10% Reduction in wages

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5. LABOR AND WAGES:

b. Comparative Statement of Wages and Product: (Cont)

Proportion of Surface to Underground Men:

1931 - 1 to 4.63	1	8-hr	shift,	5	days	per	week,	January 1st to May 1st
	1	8-hr	"	4	"	"	"	May 1st to June 8th
	1	8-hr	"	3	"	"	"	June 8th to Nov. 16th
	1	8-hr	"	2	"	"	"	Nov. 16th to Dec. 31st
1930 - 1 to 4.49	1	8-hr	"	6	"	"	"	January 1st to July 16th
	1	8-hr	"	5	"	"	"	July 16th to Dec. 31st
1929 - 1 to 3.84	1	8-hr	"	5	"	"	"	Jan. 1st to April 15th
	1	8-hr	"	6	"	"	"	April 15th to Dec. 31st
1928 - 1 to 4.11	1	8-hr	"	5	"	"	"	
1927 - 1 to 4.32	1	8-hr	"	5	"	"	"	

6. SURFACE:

a. Buildings, Repairs:

The work of enclosing the entrance to the skip pit at the collar of the shaft started last December was completed in January of this year, making it much safer to do repair work on the skips and skip roads in freezing weather.

The new steel rope slides, which are now standard at all properties, were installed in the engine house, which removed the danger of fire from the old wooden slides, and as these slides practically close the opening a great deal of the draught is cut off.

The coal dock was repaired and six legs replaced with new ones.

The loading pocket and dump at the shaft were repaired and also the roofs of the dry and engine house.

The West pocket at the Maas crushing plant was dismantled during the year, the timber being salvaged for use in repairing No. 2 shaft at the Negaunee Mine. This shaft is the ventilation shaft for both properties.

b. Stockpiles:

Seven more bents were erected on the rock trestle at the East end of the steel trestle which now extends 1500' East of the shaft.

In May it was necessary to erect five more bents on the West wood trestle for Maas Ore, making a total of 39 bents in all, or about 500' further West than ore was ever stocked before.

In August the trestle to hold Maas Ore this winter was erected consisting of 22 bents.

There was some rock along the West pocket track North of the Maas stockpile which was removed to make more room for stocking and for the stockpile loading tracks.

The Race Course Ore was all shipped from the steel trestle this year, leaving only Maas Bessemer and Race Course Bessemer in stock. This will help stocking conditions as the Race Course Ore, of which there will not be very much hoisted this winter, can be stocked nearer to the shaft and leave more room for the Maas Bessemer.

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6. SURFACE:(Cont)

c. Tracks, Roads, etc.:

The following table shows the saving in cost of water consumed in 1929, 1930, and 1931. The installation of a cooling pond with a regulator to control the amount of water needed to be added for cooling purposes is partly responsible for the decrease.

	1929	1930	1931
1st Quarter	448.55	181.42	148.84
2nd "	542.21	248.92	122.65
3rd "	587.01	392.26	136.20
4th "	369.06	188.59	19.25
Total	1,946.83	1,011.19	426.94

d. Timber Yard:

A new track was installed in the timber yard close to the toe of the railroad fill so that 9½ ft. poles could be loaded on timber trucks without carrying them some distance to the North to a timber track.

e. Grounds:

There has been some rearrangement of the shrubbery and several trees removed that has improved the appearance of the grounds near the dry house.

A large part of the old rock pile, directly South of the shaft, was loaded by crane and hauled in trucks to the 2nd Addition to make the sub base for streets and alleys. Practically all the good rock was removed, the remainder is mixed with sand that came from sinking the Maas shaft. The remainder of this rock pile should be removed as soon as possible in order to improve the appearance of the mine grounds. The material can be used to level off ground to the East for an emergency stocking ground.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking in 1931.

b. Development:

The development work in 1931 consisted of drifting and raising on the 3rd, 4th, and 5th levels.

3rd Level:

In the footwall pillar near the Negaunee boundary the only development work has been one raise which was completed in the early part of the year. It extended from the 3rd level to the 465 ft. sub and passed through 35 ft. of rock and 120 ft. of ore.

The development of the ore body lying West of the dike almost directly South of the shaft on the Maas Lease and the Race Course was continued through the year. The general outline of the ore body has been determined by raises from the extension of the 3rd level haulage drift, together with the opening of the 401 ft. sub level. From the 401 ft. sub level 100 ft. above the 3rd level test raises have been put up to the hanging and along the foot which indicate that the top of the ore body is approximately 150 ft. above the 3rd level. This area will be taken up in detail under Stoping. The total footage for drifts and raises in this development is as follows:

3rd Level	170' Ore	193' Rock
Sub Level drifting	890' "	-
Raising	309' "	197' "
Total	1,369' "	390' "

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7. UNDERGROUND:

b. Development: (Cont)

4th Level:

There was very little development work done on the 4th level during 1931. The crosscut running parallel to and East of the Race Course boundary was extended to the Northwest from the footwall drift towards the shaft crosscut to make a new motor drift to take the place of the one along the Race Course boundary which is in the mining area and will soon crush. It was expected that this extension would be in rock as the footwall drift was partially in rock a short distance on either side of this crosscut, but the drift is still in ore after advancing 80 ft., indicating a roll in the foot possibly influenced by the dike to the Northwest.

A short raise was put up to the 140 ft. sub in the ore body to the West of the dike in the Race Course property and a drift driven 90 ft. in ore to determine the Western extent of this ore body. The hanging which was encountered in the breast at this distance came in very much sooner than was anticipated. There have been only two other raises put up from the 4th level this year, one in No. 1 crosscut in the Race Course ore body and one in the drift parallel to the South boundary of the Race Course. The total raising in ore was 94 ft.

5th Level:

The development of the 5th level was continued throughout 1931 and has consisted chiefly of rock work, the only ore development being 85 ft. of lean ore drift in the main crosscut from the shaft in the Race Course property and an ore raise from this drift to the 4th level 100 ft. in ore to improve ventilation.

The shaft crosscut in the footwall, which was started in August 1930, advanced 870 ft. in rock in 1931 to a point 1594 ft. South of the shaft where the dike was encountered. South of this dike lean ore was encountered which extended 75 ft. when good grade ore was reached and the drift was stopped temporarily. The footwall drift to the Southeast was started and advanced 30 ft. in rock to make room for a switch, after which the footwall drift to the Southwest was driven 300 ft. in rock and Nos. 5 and 6 crosscuts turned off. No. 6 crosscut was driven 85 ft. to the dike where it was stopped temporarily. A large ditch to carry the water has been excavated along the entire drift from the shaft and the pumphouse and sump have been nearly completed. The material in the pumphouse, sump, and first 200 ft. of the shaft crosscut was a very hard quartzite while the remainder was mixed slate and quartzite until near the ore body where slate was encountered. Development of the Race Course ore body will be resumed in April 1932.

The following table shows the amount of drifting and raising done during the year:

	Drifting		Raising		Total 1931		Total 1930	
	Ore	Rock	Ore	Rock	Ore	Rock	Ore	Rock
2nd Level	-	-	-	-	-	-		120'
480' Sub Level	-	50'	-	-	-	50'	-	-
430' " "	-	-	-	102'	-	102'	-	-
465' " "	-	-	-	-	-	-	-	425'
401' " "	970'	70'	187'	186'	1157'	256'	-	-
355' " "	40'	-	-	-	40'	-	270'	-
335' " "	60'	10'	-	-	60'	10'	-	-
3rd Level	170'	193'	303'	128'	473'	321'	1252'	268'
140' Sub Level	90'	-	-	-	90'	-	-	-
4th Level	80'	-	94'	-	174'	-	1283'	20'
5th Level	15'	1448'	100'	-	115'	1448'	-	838'
Pumphouse & Sump	-	360'	-	-	-	360'	-	-
Total	1425'	2131'	684'	416'	2109'	2547'	2805'	1671'

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7. UNDERGROUND:

b. Development: (Cont)

There have been 9 contracts developing in 1931 of which two were on double shift as compared with 7 contracts with 2 on double shift in 1930.

c. Stoping:

(1) General Remarks:

Mining operations during 1931 have been confined to the footwall pillar above the 3rd level near the Negaunee boundary, to development work in the western end of the 3rd level and above, and to the subs above the 4th level along the East boundary of the Race Course and between the South boundary of the Race Course and the Negaunee Mine boundary.

In the footwall pillar above the 3rd level nearly two sub levels have been completed during the year with an average of ten contracts and mining has now reached the elevation of the 465 ft. sub 150 ft. above the 3rd level. As this sub level served as a distributing level for timber it became necessary to have another one at a lower elevation and consequently two contracts have been working here nearly the entire year driving connecting drifts between the raises and putting up two raises to the 465 ft. sub in the rock footwall to serve as timber slides. The timber will be brought to the 401 ft. sub and then hoisted in the separate raises to the working places. A connection will also be made on this elevation with the Negaunee Mine, 11th level drift, to improve the ventilation. One additional raise was put up this year from the 3rd level to the 465 ft. sub on the footwall to help drain off the water which occurs here in very troublesome quantities. The foot side will then be worked one sub level in advance of the hanging side in order to keep the latter dry.

There have been an average of three contracts developing and one mining in the ore body above the Western end of the 3rd level which was partially opened up in 1930. As this ore body is now outlined on the 401 ft. sub, 100 ft. above the 3rd level, it appears to be triangular in shape with a 260 ft. base East and West along the footwall and with an altitude of 160 ft. North and South from foot to hanging. A raise on the footwall put up at approximately 45^{0} 100 ft. to where the hanging and foot come together and test raises put up on the hanging side of the ore body also went up from 40 to 50 ft. before they encountered the jasper. This proves that there is a flattening of the ore body in this area and that it is not likely to go higher at any point on the sub level. To test this theory a raise was put up from an old exploratory drift that was driven several years ago to look for the ore in No. 7 diamond drill hole on the 430 ft. elevation or 130 ft. above the 3rd level. A raise was put up to the Southwest from this old exploratory drift a distance of 100 ft.; the top was only 120 ft. North of the footwall drift on the 401 ft. sub yet it did not encounter any good ore, also a drift cut out 50 ft. above the 430 ft. sub and driven about 40 ft. West was in lean ore and jasper.

It was thought that there might be a roll in the hanging on the 3rd level and, therefore, the haulage drift was extended to the Northwest 140 ft. to the point where the hanging and foot came together and cut off the ore. A test raise was put up 30 ft. near this point to the hanging. From the top of this raise exploratory drifts were driven which proved that there was apparently no western extension of the ore body unless there is a considerable drop in the hanging which cuts off the entire ore body at this elevation. Several raises were then put up to the hanging and by offsetting

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7. UNDERGROUND:

c. Stoping: (Cont)

(1) General Remarks: (Cont)

they were extended to the 401 ft. elevation. It was then decided to extend the 3rd level drift into the footwall and turn East parallel to the foot in order that some raises could be extended up through the footwall and intersect the ore body at locations that would permit of economical handling of the ore with scraper hoists. A raise was also put up in the footwall from the shaft crosscut that holed to the East side of the ore body at the elevation of the 401' sub level. The tops of these raises will be connected by drifts on the 401' sub level and all the ore above will be handled through these drifts.

One contract has been mining in the Eastern end of this ore body where the ore did not extend so far above the 4th level and has mined out two small sub levels 65 ft. and 75 ft. above the 3rd level.

