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8. COST OF OPERATING

b. Detailed Cost Comparison (Cont.)

The increase in cost was due partly to the decrease in production and the raise in wages, but mostly to the increase in idle and winter expense due to more repairing of equipment and improvement of the roads. The idle expense for 1948 was approximately $61,000 as compared with $34,000 in 1947.

Cost of Production

	1948		1947	
Operating Pit	Cost Per Ton	%	Cost Per Ton	%
Labor	.411	48.0	.302	47.8
Supplies	.446	52.0	.329	52.2
Total	.857	100.0	.631	100.0

Days & Shifts Operating

	1948	1947
1 8-hour	76	97

Production

	1948	1947
Tons Produced	140,692	168,669
Tons Shipped from Pocket	88,912	109,359
Tons Shipped from Stockpile	33,479	65,365
Tons Stocked	51,780	59,310
Balance on hand December 31st	57,342	39,041
Average Product per Shift	1,851	1,739
Tons per Man per Day	61.47	55.71

Detail of Accounts

Power Shovels, Maintenance

	1948	1947
Amount	12,982.21	5,582.09
Cost per Ton	.092	.033

The increase in maintenance cost for the shovels was due to major repairs to the Marion shovel. Previous to 1947 there were four shovels at the Tilden Mine, three of which were used in the East and Summit Pits; but since then the Marion shovel only has had to do the greater part of the loading while the Bucyrus shovel was kept mostly in the West Pit. As a consequence, the Marion Shovel which has been in use since, had to have an almost complete overhaul and it was necessary to purchase several expensive parts such as new dipper stick, etc.

Euclid Truck Maintenance

	1948	1947
Amount	4,174.96	1,740.21
Cost per Ton	.030	.010

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8. COST OF OPERATING

b. Detailed Cost Comparison

Euclid Truck Maintenance (Cont.)

The increase in cost of maintenance to the Euclid trucks was due to accounting methods rather than to more repairs. In 1947 a credit of approximately $2,000 was allowed on account of renting the trucks to the Mather Mine, while in this years figures this rental was not allowed as a credit, but set up in a separate account against which part of the future repairs can be credited.

Crushing & Screening

	1948	1947
Amount	30,142.87	28,253.11
Cost per Ton	.214	.168

It was necessary to purchase new parts for both 10" crushers and also the 42" crusher, totaling approximately $10,000.

General Open Pit Expense

	1948	1947
Amount	16,716.93	12,600.61
Cost Per Ton	.119	.075

The main road to the East of the crusher was macadamized to a point about 100' East of the office at a cost of approximately $1,200, and there was also considerable maintenance and relocation of the roads in the East and Summit Pits.

Idle & Winter Expense

This expense has been distributed to the various operating accounts for the past two years, but the following table is shown for comparison. As has been stated previously, considerable more repairs to equipment were necessary during 1948.

	Labor	Supplies	Total
January	3,789.40	2,019.10	5,808.50
February	3,346.34	10,350.22	13,696.56
March	3,410.77	5,827.68	9,238.45
April	3,547.97	2,627.43	6,175.40
May	2,029.68	4,821.35	6,851.03
September	4,262.97	206.40	4,056.57
October	3,943.75	2,865.88	6,809.63
November	2,337.23	766.58	3,103.81
December	1,767.62	3,660.83	5,428.45
Total	28,435.73	32,732.67	61,168.40

	1948		1947	
	Amount	%	Amount	%
Labor	28,435.73	46.7	14,924.88	43.5
Supplies	32,732.67	53.3	19,403.95	56.5
Total	61,168.40	100.0	34,328.83	100.0

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10. TAXES

Tilden Township

Tilden Mine

	1948		1947	
	Valuation	Taxes	Valuation	Taxes
N½ of Sec. 26, 47-27-32OA	175,000	3,794.14	195,000	4,104.67
Personal Supplies & Equipment	120,000	2,601.69	165,000	3,473.18
Collection Fees		63.96		75.78
Total	295,000	6,459.79	360,000	7,653.63

11. PERSONAL INJURY

For the first time in several years there was a lost time accident at the Tilden Mine. This occurred after the property was shut down and was occasioned when a disabled truck was being placed in the garage. The clutch became disengaged and the truck went thru the back of the garage and down an embankment. Fortunately the driver escaped with only a broken wrist and minor bruises. The truck, which had been received this year from the used equipment in the Mesabi Range, was a total loss and negotiations are now in progress whereby the insurance coverage will probably be approximately $4,000.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

There was no new construction in 1948, nor is there any proposed for 1949.

13. EQUIPMENT AND PROPOSED NEW EQUIPMENT

There were two used 15-ton Euclid trucks purchased from the company properties on the Mesabi Range and there was also one new portable compressor purchased from the Joy Meyer Company during 1948.

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1. GENERAL:

The Athens Mine operated on a schedule of six days per week on a full two-shift basis. In addition a portion of the Fourth Level was on a three-shift basis in order to increase production. Toward the end of the year Block No. 2 in the Corbit Lease, development of which was started in November 1947, came into production, increasing the production in December to a point where it became necessary to hoist eight hours overtime every weekend. It now seems that production will have to be somewhat curtailed in January as production is increasing to a point beyond the capacity of the hoist. This will be accomplished by cutting off 8 gangs of miners on the midnight shift and operating only in the Corbit Lease on the night shift with two gangs in Athens Lot No. 10, all above the Fourth Level.

The production from the Athens Mine in 1948 was 506,600 tons, as compared with 508,100 tons in 1947. The decrease was due principally to the fact that the first block caving area was in operation during 1947, whereas the second block was being developed through most of 1948. Production from areas outside the block caving areas was higher in 1948 than during the previous year. The production in January 1948, omitting the block, was 1164 tons per day. In October the average daily hoist amounted to 1812 tons, and this was increased further during the last two months with the first drawing from Block No. 2. The number of contracts decreased from 31 at the beginning of the year to 26 in December.

In 1948 there was 4972 feet of ore development and 2366 feet of rock development, as compared with 4080 feet of ore and 2204 feet of rock development in 1947. The major portion of this occurred in the Corbit Lease developing No. 2 Block for block caving and for mining the ore on the fringes of the block. There was an average of nine crews employed on development throughout the year, as compared with seven gangs in 1947.

In December E&A No. AM-24 was authorized for the expenditure of $154,255 to develop and explore the new ore deposit north of the large E-W dike from the Eighth and Tenth Levels. This project got underway in December.

Considerable exploratory drilling was done during the first half of the year in the new deposit, the expense of which was charged to operations. Four holes totaling 494 feet were drilled from the top of No. 971 Raise at the elevation of the Eighth Level. These four holes encountered considerable ore and increased the estimated tonnage in the new deposit by 275,467 tons. On completion of this drilling two long holes, one of 613 feet and the other 750 feet were drilled southwesterly from the far end of the tail track drift north of the shaft on the Fourth Level. These holes were drilled to determine the height of the ore, but proved that the ore did not extend to that elevation.

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1. GENERAL (Cont.)

During the year The Cleveland-Cliffs Iron Company, following an established policy, shifted certain key personnel at several properties under its management. In January, the writer, John Trosvig, was transferred to the Athens, the former superintendent, Curtis R. Sundeen, being switched to the Negaunee Mine. Later in the year, a switching of mining captains was made, with Wilfred Tippett replacing John Tregonning. A further change was also made in combining the positions of surface and mechanical foremen into one job, with the addition of an assistant. The several men involved in these changes have worked together on previous occasions very satisfactorily, and the operations at the property should be benefitted greatly.

2. PRODUCTION, SHIPMENTS, AND INVENTORIES:

a. Production by Grades

Grade of ore	1948	1947	Increase	Decrease
Athens Ore	313,626	383,606		69,980
Mitchell Lease Ore	116,991	122,239		5,248
Corbit Lease Ore	75,983	2,255	73,728	
Total Ore	506,600	508,100		1,500
Rock	24,760	26,270		1,510
Total Hoist	531,360	534,370		3,010

b. Shipments

Grade of ore	Pocket Tons	Stockpile Tons	Total 1948	Total 1947
Athens Ore	202,012	126,395	328,407	395,319
Mitchell Lease Ore	65,244	58,506	123,750	124,798
Corbit Lease Ore	45,448	4,447	49,895	2,158
Total	312,704	189,348	502,052	522,275
Total Last Year	268,423	253,852	522,275	
Increase	44,281			
Decrease		64,504	20,223	

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2. PRODUCTION, SHIPMENTS, AND INVENTORIES: (Cont'd)

c. Stockpile Inventories:

Grade of Ore	Dec. 31, 1948	Dec. 31, 1947	Increase	Decrease
Athens Ore	28,842	43,623		14,781
Mitchell Lease Ore	8,348	15,107		6,759
Corbit Lease Ore	26,185	97	26,088	
Total	63,375	58,827	4,548	

d. Division of Product by Levels:

	1948		1947	
	Tons	Percent	Tons	Percent
4th Level	151,047	29.82	190,859	37.6
6th Level	188,016	37.11	99,629	19.6
7th Level			579	0.1
8th Level	51,519	10.17	104,099	20.5
9th Level	71,738	14.16	54,755	10.8
10th Level	44,280	8.74	58,179	11.4
Total	506,600	100.	508,100	100.

e. Production by Months:

Month	Athens	Mitchell	Corbit	Total	Rock
January	31,579	9,664	1,760	43,003	2,145
February	22,479	14,274	1,695	38,448	2,910
March	26,958	13,954	1,315	42,227	5,380
April	26,364	8,075	1,342	35,781	4,870
May	30,777	4,350	2,103	37,230	3,330
June	29,721	8,402	2,834	40,957	1,410
July	19,789	5,274	3,008	28,071	615
August	26,394	10,886	5,384	42,664	885
September	24,460	6,792	7,731	38,983	1,035
October	28,782	9,099	9,281	47,162	435
November	24,661	11,253	14,359	50,273	695
December	25,681	7,436	25,200	58,317	1,050
Total 1948	317,645	109,459	76,012	503,116	24,760
Current Year's Stockpile Overrun	2,847	586	51	3,484	
Total 1948	320,492	110,045	76,060	506,600	24,760
Total 1947	383,963	121,882	2,255	508,100	26,270
Increase			73,808		
Decrease	63,471	11,837		1,500	1,510

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2. PRODUCTION, SHIPMENTS, AND INVENTORIES: (Cont'd)

f. Ore Statement:

ORE STATEMENT - DECEMBER 31, 1948

	Athens	Mitchell Lease	Corbit Lease	1948 Total	1947 Total
On Hand January 1st, 1948	43,623	15,107	97	58,827	73,002
Out-put for year	317,645	109,459	76,012	503,116	507,616
Transfers	6,866	6,946	80		
Current Year's Overrun	2,847	586	51	3,484	484
Total	357,249	132,098	76,080	565,427	581,102
Shipments	328,407	123,750	49,895	502,052	522,275
Balance on Hand	28,842	8,348	26,185	63,375	58,827
Decrease in Output	65,984	12,273		4,500	
Increase in Output			73,757		
Increase in Ore On Hand			26,088	4,548	
Decrease in Ore On Hand	14,781	6,759			

SHIPMENTS FOR YEAR 1948

Grades	Pocket	Stockpile	1948 Total	1947 Total
Athens	202,012	126,395	328,407	395,319
Mitchell Lease	65,244	58,506	123,750	124,798
Corbit Lease	45,448	4,447	49,895	2,158
Total	312,704	189,348	502,052	522,275
Total Last Year	268,423	253,852	522,275	
Decrease in Shipments		64,504	20,223	
Increase in Shipments	44,281			

g. Delays:

March 13 - 5 Hours - Loss of Product, 350 Tons:
Broken Runners in Shaft.
April 10 - 4 Hours - Loss of Product, 300 Tons:
Repairing leak in main air line to shaft - near shaft.
April 12 - 5½ Hours - Loss of Product - 700 Tons:
Broken Runners in shaft.
May 6 - 5½ Hours - Loss of Product, 200 Tons:
Broken Runners in shaft.
May 17 - 2 Hours - Loss of Product - 200 Tons:
Broken Runners in shaft.
July 9,- 1 Hour - No Loss in Product:
Current Failure - Electricial Storm.
August 19 - 3 Hours - Loss of Product - 200 Tons:
Broken Runners in shaft.
September 3 - 6 Hours - Loss of Product - 500 Tons:
Broken Runners in shaft.
September 10 - 6 Hours - Loss of Product - 450 Tons:
Broken Runners in shaft.
September 30 - 4 Hours - Loss of Product - 200 Tons:
Repair Skip Hoist Generator.
September 28 - 6 Hours - Loss of Product - 600 Tons:
Caused by using acetylene torch to cut off a steel rail in back of drift.

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2. PRODUCTION, SHIPMENTS, AND INVENTORIES: (Cont'd)
g. Delays: (Cont'd)

October 30 - Loss of Product from 11 gangs of miners - 600 Tons:
Due to repairing 8th Level pocket.
December 4 - 1 Hour - Loss of Product - 125 Tons:
Burnt out compensator on compressor.
December 7 - 1 Hour - Loss of Product - 100 Tons:
Shortage of water to cool compressor. Breakdown at city water plant.
December 9 - 1 Hour - Loss of Product - 100 Tons:
Changing skip wearing shoes.
December 20 - 3¼ Hours - Loss of Product - 325 Tons:
Repairing skip.
December 22 - 1½ Hours - Loss of Product - 150 Tons:
Repairing underground pocket.
December 27 - 1½ Hours - Loss of Product - 150 Tons:
Repairing Underground pocket.

Total Delay in 1948 - 57¼ Hours - Loss of Product 5,250 Tons.