On the 4th level where the majority of the contracts have worked during 1931 mining conditions have been good as there is very little water and the ore breaks well, the only difficulty being to keep the working places properly ventilated by the use of doors and booster fans. Most of the Bessemer ore is produced in this area which will soon have to be handled through 5th level raises as the workings are gradually approaching the 4th level and crushing has already started in one area.

There has been an average of 37 contracts stoping during 1931, of which four were on double shift, as compared with 39 contracts, 3 of which were on double shift, in 1930.

During the year ore has been mined on the following leases: Maas Lease, Roman Catholic Cemetery Lease, City of Negaunee Lease, American Mining Co. right of way, C. C. I. Co. right of way, and the Race Course.

The detail of mining on the various levels and sub levels is as follows:

Subs between the 2nd and 3rd Levels:

495' Sub Level - East footwall pillar:

Mining was started in this area in January 1929 and completed in January 1931 with the mining of a small pillar in the Cemetery Lease.

485' Sub Level - East footwall pillar:

This sub level was opened in this area in November 1929 and mining has been continuous ever since with one contract mining the last pillar in December. Mining here in 1931 was entirely on the Maas and Roman Catholic Cemetery Leases.

475' Sub Level - East footwall pillar:

Mining was started on this part of the sub level in September 1930 in the extreme East portion and has continued in 1931. In December there were three contracts stoping in the Roman Catholic Cemetery Lease and three in the Maas Lease.

465' Sub Level - East footwall pillar:

This sub level was first opened in 1929 to serve as a distributing level for timber and also as a transfer drift while raises were being put up from the 3rd level. When these raises were completed early in 1930 work at this elevation was stopped until June of this year when stoping operations were completed on the sub above in the railroad pillar near the Negaunee boundary. In December three contracts were stoping, two in the Roman Catholic Cemetery Lease, and one in the Maas Lease.

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7. UNDERGROUND:

c. Stoping: (Cont)

430' Sub Level - West:

This sub was originally opened in 1927 for the purpose of locating the ore shown in diamond drill hole No. 7. A raise was put up 75 ft. to the Northwest from the end of the drift but no ore was encountered except a few small seams, after which this work was abandoned. From development work this year on the 401' sub to the South of this drift it was thought that ore might be encountered by a raise to the Southwest from this old drift on the 430' sub. Accordingly, a contract put up a raise 100 ft. in jasper and lean ore and cut out a small test drift 50 ft. above the 430' sub level in the rich jasper but after drifting 40 ft. without finding any commercial ore this sub was again abandoned.

401' Sub - East footwall pillar:

This sub level was opened several years ago and then abandoned as it was found that there was considerable ore on the foot above the 2nd level. The next work done here was in 1928 when the raises from the 3rd to the 2nd level were connected by a drift for inspection purposes. This drift was lost when these raises crushed. In 1931 mining reached the 465 ft. sub which is used for timber distribution and, therefore, a lower sub had to be opened for handling timber. In January of this year two contracts started cutting out from 109 and 118 raises respectively on the 401 ft. sub, drifted to the foot and put up two rock raises to the rock drift in the foot on the 465 ft. sub to serve as timber slides. Drifts were then started to connect raises being used at present for mining and as soon as this work is completed the timber will be hoisted from this sub to the working contracts above. A connection will also be made with the Negaunee Mine, 11th level drift, to improve ventilation. In December one of these contracts had reached the Negaunee boundary and the other had advanced a drift in ore from 109 to 112 raise. There is still over 200 ft. of drifting necessary to connect all the raises.

401' Sub - West Deposit:

This sub level was opened in December 1930 by raising on the footwall from the 355 ft. sub level. Exploring in this upward extension of the Race Course ore body West of the dike has continued throughout this year with an average of two contracts mining, drifting and raising. A raise in the footwall at 45° has encountered the hanging at a point 45 ft. above the level as have also several test raises further South, showing the hanging to be fairly flat over this area. A drift to the West driven early in the year encountered the footwall on the right side and the hanging wall on the left about 220 ft. West of the raise. All this ore had to be transferred on the 355 ft. sub below and as the ore above would also have to be transferred it was decided to put up two additional raises in the footwall from the 3rd level, one of which has been completed. A North-South crosscut from another raise put up to the hanging from the 3rd level holed to the East-West drift and proved the width of the ore body to be about 200 ft. in the center. The tonnage developed on and above this sub level was greater than was anticipated. In December four contracts were working on this sub preparatory to opening under the hanging to start stoping.

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7. UNDERGROUND:

c. Stoping: (Cont)

385' Sub Level:

Mining at this elevation in a small deposit under the hanging, directly South of the shaft, was started in December 1930 and finished in January 1931, after which considerable time was spent in blasting down the hanging rock to form a mat or cushion on the poles that had been laid on the floor of the sub level.

375' Sub Level:

This sub level, directly under the above mentioned area, was started in March and completed in June with only a slight increase in the size of the ore body.

365' Sub Level:

Mining at this elevation was started in July in this same ore body and in December one contract was stoping in the area which is now much larger, being about 160 ft. in length by 50 ft. in width.

355' Sub Level:

This sub level was opened during 1930 in the upward extension of the Race Course ore body found South of the shaft and West of the dike and the only work done this year was the holing of a drift from 1-E raise to 4-W raise for ventilation, and about 30 ft. of drift North of 8-W raise.

335' Sub Level:

During March and April of this year a short raise was put up to this sub level from the 3rd level and a drift started to explore for the Western extent of the Race Course ore body so as to give information needed to locate an extension of the 3rd level drift. However, there does not appear to be any ore to the West as the raise struck the hanging at this elevation, a drift 60 ft. to the North struck the foot, and a drift to the West at a point about 30 ft. from the raise encountered the hanging in 10 ft. It was, therefore, decided that it was not necessary to extend the 3rd level drift any further to the West.

3rd Level:

The only work done during the year at the Eastern end of the level was confined to one raise, No. 111-A on the footwall, which was extended to the 465 ft. sub. This raise will help drain off the water near the footwall on the sub levels below the 2nd level. This raise passed through 35 ft. of rock and 120 ft. of ore, total height 155 ft.

In the Western end of the level the main level drift, started in 1930, was continued to the Northwest 140 ft. in ore to the point where the hanging and foot came together. Later in the year it was then continued to the North into the footwall and then turned East so that raises would be put up in the footwall direct to the ore body 100 ft. above. The work done this year proves up a slight increase in the size of the ore body above the 3rd level which is now approximately 380' by 80'. Five raises have been put up from this drift during 1931. These raises passed through 122 ft. of ore and 95 ft. of rock.

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7. UNDERGROUND:

c. Stoping: (Cont)

Subs Above the 4th Level:

200' Sub Level

Mining was completed in February of this year in a small roll in the hanging just South of the Race Course boundary, which completed all mining that will be done at this elevation for several years.

195' Sub Level

Mining was continued in 1931 in an area approximately 500' by 300' between the Race Course property and the Negaunee Mine boundary. In December one contract was stoping on double shift in the remaining pillar in the Southeast corner of this area.

185' Sub Level

A small area near the Southeast corner of the Race Course property was mined several years ago on this sub level. Work was resumed here last year and continued during 1931. Operating conditions in this territory are the best in the mine and also most of the Bessemer Ore is produced from this area. The area being mined here is located on the Maas Lease and the Right of Way Strip adjacent to the Negaunee boundary. In December six contracts were mining here, one of which was on double shift.

170' Sub Level:

Mining work at this elevation during 1931 has been limited to three areas. One area near the North footwall where the ore along the East boundary of the Race Course was found to go somewhat higher than had been supposed as the hanging had cut the ore off in two adjacent raises on lower sub levels. In December one contract was blasting down filling to make a mat here before moving down and cutting out on the next sub level. The other two areas lie South and East of the Race Course property where mining has been completed on the sub levels above. A drift was driven Southeast for 90 ft. in dike and jasper from 617 raise to explore South of the dike but no ore was found. In December 9 contracts were mining, 3 of which were on double shift, all located in the Maas Lease.

160' Sub Level:

This sub level was first opened along the East boundary of the Race Course in 1929 and mining in this area was completed last year between the limit set to the East and the hanging to the West.

Early in 1931 mining was started near the Southeast corner of the Race Course where the ore body had extended to the Southwest under the hanging, and also in the area to the East of the Southeast corner of the Race Course where mining had been completed on the subs above. This is the lowest elevation at which this latter area will be worked for some time as it is planned to concentrate mining to an area along the boundary of the Race Course property as soon as the 5th level raises are completed. In December three contracts were mining here.

150' Sub Level:

Mining was started here in 1929 and has been continued since; only a small area was mined in 1931 as mining has only been finished in a small area on higher sub levels. In December three contracts were mining, one in the City of Negaunee Lease and two in the Race Course.

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7. UNDERGROUND:

c. Stoping: (Cont)

140' Sub Level:

Mining at this elevation was started in April of this year in a small area as this sub level is only 30 ft. above the 4th level. It was not deemed advisable to do much mining above the main haulage drift until the new crosscut to the East had been completed as most of the ore produced in the 4th level territory has to be trammed through this drift. Mining was done from one raise near the footwall just East of the Race Course and one contract was working here in December.

During the year two exploratory operations were carried out in the Race Course; a small area under the hanging above No. 1 crosscut in the Race Course was mined. The ore here was found in a small roll in the hanging and it was explored to see if there was any extension to the West. The other exploratory work was done to determine the Western extent of the small Race Course ore body Northwest of the dike before laying out the 5th level West footwall drift. A drift was driven at the elevation of this sub level 90 ft. to the Northeast from 306 raise to the jasper hanging which proved that if the ore extends to the West at all it must be in a much more Southerly direction. It is planned to put up another raise near the dike and do more sub level drifting before continuing either the 4th or 5th level footwall drifts.

4th Level:

There was very little work done on the 4th level in 1931. Three raises were put up, two in the Race Course and one in the drift just South of the Race Course which passed through 94 ft. of ore. One of these, #268 in the Race Course, found the hanging 28 ft. above the level.

The Northern extension of the new haulage crosscut to the East of the Race Course was started and driven 80 ft. in ore, after which it was stopped temporarily. It will be continued in 1932 to the shaft crosscut. The ore found in this drift was quite unexpected as the footwall had been encountered in the footwall drift close by on either side. There is undoubtedly a local roll in the footwall here due perhaps to the dike to the North.

5th Level:

Drifting on this level was started in August 1930 and at the end of the year had advanced 724 ft. from the shaft. The shaft crosscut advanced 870 ft. in 1931 to the South through a layer of dense quartzite and grey slate with the slate predominating as the drift went to the South until the dike on the footwall was cut. After passing through the dike the drift advanced 75 ft. in lean ore and then 17 ft. in merchantable ore when it was stopped temporarily. A raise was put up near the footwall to the 4th level for ventilation as previous to holing the raise a large fan had to be used to suck out the fumes from blasting.

The Southeast footwall drift was started and advanced 30 ft. to provide a turn out. Then the Southwest footwall drift in the Race Course was started and driven some 300 ft. in rock and Nos. 5 and 6 crosscuts started. No. 5 crosscut was extended South to the dike until it was decided to stop drifting temporarily and move the crew to finish the pumphouse and sump. The excavation of the pumphouse has been completed and at the end of the year the sump had been excavated in the pumphouse and the main sump partially stripped to increase capacity. Widening of the sump drift will be continued until the sump has a capacity of approximately 300,000 gallons. The pumps will be installed early in 1932. The sump was excavated in very hard quartzite and the material was handled by two scrapers in tandem on account of the long distance to scrape.

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7. UNDERGROUND:

c. Stoping: (Cont)

5th Level: (Cont)

There is a large ditch excavated the entire length of the main haulage drift and the installation of rails, trolley, and air pipe is about completed.

The 5th level plat and haulage drift to the ore body is undoubtedly the best ever opened at a Company mine. There is ample room, the ground is solid, there is a well ballasted track with 50 lb. rail laid on large sound tamarack ties with tie plates, also a large water ditch, 6" air line, 4-0 trolley wire, and a concrete loading pocket.

d. Timbering:

The total cost for timber in 1931 decreased due to less timber used on account of smaller production. The amount of cribbing decreased due to less raising in 1931. The cost per ton for timber increased due to more 9 ft. legs and caps being used and also due to the use of larger sizes of timber as the pressure was very heavy throughout the mine and the drifts had to stand open longer on account of the reduced working schedule. The cost per ton for 9½ ft. poles increased on account of a more extensive program of covering down.

The wire fencing was not used as extensively toward the latter part of the year as it was decided that it was unnecessary to use it where there was a good mat.

Statement of Timber Used:

	LINEAR FEET	AVG. PRICE PER FOOT	AMOUNT 1931	AMOUNT 1930
6 to 8" Cribbing Timber	45,720	.049	2,231.28	4,960.54
8 to 10" Stulls	51,259	.059	3,002.17	5,940.20
10 to 12" "	62,841	.081	5,087.88	5,337.91
12 to 14" "	38,317	.110	4,223.78	1,923.32
12 to 14" Treated Timber	1,760	.242	425.61	528.96
Total Timber - 1931	199,897	.075	14,970.72	
Total Timber - 1930	278,439	.0671		18,690.93
7' Lagging	1,050,496	.675	7,096.63	11,600.02
9½' Poles	666,653	1.419	9,458.50	11,038.39
Covering Boards				136.07
Total - 1931	1,717,149		16,555.13	
Total - 1930	2,351,765			22,774.48
*Wire Fencing (1626 rods) sq.ft.	111,788	.833 Rod	1,354.03	1,266.53
Grand Total - 1931			32,879.88	
Grand Total - 1930				42,731.94

*In use only 6 months in 1930

Product	305,604	416,653
Feet of timber per ton of ore	.6541	.6682
" " lagging " " " "	3.4377	3.7756
" " poles " " " "	2.1814	1.8505
" " wire fencing per ton of ore	.3657	.5364
" " lagging per foot of timber	5.25518	5.6500
" " poles per foot of timber	3.3350	2.769

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7. UNDERGROUND:

d. Timbering: (Cont)

Statement of Timber Used: (Cont)

	AMOUNT 1931	AMOUNT 1930
Cost per ton for timber	.0490	.0449
" " " " lagging	.0232	.0278
" " " " cover boards		.0003
" " " " wire fencing	.0044	.0030
" " " " poles	.0310	.0265
Cost per ton for all timber and wire fencing	.1076	.1025
Equivalent of stull timber to board measure	462,040	485,484
Feet of board measure per ton of ore	1.512	1.165

Total cost for timber, lagging, poles, etc., and cost per ton:

Year	Amount	Cost per ton:
1931	32,879.88	.1076
1930	42,731.94	.1025
1929	43,332.70	.1305
1928	28,083.62	.1074
1927	23,097.31	.0855
1926	22,163.56	.0906

e. Drifting and Raising:

Drifting and raising on the 5th level is not included in the following statement as this work was done under E. & A. #548.

	Drifting		Raising		
Year	Ore	Rock	Ore	Rock	Total
1931	1,562'	474'	849'	255'	3,140'
1930	1,240'	898'	2,028'	138'	4,304'
Increase	322'			117'	
Decrease		424'	1,179'		1,164'

The amount of rock drifting and ore raising decreased 54% in 1931 while ore drifting and rock raising increased 32%; the net decrease was 26%.

f. Explosives, Drilling and Blasting:

The cost per ton for all explosives increased one quarter of a cent in 1931, due to more mining and development in tough, hard, ground. This was particularly true of the ore area opened for mining on the footwall of the Race Course above the 3rd level.

In the Fall a careful study was made of blasting practice in the entire mine, as a result of which it is hoped to effect a small saving mainly through the use of Gelamite "A" at .1275 per lb. instead of 60% Gelatin at .1378 per lb. These powders are of different composition but have practically the same breaking strength, therefore, can be substituted stick for stick. The Gelamite "A", however, can only be used in areas where there is good ventilation.

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7. UNDERGROUND:

f. Explosives, Drilling and Blasting:

Statement of Explosives Used: (Ore Development and Stoping)

	Quantity	Average Price	Amount 1931	Amount 1930
1¼" 50% Ammon. Gel. - lbs	41,230	.1251	5,159.73	6,713.87
1¼" 60% " " "	70,445	.1378	9,706.70	11,355.58
1¼" Gelamite "A" "	6,670	.1272	848.13	-
1¼" " 1-x "	1,350	.1275	172.12	2,346.89
1¼" " 2-x "				567.38
Total Powder - 1931	119,695	.1327	15,886.68	
Total Powder - 1930	155,850	.1346		20,983.72
Fuse	420,773	.57	2,399.91	3,056.02
Caps - #6	67,518	1.155	779.92	973.36
Powder Bags	37	2.96	109.63	113.40
Tamping Bags	15,000	2.15	32.25	
Fuse Lighters	2,000	9.45	18.90	
Total Fuse, Caps, etc.			3,340.61	4,142.78
Total All Explosives - 1931			19,227.29	
Total All Explosives - 1930				25,126.50
Product			305,604	416,653
Pounds of powder per ton of ore			.3917	.3740
Cost per ton for powder			.0520	.0503
" " " " fuse, caps, etc.			.0109	.0100
" " " " all explosives			.0629	.0603
Rock Development & Filling				
Total Powder - 1931	8,105	.1320	1,070.23	
Total Powder - 1930	7,400	.1398		1,034.44
Total Fuse, Caps, etc. 1931			197.24	
Total Fuse, Caps, etc. 1930				155.48
Total All Explosives - 1931			1,267.47	
Total All Explosives - 1930				1,189.92
Total All Explosives used in mine - 1931			20,494.76	
Total All Explosives used in mine - 1930				26,316.42
Average price per pound for powder			.13265	.13487

65% of all powder used in 1931 was 60%
65% " " " " " 1930 " 60%

Statement showing cost per ton for explosives exclusive of rock development for the period 1927-1931 inclusive:

Year	Cost per ton	Product
1931	.0629	305,604
1930	.0603	416,653
1929	.0654	331,922
1928	.0607	261,454
1927	.0666	270,006

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7. UNDERGROUND:

g. Mining and Loading:

For the last two years all of the ore mined has been handled with scrapers. This year 8 new electric scraper units of 10 and 15 h.p. were purchased and some of the obsolete electric and air scrapers were scrapped. Larger scrapers have been introduced and there would have been an appreciable increase in the tons per man and a corresponding decrease in the cost if the operating schedule had not been reduced. The slices are now open too long a time before they are completed and consequently the contracts are delayed by stopping to repair their working places which crush during the idle time. It is planned to work the contracts on double shift as long as the two-day operation is effective. One set of men will work in one place four days per week and then another crew will come on and work four days the next week. Each place will work 16 shifts per month but the miners will get only 8 shifts.

i. Ventilation:

In June of this year it was noticed that the air coming from the main ventilation fan installed in No. 2 shaft, Negaunee Mine, was decreasing in volume and upon inspection it was found that in several areas the shaft sets had given way and partially plugged the shaft. Extensive repairs have been made in No. 2 shaft and the volume of air is now back to normal. Additional work has also been done to control the distribution of the air in the Maas Mine by doors and booster fans. Except in a few isolated cases when a sub level was being finished the ventilation has been good.

j. Pumping:

The number of gallons pumped per minute during 1931, 1930, and 1929, are shown below:

Month	1931	1930	1929
January	925	1,101	1,076
February	1,114	1,042	1,089
March	1,124	1,036	1,075
April	1,149	1,080	1,009
May	1,147	1,094	1,023
June	1,134	1,109	1,014
July	1,135	1,106	1,018
August	1,061	1,095	1,030
September	1,091	1,103	1,062
October	1,115	1,202	1,102
November	1,113	1,147	1,064
December	1,232	1,108	1,058
Total Average	1,112	1,102	1,052

The water at the Maas Mine has shown a slight increase in both 1930 and 1931, the increase last year amounting to 50 gallons per minute and the increase in 1931 to 10 gallons per minute. The increase is due to the extension of the area of broken capping caused by mining operations which has diverted some of the water that formerly went to the Negaunee Mine to the Maas and also increased the drainage area on the footwall side of the Maas ore body.

The average number of gallons pumped per minute over the last six years is as follows:

Year	Gals. per minute
1931	1,112
1930	1,102
1929	1,052
1928	1,052
1927	1,013
1926	970

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7. UNDERGROUND:

k. Underground in General:

More 9 ft. legs and caps were used this year which increased the output in tons per man per day stoping. The use of wire fencing in areas where there is a good mat has been discontinued. It is still used in areas under new hanging on top of close laid poles. Every effort is being made to make a good close mat to prevent runs of rock and to increase safety.

The main level drifts, raises, and traveling roads have been kept clean and neat as this is important in promoting safety.

A scraper foreman is now in charge of all scraper units in the mine. This new position was created to insure more careful supervision of the scraper equipment and thus prevent delays due to breakdowns. It is expected that the cost for repairs will be materially reduced.

A large amount of pipe and fittings was salvaged underground, brought to surface and overhauled, then used again in the mine. Purchases of this material have been materially reduced the last six months of the year.

8. COST OF OPERATING:

a. Comparative Mining Costs:

	1931	1930	Increase	Decrease
PRODUCT	305,604	416,653		111,049
Underground Costs	1.241	1.272		.031
Surface Costs	.156	.152	.004	
General Mine Expenses	.271	.205	.066	
Cost of Production	1.668	1.629	.039	
Depletion - Original Cost	.074	.073	.001	
Depreciation - Plant & Equipt.	.047	.046	.001	
Development	.039	.039		
Movable Equipt.	.003	.002	.001	
Taxes	.447	.313	.134	
Loading & Shipping	.020	.020		
Total Cost at Mine	2.298	2.122	.176	
Obsolete Supplies	-	.001		.001
TOTAL COST	2.298	2.123	.175	
No. of Days Operated	191	278		87
No. Shifts & Hours	1 8 hr	1 8 hr		
Average Daily Product	1,600	1,499	101	

COST OF PRODUCTION:

	1931	%	1930	%	Increase	Decrease
Labor	.833	50.0	.851	52.2		.018
Supplies	.835	50.0	.778	47.8	.057	
Total	1.668	100.0	1.629	100.0	.039	

b. Detailed Cost Comparison:

(1) Days and Shifts:

Year	Days Worked	Shifts & Hours	Men Employed	Total Days Worked
1931	191	1 8-hr	239½	49,623
1930	278	1 8-hr	233½	68,061
Increase			6	
Decrease	87			18,438

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)

(2) Wages:

The mine operated on the same wage schedule as in 1930 until October 1st, 1931, when a 10% reduction became effective. There was also a decrease of one day in working schedule with a corresponding decrease in monthly wages for all salaried employees effective June 16th of this year.