3. ANALYSIS:

a. Average Mine Analysis on Output:

	1948				1947			
Grade	Tons	Iron	Phos	Sil	Tons	Iron	Phos	Sil
Athens Ore and Corbit Ore	393,657	58.35	.113	9.03	385,884	58.89	.118	8.17
Mitchell Lease Ore	109,459	58.30	.118	9.75	121,732	58.58	.121	8.83

503 116

b. Average Analysis on Straight Cargoes:

There were no straight cargo shipments in 1948.

c. High Sulphur Ore:

There was no high sulphur ore encountered in the Athens Mine during 1948:

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption: 12.75 Cubic feet equals one ton
10 per cent for rock & loss in mining Percent of Bessemer - None.

	Athens Lots 1-7, 10 & 12	Mitchell Lease Lots 8, 9 & 11	Corbit Lease Lot No 13	Total Tons
4th Level and Above	96,674	42,667	428,928	568,269
4th to 6th Level	424,426	489,752	41,023	955,201
6th to 7th Level	10,588	71,694		82,282
7th to 8th Level	12,278			12,278
8th to 9th Level	152,803			152,803
9th to 10th Level	229,722			229,722
Below 10th Level	74,216			74,216
New Ore Body	890,689			890,689
Total Gross Tons as of November 30, 1948	1,891,396	604,113	469,951	2,965,460

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4. ESTIMATE OF ORE RESERVES: (Cont'd)
a. Developed Ore: (Cont'd)

	Athens Lots	Mitchell Lease	Corbit Lease	Total Tons
Total Gross Tons as of November 30, 1948	1,891,396	604,113	469,951	2,965,460
Less December Production	25,681	7,436	25,200	58,317
Total Gross Tons as of December 31, 1948	1,865,715	596,677	444,751	2,907,143
Less 10% for Mining and Rock	189,140	60,411	46,995	296,546
Net Tons 1948	1,676,575	536,266	397,756	2,610,597
Net Tons 1947	1,618,619	611,448	473,030	2,703,097
Increase	57,956			
Decrease		75,182	75,274	92,500

The above tabulation shows a decrease of 92,500 tons in the estimate of ore reserves on December 31st, 1948 as compared with that of December 31st, 1947. Deducting the 92,500 tons from the 1948 production which was 506,600 tons shows that 414,100 tons were developed in 1948. Due to exploration by drilling during 1948 the estimate of ore in the new deposit, north of the big dike, was increased 275,467 tons and this estimate is very conservative. The remaining 138,633 tons developed was due to the outlines of the old ore areas being increased by information gained through the process of mining.

b. Prospective Ore:

All ore in the mine is considered developed.

c. Estimated Analysis:

Ore Reserves:

		Approximate Expected Natural Analysis								
	Tons	Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moist
Athens	2,610,597	51.00	.100	8.00	.30	2.75	.40	.76	.010	1.40	13.50

Ore In Stock:

		Average Natural Analysis								
	Tons	Iron	Phos	Sil	Mang	Alum	Lime	Mag	Sul	Loss	Moist
Athens	28,842	50.56	.099	8.13	.29	2.83	.38	.76	.010	1.50	13.57
Mitchell	8,348	50.98	.099	7.89	.29	2.65	.38	.78	.010	1.42	13.57
Corbit	26,185	50.56	.099	8.13	.29	2.83	.38	.76	.010	1.50	13.57

5. LABOR AND WAGES:

a. Comments:

The average number of employees in 1948 was 343 as compared with 340 in 1947, an increase of three men. During the year a total of 28 men were hired. Of those who left our employ, 20 quit, 1 was transferred to another mine, 6 were retired and 3 died making a total of 30 men. The supply of labor was plentiful during 1948.

The average wages per month, including the captain and clerks, increased from $271.52 in 1947 to $299.52 in 1948. The increase was due to a wage adjustment effective as of July 16th 1948.

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5. LABOR AND WAGES: (Cont'd)
b. Comparative Statement of Wages and Product:

	1948	1947	Increase	Decrease
Product	506,600	508,100		1,500
No Shifts & Hours	1/8 Hr. 3 2/8 Hr 299	1/8 Hr. 4 2/8 Hr 293	1/8 Hr 1 2/8 Hr 6	
Average No. Men Working:				
Surface	69	66	3	
Underground	274	274	0	
Total	343	340	3	
Averages Wages Per Day:				
Surface	11.16	10.14	1.02	
Underground	12.19	11.13	1.06	
Total	11.98	10.96	1.02	
Average Wages Per Month:	(Based on mine payroll including captain & clerks)			
Surface	278.15	252.92	25.23	
Underground	304.90	276.00	28.90	
Total	299.52	271.52	28.00	
Product Per Man Per Day:				
Surface	24.55	26.07		1.52
Underground	6.16	6.24		.08
Total	4.92	5.04		.12
Labor Cost Per Ton:				
Surface	.455	.394	.061	
Underground	1.979	1.786	.193	
Total	2.434	2.180	.254	
Average Product Mining:				
Stoping	22.93	21.58	1.35	
Development in Ore	7.08	8.46		1.38
Total	20.43	20.15	.28	
Average Wages Per Day For Contract Miners:	12.63	11.57	1.06	
Total Number Of Man Days:				
Surface	20633	19491	1142	
Underground	82254 3/4	81365	889 3/4	
Total	102887 3/4	100856	2031 3/4	
Amount For Labor				
Surface	230,308.33	200,312.68	29,995.65	
Underground	1,002,525.57	907,481.41	95,044.16	
Total	1,232,833.90	1,107,794.09	125,039.81	
Average Wages Per Month as Per Labor Statement - Less Captain & Clerks:				
Surface	273.88	251.21	22.67	
Underground	304.02	275.47	28.55	
Total	298.65	271.25	27.40	

Proportion of Surface to Underground Men:
1948: 1 to 3.97 — 6 2/8 Hour Shifts
1947: 1 to 4.15 — 6 2/8 Hour Shifts

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5. LABOR AND WAGES: (Cont'd)

c. Operating Schedules - 1948:

Month	Days Mine Worked Per Week	Days Per Month	Days Men Worked Per Week	Avg. Shifts Worked Per Month By Each Man
January	6	26	6	26
February	6	24	6	24
March	6	27	6	27
April	6	26	6	26
May	6	25	6	25
June	6	26	6	26
July	6	20	6	20
August	6	26	6	26
September	6	24	6	24
October	6	26	6	26
November	6	25	6	25
December	6	27	6	25
Total		302		300

Average for year mine operated 25.16
Average for year worked by each man. 25.00

6. SURFACE:

a-1 Buildings:

There were no major repairs to any of the mine buildings during 1948.

Two Thermoliers were installed, one in the carpenter shop and one in the machine shop to supplement the old heating system consisting of a series of steam pipes strung along the outside walls.

The first aid room located in the Dry Building was cleaned, painted and a wash basin installed.

The surface men's change room was revamped and four shower heads installed along the south wall.

Installed a new hot water tank in Dry Building to replace one that was badly corroded and leaking.

Due to settlement of the ground from caving the Dry building is getting very much out of kilter and full of cracks from one end to the other. The cracks were sealed twice during the year to keep the weather out. The irregular settlement of the building pulled the main steam line apart making it necessary to install a long expansion joint to take up the movement.

The old sump tank into which all the waste water and sewerage from the Dry Building is collected settled so much that it pulled apart all the sewer lines from the Dry and also the pipe to the main discharge line. A new sump was constructed close to the Dry Building and new sewer and discharge lines installed.

The cooling pond for the air compressors was cleaned and the piping for the cooling systems renewed using copper pipe. The assembly of tubes for the intercooler on the Ingersoll Rand Compressor was also renewed.

a-2 Docks, Trestles and Pockets:

Considerable work was done on trestles and pockets during the year and at great expense. A full length ore trestle was erected parallel with and south of the north steel trestle. All material for this trestle had to be purchased new as there was none at the mine. The only old material used was caps obtained from the Princeton Mine.

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6. SURFACE: (Cont'd)

a-2 Docks, Trestles and Pockets: (Cont'd)

The two steel trestles were overhauled and reinforced. Many of the knee braces had to be renewed. The reinforcing consisted of tying together the knee braces in each group midway between the girders and the pillars. A double track wooden bent was erected on the end of the north steel trestle to carry the return sheave and dolly so as to increase the stocking capacity of this trestle.

A steel erecting crew spent the greater part of last winter rebuilding the railway pockets and chutes and erecting new stages at the chutes. This crew assisted by two men from the mine spent the week of July 26th (vacation week) rebuilding the chutes in the skip dump.

a-3 Stocking Grounds:

The capacity of the stocking grounds were increased considerably during the year. A large amount of earth and rock was excavated at the east end of the north steel trestle and the entire track lay out of the tracks east of the shaft was changed moving them farther to the north, increasing the stocking capacity about 35,000 tons. The entire stocking ground, which was in very bad shape, was covered with 8 to 10 inches of rock and graded.

b. Stockpiles:

(1) Ore:

Ore at the Athens Mine was stocked in two piles in 1948, the Athens ore under the north steel trestle and the Mitchell ore under the south steel trestle. Loading from stockpile was started on April 14th and completed on August 9th with the exception of wet ore which was stocked during the summer. This ore was loaded out in October.

(2) Rock:

The rock was stocked under the wood trestle extending southwest from shaft on caving ground. As it accumulated under the bents it was bulldozed into the cave.

c. Cave to Surface:

The entire area within the previous cracks continued settling, and a few new cracks also developed. One of these is approximately 120 feet north of the previous most northerly crack near the west boundary of the property. The last 65 feet of the timber tunnel southwest of the shaft also developed new cracks, indicating a draw or pull to the southwest. Cracks have also appeared in several of the surface buildings, and an exhaustive survey is being made to determine the extent of the draw action, particularly at the dry building, timber tunnel and timber yard. The shaft will also be surveyed to determine whether it has been affected to any extent.

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6. SURFACE: (Cont'd)

c. Deep Wells:

No 1 Deep Well continued operating throughout the year. The pump in this well was overhauled during the summer and put in good condition. A daily inspection of the pump was made to keep it properly lubricated and in good operating condition.

The pump from No 2 Deep Well which has not operated for several years was taken out, overhauled and put in storage.

d. Breitung Shaft:

Pumping was continued throughout the year from the Breitung shaft. This pump is visited daily to take care of lubrication and see that it is in good working order.

e. Water Purchased For Heating, Cooling, etc.:

	1948		1947		1946	
	Gallons	Amount	Gallons	Amount	Gallons	Amount
1st Quarter	5,671,000	400.00	5,700,000	402.00	4,738,000	334.66
2nd Quarter	4,774,000	337.18	5,559,000	392.13	5,526,000	389.82
3rd Quarter	5,771,000	406.97	6,847,000	482.29	6,178,000	435.46
4th Quarter	6,476,000	456.32	7,545,000	531.15	6,425,000	452.75
Total	22,692,000	1,600.47	25,651,000	1,807.57	22,867,000	1,612.69
Product - Tons	506,600		508,100		367,361	
Cost Per Tons	.00316		.004		.004	

f. Ground and Fences:

The grounds around the mine buildings were maintained in good condition throughout the year.

Fences around the mine property, company houses and caves were kept in good repair during 1948.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking in 1948.

b. Development, General Remarks:

Major emphasis was placed on the development of the Corbit Lease, Lot 13, where Block Caving Area No 2 was brought into production in November. Development of the main level crosscuts, two of four transfer drifts, thirty-two mill raises, four of seven grizzly drifts with ventilation and travelling connections, and the completion of and undercutting over thirty-two finger raises brought regular controlled production from the southwest quarter of Area No 2 by November 30th. In addition, the third transfer drift was partially completed and a double compartment ore raise was advanced along the Athens-Lucky Star boundary from this transfer drift to the -230' sub-level where the cutting off of Area No 2 from the Lucky Star property was started.

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7. UNDERGROUND: (Cont'd)
b. Development, General Remarks: (Cont'd)

In addition, a raise was completed from the 4th Level to the -230' Sub-Level and the -170' Sub-Level in order that a wedge of ore laying between the north foot wall and the north boundary of block area might be mined by sub-level caving.

By agreement with the Inter State Iron Co officials, an abservation drift was advanced from foot to hanging in the Lucky Star property, parallel with and 20 feet east of the boundary line with E-W connections to No 46 Raise and the cut-off raise. Later two more drifts will be advanced west from this drift to the boundary. The purpose of this drift and crosscuts is to observe the mining of the ore along the Lucky Star boundary.

Ore from Mitchell Lease Lot 11 which was previously trammed from 4th Level raises is now being trammed from three new raises which were brought up from 6th Level.

The development and exploration of the new ore body north of the large diorite dike continued through the year with four holes being drilled through the formation at the 8th Level elevation and two holes being drilled into the formation at 4th Level elevation. In addition, a new crosscut was begun on the 8th Level in order that further exploration might be effected and the area be developed for mining.