(3) Comparison of Production:

Production - 1931	305,604 tons
Production - 1930	416,653 "
Decrease	111,049 "

(4) Comparison of Number of Men and Wages:

	No. Men	No. Days	Amount	Rate per day
1931	239½	49,623	245,094.32	4.94
1930	233½	68,061	346,559.82	5.10
Increase	6			
Decrease		18,438	101,464.50	.16

(5) Tons per man per day:

The tons of ore mined per man per day were as follows:

	1931	1930	Increase	Decrease
Surface	30.59	30.82		.23
Underground	7.71	7.64	.07	
Total	6.16	6.12	.04	

(6) Cost of Production:

1931	$509,916.44	Cost per ton	$1.668
1930	678,818.53	" " "	1.629
Decrease	168,902.09	Increase	.039

	Total Cost				Cost per Ton		
	Labor	%	Supplies	%	Labor	Supplies	Total
1931 -	254,735.56	50.0	255,180.88	50.0	.833	.835	1.668
1930 -	354,456.91	52.2	324,361.62	47.8	.851	.778	1.629
Incr.				2.2		.057	.039
Decr.	99,721.35	2.2	69,180.74		.018		

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8. COST OF OPERATING:
b. Detailed Cost Comparison:
(7) Detail of Accounts:

	1931		1930		Increase		Decrease	
Days per week	4-3-2		6-5-4					
Shifts and Hours	1 8-hr		1 8-hr					
Production, Tons	305,604		416,653				111,049	
Avg. Daily Prod. - Tons	1,600		1,499		101			
Number of Days Worked	191		278				87	
Underground Costs	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
1. Exploring in Mine	687.78	.002	271.43	.001	416.35	.001		
3. Development in Rock	5685.97	.018	6176.03	.015		.003	490.06	
4. Development in Ore	12562.72	.041	19786.76	.047			7224.04	.006
5. Stoping	127005.71	.416	176022.41	.422			49016.70	.006
6. Timbering	96385.64	.315	137699.09	.331			41313.45	.016
7. Tramming	26167.04	.086	37235.76	.089			11068.72	.003
8. Ventilation	5526.35	.018	5395.58	.013	130.77	.005		
9. Pumping	51016.75	.167	50606.54	.121	410.21	.046		
10. Compr. & Air Pipes	29204.50	.096	50039.64	.120			20835.14	.024
11. Back Filling	557.70	.002	269.88	.001	287.82	.001		
12. U. G. Superintendence	11970.37	.039	14157.05	.034		.005	2186.68	
13. Cave-in	7.60		106.88				99.28	
14. Maint:Compr. & Pwr Drls	2436.40	.008	6535.67	.016			4099.27	.008
16. Elec.Tram Equipt.	5438.27	.018	20217.34	.049			14779.07	.031
17. Pumping Machy.	4609.68	.015	5608.42	.013		.002	998.74	
Total U. G. Costs	379262.48	1.241	530128.48	1.272			150866.00	.031
Surface Costs:								
18. Hoisting	18847.28	.062	25904.09	.061		.001	7056.81	
19. Stocking Ore	7541.48	.025	9852.27	.024		.001	2310.79	
21. Dry House	6090.99	.020	6498.35	.016		.004	407.36	
22. Gen. Surface Expense	4218.61	.013	5555.02	.013			1336.41	
23. Maint: Hoisting Equipt.	4553.52	.015	7382.10	.018			2828.58	.003
24. Shaft	1131.28	.004	2092.29	.005			961.01	.001
25. Top Tram Equipt.	2615.14	.008	2015.29	.005	599.85	.003		
26. Dks, Tres.& Pkts.	2317.43	.007	726.66	.002	1590.77	.005		
27. Mine Buildings	500.82	.002	3247.63	.008			2746.81	.006
Total Surface Costs	47916.55	.156	63273.70	.152		.004	15357.15	
General Mine Expenses:								
28. Insurance	194.32	.001	136.14	.000	58.18	.001		
29. Mining Engineering	2865.69	.009	2829.49	.007	36.20	.002		
30. Mech. & Elec. Engrg.	2019.84	.007	1888.73	.005	131.11	.002		
31. Analysis & Grading	11462.22	.038	14172.24	.034		.004	2710.02	
32. Personal Injury	16132.28	.053	17188.75	.041		.012	1056.47	
33. Safety Department	1332.21	.004	1431.19	.004			98.98	
34. Tel. & Safety Devices	1292.61	.004	1013.85	.003	278.76	.001		
35. Local & Gen. Welfare	5394.52	.018	5330.07	.013	64.45	.005		
36. Spec.Exp.,Pens. & Allow.	12174.33	.040	10978.40	.026	1195.93	.014		
37. Ishpeming Office	16322.22	.053	15554.56	.037		.016	767.66	
39. Mine Office	13547.17	.044	14892.93	.035		.009	1345.76	
Total Gen. Mine Exp.	82737.41	.271	85416.35	.205		.066	2678.94	
COST OF PRODUCTION	509916.44	1.668	678818.53	1.629		.039	168902.09	
40. Taxes	136517.51	.447	130359.38	.313	6158.13	.134		
Total Cost	646433.95	2.115	809177.91	1.942		.173	162743.96	

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)
(7) Detail of Accounts: (Cont)

Due to increase in average daily output, the underground cost per ton decreased, surface costs were about the same, but General Expense increased, so the cost of production was .039 higher than in 1930. The Maas showed the smallest increase in cost in 1931 of any of the mines in the Negaunee District.

3.

	Drifting	Raising	Total Feet	Cost per foot
1931	474'	255'	729'	7.80
1930	898'	138'	1036'	5.96
Increase		117'		1.84
Decrease	424		307'	

The total expense was lower but the cost per ft. increased due to harder rock encountered in drifting and raising. The cost per ton increased due to lower product.

4.

	Drifting	Raising	Total Feet	Cost per foot
1931	1562'	849'	2411'	5.21
1930	1240'	2028'	3268'	6.06
Increase	322'			
Decrease		1179'	857'	.85

Decrease due to less raising in ore.

5.

	Labor	Cost per Ton	Supplies	Cost per Ton	Scraper Hoists Charged	
1931	87,606.88	.287	39,398.83	.129	8 hoists	8,831.32
1930	123,583.97	.296	52,438.44	.126	9 "	10,800.00
Incr.				.003		
Decr.	35,977.09	.009	13,039.61			

Decrease due to mine operating less days. Decrease in cost per ton due to increased daily product.

6.

	Labor	%	Supplies	%
1931	57,842.65	60	38,542.99	40
1930	85,750.35	62	51,948.74	38
Decr.	27,907.70		13,405.75	

Decrease due to mine operating 87 less days. Decrease in cost per ton due to increased daily product.

9.

	1931	1930	Increase	Decrease
Total gallons water pumped	585,922,823	577,702,994	8,219,829	
Gallons pumped per minute	1,125	1,115	10	
Cost of electric current	40,079.58	39,475.11	604.47	

Increase due to more water pumped in 1931.

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YEAR 1931

8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)
(7) Detail of Accounts: (Cont)

10. Detail:

	1931	%	1930	%
Compressors	25,501.35	87.3	43,171.19	86.2
Air Pipes	3,703.15	12.7	6,868.45	13.8
Cu. ft. air compressed	756,405,000		1,374,390,000	
Cu. ft. of air per ton	2,475		3,299	

Decrease due to operating only one compressor on the night hoisting shift and less supplies and labor on air lines.

14. Detail:

	1931	1930
Compressors	971.82	987.26
Power Drills	1,332.87	5,049.30
Air Lines	131.71	499.11

Decrease due to 7 power drills charged in 1931 as compared with 29 in 1930 and less repairs to air lines in shaft.

16. Detail:

	1931	1930
Generator & Motors	85.36	142.94
Locomotives	1,407.83	3,198.96
Wiring	806.90	1,343.57
Tracks	2,566.86	6,457.13
Cars	571.32	9,074.74

Decrease due to curtailed operations, requiring less labor and materials for repairs and upkeep. There were 16 new rocker dump cars charged in 1930 and only one second-hand car in 1931.

17. In 1930 two centrifugal pumps were installed on the 3rd level. In 1931 unusual repairs were necessary to the 3rd level pumps. Installed 5 subway boxes, cost $1300.00, in 1931.

18. Detail:

	1931	1930
Electric Current	13,559.62	18,685.56
Cost per ton for current	.0444	.0448

Decrease in electric current due to the sinking cage carried under main cage 7 months in 1930 and less ore hoisted in 1931.

19.

	1931	1930
Tons stocked	233,942	262,696

Decrease due to less ore stocked in 1931 and less stocking trestle erected. There were 24 ore bents erected in 1931 as compared with 30 in 1930.

21.

	1931	1930
Tons coal used in heating plant	703	606½
Cost per ton	5.03	5.23
Cost of coal	3,537.62	3,172.00

Decrease due to fewer working days, requiring less labor.

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)
(7) Detail of Accounts: (Cont)

23. Detail:

	1931	1930
Electric Hoist	750.81	2,227.66
Wire Rope & Sheaves	1,703.05	61.43
Skips, Cages, & Skip Roads	2,199.66	5,093.01

Decrease due to less repairs to hoisting equipment and less repairs to skips and skip roads. There were 4 ropes charged out in 1931 and more sheaves. No hoisting ropes charged in 1930.

24. Decrease due to less shaft and shaft pocket repairs in 1931. The 3rd level pocket was completely rebuilt in 1930.

25. Detail:

	1931	1930
Engine & Motors	157.89	115.12
Tracks & Cars	579.01	911.85
Wire Rope	1,144.44	785.99
Sheaves & Rollers	743.80	202.33

Increase due to more repairs to engines and motors, more wire rope replaced, and more sheaves and rollers replaced. There were less repairs to Tracks & Cars.

26. Increase due to erection of additional stocking trestle and more repairs to permanent trestles and pockets in 1931. There were 6 rock bents erected in 1931 as compared with 5 in 1930.

27. Detail:

	1931	1930
Office	59.71	1,101.32
Warehouse	43.34	85.21
Shops	29.97	31.82
Garage	-	571.16
Engine House	50.99	77.19
Dry House	130.29	1,036.22
Coal Dock	54.26	312.99
Shaft House	108.36	-
Miscellaneous	23.90	31.72

Decrease due to less repairs to office, garage, dry house, and coal dock. There were more repairs to shaft house due to enclosing the skip roads at the ground level.

31.

	1931	1930
No. determinations worked	29,811	45,136
Cost per determination	.20135	.1535

Decrease due to large decrease in number of determinations on account of mine working part time and elimination of daily stope samples in certain territories.

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)
(7) Detail of Accounts: (Cont)

32.

Detail:	1931	1930
Compensation Insurance Reserve and Catastrophe Insurance	5,491.17	7,469.46
Compensation Dept. Expense	784.57	975.77
Ishpeming Hospital Loss	9,831.41	8,743.52

Decrease due to lower total payroll for year on account of mine operating 87 less days - 2% deducted and 8¢ per $100 for catastrophe insurance.

33.

Detail:	1931	1930
Salaries - includes First Aid and Foremen's Meetings	1,242.23	1,316.71
First Aid Supplies	80.20	83.17
Traveling Expense	-	9.02
Inspection Committee, etc.	10.78	22.29

Decrease in all accounts on account of salary decrease in June and mine working less time.

34.

Detail:	1931	1930
Mine Telephones	38.70	226.82
Safety Gates, etc.	48.81	76.53
Fire Protection	208.50	-
Lighting for shaft & levels	821.60	444.01
Signs boards, signals, etc.	175.00	252.22
Care of Injured	-	14.27

Mine telephone expense high in 1930 on account of installing telephones on the new 5th level, extending lines, etc.

Increase in lighting expense on account of new division in electric haulage expense based on number of lights underground.

Fire protection expense covers cost of 3 2½ gal. Phister fire extinguishers, one for engine house and one for each pumphouse.

39.

Detail:	1931	1930
Central Office Charges - Salaries	10,959.13	11,557.69
Proportion Warehouse overhead	1,490.74	1,404.99
Telephone & telegraph	174.59	333.67
Supplies & Equipment, etc.	132.90	552.30
General Office Expense	789.81	1,044.38

Supplies for office higher in 1930 due to purchase of a calculating machine.

All accounts show decreases in 1931 due to reduction in salaries effective June 16th and general economies. General Storehouse overhead increased, however, in 1931.

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8. COST OF OPERATING:

b. Detailed Cost Comparison: (Cont)
(7) Detail of Accounts: (Cont)

40. Taxes increased due to higher valuation on property by State Tax Commission and increase in tax rate.

Supplies Used 1931

	Jan. 1 to June 1	June 1 to Dec. 31	Increase	Decrease
Days mine Operated	103	88		
1. Gen'l Supplies - cost per day	104.66	122.00	17.34	
2. Iron & Steel " " "	30.91	23.70		7.21
3. Oil & Grease " " "	11.10	13.30	2.20	
4. Machy Supplies " " "	85.14	106.47	21.33	
5. Explosives " " "	103.18	112.37	9.19	
6. Lumber & Timber " " "	183.53	222.31	38.76	
7. Fuel " " "	17.91	19.22	1.31	
8. Electric Power " " "	398.81	484.50	85.69	
9. Sundries " " "	16.70	19.23	2.53	
Total	952.94	1123.10	170.16	

1. Increase due to charging out new subway boxes - $700.00 - and several hoisting ropes in latter part of the year.
2. Decrease due to salvage of old equipment.
3. Excessive amount of oil used on pumps now under investigation
4. More expense for scraper hoists in last half of year
5. More explosives used last half of year on account of harder ground and more rock drifting.
6. Increase due to charging out trestle timber - $1300.00 - in last half of the year.
7. Increase due to charging out 100 ton coal shortage last half of the year
8. More water pumped last 7 months of year; mine working less days made charge per operating day higher

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

There were no explorations by diamond drilling in the Maas Mine during 1931.

10. TAXES:

	1931		1930	
City of Negaunee	Valuation	Taxes	Valuation	Taxes
Maas Mine, 257.18 Acres	1,400.000	54,784.80	1,850,000	71,509.90
Race Course, 15.58 Acres	800,000	31,305.60	600,000	23,192.40
Adams Strip, 3.2 Acres	260,000	10,174.32	280,000	10,823.12
Stockpile, Equipment, etc.	975,000	38,153.70	590,000	22,805.86
Miscellaneous Parcels	19,100	747.44	19,075	737.39
Total	3,454,100	135,165.86	3,339,075	129,068.67
Collection Fee		1,351.65		1,290.73
Total Operating Maas Mine		136,517.51		130,359.40
Tax Rate		3.9132		3.8654
Total City of Negaunee Tax		621,285.41		611,259.85
Maas Mine % of City Tax		21.97		21.32

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10. TAXES: (Cont)

City of Negaunee	1931 Valuation	1931 Taxes	1930 Valuation	1930 Taxes
Maas Mine Rented Houses:				
C. C. I. Co. 1st Addition	109,900	4,300.92	109,900	4,238.56
Harris Addition	6,500	254.36	5,000	193.28
Corbit's 1st Addition	8,300	324.83	8,300	320.88
" 2nd "	7,400	289.59	7,400	286.10
Kirkwood & Kellan's Addition	37,700	1,475.42	38,200	1,476.82
Gaffney's Addition	55,000	2,152.35	53,500	2,068.15
Pioneer Plat	10,400	406.99	10,400	402.03
Reed & Winter Addition	6,100	238.72	6,100	235.80
McKenzie Addition	900	35.22	900	34.79
Miscellaneous - Unplatted	12,100	473.51	12,100	467.72
Total Rented Houses	254,300	9,951.91	251,800	9,724.13
Collection Fee		99.52		97.24
Total		10,051.43		9,821.37

Taxes increased in 1931 due to increase of $115,000.00 in State Tax Commission valuation of mine and higher tax rate in Negaunee.

11. ACCIDENTS AND PERSONAL INJURY:

I regret to report that there was a fatal accident at the Maas Mine in 1931. This accident occurred on January 5th to August Kaheliin, timberman, who was severely injured when struck on the head by a piece of falling ore at 11:35 A. M., dying about 7:30 P. M. at the Ishpeming Hospital.

Kaheliin was employed on the timber gang and was planking a new raise that had just been completed to a height of 170 ft., but had not as yet holed to any workings above. Two men were working here all Monday morning and considered the raise safe to work in as the timber boss had been up to the top and examined it the previous Saturday. Evidently the cribbing placed over the top of the raise was not close enough as just before noon some fine dirt came down and then a larger chunk, striking Kaheliin on the side of the head and knocking him off the ladder to the sollar 10 ft. below.

It was decided that the timber boss did not make a thorough inspection as he should have gone into the dirt compartment to make sure that it was properly covered.

The following table shows the classification of accidents for the years 1931, 1930, and 1929:

	1931	1930	1929
Fatal	1	-	1
Time Lost - over 4 months	1	2	2
" " - 1 to 4 "	2	7	4
" " - less than 1 month	2	1	9
Total accidents	6	10	9
Number of cases paid compensation for accidents prior to January 1, 1931	7	9	7
Number of cases being paid difference in wages	1	1	3

The nature of the injuries causing lost time was as follows: The accident that caused the loss of over 4 months time occurred on a motor when a piece of timber was pushed off the truck by hitting a projection in the drift struck the motorman, breaking and lacerating his arm. The 1 to 4 months injuries were a fractured arm and bruised hip and a fractured thumb. The lesser injuries were to an eye in one case and a finger in the other, neither cases being very serious.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

a. E. & A. #504 - Moving Race Course Houses to C. C. I. Co. 1st Addition:

Total Estimate	135,951.00
Expended to January 1, 1930	103,332.66
Balance	32,618.34
Expended in 1930 and 1931	712.73
Unexpended balance Dec. 31, 1931	31,905.61

Expenditures were in Acct. No. 7 - Transferring Houses. This E. & A. was completed in 1931.

b. E. & A. #533 - Painting 30 Houses and Sheds:

Total Estimate	4,713.00
Expended to January 1, 1931	3,959.18
Balance	753.82

No expenditures in 1931.

E. & A. not closed.

c. E. & A. #548 - Sinking Maas Shaft & Developing 5th Level:

Total Estimate	133,160.00
Total Expended to Jan. 1, 1931	90,749.68
Balance January 1, 1931	42,410.32
Total Expended in 1931	36,301.96
Unexpended balance January 1, 1932	6,108.36

Acct. 5 - Drifting to Ore Body

Total Estimate	38,800.00
Unexpended balance January 1, 1931	21,089.84
Total Expended in 1931	19,936.72
Unexpended balance December 31, 1931	1,153.12

Completed in 1931.

Acct. 10 - Permanent Equipment

Total Estimate	22,600.00
Unexpended balance January 1, 1931	10,539.96
Expended in 1931	13,547.43
Unexpended balance January 1, 1932	-3,007.47

Not completed at end of 1931. Pumphouse and Sump not completed.

Acct. 76 - Hoisting Plant

Total Estimate	6,705.00
Unexpended balance January 1, 1931	1,942.93
Expended in 1931	1,326.21
Unexpended balance January 1, 1932	616.72

Completed in 1931.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION: (Cont)

c. E. & A. #548 - Sinking Maas Shaft & Developing 5th Level: (Cont)

Acct. 81 - Electric Haulage

Total Estimate	11,950.00
Unexpended balance January 1, 1931	3,374.37
Expended in 1931	899.28
Unexpended balance January 1, 1932	2,475.09

Not completed in 1931. Three rocker dump cars to purchase in 1932.

Acct. 82 - Pumping Plant:

Total Estimate	4,800.00
Unexpended balance January 1, 1931	4,714.07
Expended in 1931	504.85
Unexpended balance January 1, 1932	4,209.22

Not completed in 1931. Pumps not installed.

Acct. 84 - Safety Appliances & Lights

Total Estimate	200.00
Unexpended balance January 1, 1931	160.99
Expended in 1931	87.47
Unexpended balance January 1, 1932	73.52

Not completed in 1931.

Summary E. & A. #548

Assembling Equipment	1,416.05
Acct. 4 - Sinking in Rock	28,156.96
" 5 - Drifting to Ore Body	37,646.88
" 6 - Plats & Pockets	17,943.83
" 10 - Permanent Equipment	25,607.47
" 76 - Hoisting Plant	6,088.28
" 81 - Electric Haulage	9,474.91
" 82 - Pumping Plant	590.78
" 84 - Safety Appliances & Lights	126.48
Total Expenditures	127,051.64
Total Estimate	133,160.00
Unexpended balance January 1, 1932	6,108.36

The main work remaining to be done under E. & A. 548 consists of finishing the sump, installation of pumps, concrete floor in pumphouse, concrete dam with pipe and valves to seal off sump from the pumphouse, lights in pumphouse, completion of 6" air line to ore body, completion of drainage ditch to ore body, and purchase of 3 rocker dump cars. It is expected that all work under this E. & A. will be completed by June 1st, 1932.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

d. E. & A. #611 - Scraper Hoists:

Total Estimate	10,000.00
Expended in 1931	6,306.32
Unexpended balance January 1, 1932	3,693.68

E. & A. closed. Purchases completed.

e. E. & A. #614 - C. C. I. Co. 2nd Addition to City of Negaunee:

Total Estimate	255,102.00
Expended in 1930	9,168.47
Unexpended balance January 1, 1931	245,933.53
Expended in 1931	44,932.10
Unexpended balance January 1, 1932	201,001.43

Acct. 2 - Streets in Plat:

Total Estimate	30,110.00
Expended to December 31, 1931	9,859.73
Unexpended balance January 1, 1932	20,250.27

A crane, rented from the Cliffs Power & Light Company, was used to grade the streets and alleys where the cut was 2 ft. or more in depth. Grading of the shallow cuts was done with two tractors and special dumping scrapers. This work was started in June and completed in August. The streets and alleys were then rolled, low spots filled, after which mine rock for surfacing the streets and alleys was loaded by the crane from the rock pile at the Maas and hauled by truck to the 2nd Addition. Surfacing was completed and the rock rolled and leveled. By the end of October all streets, except Maas Street, had been surfaced.

Acct. 4 - Curbing:

Total Estimate	7,030.00
Expended to December 31, 1931	893.98
Unexpended balance January 1, 1932	6,136.02

In October 1320 ft. of curb and gutter was installed on the South side of Maple Street and the East side of North Maple Street by company employees. The cost, including the expense of all necessary equipment for the work, was $.677 per ft. Excluding the cost of equipment and getting the work underway, the cost ran about 40¢ per ft. or 25 cents under a submitted contract price. The cost for the balance of curbing should not exceed 45¢ per ft. or 20¢ under the lowest bid received. The curbing installed this year will not interfere with moving the houses.