DEVELOPMENT WORK SHEET

	Drifting		Raising		Total	
Location	Ore	Rock	Ore	Rock	Ore	Rock
-200' Sub-Level	15	0	10	0	25	0
-230' Sub-Level	665	53	127	0	792	53
-290' Sub-Level	363	16	284	35	647	51
-315' Sub-Level	747	0	123	0	870	0
-330' Sub-Level	443	0	442	0	885	0
-355' Sub-Level	279	51	49	0	328	51
-365' Sub-Level	0	395	0	290	0	685
-385' Sub-Level	270	25	554	0	824	25
4th Level	48	712	0	84	48	796
-405' Sub-Level	51	217	0	0	51	217
-500' Sub-Level	59	0	0	0	59	0
6th Level	0	10	419	169	419	179
-745' Sub-Level	20	0	4	0	24	0
8th Level	0	71	0	67	0	138
-830' Sub-Level	0	24	0	25	0	49
-975' Sub-Level	0	50	0	0	0	50
10th Level	0	0	0	72	0	72
TOTALS	2960	1624	2012	742	4972	2366

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7. UNDERGROUND: (Cont'd)
b-1 Development in Ore:

-200' Sub-Level:

A mining contract cut out over a raise at this elevation and advanced 10 feet of raise above this elevation while developing for "cut off" operations along the boundary between the Athens and Lucky Star Mines.

-230' Sub-Level:

Ore development at this elevation, which included 680 feet of ore drifting and 137 feet of ore raising, consisted largely of transfer drifts and mill raises which were developed in the area between the north boundary of Block Caving Area No 2 and the north footwall where mining is now in progress to remove this wedge of ore before block caving operations approach this area. In addition, an observation, sub-level drift and two observation dog drifts were developed in order that possible caving action in the Lucky Star Mine pillar adjacent to Block Caving Area No 2 might be observed.

-290' Sub-Level:

Development amounting to 363 feet of dog drifting in ore and 284 feet of dog raising in ore was effected in the process of undercutting the area over Grizzly Drifts Nos 1 & 2 in Block No 2.

-315' Sub-Level:

Ore Development totaling 747 feet of drifting and 123 feet of raising was effected in the process of developing Grizzly Drift No 1 with ventilation and traveling connections, finger raises from Grizzly drift No 1 and dog drifting in the undercut area over Grizzly Drift No 2.

-330' Sub-Level:

Ore development totaling 443 feet of drifting and 442 feet of raising was effected in developing Grizzly Drift No 2 with ventilation and traveling connections, finger raises from Grizzly Drift No 2 and in undercutting the area over Grizzly Drifts Nos 3 & 4 at this elevation. In addition, two short mill raises were advanced in a small stoping area in Athens Lot No 12 by mining contract.

-355' Sub-Level:

Ore development consisting of 279 feet of drifting and 49 feet of raising was effected in developing Grizzly Drifts Nos 3 & 4 with traveling connections and finger raise cut outs.

-385' Sub-Level:

Development in ore amounting to 270 feet of drifting and 554 feet of raising was effected in developing Transfer Drift No 2 and approximately half of Transfer Drift No 3. The raising consisted of 16 mill raises which were developed from the No 2 Transfer Drift to the No 3 and No 4 Grizzly Drifts as well as the boundary cut off raise which was extended up along the Athens-Lucky Star Mine boundary from the No 3 Transfer Drift to the -230' Sub-Level.

4th Level:

Total ore development footages on this level amounted to 48 feet of drifting of which 40 feet may be attributed to the development of the Corbit Lease east boundary drift and the remaining 8 feet to the development for mining off from Raise No 669 at this elevation.

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7. UNDERGROUND: (Cont'd)
b-1 Development In Ore: (Cont'd)

-405' Sub-Level:
Fifty-one feet of ore drift was developed at this elevation by a mining contract while advancing a ventilation and traveling connection to the fourth level.

-500' Sub-Level:
Ore drifting totaling 59 feet was developed at this elevation during the process of cutting out over raises nos 665, 667 and 669.

6th Level:
Ore raising totaling 419 feet was completed from this elevation during the development of raises Nos 661 A & B, 665, 667 and 669 to the -405' sub-level and to the 4th Level. There was no ore drifting on the 6th Level during the year 1948.

7th Level:
There was no development work on the 7th Level during the year.

-745' Sub-Level:
A mining contract completed 20 feet of ore drifting and 4 feet of ore raising from this elevation during the process of blasting down a "hang-up" over the No 1 finger line of Block Caving Area No 1.

8th Level:
There was no ore development on the 8th Level during 1948.

9th Level:
There was no development in ore on the 9th Level during the year.

10th Level:
There was no development in ore on the 10th level during the year.

b-2 Development In Rock:

-230' Sub-Level:
A rock drift totaling 53 feet in length was advanced at this elevation in developing a transfer drift to the north from raise No 461.

-290' Sub-Level:
Rock development totaling 16 feet of drifting and 35 feet of raising was completed in the process of cutting out raise No 461 at this elevation and advancing raise to an ore contact above this sub-level.

-355' Sub-Level:
A total of 51 feet of rock drifting was completed in the process of cutting out raises Nos 452 and 456 and in drifting from the two raises into the ore body at this elevation. Both raises are located in the north footwall, and a certain amount of rock development was necessary to reach the ore.

-365' Sub-Level:
Rock development consisting of 395 feet of rock raising and 290 feet of rock drifting was completed at this elevation in the development of Transfer Drift No 1 with a ventilation and traveling connections and 16 mill raises from the transfer drift to Grizzly Drifts Nos 1 & 2 on the -315' sub-level and -330' sub-level respectively.

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7. UNDERGROUND: (Cont'd)
b-2 Development In Rock: (Cont'd)

-385' Sub-Level:

The development of Transfer Drift No 2 made necessary 25 feet of rock drifting from the Athens-Lucky Star Mine boundary west to the ore contact.

4th Level:

All of the rock development on this level was done in connection with the development of the Corbit Lease ore body. Rock drifting totaling 712 feet was completed during the period in extending the north footwall drift from the 100 coordinate east around to the south through the ore body into the south footwall and making a reverse connection with the 4600 crosscut at the 3400' coordinate south. Eighty-four feet of rock raising was completed in extending Raise No 461 above the level in the north footwall to make possible the mining of the ore north of the north line of proposed No 2 Block.

-405' Sub-Level:

Two hundred and seventeen feet of rock drift was driven in developing ventilation and traveling connections from Raises Nos 650B and 661A to the 4th Level.

6th Level:

Rock development totaling 10 feet of drifting and 169 feet of raising was completed from the 6th Level as part of the development of Raises Nos 665, 667 and 669 between the 6th and 4th Levels.

7th Level:

There was no rock development on the 7th Level during the year.

8th Level:

A new cross cut, to be known as the 8800 cross-cut, was driven 71 feet westerly in the large diorite dike from about the 1000 W coordinate as part of the development of the new ore body north of this dike.

A ventilation raise, No 800, was extended 67 feet above the level in footwall slate. This raise will be connected through to the 7th level and will replace ventilation raise No 808 which was lost due to caving during the year.

-830' Sub-Level:

A mining contract extended a ventilation and traveling connection 24 feet into rock at this elevation. A single compartment raise was then extended 25 feet upward thru rock to an old ventilation drift to complete a connection with 8th Level.

9th Level:

There was no rock development on the 9th Level during the year.

-975' Sub-Level:

The driving of 50 feet of rock drift was effected in the development of raises Nos 1032 and 1037 for mining at this elevation.

10th Level:

A total of 72 feet of rock raising was completed in the development of Raise No 1037, a three compartment raise, from the level to the -975' sub-level and the addition of a third compartment to Raise No 1032, said compartment also extending from the level to the -975' sub-level.

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7. UNDERGROUND: (Cont'd)

c. Stoping:

(1) General:

The product for 1948 was obtained principally from the 4th and 6th levels where 66.93% of the total annual production was trammed. The additional 33.07% of the annual production was divided approximately equally between the 8th, 9th and 10th levels. The increase in production from the 6th level from 19.6% in 1947 to 37.11% in 1948 can be attributed largely to the development of several new raises which were extended to the 4th level elevation during the year and which took over ore areas which were formerly trammed on the 4th level. The fact that the 4th level production dropped only 7.8% below 1947 can be directly attributed to the development and mining of new areas in the Corbit Lease.

The south half of Block Caving Area No 2 was brought into production on a small scale in October of this year, By the end of the year approximately 43% of the daily hoist was being produced from the block and fringe mining in the Corbit Lease.

Sub-level caving, top slicing and a combination of sub-level caving and top slicing was continued throughout the remainder of the mine during 1948. The combination of sub-level caving and top slicing was the converting from sub-level caving to top slicing.

The locations of the mining contracts at the end of 1948 and 1947 are shown below:

1948		1947	
11	above 4th Level	11	above 4th Level
7	above 6th Level	9	above 6th Level
3	above 8th Level	2	above 8th Level
3	above 9th Level	4	above 9th Level
2	above 10th Level	3	above 10th Level
Total 26		Total 29	

The Contracts were divided as follows:

1948		1947	
Mining - 12	top-slicing	Mining - 6	Top- Slicing
- 8	Sub Caving	- 13	sub caving
Developing - 4	raising	Developing - 6	raising
- 2	drifting	- 4	drifting
Total 26		29	

Above the 4th Level elevation ore was mined from the following sub-levels: -170', -185', -200', -210', -220', -230', -245', -260', -275', -290', -300', -315', -330', -340', -355', -365', -375', -385', and the 4th Level.

Between the 4th and 6th Levels, ore was mined from the -405', -415', -430', -500' Sub-levels and the 6th Level.

Between 6th and 8th Levels, ore was mined from the following sub-levels: -625', -635', -645', -660', -675', 7th Level, -710', -720', -735', -745', -760', -770', -780', and 8th Level.

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7. UNDERGROUND: (Cont'd)
c. Stoping: (Cont'd)
(1) General: (Cont'd)

Between 8th and 9th Levels, ore was mined on the -800', -815' and -830' Sub-levels.

Between 9th and 10th Levels, ore was mined on the -920', -930', -940', -955', -975' Sub-levels.

Many of the sub-levels mentioned above were not actually occupied by mining contracts, but the ore was extracted from subs underneath.

(2) Detail of Stoping:

Above 4th Level - Mitchell Lots 8, 9 & 11; Athens Lots 10 & 12;
- Corbit Lot 13:

Mining above the 4th Level during the year was fairly well distributed between Mitchell Lot 11, Athens Lot 12 and Corbit Lot 13. A small amount of mining in Athens Lot 10 was done on the -365' sub-level by Contract No 1 before the contract moved down to the -405' sub-level. Mining from Mitchell lots 8 & 9 and Athens Lot 10 was principally the removal of isolated pillars and ore lying beneath the hanging jasper in new territories which were sub-level caved by Contracts Nos 1, 15, 25 and 40 operating on the -405' sub-level.

Mining in Corbit Lot 13 consisted partially of Block-Caving in the south half of Block Caving Area No 2, partially of sub-level caving along the Athens-Lucky Star Mine boundary by Contracts Nos 17 and 32 who were engaged in cutting off the ore body within the Athens Mine from the same ore body in the Lucky Star Mine, and partially the radial, sub-level caving by Contracts Nos 9 & 14 of a small wedge of ore lying between the north footwall and the northern limit of Block Caving Area No 2.

In Athens Lot 12, Contracts Nos 3 & 4 continued to mine ore lying between the north footwall and old workings by a combination of top-slicing and sub-level caving. Mining on the -330' sub-level was completed during the year and the mining contracts moved down to the -355' sub-level where mining was continued by the same methods.

In Mitchell Lot 11, Contracts Nos 14 & 22 completed mining on the -355' sub-level early in the year. Contract No 22 then moved down to the 4th Level elevation where a new raise from 6th Level was prepared for mining in this area. The contract was joined by Contract No 12. The mining of the pillar between the 4th Level and the -355' sub-level was continued by a combination of top-slicing and sub-level caving. The decision to omit mining from the -365' and -375' sub-levels in this area was brought about by the fact that extreme heat encountered in the area engendered a fear that a fire in the timber matt above might result if the area continued to be directly exposed to a source of oxygen.

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7. UNDERGROUND: (Cont'd)
c. Stoping: (Cont'd)
(2) Detail of Stoping: (Cont'd)

Between 4th and 6th Levels - Mitchell Lots 8, 9 & 11; Athens Lot 10:

Mining in this area was confined principally to the -405' and -430' sub-levels in Athens Lot 10 and Mitchell Lot 11. The -430' Sub-levels in Athens Lot 10 and Mitchell Lot 11 was developed during the year and mining from this sub-level and the -405' sub-level was conducted by Contracts Nos 1, 8, 25, 29 and 30 using a combination of sub-level caving and top slicing.

A small amount of mining in Mitchell Lots 8 & 9 was conducted by Contracts Nos 15 and 40 operating from both the -405' sub-level and the -430' sub-level. This area is under new hanging but is intersected by an old 4th Level crosscut which was full of water and which caused considerable difficulty to both contracts in the mining of the -405' sub-level.

The only activity noted on the -500' sub-level during the year was the action of Contracts Nos 5 & 10 in cutting out over Raises Nos 665, 667 and 669 preparatory to reversing said raises and advancing same to the -405' sub-level and to 4th Level.

Between 6th & 8th Levels - Ore Area South of the Cross Dike:

The production of ore from Block Caving Area No 1 was completed on February 15th. The mining of ore remaining between the grizzly elevation and the transfer drift elevation in the east half of the Block was concluded by Contract No 11 using sub-level caving.

The No 1 or north transfer drift was then extended westerly beyond the western limit of Block No 1 where Contract No 11 mined portions of an ore pillar remaining in this area by a small sub-level stope. This area was abandoned before the pillar had been completely mined because of rushes of water into the stoping area from an area adjacent to and above this area where great quantities of water and several severe mud runs had been encountered in past mining. Innumerable small pillars lying between the 6th & 8th Levels above this area were removed by the Block Caving and stoping operations. This concludes for all time mining in this area.

Ore Area North of the Cross Dike:

During the year Contract No 18 completed mining on the -760' sub-level in the eastern extremity of the formation. The -770' sub-level was then developed and by the end of the year this contract had completed mining of approximately 90% of the ore available in this area from this sub-level. All mining in the area was by top slicing.

Between 8th & 9th Levels - North of the cross dike:

The mining of ore on the -800' sub-level by Contracts Nos 2, 19 and 27 using top slicing was concluded early in the year. The three contracts then moved down and developed, the -815' sub-level. The necessity to tap and drain off large sources of water from old 8th Level crosscuts above its area and difficulties encountered in maintaining Raise No 966 materially retarded the progress of Contract No 2 and by the end of the year the contract had been able to mine only half of the area available to it at this elevation. However, Contracts Nos 19 & 27 completed mining on the -815' sub-level during the year and then moved down and developed the -830' sub-level. By the end of the year the two contracts had mined approximately 50% of the area available to them by top slicing.

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7. UNDERGROUND: (Cont'd)
c. Stoping: (Cont'd)
(2) Detail of Stoping: (Cont'd)

Between 9th and 10th Levels - Block No 2:

A combination system of top slicing and sub-level caving was continued in this area by contracts Nos 6, 24 and 26. Contract No 6, after extending new Raise No 1037 from 10th Level to the -975' sub-level in the west half of the block, continued mining operations at that elevation in order to drain off large concentrations of water occurring in the area in advance of mining in the east half of the pillar. In this work they were assisted for a short time by Contract No 21 which was newly organized for this operation. Mining in this area was concluded early in the year and Contract No 6 moved to 4th Level to assist in developing Block Caving Area No 2. Contract No 21 was disbanded.

Meanwhile, Contracts Nos 24 and 26 mined out the east half of the pillar on the -955' sub-level by sub-level caving and in so doing removed small pillars which had extended from this sub-level upward through the -920' sub-level and resumed mining at that elevation. By the end of the year this sub-level was approximately 50% completed.

d. Timbering:

The total cost of timbering increased $50,504.48 over last year. This increase may best be explained by the increased cost of timber, increased freight costs, increased framing and handling costs incident to increased labor costs, and finally the greater use of special higher cost specially prepared timber in the development of the area for mining by block-caving.

The increasing use of four inch "H" section steel continued through the year with steel sets replacing wooden sets in most main level haulage ways. In areas hwere great pressure occurred the eight inch "I" section was used instead of the four inch "H" section, and, in extremely heavy areas two 8 inch steel sets, welded together side by side, were used with complete success. The use of steel for raise sets was attempted during the year and proved most satisfactory.

Statement of Timber Used:

	Lineal Feet	Avg. Price Per Foot	Amount 1948	Amount 1947
6" to 8" Cribbing	149,953	.0811	12,163.60	9,615.19
8" to 10" Stulls	33,970	.1278	4,340.74	2,363.87
10" to 12" Stulls	71,747	.1939	13,914.70	14,716.26
12" to 14" Stulls	29,534	.2706	7,992.40	7,012.44
14" to 16" Stulls	7,254	.3004	2,179.43	2,184.31
Special Sawed Tbr Blk Cave	7,794	.4500	3,507.43	5,315.34
Total 1948	300,252	.1469	44,098.30	
Total 1947	301,204	.1368		41,207.41
7' Lagging	1,055,495	1.6008	16,896.46	18,517.62
9½' Poles	619,097	2.9373	18,185.35	18,347.04
Total 1948	1,674,592	2.0949	35,081.81	
Total 1947	1,995,361	1.8475		36,864.66
Wire Netting	990		63.12	10.52

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7. UNDERGROUND: (Cont'd)

d. Timbering: (Cont'd)

Statement of Timber Used: (Cont'd)

	Amount 1948	Amount 1947
PRODUCT FOR YEAR - TONS	506,600	508,100
Ft. Timber Per Ton Of Ore	.5927	.5928
Ft. Lagging Per Ton Of Ore	2.0835	2.4223
Ft. Poles Per Ton Of Ore	1.2220	1.5047
Ft. Lagging Per Ft. Of Timber	3.5154	4.0862
Cost Per Ton For Timber	.0792	.0811
Cost Per Ton For Lagging	.0333	.0365
Cost Per Ton For Poles	.0359	.0361
Cost Per Ton For Wire Netting	.0001	.0000
Cost Per Ton For Timber, Lagging, Poles & Netting.	.1485	.1537
Equivalent of Stull Timber To Board Measure	460,039	513,099
Ft. Of Board Measure Per Ton Of Ore	.9081	1.0098
Lin. Ft. Of Netting Per Ton Of Ore	.0019	.0003
Sq. Ft. Of Netting Per Ton Of Ore	.0081	.0014

		Amount	Cost Per Ton
Total Cost Of Tbr, Lagging, Poles, Etc. For Year	1948	75,243.23	.1485
	1947	78,082.59	.1537
	1946	53,734.65	.1463
	1945	72,844.22	.1661
	1944	77,935.27	.1850
	1943	82,305.17	.1589
	1942	82,410.65	.1209
	1941	67,589.93	.1041
	1940	59,589.66	.1155
	1939	47,153.55	.1164
	1938	35,920.27	.1340

e. Drifting And Raising:

The following table gives a comparision of total feet of drifting and raising in ore and rock in 1948 and 1947:

	Drifting		Raising		Grand Total
Year	Ore	Rock	Ore	Rock	
1948	2885	1528	2221	628	7262
1947	1983	1533	2097	671	6284
Increase	902		124		978
Decrease		5		43	

The large development footage was due to the development of the Corbit Lease for block caving and for the sub-level caving outside of the block area as well as for the mining below the Fourth Level.

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7. UNDERGROUND: (Cont'd)

f. Explosives, Drilling and Blasting:

In 1948 there was 22,168 pounds less powder used than in 1947. This was probably due to mining more caved ore. The use of 1X Gelamite and 2X Hercomite was continued and in addition a new 60% High Pressure Gelamite made up in five inch by five inch charges for blasting chunks above the fingers in the block caving was introduced. The percentage of 1X Gelamite and 2X Hercomite was reversed having used 57% of 1X Gelamite and 41% Hercomite. This was probably due to blasting more upper holes for which the 1X Gelamite is better adapted than 2X Hercomite being more plastic whereas the 2X Hercomite is granular and has a tendency of running out when being tamped in an upper hole.

There was not much change in drilling methods during the year except that a Le Roc Triple Jumbo rig was purchased and put in operation for main level drifting using 2 DA 30 Ingersol Rand drifters and using car-set bits. Much new drilling equipment was purchased during 1948 consisting of 8 RB 12 and 2 J 50 Jackhammers, 1 HC 23 Le Roc Rock Drills, 8 Pickhammer machines, 3 DA 30 Ingersol Rand Drifters and 1 Le Roc Triple Jumbo rig.

Fuse and cap blasting was continued exclusively in the regular mining contracts, electric blasting in raises and some primacord was used for putting off charges in the finger raises of the block cave.

Statement of Explosives Used: (Ore Development and Stoping)

	Quantity	Average Price	Amount 1948	Amount 1947
60% High Pressure Gelatin 5X5	4,050	20.00	810.00	
No 1 Gelamite Powder Lbs				570.00
No 2X Hercomite Pwder Lbs	67,750	13.88	9,403.75	20,762.94
No 1X Gelamite Pwder Lbs	94,832	14.86	14,090.21	4,303.30
Total Powder	166,632	14.59	24,303.96	25,636.24
Fuse - Feet	621,050	7.84	4,871.12	4,840.39
Caps	77,375	13.99	1,082.50	1,176.62
Electric Cap & Delays	2,104	17.72	372.81	273.54
Primacord	21,000	32.00	672.00	768.00
Galvanometer	1	17.25	17.25	
Tamptite Bags				53.75
Master Lighters	500	6.76	3.38	
Tamptite Shells				32.64
Fuse Lighters	17,500	8.71	152.35	115.46
Connecting Wire, Lbs	80	.80	64.00	72.30
Blasting Machine Unit				13.50
Shot Firing Cord - Feet	500	18.66	9.33	19.38
Total Fuse, Caps Etc.			7,244.74	7,365.58
Total Cost All Explosives			31,548.70	33,001.82
PRODUCT			506,600	508,100
Pounds Powder Per Ton Of Ore			.3289	.3716
Tons Of Ore Per Lb Of Powder			3.0402	2.6912
Cost Per Ton For Powder			.0480	.0504
Cost Per Ton For Fuse, Caps, Etc.			.0143	.0145
Cost Per Ton For All Explosives			.0623	.0649

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7. UNDERGROUND: (Cont'd)

f. Explosives, Drilling and Blasting: (Cont'd)

Statement of Explosives Used: (Sinking, Rock Development, Etc.)

	Quantity	Average Price	Amount 1948	Amount 1947
No 1 Gelamite Powder Lbs.				
No 1X Gelamite Powder Lbs	11,958	14.37	1,717.80	1,908.60
No 2X Hercomite Powder Lbs				203.31
Total Powder 1948	11,958	14.37	1,717.80	
Total Powder 1947	14,950	14.13		2,111.91
Fuse - Feet	64,250	7.75	497.96	440.72
Caps	8,225	13.72	112.82	106.72
Electric Caps & Delays	482	18.07	87.12	146.61
Shot Firing Cord - Feet	500	18.66	9.33	10.66
Total Fuse, Caps, Etc.			707.23	704.71
Total All Explosives			2,425.03	2,816.62
Total Explosives Used At Mine			33,973.73	35,818.44
Avergae Price Per Pound For Powder			.1457	.1362

g. Mining and Loading:

There were three systems of mining used during the year, VIZ., top slicing, sub-level caving and block caving. During 1947 much of the mining was changed from top-slicing to sub-level caving. After a fair trial it was found that most of the ore areas being mined were not adaptable to sub-level caving as the ore breaks in very large chunks and the hanging rock which breaks very fine comes through before the ore can be extracted causing excessive contamination and very poor recovery. In April a start was made to revert back to top-slicing in the territory between the 4th and 6th Levels. In changing over the slices were advanced close together, double covering the bottom and blasting down the back.

The mining of the area developed in 1947 for block-caving was completed on the 14th of February. Production from this block for 1948 was 16,695 tons. This block proved so successful that the development of a larger block was started above the 4th Level in the Corbit Lease in which no previous mining had been done. This development which was started in December of 1947 was by the later part of October advanced to a point where the draw could be started and accounted for the step up of production in November and December. It is estimated that the block will last throughout 1949.

Tramming during the year was done on five levels, the 4th, 6th, 8th, 9th and 10th. Hoisting was done from the 4th, 8th and 10th Levels. Many of the underground cars were overhauled during the year.

h. Ventilation:

In general, ventilation was good during 1948, with a total volume of 75,000 to 80,000 cubic feet of air per minute being delivered by the main fan located on the bottom or 10th Level. The fresh air is drawn down through the cage department and after traversing through the mine is exhaused from the 4th or top level up the two skip compartments. Regular ventilation surveys were made during the year by the Safety Department engineers and in general all their recommendations have been complied with.

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7. UNDERGROUND: (Cont'd)
K. Ventilation: (Cont'd)

One of the main ventilation raises between the 7th and 8th Levels was lost during the year due to caving over the top of the raise. A new raise was started well back in the foot on the 8th Level main haulage drift. In the meantime the air is being directed from the 8th Level to the 7th Level through a rock raise located near the shaft.

During the year it was decided to concrete three of the ventilation raises. Reinforcing rods, cement and agrigates were purchased for this job and the concreting of No 70 Raise between the 6th and 7th Level was started near the end of the year.

In addition to the large fan several auxilary fans are operated throughout the mine to furnish ventilation to places not reached by the main stream of air.

i. Pumping:

The following table gives data on pumping at the Athens and Breitung Shafts:

Period	Avg. KW Per Day - Athens	KW Per Month Breitung Pump	Avg. Gal. Per Min. - Athens	Total Cost Both Mines From the Athens Cost Sheet
January	4381	1390	331	$ 3046.12
February	3869	960	329	2639.74
March	3716	840	307	3969.36
April	3581	2480	307	2500.74
May	3806	4200	327	2760.70
June	3827	3100	329	2586.29
July	3820	2920	323	2560.56
August	3839	2050	331	2828.53
September	3787	1580	323	2752.25
October	3853	1220	321	2840.13
November	3719	960	310	2768.90
December	3673	940	307	2765.35
1938 Avg.	3767	3433	314	2350.42
1939 Avg.	3991	4391	331	2291.90
1940 Avg.	4141	858	351	2381.69
1941 Avg.	4008	1883	354	2351.56
1942 Avg.	4435	2258	388	2668.91
1943 Avg.	4351	3358	372	2701.08
1944 Avg.	3696	1688	308	2528.62
1945 Avg.	3951	2853	332	2356.83
1946 Avg.	3909	1839	320	2456.08
1947 Avg.	3958	3665	340	2599.82
1948 Avg.	3823	1887	320	2834.89

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7. UNDERGROUND: (Cont'd)
i. Pumping: (Cont'd)

The Average Cost in 1934 prior to pumping at the Breitung was $2,611.79.

Saving in 1935 when expense was heavy account of installing	2,600.59
Saving in 1936	10,148.52
Saving in 1937	10,352.04
Saving in 1938	3,135.04
Saving in 1939	3,838.65
Saving in 1940	2,761.20
Saving in 1941	2,922.76
Saving in 1942	685.44*
Saving in 1943	1,071.50*
Saving in 1944	83.17
Saving in 1945	3,059.52
Saving in 1946	155.71
Saving in 1947	11.97
Saving in 1948	223.10*

(*) Above the cost, prior to pumping at the Breitung.