Acct. 5 - Sewer System:

Total Estimate	25,276.00
Expended to December 31, 1931	27,463.24
Unexpended balance January 1, 1932	-2,187.24

Work in this account is completed. Overrun due to use of concrete sewer pipe to carry Maas Mine water instead of tile pipe. Difference in cost approximately $4,300.00.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

e. E. & A. #614 - C. C. I. Co. 2nd Addition to City of Negaunee: (Cont)

Acct. 5 - Sewer System: (Cont)

The crane was used to excavate the ditch for the 24" concrete pipe for carrying the Maas Mine water. There was 3,836 ft. of this pipe installed. It runs from a manhole near the mine, under the Railroad fill near the Maas Mine Crusher Plant, through the 2nd Addition, and on to the West until it crosses the State highway, then turns North for 1200 ft., discharging into a ravine that connects with the Carp River. The ditch was 10 ft. deep at some points to maintain the grade. A total of 8 manholes were installed on this sewer line and connections run from four of these manholes to the site of 14 storm catch basins on Spruce Street. The E. & A. carried an estimate for 24" tile pipe; concrete pipe was substituted at an increased cost of $1.12 per ft. This explains the overrun in this account.

The main sanitary sewer was installed on the Baldwin Kiln Road and connected to the main trunk sewer on Hungerford Avenue in November and December 1930. This year it was extended into the 2nd Addition and later in the summer the laterals were extended to the foundation line of the houses. A total of 12 manholes were built on this, the main sewer line, and laterals run to the curb line for 15 storm catch basins on Maple Street and Baldwin Kiln Road.

Acct. 6 - Water System:

Total Estimate	13,215.00
Expended to December 31, 1931	10,320.09
Unexpended balance January 1, 1932	2,894.91

The water mains in the location were installed in June and July and later in the year the 3/4" copper service lines were installed to the foundation line of the houses. The copper pipe came in coils of exact length so that there are no joints between the main and the house. No digging up of service lines will ever be necessary.

Acct. 7 - Transferring 57 Houses:

Total Estimate	136,660.00
Expended to December 31, 1931	2,077.77
Unexpended balance January 1, 1932	134,582.23

The expense incurred in this account covers cost of two garages built last Spring for use as storage sheds for tools, supplies, and the two tractors. These garage buildings were constructed on the alley line and will be used later for garages. The balance of expenditures covers grading work done on lots.

Acct. 8 - Superintendence & Engineering

Total Estimate	4,000.00
Expended to December 31, 1931	3,477.47
Unexpended balance January 1, 1932	522.53

Expenditures were quite large in this account but most of the engineering work is now completed, including the making of plat maps, etc. Location and grade line for basements, sidewalks, balance of curbing, and fences, comprise the engineering work remaining to be done.

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12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

e. E. & A. #614 - C. C. I. Co. 2nd Addition to City of Negaunee: (Cont)

Acct. 9 - Legal	
Total Estimate	100.00
Expended in 1931	8.29
Unexpended balance January 1, 1932	91.71

Summary of Expenditures to January 1, 1932

Acct. 2 - Streets in Plat	9,859.73
" 4 - Curbing	893.98
" 5 - Sewer System	27,463.24
" 6 - Water System	10,320.09
" 7 - Transferring 57 Houses	2,077.77
" 8 - Superintendence & Engineering	3,477.47
" 9 - Legal	8.29
Total	54,100.57

Summary of Year's Work

The location is graded, the unsightly ditch and settling basins for Maas Mine water are gone, sewers and water lines installed, streets graded and surfaced with mine rock, in fact all necessary work completed before the concrete basements are built and the houses moved. Nearly 100 men were employed working in two crews, 3 days per week, during the summer and in three crews, 2 days per week, in the Fall. This work proved of great help in reducing the local unemployment during the summer and Fall.

The 2nd Addition is located on fairly level ground in a beautiful setting with the quartzite hills to the North and Teal Lake to the West. In a few years after the houses are moved it will be a very attractive addition to the City of Negaunee.

13. EQUIPMENT AND PROPOSED EQUIPMENT

a. Steam Shovels:

The Maas Mine shovel was overhauled during the winter at the Negaunee Mine shops.

b. Stockpile Trestles:

On account of the delay in starting the shipping season it was necessary to extend the Maas trestle West of the shaft much further than ever before; 15 additional bents were erected, making the trestle approximately 1100 ft. in length. To accomodate the Fall and Winter production a new trestle has been erected with 23 bents up at the end of the year. Six additional bents were erected on the rock trestle at the East end of the steel trestle.

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13. EQUIPMENT AND PROPOSED EQUIPMENT

c. Scraper Hoists

The mine is now equipped with the following scraper hoists:

	On Hand 1/1/1931	Purchased 1931	On Hand 1/1/1932	Repair Cost per Machine per Year
Ingersoll-Rand 15 h.p.elec.	4	4	8	13.44
" " 10 " "	-	3	3	-
" " 6 h.c.air	21	-	15	39.17
Denver Air	1	-	-	-
Sullivan 25 h.p. electric	1	1	2	-
" 20 " "	0	1 *	1	-
" 15 " "	12	0	12	20.24
" 7½ " "	2	-	2)	
" 6½ " "	7	-	6)	60.12
Lake Shore steel scraper slide with 20 h.p. motor	1	-	1	-
Total	49	9	50	

* 2nd hand purchased from Archibald Mine equipment.
During the year there were scrapped: 6 Ingersoll air hoists
1 Denver " "
1 6½ h.p. Sullivan electric

14. MAINTENANCE AND REPAIRS:

There were no extraordinary maintenance or repair charges in 1931, the greatest expense being incurred in repairs to compressors and U. G. Pumps. A new water cooler was installed on the compressor and several of the U. G. electric pumps were overhauled.

15. POWER

Electric power was supplied by the Cliffs Power & Light Company, a subsidiary of The Cleveland-Cliffs Iron Co. The rate charged for current was 1½¢ per k. w. hour, the same as last year.

The boiler plant and steam turbine was not operated during the year.

The following table shows a comparison of the k. w. used and cost per ton in the different mine accounts:

Account	1931 K. W.	1931 Cost	1931 Per Ton	1930 K. W.	1930 Cost	1930 Per Ton
Stoping	78,602	1,179.03	.0039	77,765	1,166.48	.0028
Timbering	5,124	76.86	.0003	11,465	171.97	.0004
*Pumping	2,671,972	40,079.58	.1311	2,631,674	39,475.11	.0947
*Hoisting	903,974	13,559.62	.0444	1,245,704	18,685.56	.0448
*Stocking Ore	42,264	633.96	.0021	30,854	462.81	.0011
*Dry House	6,156	92.35	.0003	11,267	169.01	.0004
Lights at Levels	36,379	545.69	.0018	6,000	90.00	.0002
*Mine Office	1,298	19.47	.0001	2,000	30.00	.0001
*Electric Haulage	151,606	2,274.09	.0074	206,428	3,096.42	.0074
*Machine Shop	5,250	78.75	.0002	7,070	106.05	.0002
*Compressors	1,678,565	25,178.48	.0824	3,024,226	45,363.39	.1089
*Optg. Maas Crusher	2,810	42.15	.0001	3,870	58.05	.0001
E & A 548-4-a Sinking				20,000	300.00	.0007
5-a Drifting	480	7.20	.0000			
5-c Ventilation	4,160	62.40	.0002			
6 Plats & Pockets				20,000	300.00	.0007
Total	5,588,640	83,829.63	.2743	7,298,323	109,474.85	.2627

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15. POWER: (Cont)

* Metered Accounts

	1931	1930
Product	305,604	416,653
K. W. per ton of ore	18.29	17.52
Cost per K. W.	.015	.015

Stoping - Increase in cost per ton due to new division of current in 1931.
Pumping - " " " " " " " curtailed working schedule in 1931 and more water pumped.
Stocking Ore - Increase in cost per ton due to new division of current in 1931
Lights at Levels - " " " " " " " " " " " " " " and curtailed working schedule.
Compressors - Decrease due to more efficient operation of compressors.

17. CONDITION OF PREMISES:

There was a further improvement of the premises by grading the grounds South of the shaft where some of the rock pile was removed for surfacing the roads in the 2nd Addition. There was also some rearrangement of the shrubbery in the office grounds and leveling the automobile parking area West of the office outside of the office grounds.

18. NATIONALITY OF EMPLOYEES:

This has been prepared under two statements. The first statement gives the report as has been ordinarily submitted to the Company, that is, it shows the nationality of employees according to parentage. The second statement divides the employees according to country of birth.

As to parentage	1931	%	1930	%
English	80	32.5	87	34.0
Finnish	86	35.2	93	36.5
Italian	22	9.0	22	8.5
Swedish	24	9.7	22	8.5
French Canadians	11	4.4	11	4.0
Americans (mixed)	3	1.2	3	1.0
Germans	7	2.8	8	3.0
Crotian	1	.4	0	0
Norwegians	1	.4	1	0
Irish	6	2.4	7	3.0
Danish	5	2.0	4	1.5
Total	246	100.0	258	100.0

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18. NATIONALITY OF EMPLOYEES: (Cont)

As to birth	Total 1931	Total 1930	American born 1931	American born 1930	Foreign born 1931	Foreign born 1930
American	20	21	20	21	-	-
English	80	87	24	30	56	57
Finnish	86	93	20	31	66	62
Italian	22	22	5	3	17	19
Swedish	24	22	13	12	11	10
Germans	7	8	6	7	1	1
Crotian	1	-	-	-	1	-
Norwegians	1	1	-	-	1	1
Danish	5	4	3	2	2	2
Total	246	258	91	106	155	152
Percentage				41		59

19. MAAS CRUSHER:

		1931	1930	Increase	Decrease
Product		11,755	12,338		583
Composed of:	Cliffs Shaft	1,369	-	1,369	
	Morris Lloyd	7,728	7,990		262
	Negaunee	2,658	4,348		1,690

The crusher operated 12 single 8-hour shifts in 1931 as compared with 77 single 8-hour shifts in 1930.

Average tons crushed per shift in 1931 - 980
" " " " " " 1930 - 1,028

There were no extraordinary repairs to the crusher proper during the year as the crusher plant only operated 12 shifts, but the conveyor belt was nearly worn out in the Spring of 1930 and had to be replaced in 1931, cost $1,780.00.

In July the loading pocket formerly used in connection with the second crushing unit was dismantled and the timbers used in repairing the ventilation shaft at the Negaunee Mine.

There is no comparison of costs for operating included in this report as there have been no figures from Cleveland since August.

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1. GENERAL:

The mine operated one 8-hour shift five days per week until February 27th when the working schedule was reduced to four days per week. On June 8th it went on a three-day per week schedule which continued until November 16th when the operating time was reduced to two days per week. The mine operated 182 days in 1931 as compared with 282 days in 1930.

When the three days per week schedule went into effect the mine worked on Monday, Wednesday, and Friday each week until the middle of August when a change was made to the first three days of the week. This gave three successive operating days and increased the output as there was less repairing necessary in the working places. Props were installed once a week to prevent the slice from breaking down during the idle period, whereas on the interrupted schedule some propping was done at the end of each shift.

When the two day schedule started on November 16th the mine was operated on Monday and Wednesday and the night shift hoisting crew worked on the day shift Tuesday and Thursday. This put all work underground on the day shift under the direct supervision of the Captain. Efficiency increases at least 25% on day shift work as compared with night shift. After a few weeks operation on the two day schedule it was evident that the number of working places must be decreased in order to permit of a longer operating schedule. The time required to mine a slice 80 ft. long was approximately two months and before mining could be finished the slice would crush as also the communicating drifts used for handling timber and for ventilation and a second outlet. It was decided to finish work on the sub levels above the 6th and transfer the gangs to the 8th level territory to work double shift. One crew will work four days straight and then stay at home the following week when another crew will work. This puts the working places on a four day per week schedule and operating results will be much better. Some extra expense will be incurred in keeping the 6th level drifts and raises repaired but this will only be a fraction of the total cost for repairs necessary under a straight two days per week schedule.

It will require another month to make this plan fully effective as but five contracts out of 36 were on double shift at the end of the year, leaving 13 to double up as their working places are finished. The above plan has been adopted at all mines having heavy pressures in the working areas.

There was an oversupply of labor available during the year. A number of single men were working only one day per week at the end of the year in order to divide the working time among more of the old employees.

Development of the ore body on the South side of the ore trough above the 6th level has been under way during the year and is now nearly completed. It is planned to work a few contracts in this area as the ore extends a short distance above the 4th level and is thus much higher than the area being mined further to the North. Also most of the production will be from the Mitchell Lease and it is desirable from the royalty standpoint to obtain some product.

Further progress was made in safety work in 1931. A number of meetings of foremen were held with good results. The record for 1931 was much better than in the previous year, there having been only two lost time accidents as compared with six last year.

The general condition of the mine is not as good at this time as it was a year ago due to the curtailed operating schedule in effect the past six months. There are more drifts partly crushed and much more overtime repair work; it is expected, however, that this condition will be largely corrected within a few months due to practically all the mining contracts working on a four-day per week schedule (on double shift) and to the concentration of work largely in one territory.

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2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

Grade	1931	1930	Increase	Decrease
Athens Fee	243,722	368,524		124,802
Mitchell Lease	7,858	16,937		9,079
Total Ore	251,580	385,461		133,881
Rock	3,293	2,060	1,233	
Total Hoist	254,873	387,521		132,648

Production decreased in 1931 due to mine operating 100 less days.

b. Shipments:

Grade of Ore	Pocket Tons	Stockpile Tons	Total Tons	Total Last Year
Athens Ore	82,006	77,610	159,616	325,836
Mitchell Lease	3,231	5,118	8,349	19,804
Total	85,237	82,728	167,965	345,640
Total Last Year	86,963	258,677	345,640	
Decrease	1,726	175,949	177,675	

Shipments decreased 52% in 1931 entirely in ore loaded from stockpile. There was a slight decrease in pocket shipments due to shortened working schedule

c. Stockpile Inventories:

Grade of Ore	Dec.31,1931	Dec.31,1930	Increase	Decrease
Athens Fee	173,657	89,551	84,106	
Mitchell Lease	1,192	1,683		491
Total	174,849	91,234	83,615	

Ore in stock increased 91% over the previous year due to decrease of 177,675 tons shipped and 133,881 tons less ore produced.

d. Division of Product by Levels:

The ore hoisted from various levels was as follows:

	1931	1930
4th Level	-	13,495
6th Level	107,620	161,220
8th Level	143,960	210,746
Total	251,580	385,461

The ore produced on the 6th level is handled by raises near the shaft to the 8th level shaft pocket.

e. Production by Months:

The production by months is as follows:

Month	Athens	Mitchell Lease	Total	Rock
January	29,490	610	30,100	169
February	27,605	797	28,402	262
March	23,560	754	24,314	600
April	21,883	685	22,568	282
May	22,401	337	22,738	408
June	19,581	302	19,883	162
July	20,841	379	21,220	249
August	18,591	565	19,156	54
September	19,872	886	20,758	169

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2. PRODUCTION, SHIPMENTS & INVENTORIES:

e. Production by Months: (Cont)

Month	Athens	Mitchell Lease	Total	Rock
October	17,307	825	18,132	478
November	12,522	941	13,463	372
December	10,069	544	10,613	88
Total	243,722	7,625	251,347	3,293
Transferred from	-	-	-	-
Stockpile Overrun	-	233	233	
Total	243,722	7,858	251,580	
Total 1930	368,524	16,937	385,461	2,060
Increase				1,233
Decrease	124,802	9,079	133,881	

Production decreased due to change in working schedule.

The product was distributed as follows:

Grade	1931	1930	Increase	Decrease
Athens	243,722	368,524		124,802
Mitchell Lease	7,858	14,232		6,374
Total	251,580	382,756		131,176

f. Ore Statement:

	Athens	Mitchell Lease	Total	Total Last Year
On Hand Jan. 1, 1931	89,551	1,683	91,234	51,413
Product for Year	243,722	7,625	251,347	382,756
Overrun	-	233	233	2,705
Transferred from	-	-	-	-
Total	333,273	9,541	342,814	436,874
Shipments	159,616	8,349	167,965	345,640
Balance on Hand	173,657	1,192	174,849	91,234
Decrease in Product			131,409	
Increase in ore on hand			83,615	

1931 - 1 8-hour shift, 5 days per week, January 1st to February 27th
4 " " " February 27th to June 8th
3 " " " June 8th to November 16th
2 " " " November 16th to December 31st

1930 - 1 8-hour shift, 6 " " " January 1st to July 16th
5 " " " July 16th to December 31st

g. Delays:

There was only one delay in 1931 of 12 hours due to a break-down of the compressor, but there was very little loss of tonnage as the men worked an extra day to make up the lost time.

h. Delays from Lack of Current:

There were no delays due to lack of current.

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3. ANALYSIS:

a. Average Mine Analysis on Output:

Grade	1931 Iron	1931 Phos.	1931 Silica	1930 Iron	1930 Phos.	1930 Silica
Athens	60.19	.124	6.41	60.44	.123	6.40
Mitchell Lease	60.99	.123	5.52	58.72	.143	7.12

The average mine analysis on output was lower in 1931 due to lean areas mined above the 6th level and to small dikes in an area mined above the 8th level.

b. Average Analysis on Straight Cargoes:

Grade	Mine Iron	Mine Phos.	Mine Moist	Lake Erie Iron	Lake Erie Phos.	Lake Erie Moist
Athens		None			None	
Mitchell Lease		"			"	

c. High Sulphur Ore

In 1931 no high sulphur ore was encountered in mining or development work.

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption: 12.75 cu.feet equals one ton
10% deducted for rock
10% deducted for loss in mining
Percentage of Bessemer equals 0.

4th Level and above	972,016 tons
4th Level to 6th Level - South side of dike	1,640,533 "
" " " " " - North " " "	306,162 "
6th Level to 660' Sub - South " " "	361,126 "
" " " " " - North " " "	192,567 "
660' Sub to 8th Level	854,626 "
8th Level to 9th Level	451,949 "
9th " " 10th "	354,812 "
Below 10th Level	49,236 "
Total developed ore Nov. 30, 1931	5,183,027 "
Less ore mined December 1931	10,613 "
Total developed ore Dec. 31st, 1931	5,172,414 "

The estimate of developed ore for 1931 shows 162,974 tons less than in 1930, but when the production for the year is considered there was an actual increase of 88,606 tons, nearly equally divided between ore above and below the 6th level, due to changes in the outline of the hanging.

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4. ESTIMATE OF ORE RESERVES: (Cont)

a. Developed Ore: (Cont)

Statement showing ore reserves and new ore development for the following years:

	1927	1928	1929	1930	1931
Ore in mine Jan. 1st	6,715,311	6,205,591	5,901,102	5,371,092	5,335,388
Production	232,748	241,590	343,147	385,461	251,580
Balance	6,482,563	5,964,001	5,557,955	4,985,631	5,083,808
Ore in Mine Dec. 31st	6,205,591	5,901,102	5,371,092	5,335,388	5,172,414
New ore developed	- 276,972*	- 62,899**	- 186,863#	349,757##	88,606

Total decrease in developed ore 1927-1931, or 5 years, equals 108,371 tons.
* Decrease due to use of factor of 12.75 cu. ft. per ton instead of 12.00
** " " " large roll in jasper hanging cutting off the ore
# " " " flattening of footwall and intrusion of lean area and dikes
##Increase is mostly in the ore body South of dike between 4th and 6th levels

b. Prospective Ore:

No prospective ore included in the estimate. All ore in mine considered as developed since 1928.

c. Estimated Analysis:

Ore Reserves: Approximate Expected Natural Analysis:

	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sul.	Igni.	Moist
Athens Ore	52.50	.115	5.90	.390	2.70	1.00	.900	.011	1.44	13.00

Ore in Stock: Average Natural Analysis:

	Iron	Phos.	Silica	Mang.	Alum.	Lime	Mag.	Sul.	Igni.	Moist
Athens Ore	52.84	.110	5.55	.386	2.81	1.04	.769	.011	1.30	12.50

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5. LABOR AND WAGES:

a. Comments:

(1) Labor:

There was an excess of labor during 1931 on account of the general unemployment situation. The single men and a few married men worked alternate weeks so that more men could receive some time.

(2) New Construction:

The only E. & A. that was active during 1931 was E. & A. #609, which covered the purchase of scraper hoists. Four hoists were purchased, which leaves two to buy, purchase of which can be postponed until the working schedule is increased.

Detail will be covered under Item 12 - "New Construction and Proposed New Construction".

b. Comparative Statement of Wages and Product:

	1931	1930	Increase	Decrease
PRODUCT	251,580	385,461		133,881
No. Shifts and Hours	1 8-hr	1 8-hr		
AVERAGE NO. MEN WORKING:				
Surface	45	44	1	
Underground	166	161	5	
Total	211	205	6	

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5. LABOR AND WAGES: (Cont)

b. Comparative Statement of Wages and Product: (Cont)

	1931	1930	Increase	Decrease
AVERAGE WAGES PER DAY:				
Surface	4.41	4.41		
Underground	5.03	5.13		.10
Total	4.89	4.97		.08
AVERAGE WAGES PER MONTH:	15.2 days	23.5 days		8.3
Surface	67.03	103.64		36.61
Underground	76.46	120.55		44.09
Total	74.33	116.80		42.47
PRODUCT PER MAN PER DAY:				
Surface	25.87	28.94		3.07
Underground	7.78	8.36		.58
Total	5.98	6.48		.50
LABOR COST PER TON:				
Surface	.171	.152	.019	
Underground	.647	.614	.033	
Total	.818	.766	.042	
AVERAGE PRODUCT MINING:				
Stoping	22.09	21.96		.13
Ore Development	9.81	12.12	2.31	
Total	21.38	21.44		.06
AVERAGE WAGES CONT. LABOR	5.75	5.87	.12	
TOTAL NUMBER OF DAYS:				
Surface	9,723	13,321		3,598
Underground	32,347	46,133		13,786
Total	42,070	59,454		17,384
AMOUNT FOR LABOR:				
Surface	42,877.73	58,767.95		15,890.22
Underground	162,854.17	236,466.51		73,612.34
Total	205,731.90	295,234.46		89,502.56

AVERAGE WAGES PER MONTH BASED ON MEN CARRIED ON MINE PAYROLL:

	18 days per Mo.	13 days per Mo.	9 days per Mo.*
Surface	78.30	56.94	35.46
Underground	93.24	66.69	40.05
Total	88.38	64.61	38.97

* 10% Reduction in Wages

Proportion of Surface to Underground Men:

1931 - 1 to 3.48 One 8-hour shift, 5 days per week, Jan. 1st to Feb. 27th
4 " " " Feb. 27th to June 8th
3 " " " June 8th to Nov. 16th
2 " " " Nov. 16th to Dec. 31st

1930 - 1 to 3.66 One 8-hour shift, 6 days per week, Jan. 1st to July 16th
5 " " " July 16th to Dec.31st

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5. LABOR AND WAGES: (Cont)

b. Comparative Statement of Wages and Product: (Cont)

Proportion of Surface to Underground Men: (Cont)

1929 - 1 to 3.41 One 8-hour shift, 6 days per week

1928 - 1 to 3.54 One 8-hour shift, 5 days per week

1927 - 1 to 3.51 One 8-hour shift, 5 days per week

6. SURFACE:

a. Buildings, Repairs:

One new building was erected in 1931 North of the machine shop for the storage of plate, pipe, etc.; it is about 20' x 20' in size, of frame construction, and is covered with toncan metal.