The number of gallons pumped per minute at the Athens Mine in each month of the year for the past eight years is given in the following statement:

Month	1948	1947	1946	1945	1944	1943	1942	1941	1940
January	331	297	303	306	315	359	399	330	325
February	329	290	331	302	297	334	388	327	318
March	307	287	282	293	296	330	272	324	322
April	307	292	327	342	295	356	374	334	318
May	327	363	366	365	307	404	402	334	340
June	329	385	330	359	312	411	402	367	380
July	323	376	321	369	314	431	393	386	420
August	331	374	314	355	313	429	394	363	350
September	323	368	316	338	311	390	384	363	369
October	321	357	316	329	312	364	397	360	373
November	310	346	304	325	316	337	379	365	343
December	307	346	302	307	308	328	368	397	348
Average	320	340	320	332	308	372	388	354	351

8. COST OF OPERATING:

a. Comparative Mining Costs:

	1948	1947	Increase	Decrease
Product	506,600	508,100		1,500
Underground Costs	2.692	2.444	.248	
Surface Costs	.316	.264	.052	
General Mine Expense	.448	.414	.034	
Cost Of Production	3.456	3.122	.334	
No Of Days Operated	302	297	5	
No Shifts & Hours	3 1/8 Hr	4 1/8 Hr		1 1/8 Hr
	299 2/8 Hr	293 2/8 Hr	6 2/8 Hr	
Average Daily Product	2160	1711	449	

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8. COST OF OPERATING: (Cont'd)

a. Comparative Mining Costs: (Cont'd)

COST OF PRODUCTION	1948	Percent	1947	Percent	Increase	Decrease
Labor	2.512	72.7	2.251	72.1	.261 .6	
Supplies	.944	27.3	.871	27.9	.073 -	- .6
Total	3.456	100	3.122	100	.334	

b. Detailed Cost Comparison:

(1) Days and Shifts:

Year	Days Mine Worked	Shifts & Hours	Men Employed	Total Shifts Worked
1948	302	6 2/8 Hrs	343	601
1947	297	6 2/8 Hrs	340	590
Increase	5		3	11

(2) Comparison of Production:

Production - 1948	506,600 Tons
Production - 1947	508,100 Tons
Decrease	1,500 Tons

(3) Comparison Of Number Of Men And Wages:

	No. Men	No. Days	Amount	Rate Per Day
1948	343	102,887 3/4	1,232,833.90	11.98
1947	340	100,856	1,107,794.09	10.98
Increase	3	2,331 3/4	125,039.81	1.00

(4) Tons Per Man Per Day:

	1948	1947	Decrease
Surface	24.55	26.07	1.52
Underground	6.16	6.24	.08
Total	4.92	5.04	.12

(5) Cost Of Production:

	Total	Cost Per Ton
1948	1,750,725.02	3.456
1947	1,586,302.83	3.122
Increase	164,422.19	.334

	Labor	Percent	Supplies	Percent
1948	1,272,485.48	72.7	478,239.54	27.3
1947	1,143,700.46	72.1	442,602.37	27.9
Increase	128,785.02	.6	35,636.17	
Decrease				.6

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

COST OF PRODUCTION

		1948		1947	
		Amount	Per Ton	Amount	Per Ton
	UNDERGROUND COSTS:				
1	Exploring in Mine	7689.01	.015	3410.13	.007
2	Development in Rock	36157.30	.071	37601.21	.074
3	Development in Ore	62242.20	.122	41528.86	.082
4	Stoping	335706.30	.663	326715.42	.643
5	Timbering	491682.96	.971	441178.48	.868
6	Tramming	155018.16	.306	140751.83	.277
7	Ventilation	18669.53	.037	20013.70	.039
8	Pumping	34018.67	.067	31197.83	.061
9	Compressors and Air Pipes	61046.34	.121	60767.77	.120
10	Back Filling			190.08	.000
11	Underground Superintendence	47498.54	.094	41492.41	.082
12	Cave-in, or Fire in Mine	66.28	.000	582.83	.001
13	Maint: Compressors and Power Drills	12256.97	.024	5089.03	.010
14	Scrapers and Mechanical Loaders	55093.77	.109	55182.48	.109
15	Tramming Equipment	39905.47	.079	29576.85	.058
16	Pumping Machinery	6543.54	.013	6662.76	.013
	Total Underground Costs	1363595.04	2.692	1241941.67	2.444
	SURFACE COSTS:				
17	Hoisting	52107.47	.103	48791.47	.096
18	Stocking Ore	14220.77	.028	13672.90	.027
19	Dry House	17224.52	.034	13021.15	.026
20	General Surface Expense	17942.13	.035	14212.40	.028
21	Maint: Hoisting Equipment	17394.64	.034	21796.61	.043
22	Shaft	10808.69	.021	14128.67	.028
23	Top Tram Equipment	3083.22	.006	2441.13	.005
24	Dock, Trestles and Pockets	24267.23	.048	3858.93	.007
25	Mine Buildings	3394.62	.007	2084.28	.004
	Total Surface Costs	160443.29	.316	134007.54	.264
	GENERAL MINE EXPENSES:				
26	Geological	951.48	.002	738.97	.001
27	Mining Engineering	9079.75	.018	7179.36	.014
28	Mechanical and Electrical Engineering	3094.21	.006	3117.83	.006
29	Analysis and Grading	20754.10	.041	20602.19	.041
30	Safety Department	4119.41	.008	3871.16	.008
31	Telephones and Safety Devices	6355.40	.013	4043.92	.008
32	Local and General Welfare	4884.89	.010	4820.75	.009
33	Special Expense, Pensions and Allowances	8943.49	.018	7800.55	.015
34	Ishpeming Office	31644.66	.062	26323.98	.052
35	Mine Office	31884.67	.063	27213.15	.054
36	Insurance	19034.87	.038	10064.35	.020
37	Personal Injury	17969.41	.035	28143.32	.055
38	Social Security Taxes	24540.07	.048	23803.61	.047
39	Employees Vacation Pay	43430.28	.086	42630.48	.084
	Total General Mine Expense	226686.69	.448	210353.62	.414
	COST OF PRODUCTION.	1750725.02	3.456	1586302.83	3.122
	PRODUCT	506,600 Tons		508,100 Tons	

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

1. Exploring in Mine:
In 1948 there were 2,001 feet drilled with Bortz bits while in 1947 there were 525 feet drilled with Bortz bits. The increase in cost for 1948 was $4,278.88 and cost per ton $.008.

2. Development in Rock:
Total feet of drifting and raising in rock 2,156 feet in 1948 as compared with 2,184 feet in 1947. Decrease in expense $1,443.91 and in cost per ton $.003. Drifting in 1948, 1,528 feet; in 1947, 1,581 feet. Raising in 1948, 628 feet; in 1947, 127 feet.

3. Development in Ore:
The increase in expense was $20,713.34 and cost per ton $.040. There were 1,080 feet more drifting in 1948. Increase due to developing Block No 2.

4. Stoping:
There was an increase in expense of $8,990.88, and cost per ton $.020. Increase due to wage adjustment in July.

5. Timbering:
The increase in expense was $50,504.48, and cost per ton $.103. The cost for timber, lagging and poles decreased $.0052 per ton due to a greater amount of steel H Beams and I Beams being used in place of timber. The cost of steel beams was $5,923.00. There were four new H.U. utility single drum air hoists and one double drum hoist purchased in 1948 cost $3,366.00. There were also two new electric power chain saws costing $971.00 purchased in 1948 to be used in framing timber. In 1947 there were only two single drums and one double drum hoists bought.

6. Tramming:
There was a decrease of 1,500 tons in production. The expense to this account increased $14,266.33 and cost per ton increased $.029. Increase due to wage adjustment in July.

7. Ventilation:
The expense to this account decreased $1,344.17 and cost per ton $.002. The charge for electric power was $245.35 less in 1948. There were no new fans bought in 1948 while in 1947 there were two 5-HP Jeffrey fans purchased costing $780.00.

8. Pumping:
Expense increased $2,280.84 and cost per ton increased $.006.

Gallons of water pumped in 1948. . . .	.169,128,796
Gallons of water pumped in 1947. . . .	.178,537,561
Gallons of water decreased.	9,408,765
Average gallons per minute in 1948 . . .	320
Average gallons per minute in 1947 . . .	340
Decrease in gallons per minute	20

The cost for electric power was $1,101.65 less than in 1947.

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YEAR 1948

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

9. Compressors and Air Pipes:

Expenditures increased $278.57 and cost per ton increased $.001

Cubic feet air compressed in 1948 -	1,184,040,000
Cubic feet air compressed in 1947 -	1,191,510,000
Decrease	7,470,000
Cost of electric power in 1948	36,558.60
Cost of electric power in 1947	37,232.28
Decrease	673.68

During the year several hundred feet of air pipe was renewed in the shaft.

10. Back Filling:

There was no expense to this account for 1948. Expense for 1947 was $190.08.

11. Underground Superintendence:

The increase in expense was $6,006.13 and cost per ton $.012. Increase was due to adjustment of salaries and adding one shift boss.

12. Cave-in and Fire in Mine:

The expense to this account decreased $516.55 and cost per ton $.001.

13. Compressors and Power Drills:

The increase in expense was $7,167.94 and cost per ton $.014. In 1948 there were six new and two second hand RB-12 Jackhammers purchased costing $2,090.00; eight L-29 Pickhammers $1,180.00; two J-50 wet type Jackhammers $570.00; one HC23-Le Roi Rock Drill with column $770.00; one Le Roi Triple Jumbo $1,980.00; and three DA-30 power feed drifting machines costing $2,187.00.

14. Scrapers and Mechanical Loaders:

The expense in 1948 decreased $88.71 while the cost per ton remained the same. In 1948 there was one 40-HP Sullivan electric hoist purchased costing $3,933.00 and twenty three Holcomb scrapers for $5393.81. In 1947 four 25-HP electric hoists and four Holcomb Scrapers.

15. Electric Tram Equipment:

The increase in expense was $10,328.62 and cost per ton $.021.

Detail:

	Generators	Locomotives	Wiring	M.L. Track	M. L. Cars
1948	445.97	10,173.92	1,882.60	20,982.72	6,420.26
1947	386.21	8,723.49	1,104.94	14,343.30	5,018.91
Increase	59.76	1,450.43	777.66	6,639.42	1,401.35

The increase to Locomotives was due to purchasing a second hand locomotive from the Princeton Mine for $1,000.00 and the cost of overhauling it. To wiring and M.L. Tracks was for extensions and repairs and to M.L. Cars for repairs and purchase of a second hand car for $325.00.

16. Pumping Machinery:

Expenditures decreased $119.22 and cost per ton remained the same.

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

SURFACE COSTS:

17. Hoisting:

	Ore	Rock	Total
Product 1948 - Tons	506,600	24,760	531,360
Product 1947 - Tons	508,100	26,270	534,370
Decrease	1,500	1,510	3,010

There was an increase in expense of $3316.00 and cost per ton $.007. The electric power charge was $183.27 less than in 1947. Increase in cost due to adjustment of wages in July.

18. Stocking Ore:

Tons Stocked in 1948 -	190,413
Tons stocked in 1947 -	239,193
Decrease	48,780

The increase in expense was $547.87 and in cost per ton $.001. The electric power charge was $108.73 less than in 1947.

19. Dry House Expense:

There was an increase in expense of $4203.37 and cost per ton $.008. Increase was due to replacing one hot water tank, revamping the surface men's change room and first aid room and installing expansion joint in main steam line.

20. General Surface Expense:

Expense to this account increased $3729.73 and cost per ton $.007.

21. Hoisting Equipment:

	Electric Hoists	Hoisting Ropes	Skips and Skip Roads	Sheaves
1948	3,585.96	- - -	13,381.81	426.87
1947	3,106.23	9,563.45	8,998.55	128.38
Increase	479.73		4,383.26	298.49
Decrease		9,563.45		

The decrease in expense was $4401.97 and cost per ton $.009. The increase in expense to electric hoists was due to more repairs. There were no ropes charged in 1948. In 1947 there were three skip ropes and one cage rope charged out. The increase to dkips and skip roads was due to more repairs to skips and skip roads and overhauling cage. The expense to sheaves increased due to replacing pulley stand sheaves and liners on head frame sheaves.

22. Shaft:

There was a decrease in expense of $3319.98 and cost per ton $.007.

	Steel Sets	U. G. Pockets
1948	2,970.02	7,838.67
1947	2,857.70	11,270.97
Increase	112.32	
Decrease		3,432.30

The decrease to U.G. Pockets was due to repairs at bottom of shaft and building concrete trench for cleaning skip pit in 1947.

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

23. Top Tram Equipment:
There was an increase in expense of $642.09 and cost per ton $.001.

	Engines & Motors	Wire Rope	Sheaves Rollers, Etc.	Track & Cars
1948	289.85	355.00	1,447.65	990.72
1947	170.71	448.31	953.43	868.68
Increase	119.14		494.22	122.04
Decrease		93.31		

190,413 tons were stocked as compared with 239,193 in 1947.

24. Docks, Trestles, and pockets:
The increase in expenditure was $20,408.30 and cost per ton $.041. The increase in expense was due to excavating and grading to increase stocking capacity on north trestle and building new wood trestle. This was made necessary due to abandoning part of the south stocking trestle which was too close to caving area. The two steel trestles were overhauled and reinforced.

25. Mine Buildings:
Expenditures increased $1310.34 and cost per ton $.003.

The detail of expense is as follows:

Office	218.36	Installing new lighting fixtures.
Warehouse	5.66	Painting floor.
Shops	21.26	Repairing windows and doors.
Shaft House	1,733.57	Replacing corroded steel in frame.
Engine House	109.48	Painting floors and repairing windows.
Heating Plant Bldg.	18.31	Repairing coal bin.
Dry House	750.05	Installing new hot water tank and repairing water lines. Making new cess pool for sewer and installing pump.
Coal Dock	83.02	Inclosing coal dock for stoker coal.
Timber Tunnel	9.62	Repairing doors.
Top Tram Building	12.38	Repairing windows and roof.
Storage	85.24	Widening doorway on garage room and changing partitions.
Miscellaneous Bldgs	347.67	Building shed for tractor.
Total	3,394.62	

GENERAL MINE EXPENSE:
26. Geological:
The increase in expense was $212.51 and cost per ton $.001.

27. Mining Engineering:
The increase in expense was $1900.39 and cost per ton $.004. Covers time and expense of mining engineers and helpers.

28. Mechanical and Electrical Engineering:
There was a decrease in expense of $23.62 while the cost per ton remained the same. The charge to this account covers the time spent by mechanical and electrical departments on inspections and repairs.

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

29. Analysis and Grading:

	Sampling At Mine	Central Laborator Exp.	Shipping Dept Exp	Trucking Samples, Etc.
1948	4,708.73	11,176.99	3,595.69	1,272.69
1947	5,225.65	10,808.73	3,595.39	1,062.42
Increase		368.26	90.30	210.27
Decrease	516.92			

Determinations 1948 - 54,955; Cost per determination $.203384
Determinations 1947 - 55,795; Cost per determination $.193722

There was an increase in expenditures of $151.91 and cost per ton remained the same.

30. Safety Department:

	First Aid Safety Supplies	Safety Goggles Hats, Respirators Etc.	First Aid Helmet Practice
1948	109.89	606.05	347.47
1947	739.39		301.31
Increase		606.05	46.16
Decrease	629.50		

	First Aid Room	Ishpeming Office Charge
1948	83.86	2,972.14
1947		2,830.46
Increase	83.86	141.68

The expense to this account increased $248.25 and cost per ton remained the same.

31. Telephones and Safety Devices:

	1948	1947	Inc.	Dec.
Lights at Shaft & Levels	2131.27	1851.45	279.82	
Mine Telephone	432.72	378.80	53.92	
Safety Gates	480.64	665.04		184.40
Sign Boards & Signals	1191.82	838.45	353.37	
Fire Equipment & Fire Patrol	2118.95	310.18	1808.77	
Total	6355.40	4043.92	2311.48	

Cost per ton increased $.005.

32. Local and General Welfare:
The expense to this account increased $64.14 and cost per ton $.001.

33. Special Expense, Pensions and Allowances:

	Legal	Examination	Retirement	Other Expense	Pensions & Allowances	Employment Office
1948	548.34	560.00	6,289.65	431.01	509.03	605.46
1947	537.83	627.50	4,382.48	1,673.07	579.67	
Increase	10.51		1,907.17			605.46
Decrease		67.50		1,242.06	70.64	

There was an increase in expenditures of $1142.94 and cost per ton increased $.003.

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

34. Ishpeming Office:

Ishpeming Office expense is pro-rated to the various mines on the basis of labor costs. There was an increase in expense of $5320.68 and cost per ton $.010.

35. Mine Office:

	Salaries	Central Warehouse Expense	Miscellaneous
1948	22,905.88	7,429.97	1,548.82
1947	19,457.24	6,718.95	1,036.96
Increase	3,448.64	711.02	511.86

The increase in expense was $4671.52 and cost per ton $.009.

36. Insurance:

	Property	Group	Catastrophe	Group Annuity
1948	1,451.58	14,771.21	1,020.81	1,791.27
1947	1,670.27	6,714.84	379.90	1,299.34
Increase		8,056.37	640.91	491.93
Decrease	218.69			

There was an increase in expense of $8970.52 and cost per ton $.018.

37. Personal Injury:

	Compensation and Doctors	Compensation Department	Hospital Loss
1948	4,445.84	1,368.69	12,154.88
1947	17,850.80	1,181.34	9,111.18
Increase		187.35	3,043.70
Decrease	13,404.96		

There was a decrease to this account of $1017.91 and cost per ton decreased $.020.

38. Social Security Taxes:

	Unemployment Insurance Tax	Old Age Benefit Tax
1948	13,870.80	10,669.27
1947	13,491.09	10,312.52
Increase	379.71	356.75

There was an increase to this account of $736.46 and cost per ton $.001

39. Employees Vacation Pay:

The increase in expense was $799.80 and cost per ton $.002.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS:

Holes No 23 and 24 were drilled from the back of the 4th level to determine the iron formation - slate contact so that the proper elevation for the No 1 Transfer in Block No 2 could be known.

Holes Nos 25,26,27 and 28 were drilled from the top of No 880 Raise at the elevation of the 8th Level for the exploration of the new ore body north of the large E-W dike.

Holes No 29 and 30 were drilled from the end of the tail drift north of the shaft on the 4th Level to determine if the ore in the new deposit extended to that elevation. This drilling proved that it did not extend to that height.

Following are the locations, courses and depths of diamond drill holes:

No of Hole	Location	Dip	Course	Elevation	Depth
23	4th Level S 3450' & 87' E	+51°	N 1° 02' W	-381'	62'
24	4th Level S 3415' & 180' E	+54°			123'
25	8th Level S 3151' & 1144' W	+2°	South	-784'	46'
26	8th Level S 3136' & 1140' W	+1°30'	N0° 18' E	-785'	32'
27	8th Level S 3142' & 1142' W	+2°	West	-784'	120'
28	8th Level S 3144' & 1143' W	+2°30'	N79°45' W	-784'	296'
29	4th Level S 2570' & 490' W	+1°	S 50° W	-396'	613'
30	4th Level S 2568' & 493' W	+2°	S 65° W	-396'	750'

Much drilling from the 8th and 10th Level has been proposed for the further exploration of this new ore body. This drilling will get underway as soon as the main haulage drifts are extended in this vicinity.

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10: **TAXES:**

COMPARATIVE STATEMENT OF TAXES FOR THE YEARS 1948 AND 1947

DESCRIPTION	1948 VALUATION	1948 TAXES	1947 VALUATION	1947 TAXES
ATHENS MINE				
Including Stockpiles, Supplies and Equipment as placed by the State Tax Commission				
Real Estate	1,450,000	64,257.19	1,540,000	68,170.26
Personal Property	600,000	26,589.18	625,000	27,666.50
Collection fee		908.46		958.37
Total Athens Mine	2,050,000	91,754.83	2,165,000	96,795.13
HARVEY ADDITION				
Proportion of Lot 1	950	42.10	950	42.05
" " 2	190	8.42	190	8.41
" " 3 Fontaine Pur. Lit 23-3	600	25.59	600	25.56
" " 2 Gayette Pru. Lit 24-609	950	42.10	950	42.05
" " 5 & 6 -33A Cederblade	760	33.69	760	33.68
" " 6 - 36A	855	37.89	855	37.85
" " 7 Lehman-Lib 20-82	475	21.05	475	21.03
" " 7 Liber 28-21	475	21.05	475	21.03
" " 7 Liber 30-213	665	29.47	665	29.44
" " 8 Blair-Liber 19-72				House Dismantled
STERLING ADDITION				
Lot 1, W 13' Lot 2, & W 6½' Lot 3	190	8.42	190	8.41
7 Vassanen	1,330	58.94	1,330	58.87
Lots 8 & 9 Bjornberg	1,140	50.52	1,140	50.47
Lot 10 Delarye	855	37.89	855	37.85
11 Two houses	1,140	50.52	1,140	50.46
Lots 12 & 13	2,185	96.83	2,185	96.72
Lot 14 Wick	1,045	46.31	1,045	46.26
15 Johnson	1,425	63.15	1,425	63.08
Lots 16 & 17 Roma	1,520	67.36	1,520	67.28
Lot 18 CCI Co.	1,140	50.52	1,140	50.46
19 Turpinen	855	37.89	855	37.85
20 Savola	475	21.05	475	21.03
22 Pachette	475	21.05	475	21.03
Lots 23 & 24 CCI Co.	1,425	63.15	1,425	63.08
Lot 25 Forsland	855	37.89	855	37.85
Lot 26 CCI Co.	855	37.89	855	37.85
27 Maki	855	37.89	855	37.85
28 CCI Co.	1,330	58.94	1,330	58.87
29 Mattson	1,710	75.78	1,710	75.70
30 Rund	1,330	58.94	1,330	58.87
Lots 31 to 38 Inc. CCI Co.	4,370	193.66	4,370	193.45
Lot 72 Lehman	100	4.43	100	4.43
Lot 73, 74 & 75	290	12.85	290	12.84
Collection fee		14.54		14.52
Total Rented Buildings	32,815	1,468.76	32,815	1,467.14
Total Athens Iron Mining Co	2,082,815	93,223.59	2,197,815	98,262.27

DISPOSITION OF CHARGES	OPERATING	MINE RENTED BUILDINGS	OPERATING	MINE RENTED BUILDINGS
Total as Above	91,754.83	1,468.76	96,795.13	1,467.14
Charged 11 Months	84,300.00	1,342.00	88,900.00	1,331.00
BALANCE DECEMBER MONTH	7,454.83	126.76	7,895.13	136.14

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11. ACCIDENTS AND PERSONAL INJURY:

The following table gives number and time lost from compensable accidents in the past eight years.

	1948	1947	1946	1945	1944	1943	1942	1941	1940
Fatal	0	0	0	0	0	0	0	0	0
Time Lost Over 4 Months	1	3	1	0	2	4	2	1	1
Time Lost 1 to 4 Months	5	6	2	7	7	4	9	7	4
Time Lost Less than 1 Month	7	16	8	7	12	18	5	10	3
Total Compensable Accidents	13	25	11	14	21	26	16	18	11
Number of cases paid compensation for accidents prior to Jan. 1st each year	4	2	1	4	4	4	4	4	4
Number of cases paid difference in wages. (Included in above total)	1	2	0	2	2	1	2	2	3

Nature and Classification of Compensable Accidents:

On December 31, 1948 payments were being made on four accidents which occurred prior to January 1, 1948. One receives partial compensation and three are occupational disease cases.

Acc. No.	Date of Accident	Name	Injury	Days Lost
513	2- 4-48	Alfred Parlato	Contused left hip	27
514	1-27-48	Russell Kulju	Contused left hip	33
515	3- 4-48	Geno J. Paris	Bruised back, right shoulder and arm	38
516	3-24-48	Bruno Balzarini	Bruised right leg	19
517	3-24-48	Carl Almli	Burns right hand	14
518	4-26-48	Angelo Carilli	Fractured finger	23
519	5- 3-48	David Terzaghi	Bruised left arm	17
520	5- 8-48	Walter Numikoski	Bruised lower back	12
521	6-12-48	Rinaldo Philippi	Bruised right arm and shoulder	42
522	7- 1-48	William Boogren	Bruised right foot	9
523	9-11-48	John Kujala	Bruised left hip	14
524	10-23-48	Andrew Nord	Fracture both bones left forearm	Home
525	12-17-48	Frederick Wrigley	Fracture left leg	Home

There was a total of 13 compensable accidents in 1948, as compared with 25 compensable accidents in 1947.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

The only new construction for the year was the purchase of all material and the erection of a new wooden ore trestle.

Requirements for new construction are indeterminate at this time, but studies are being made relative to the surface situation which has arisen during the past few months. Particular emphasis is being made on studying the condition of the Dry Building, timber yard and timber tunnel.

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13. EQUIPMENT AND PROPOSED EQUIPMENT:

a. Tractors:

In October a new D6 Tractor equiped with and angledozer, Hystaway Crane, one 3/8 yard and one 1/2 yard clamshell bucket and a timber grapple at a total cost of $15,713.33. This is the cost after receiving a credit of $2,000. for the old Cletrac Tractor.

b. Power Shovels:

A great deal of money was spent on overhauling the electric shovel rebuilding the cab. This is the shovel used for loading out stockpile.

A new model 21 Eimco underground loader was purchased in October at a cost of $4,448.

c. Scraper Hoists:

Following is a list of scraper hoist equipment at the mine:

	1948			1947	
	Machines	Total Cost Of Repaired	Each Rep.	Repaired	Each Rep.
40 HP Sullivan	3	1	192.42		
Sullivan 15 HP Elec	17	9	318.46	8	247.80
Sullivan 20 HP Elec	3	2	354.69	1	320.47
Sullivan 25 HP Elec	5			2	273.24
Ing. Rand 15 HP Elec	5	5	530.52	1	476.63
Ing. Rand 20 HP Elec	7	2	94.53	6	201.35
Ing. Rand 25 HP Elec	8	3	754.55	3	427.45
Total	48	22	8873.15	21	5766.45

d. Drill Machines:

Purchases in 1948 and 1947 are listed below:

1948

8 - RB-12- Ing. Rand Jackhammers
2 - J50 " " "
1 - HC23 Le Roi Rock Drill
8 - Pickhammer Machines
3 - DA-30 Ing. Rand Drifters
1 - Le Roi Triple Jumbo

1947

2 - RB-12 - Ing. Rand Jackhammers
2 - J50 " " "
4 - JB-4 " " "
8 - Pickhammer Machines
6 - Jack Legs

e. Motor Haulage Cars:

1 - 65 Cu.Ft. bought from Princeton Mine second hand cost $325.00.

f. Timber Hoists:

Four new HU Utility single drum air and one A5-NN-04 double drum air were purchased during 1948.