The other storage buildings erected last Fall were given a coat of paint this Spring.

The roof of the engine house was repaired during the year and the decking on the permanent steel trestle where it connects with the rock trestle was renewed.

Several braces on the steel trestle gave way this year and they have been strengthened with large channels.

b. Stockpiles:

A new wooden trestle 18 bents in length was erected between the North and South steel trestles to make more stocking room this winter on account of the increase of 83,000 tons of ore on hand. This new trestle will not interfere with loading from the steel trestles so can be left standing for future use.

There are 13 wooden bents on the East end of the Southeast steel trestle for stocking Mitchell Ore. Some repairs were made to this trestle during the year.

c. Timber Treating Plant:

The comparative cost of treating timber for 1931 and 1930 is as follows:

	Cost of treating, per foot	
	1931	1930
Peeling	.0312	.0313
Treating	.0365	.0396
Decking	.0124	.0080
Zinc Chloride	.0681	.0465
Heat, Water, etc.	.0075	.0075
Total	.1557	.1320
Maintenance Cost	.0118	.0124
Grand Total	.1675	.1444

Number of pieces treated, 1931 - 1,355 No. of feet, 11,763
" " " " 1930 - 682 " " " 5,461

	1931	1930
Number of pieces used at Athens Mine	199	378
" " " shipped to Maas Mine	264	357
" " " " " Negaunee Mine	-	-
" " " " " Morris-Lloyd Mine	-	-
Total pieces used and shipped	463	735
Decrease in 1931	272	

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6. SURFACE: (Cont)

c. Timber Treating Plant: (Cont)

	Treated Timber On Hand 12/31/31	Peeled Untreated Timber On Hand 12/31/31
9' Pieces	1,162	1,268
8' "	1,254	80
Total	2,416	1,348
Total - 1930	2,413	1,788
Increase	3	
Decrease		440

Experiments had shown that the maximum penetration with zinc chloride was obtained by leaving the timber approximately 8 hours in the hot solution and over night in the cold. This plan was followed most of the summer until the time of treatment had to be decreased in order to treat the prepared timber on hand before winter. The longer treatment and greater penetration increased the amount of zinc chloride used this year as compared with 1930.

d. Water Purchased from City of Negaunee:

The following table shows the cost of the water consumed in heating, cooling, etc. for the years 1929, 1930, and 1931:

	1929		1930		1931	
	Gallons	Amount	Gallons	Amount	Gallons	Amount
1st Quarter	843,000	67.22	1,385,000	105.00	1,570,000	117.77
2nd "	2,078,000	156.35	1,849,000	140.59	1,715,000	131.63
3rd "	2,872,000	215.26	2,483,000	186.65	1,695,000	131.73
4th "	1,091,000	86.87	2,128,000	159.63	1,542,000	116.15
Total	6,884,000	525.70	7,845,000	591.87	6,522,000	497.28
Product	343,000		385,461		251,580	
Cost Per Ton		.00153		.00154		.00197

The cost per ton increased in 1931 due to lower product. The cooling pond is too small and cold water has to be run in to lower the temperature and some of the heated water has to be drained off. A larger pond is needed to effect economy in use of water

e. Grounds:

A new parking area for employees' automobiles was graded and low division fences erected on the North side of Ann Street opposite the office. Formerly these automobiles had been parked inside the mine grounds where they had to pass through a viaduct under the railroad timber track. This was considered very dangerous as there is not much room in the viaduct and no vision ahead.

The mine grounds have been kept in good condition as usual.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking in 1931.

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7. UNDERGROUND:

b. Development:

In 1930 underground diamond drill hole No. 11 proved the existence of a 400' width of ore South of the fault dike midway between the 4th and 6th levels on Mitchell Lots 8 and 9. Development was started immediately to prepare this ore for mining in step with Block #3 being mined on both sides of the dike above the 6th level. This development was continued throughout 1931 and at the end of the year was nearly completed and the ore within the limits of Block #3 ready for mining. The crosscut on the 6th level was completed in the quartzite footwall in May and four of the six raises had reached the jasper hanging wall near the 4th level elevation at the end of the year. In addition an intermediate sub level for traveling and ventilation purposes had been driven to connect three of the six raises at elevation -485 and the tops of the first four raises had been connected by exploratory mining drifts under the jasper hanging wall at elevations -450 to -430. Connection was made from the first raise to the -550' sub level traveling roads, serving the workings on both sides of the dike above the 6th level, and at this elevation an airway was driven on the North side of the dike to #610 raise to replace the caved -480' sub level exhaust airway. A raise was put up from this drift to the working sub (the -500) inside the mining limit for the same purpose.

Two raises were put up in ore to the working sub levels from the 6th level on the North side of the dike to reduce the size of the pillar caused by the Westerly retreat of the old mining limit.

The only development below the 6th level during 1931 was the putting up of two raises from the 8th level, one because of the retreating mining limit, and the other to facilitate mining the wet ore body on the South side of the dike.

c. Stoping:

Mining operations were continued all year in the two blocks that were being mined at the end of 1930, i.e., Block #2 above the 8th level, and Block #3 above the 6th level. No work was done outside of these blocks except general repair work on the 4th, 9th, and 10th level airways and traveling roads.

At the end of the year mining in Block #2 had progressed downward to an elevation centered about 60 ft. above the 8th level, in Block #3 to an elevation 110' below the 4th level or 90 ft. above the 6th level. Each of these blocks are divided into two territories - one North and one South of the fault dike - and this year a new territory has been added by development on the South footwall in Mitchell Lease ore. With the reduced working schedule in force the latter part of the year it was noted that the combined size of these territories would not allow a clean and complete extraction of the ore before the weight and pressure crushed the tops of raises, traveling roads, and even the working slices on the sub levels. At the end of the year a temporary abandonment of the territories North and South of the dike in Block #3 above the 6th level was underway, the contracts being transferred to Block #2 above the 8th level to work double shift with the gangs in this area. Development and mining will be continued in the footwall or Mitchell territory in Block #3 above the 6th level in order to produce some ore to offset the minimum royalty on this lease.

Until the reduced working schedule went into effect underground stoping conditions were favorable and allowed efficient mining in all territories except the West portion of the territory South of the dike in Block #2 above the 8th level. Here a large amount of water is intentionally concentrated in a small area benefitting other working places but making it difficult to keep this portion in step with the other areas. One of the new raises from the 8th level gave some relief and left the mine on 100% scraper operation throughout the year.

An average of 37.5 contracts were stoping as compared with 375 in 1930.

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7. UNDERGROUND:

c. Stoping: (Cont)

The detail of mining operations on the various levels and sub levels is as follows:

Subs above the 6th Level:

-430' Sub Level - South side of dike:

In November and December a contract cut out the top of the third raise from the new #620 crosscut and drifted to the fourth raise under the jasper hanging for the purpose of locating the hanging and providing for the circulation of air in the raises to prevent dry rot. The floor of the sub level to be cut out in the fourth raise to connect to the fifth will be less than 25 ft. below the 4th level. A few feet North of #623, the third raise at the elevation of the 4th level, an underground diamond drill hole showed 35 ft. of ore, indicating that this raise will have to be extended through a roll in the jasper hanging wall to the 4th level elevation.

-440' Sub Level - South side of dike:

In October and November a connection was made from the second to third raise for the same purpose described above.

-450' Sub Level - South side of dike:

In September and October a similar connection was made from the top of the first raise to the second.

-470' Sub Level - North side of dike:

At the end of 1930 this sub level was mined with the exception of a few pillars on the East side of Block #3. These pillars were removed during the first three months of the year, which completed mining in this area.

-485' Sub Level - North side of dike:

Mining operations were started on this traveling road and airway intermediate sub level late in 1930 and were completed in August 1931. A considerable reduction in the North central portion of the ore area was caused by a lack of enrichment of the ore under the jasper hanging wall which in one place extended South to the center of the ore body. Mining was tried here by careful selection and sorting but so many lean seams had to be drifted through and broken that the grade could not be maintained. This condition is expected to hold downward for several sub levels as indicated by lean ore areas in #639-A and #640-A branch raises.

-485' Sub Level - South side of dike:

Mining started here in September 1930 and was completed in May 1931. It was necessary to set a mining limit parallel to the dike to form the South boundary of the ore area. This was done to prevent undercutting the ore proved by diamond drill hole #11 now being developed by raises above #620 crosscut on the 6th level.

South Foot

An intermediate sub level connecting the raises above #620 crosscut was started from #624 raise in August and at the end of the year a total of 110' of drifting in ore had been completed and Nos. 623 and 625 raises connected.

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7. UNDERGROUND:

c. Stoping: (Cont)

-500' Sub Level - North side of dike

At the end of the year this was the main working sub level above the 6th level and is to be the elevation of the temporary transfer of mining contracts on both sides of the dike to increase the working schedule in Block #2 above the 8th level. It is thought that the added repair work which will be necessary to maintain the remaining 90' of raises between this sub level and the 6th level will be more than offset by the increased efficiency of underground mining operations. At the end of the year mining was well under way in the Western portion of the ore area, and in the Eastern portion two working places were working four days a week by combining two contracts. A total of 8 contracts were working here at the end of the year.

-500' Sub Level - South side of dike:

This sub level was cut out in December 1930 and only two pillars remained to be mined in the East portion of the ore area at the end of the year. Because of the Southerly dip of the jasper, mining reached the South mining limit along most of its length between the East and West limits. Two single contracts and one double contract worked here in December 1931.

-515' Sub Level - South side of dike:

This sub level was opened in October and when the three Westerly raises are connected, and the connecting drifts bulkheaded to prevent crushing, operations will cease temporarily and the contracts transferred to the 8th level area. One contract worked here in December.

-550' Sub Level - North side of dike:

With the mining of the -485 ft. sub level the airway exhaust to #610 raise and thence to the 4th level was lost early in the year. A new airway connection to #610 raise was driven at this elevation (40' above the 6th level) starting in January. The length of drift was 125 ft. in ore. A double compartment raise to serve as exhaust air escape from the working sub levels above was put up from this drift just inside the mining limit. The total height was 55' and the material ore.

-550' Sub Level - South side of dike & South Foot:

Connection was made to the existing traveling roads on the 550' sub from #621 raise, the first raise from the new #620 crosscut on the 6th level. The drift was 130' in length and the material ore.

6th Level - North side of dike:

Late in the year a section about 40' long in the hanging wall of #610 raise slabbed off and crushed the cribbing in this important airway connection between the 4th and 6th levels. Repair work was started immediately and it was then found that in order to save the raise and make thorough repairs with safety it was necessary to double crib (new short length cribbing inside the old partly rotted cribbing) the whole length of the raise. This work was nearly completed at the end of the year.

Two new raises were put up to aid in mining the lengthening pillar caused by the Westerly retreating old mining limit. No. 643 raise was started in May and completed in September at a total height of 95 ft. The material was ore. No. 645 raise was started in January and completed in February at a total height of 70' in ore.