14. MAINTENANCE AND REPAIRS:

a. Steel Trestles:

After the stockpiles were loaded out last summer the two steel trestles were found to be badly in need of a thorough overhauling. Many of the knee braces were bent and twisted. two of the knee braces on the south side of the south trestle gave way and dropped the girders, throwing the top tram car off the trestle and wrecked the car. Both trestles were thoroughly gone over and wherever necessary new braces were installed. In additon to replacing braces all were reinforeed by tieing together the braces in each group midway between the girders and the pillars.

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14. MAINTENANCE AND REPAIRS: (Cont'd)

b. Comparison of Costs - 1948 with 1947:

Maintenance and repairs listed under underground costs:

	Amount	Cost Per Ton
1948	162589.12	.225
1947	96511.12	.190
Increase	66078.00	.035

Maintenance and repairs listed by the four accounts as shown on the cost sheet:

	1948	1947	Inc.	Dec.
Comp. & Power Drills	61046.34	5089.03	55957.31	
Scraper Equipment	55093.77	55182.48		88.71
Elec. Tram Equipt.	39905.47	29576.85	10328.62	
Pumping Machinery	6543.54	6662.76		119.22
Total	162589.12	96511.12	66078.00	

Purchases 1948:

Drill Machines

3 - DA-30 Ing. Rand Power feed drifters	2187.00
1 - Le Roi Triple Jumbo	1980.00
2 - J-50 Ing. Rand Wet Jackhammers	570.00
6 - L-29 Ing. Rand Pickhammers	870.00
2 - RB-12 Ing. Rand Jackhammers (2nd hand)	500.00
6 - RB-12 Ing. Rand Jackhammers	1590.00
1 - HC-23 Le Roi Rock drill with column	770.00
2 - L-29 Ing. Rand pickhammers	310.00

Electric Scraper Hoists and Scrapers:

1 - 40 HP Sullivan Scraper Hoist	3933.00
17 - Twin City Westeeco Scrapers	4963.81
6 - Twin City Westeeco Scrapers (2nd Hand)	450.00

Locomotives & Tram Cars:

1 - Jeffery Locomotive purchased from Princeton Mine (2nd Hand)	1000.00
1 - 65 Cu.Ft. Rocker Dump Car purchased from Princeton Mine (2nd Hand)	325.00

Maintenance and repairs listed under surface costs:

	Amount	Cost Per Ton
1948	58948.40	.116
1947	44309.62	.087
Increase	14638.78	.029

Maintenance and repairs listed in the five accounts as shown on the cost sheet.

	1948	1947	Inc.	Dec.
Hoisting Equipment	17394.64	21796.61		4401.97
Shaft	10808.69	14128.67		3319.98
Top Tram Equipment	3083.22	2441.13	642.09	
D. T. & Pockets	24267.23	3858.93	20408.30	
Mine Buildings	3394.62	2084.28	1310.34	
Total	58948.40	44309.62	14638.78	

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15. POWER:

DETAIL OF ELECTRIC CURRENT PURCHASED COMPARED WITH 1947

	1948 - 12 Mos. Optg.	Per Ton	1947 - 12 Mos. Optg.	Per Ton.
Stoping	3693.19	.007	3519.39	.007
Ventilation	12245.95	.024	12491.30	.025
Pumping	19875.31	.039	20976.96	.041
Hoisting	29409.63	.058	29592.90	.058
Stocking Ore	815.26	.002	923.99	.002
Dry House	687.60	.001	673.95	.001
Lights at Levels	1091.08	.002	846.43	.002
Compressors	36558.60	.072	37232.28	.073
Electric Haulage	3395.35	.007	3228.57	.006
Shops	379.44	.001	385.67	.001
Heating	16.52	.000	15.69	.000
Office	49.40	.000	53.23	.000
Storage Battery Loco.	31.00	.000	32.00	.000
Electric Shovel	630.37	.001	771.68	.002
Surface Lights	397.54	.001	505.96	.001
Total	109276.20	.215	111251.00	.219
Main Line Meter - KW	8,143,686		8,325,989	
Separate Meter Readings	7,925,742		7,994,036	
Line Loss	217,944		331,953	
Product	506,600		508,100	
KW. Per Ton (Inc. Line Loss)	16.0752		16.3865	
Cost Per K.W. (Avg.)	.0137875040		.01391675	
15 Min. Demand (Avg.)	1531		1538	
Load Factor (Avg.)	60.17		61.75	

17. CONDITION OF PREMISES:

The grounds around the premises were kept in good condition throughout the year.

b. Athens Mine Houses:

The following statement gives the total cost of repairs and the average cost per house for 1948 and 1947:

Year	No. Houses	Amount Repairs	Avg. Cost Per House	Rental Income	Taxes and Insurance	Net Income
1948	31	$3,351.86	$108.12	6,017.89	1,907.52	758.51
1947	31	1,083.38	34.95	6,032.32	1,880.15	3,062.04

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18. NATIONALITY OF EMPLOYEES:

The following statements show, first, the nationality by parentage, and secondly, a separation of nationalities into American and Foreign Born.

As to Parentage	1948	Percent	1947	Percent
Finnish	135	39.36	137	40.3
Italian	66	19.25	66	19.4
English	62	18.08	57	16.7
French (Canadian)	32	9.33	37	10.9
Swedish	27	7.88	23	6.7
French (France)	3	.88	1	.3
Danish	1	.29	1	.3
German	5	1.45	3	.9
Austrian	5	1.45	4	1.2
Norwegian	4	1.16	5	1.5
Irish	1	.29	3	.9
Greek	1	.29	1	.3
Polish	1	.29	1	.3
Scotch	0	.00	1	.3
Total	343	100.	340	100.

	American Born		Foreign Born	
	1948	1947	1948	1947
Finnish	104	101	31	36
English	54	48	8	9
Italian	38	35	28	31
French (Canadian)	30	37	2	
Swedish	24	20	3	3
French (France)	3	1		
Scotch	0	1		
German	5	3		
Austrian	5	4		
Norwegian	3	5	1	
Irish	1	3		
Greek			1	1
Danish	1	1		
Polish	1	1		
Total	270	260	74	80

CAMBRIA-JACKSON MINE
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1. GENERAL:

The Cambria-Jackson Mine operated on a twelve-shift per week schedule during the entire year. A crew of about ten men were employed on the midnight shift to take down timber supplies and hoist rock, as well as any accumulation of ore in the pockets. All rock development was also carried on during the midnight shift, to allow for the handling of rock. During the year there were three major interruptions to production, in order to improve the general condition of the main hoisting shaft. Three five-day shutdowns were made during January and February to remove old blocking, casing plank and loose rock behind the shaft timbers. A vacation period of two weeks, during the first half of August, was used to further improve the shaft by the installation and concreting of fourteen steel sets.

Excepting these shutdowns, the Cambria-Jackson had a successful year and produced 491,817 tons, absorbing the high-sulphur ore produced at the west end of the property in its standard grade. With reference to the reserves as of December 31st, 1948, there was no standard ore developed and the present figures show a loss of approximately 34,000 tons; a gain of 29,000 tons was developed in the high-sulphur areas to the west.

One of the outstanding highlights during the year was the disappointment in the results of diamond drilling to determine the extent of ore below the 7th level. This drilling indicated that all remaining ore lies within a depth of sixty feet below the 7th, or bottom level.

Development work for the new 8th level was started in December, 1948. This development will include two pockets and a conveyor gallery, at an angle of fifteen degrees, to a vertical depth of eighty feet. This will be the first time on the Marquette Range that a conveyor will be used underground to elevate ore between levels. Its success may well have a considerable influence in the changing of the elevation of ore between levels, where shaft sinking is not practical.

2. PRODUCTION
SHIPMENTS &
INVENTORIES:

a. Production by Grades:

	1948	1947	Increase	Decrease
Cambria Lease Ore	856	692	164	
Jackson Strip Ore	490,961	555,974		65,013
Rock	10,220	6,356	3,864	
Total Hoist	502,037	563,022		60,985

The above figures include a stockpile overrun of 5,954 tons.

b. Shipments:

	Pocket Tons	Stockpile Tons	Total Tons	Total Tons Last Year
Cambria Lease				5,070
Jackson Strip	324,034	187,657	511,691	609,937
Total 1948	324,034	187,657	511,691	615,007
Total 1947	357,341	257,666	615,007	
Decrease	33,307	70,009	103,316	

Shipments decreased 16.8% in 1948 and were 19,874 tons more than the product for the year.

CAMBRIA-JACKSON MINE
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2. PRODUCTION SHIPMENTS & INVENTORIES: (CONT.)

c. Stockpile Inventories:

	Dec. 31, 1948	Dec. 31, 1947	Increase	Decrease
Cambria Lease	856		856	
Jackson Strip	32,165	52,895	—	20,730
Total	33,021	52,895		19,874

d. Division of Product by Levels:

	1948	Percentage	1947	Percentage
6th Level	79,144	16.09	111,025	20.04
7th Level	412,673	83.91	443,080	79.96
Total	491,817	100.00	554,105	100.00

e. Production by Months:

Month	Cambria Lease	Jackson Strip	Total Ore	Rock
January		33,742	33,742	864
February		37,862	37,862	856
March		51,026	51,026	800
April		47,335	47,335	816
May		39,760	39,760	1,236
June		45,102	45,102	1,228
July		42,807	42,807	1,316
August		23,024	23,024	332
September		42,625	42,625	996
October		51,193	51,193	832
November		40,009	40,009	88
December	856	30,522	31,378	856
	856	485,007	485,863	10,220
Overrun		5,954	5,954	
Total 1948	856	490,961	491,817	10,220
Total 1947	692	553,413	554,105	6,356
Increase	164			3,864
Decrease		62,452	62,288	

f. Ore Statement:

	Camb.Lease	Jack. Strip	Tot. 1948	Tot.1947
On hand Jan. 1, 1948		52,895	52,895	111,236
Output for year	856	485,007	485,863	541,672
Overrun		5,954	5,954	14,994
Total	856	543,856	544,712	667,902
Shipments		511,691	511,691	615,007
Bal.on hand Dec.31,1948	856	32,165	33,021	52,895
Increase in output	461			247,495
Decrease in output		56,270	55,809	
Increase in ore on hand	856			
Decrease in ore on hand		20,730	19,874	

1948 - Six 2-8 hr. shifts 1-1-48 to 12-31-48.

1947 - Six 2-8 hr. shifts 1-1-47 to 12-31-47.

1946 - Five 2-8 hr. shifts and 1 1-8 hr. shift 1-1-46 to 6-24-46.
Six 2-8 hr. shifts 6-24-46 to 12-31-46.

g. Delays:

1-8-48, 2-1/2 hours delay - Loss of product - 200 tons.
Repair larry car.

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2. PRODUCTION SHIPMENTS & INVENTORIES: (CONT.)

g. Delays: (Cont.)

2-2-48, 2 hours delay - Loss of product - 300 tons.
Burned-out coil on larry car.

2-28-48, 1-1/2 hours delay - Loss of product - 130 tons.
Failure of skip catches to engage.

3-27-48 - No loss of product.
Compensator burned, engine house.

3-30-48 - No loss of product.
Burned-out larry car motor.

4-3-48 - No loss of product.
Larry car worm gear broken.

4-23-48 and 4-24-48, 18-3/4 hrs. delay-Loss of product-2,275 tons.
This delay resulted from the burning-out of two coils in the main hoisting motor. This was caused by an apparent surge of current through the substation, which also supplies Mather "B" Mine. Operations were resumed on April 25th and the capacity of the skips was reduced from 5.25 to 4.8 tons, in order to reduce the load on the motor. A complete rewind was immediately ordered and arrangements were made for a spare motor of reduced power to be used during the rewinding period.

6-17-48, 1 hour delay - Loss of product - 100 tons.
Repair wall-plate in shaft.

6-19-48, 1 hour delay - Loss of product - 120 tons.
Broken skip runners above collar.

6-28-48, 9 hours delay - Loss of product - 1,000 tons.
Need of realigning hoist motor coupling.

7-6-48 and 7-7-48, 15-3/4 hours delay-Loss of product-1,150 tons.
Old timber jammed between shaft and cage, throwing four sets out of line.

9-21-48, 2 hours delay - No loss of product.
Repairing skip.

10-28-48, 1-1/4 hours delay - No loss of product.
Repairing cage.

The total loss of product from the thirteen delays listed above amounted to 5,275 tons, as compared with nine delays and a loss of 1,225 tons in 1947.

h. Delays due to Lack of Current:

The comparatively large number of delays due to lack of current was the direct result of low voltage resulting from an abnormal power supply which prevailed throughout the year, due to the lack of water reserves in the storage basins of the hydro-electric plants.

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2. PRODUCTION SHIPMENTS & INVENTORIES: (CONT.)

h. Delays due to Lack of Current: (Cont.)

2-16-48, 1 hour delay - No loss of product.
Broken power-line at substation.

3-4-48, 1/2 hour delay - Loss of product - 80 tons.
Change transformer.

3-9-48 - Loss of product - 100 tons.
Deducted fifteen skips night shift which were light, due to low voltage.

7-9-48, 1-1/2 hours delay-Loss of product-150 tons.
Power failure on account of lightning.

11-20-48 - Loss of product - 200 tons.
Low voltage, both shifts.

3. ANALYSIS:

a. Average Mine Analysis on Output:

Grade	Tons	Iron	Phos.	Silica	Sulphur
Cambria-Jackson	491,817	58.69	.087	9.63	.049

b. Average Mine Analysis on Straight Cargoes:

All ore shipped was mixed with other grades.

4. ESTIMATE OF ORE RESERVES:

a. Developed Ore:

Assumption: 12.00 cubic feet equals one ton.
10% deduction for loss in mining and rock.

Percentage of Bessemer: None.

	Standard Ore				Sulphurous Ore	
	Negaunee		Ishpeming		Negaunee	Ishpeming
Area	Cambria Lease	Jackson Strip	Jackson Strip	Total		Jackson Strip
Above 5th Lev.-Dep.#1	24,394			24,394		
Bet.5th&6thLev.-Dep.#1	41,146					
Bet.5th&6thLev.-Dep.#2	2,667	44,821				
Tot.Bet.5th&6th Levs.	43,813	44,821		88,634		
Bet.6th&7thLev.-Dep.#2	3,188	861,431			470,770	
Bet.6th&7thLev.-Dep.#3		6,288	41,365			
Bet.6th&7thLev.-Dep.#4						85,018
Tot.Bet.6th&7th Levs.	3,188	867,719	41,365	912,272	470,770	85,018
Below 7th Level-Dep.#2		14,167			163,760	
Below 7th Level-Dep.#3		1,979	7,500			
Below 7th Level-Dep.#4						190,938
Tot.Below 7th Level		16,146	7,500	23,646	163,760	190,938
Gross as of Nov.30,1948	71,395	928,686	48,865	1,048,946	634,530	275,956
Less Dec.1948Production	856	25,222		26,078		5,300
Gross as of Dec.31,1948	70,539	903,464	48,865	1,022,868	634,530	270,656
Less 10% for Mng.&Rock	7,140	92,869	4,886	104,895	63,453	27,596
Net Tot.as of 12-31-48	63,399	810,595	43,979	917,973	571,077	243,060

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4. ESTIMATE OF ORE RESERVES: (CONT.)

b. Total Developed STANDARD Ore:

	Cambria Lease	Jackson Strip	Total
1948 Estimate	63,399	854,574	917,973
1947 Estimate	65,531	1,378,008	1,443,539
Decrease	2,132	523,434	525,566

The ore estimate of the Cambria-Jackson, composed of the Cambria Lease and Jackson Strip, is divided between the City of Negaunee and the City of Ishpeming. To obtain the amount of ore developed, the 1948 production (491,817) is deducted from the estimated decrease in ore reserves of 525,566 tons, which shows that 33,749 tons of standard ore were lost or over-estimated in 1947. The loss of this ore resulted from further diamond drilling on the 7th level, which indicated a general reduction in size of the areas in the east portion of the main orebody.

During the year approximately 29,000 tons of high-sulphur ore were developed west of the main north-south fault.

c. Expected Average Natural Analysis:

Grade: Non-Bessemer Trade Name: Cambria-Jackson

Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
917,973	51.32	.087	8.31	.17	2.46	.55	.18	.035	3.00	12.50

Grade: Non-Bessemer Trade Name: Cambria-Jackson Special

Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
814,137	52.50	.105	6.56	.11	2.44	.61	.44	.263	1.69	12.50
1,732,110										

d. Ore in Stock: Average Natural Analysis:

Grade: Non-Bessemer Trade Name: Cambria-Jackson

Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
33,021	50.733	.080	9.29	.17	2.48	.50	.18	.052	2.12	12.53

5. LABOR AND WAGES:

a. Comments:

There were 228 men on the payroll on December 31st, 1948, as compared with 229 on December 31st, 1947, showing a decrease of one man. The following is a compilation of accessions and separations:

Accessions:	
Transferred from Lloyd Mine	5
Transferred from Storehouse	8
Transferred from Negaunee Mine	1
Transferred from Mather "B" Mine	1
Transferred from CliffsPower&LightCo.	2
Straight Hires	9
Total	26
Separations:	
Retired	1
Transferred to other mines	9
Discharged	6
Quit	9
Fatally injured	1
Deceased	1
Total	27

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5. LABOR AND WAGES: (CONT.)

b. Comparative Statement of Wages and Product:

	1948	1947	Increase	Decrease
Product:	491,817	554,105		62,288
No. Shifts and Hours 1-8	6	3	3	
2-8	277	297	-	20
Total	283	300		17
Average No. Men Working:				
Surface	53-1/2	52	1-1/2	
Underground	170-3/4	166-1/2	4-1/4	
Total	224-1/4	218-1/2	5-3/4	
Average Wages per Day:				
Surface	11.14	10.25	.89	
Underground	12.88	12.19	.69	
Total	12.46	11.73	.73	
Average Wages per Month:				
Surface	267.12	255.14	11.98	
Underground	309.11	303.70	5.41	
Total	299.09	292.15	6.94	
Product per Man per Day:				
Surface	31.94	35.67		3.73
Underground	10.00	11.13		1.13
Total	7.62	8.48		.86
Labor Cost per Ton:				
Surface	.348	.287	.061	
Underground	1.288	1.095	.193	
Total	1.636	1.382	.254	
Average Product Mining:				
Stoping	31.63	29.26	2.37	
Development in Ore	7.78	9.56		1.78
Total	31.11	28.69	2.42	
Avg.Wages Contract Labor:	13.62	13.47	.15	
Total Number of Days:				
Surface	15,400½	15,536		135½
Underground	49,182	49,786		604
Total	64,582½	65,322		739½
Amount for Labor:				
Surface	171,490.27	159,209.97	12,280.30	
Underground	633,369.70	606,799.42	26,570.28	
Total	804,859.97	766,009.39	38,850.58	
Avg.Wages per Mo.as per Labor Statement-Less Capt.and Clerks:				
Surface	268.25	257.42	10.83	
Underground	308.43	303.29	5.14	
Total	299.36	292.97	6.39	

Proportion of Surface to Underground Men:

1948 - 1 to 3.19
Six 2-8 hour shifts 1-1-48 to 12-31-48

1947 - 1 to 3.20
Six 2-8 hour shifts 1-1-47 to 12-31-47

1946 - 1 to 2.70
Five 2-8 hour shifts and 1 1-8 hour shift 1-1-46 to 6-24-46
Six 2-8 hour shifts 6-24-46 to 12-31-46

Note:

	1948	1947
Proportion of Vacation Pay for Surface	6,571.38	5,838.40
Proportion of Vacation Pay for Underground	21,944.93	21,501.56
Total	28,516.31	27,339.96

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6. SURFACE:

a. Buildings:

Engine House:

In August, the engine house was painted with aluminum paint. Previously, the east addition had not been painted.

Two large overhead beams were installed over and near the Nordberg hoist and motor to facilitate the handling of this large equipment in and out of the building.

Dryhouse:

The tin roof of the dry was renailed and painted.

Office:

There were no major improvements made in the office, with the exception of the painting of the roof.

Shops:

The exterior of the new shop building was repointed and all window frames were scraped and painted.

An overhead monorail was installed over the west entrance to the shop building to be used in moving heavy equipment from trucks to the shop. This monorail was also extended west across the driveway and over a platform which was used for scrap and heavy equipment.

Storage Building:

A new steel storage building was erected during the year under Authorization No. CC-241. This building is 24x96' and is located west of the shops. The south end of the building provides a garage for the hydrocrane. The floor is elevated above the roadway to allow equipment to be moved on and off of trucks. In October, all equipment which had previously been stored in the old shop buildings was moved to the new building. The storage also includes shaft runners, ladders, wire, wire rope and surface tackle.

Oilhouse:

A new concrete-block building 18x18' in size, to be used for the storage of all grease and oil, was constructed 44 feet east of the shop building and in line with the surface garage. This building replaces the small frame structure which was located south of the office. The old frame oilhouse was moved to a position south of the new storage shed and is being used for the storage of various underground wooden equipment which is made in the carpenter shop.

Garage:

An addition 20x18' was built on to the garage to be used for the mine truck and tractor. The doors are located on the south side and a greasing pit was installed in that part of the garage which is used for the tractor.

Old Garage and Shop Buildings:

These buildings will be sold and removed from the property next spring, or summer.

b. Ore and Rock Trestles:

The north and south trestles were filled to capacity, just prior to the 1948 shipping season. By using a second set of railroad rails and the 54-B shovel, it was possible to load out all ore in stock without having to dismantle the trestles. This proved very economical and during the loading season it was necessary to replace only three trestle legs.

The rock trestle to the west was extended 72 feet, to allow the rock to fall into the old pit located near the end of the trestle.

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6. SURFACE: (CONT.)

c. Railroad Tracks:

Track work at the mine during 1948 consisted of maintenance of the main line and pocket tracks, regrading the pocket track west of the shaft, where a settlement occurred during the winter, and the laying of track for loading out of the stockpiles. Approximately 700 feet of track was laid northwest of the main line and south of the mine buildings. This track was graded and will be used for the storage of lagging, poles and lumber.

d. Fences and Caves:

All fences inclosing the caved ground to the west and south were inspected and maintained during the year.

The discharge ditch to the south was relocated to increase the grade and a new channel was blasted through the swamp to drain the area.

e. Grounds:

The road which approaches the mine from the east was relocated near the engine house. A six-inch curbing was constructed along the north side of the road. The two large areas just south of the highway north of the mine were resurfaced and converted into a lawn. A row of cedar trees was planted between the west lawn and the main parking area. The parking lot was enlarged to the west and provides ample space for all employees' cars. In general, the appearance of the property has been greatly improved and many favorable comments have been heard.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking in 1948.

b. Development:

The following table gives a comparison of the total feet of drifting and raising in ore and rock in 1948 and 1947:

	Drifting		Raising		Grand
Year	Ore	Rock	Ore	Rock	Total
1948	8,763'	1,268'	4,181'	1,104'	15,316'
1947	553'	722'	367'	None	1,642'
Increase	8,210'	546'	3,814'	1,104'	13,674'

The unusually large increase in development in ore and rock was due to a change in development classification in 1948. During that year development included not only rock drifting and exploratory work, but also premining drifting and raising on the active mining sublevels. If the latter classification was deducted, the total development footage would remain considerably higher than that reported in 1947.

b-1. Rock Development:

The following table gives the total footage of rock drifting and raising in 1948 and 1947:

	Drifting	Raising	Total 1948	Total 1947
6th level and above	607'	687'	1,294'	382'
7th level and above	661'	417'	1,078'	340'
Total 1948	1,268'	1,104'	2,372'	722'
Total 1947	722'	None	722'	
Increase	546'	1,104'	1,650'	

The rock development during the year was concentrated in two areas.

7. UNDERGROUND: (CONT.)

b-1. Rock Development: (Cont.)

A drift, south of the shaft on the 6th level, was completed to develop the ore located by diamond drilling on and above the 5th level. The extreme south end of this crosscut was also used to explore, by diamond drilling, the territory to the south and west between the 6th and 7th levels. The second area of rock development was located in the east portion of the main orebody below the 6th level mining pillar. This development included the driving of the No. 770 Crosscut to the southwest, from which two raises were extended to the 6th level elevation.

There was also some rock drifting raising chargeable to diamond drilling. This work was done to allow the drilling to be carried on south of the orebody, so that the holes could be drilled from an improved vantage point.

b-2. Ore Development:

The following is a summary of ore development in 1948, as compared with 1947:

	Drifting	Raising	Total 1948	Total 1947
6th level and above	1,689'	856'	2,545'	186'
7th level and above	7,074'	3,325'	10,399'	734'
Total 1948	8,763'	4,181'	12,944'	920'
Total 1947	553'	367'	920'	
Increase	8,210'	3,814'	12,024'	

The ore development footage for the year was fairly well distributed throughout the entire mine. The more important places include the development of the 5th level area in the Cambria Lease, the development of No. 11 Stope south of the dike near the No. 750 Crosscut, the completion of development in No. 16 Stope adjacent and east of the fault dike, and the ore raising in Raises No. 770 and No. 774 to develop the 6th level orebody from the 7th level crosscut. A considerable portion of the ore drifting and raising could be classed as premining development and was done in conjunction with mining by the sublevel caving method. It might be added that in a number of mining areas the ground does not readily cave when undercut. It is therefore often necessary to extend a small raise from the transfer, or caving drift, in the pillar, and thereafter drift to the open area, from which the floor pillar can be drilled for mining. This work accounts for over half of the total ore raising which is shown above.

c. Stoping:

(1) General:

At the end of 1948 there was a total of 23 contracts. Of this number, 10 were sublevel caving or developing for sublevel caving, 6 gangs were repairing, 4 gangs were developing in ore and rock, and 3 contracts were cutting raises on new sublevels, preparatory to drifting. In 1947, a total of 21 contracts were in operation. It will be noted that at the present time there are no contracts mining by the top-slicing method. It should also be noted that the large number of contracts carrying on repair work is more or less temporary and resulted from general mining conditions during the month, and is not an average for the year's operation.

One of the highlights in the general operation of the mine during 1948 was the gradual increase in the amount of timber repair work necessary to maintain production. Throughout the year approximately 25% of the time of all active mining contracts was chargeable to timber repair, or non-productive work. This figure compares with 15.5% during 1947.

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(1) General: (Cont.)

The practice of taking down timber and supplies and hoisting rock was continued on the midnight shift by a crew of eight men throughout 1948. In May, the practice of bundling lagging and poles with two small steel bands was adopted and has greatly speeded up the lowering of supplies, as well as handling the supplies in the mine.

The location and number of mining contracts at the end of 1948, as compared to 1947, are as follows:

Location of Contracts	December 31st, 1948	December 31st, 1947
Sixth level and above		
370' sublevel	1	
180' sublevel		1
140' sublevel		2
Sixth level	1	1
Seventh level and above		
90' sublevel	1	1
70' sublevel		1
60' sublevel		2
25' sublevel	2	2
00' sublevel	2	3
-25' sublevel	4	4
-50' sublevel	6	2
-60' sublevel	2	2
-80' sublevel	2	
Seventh level	2	
Total	23	21

Occupation of contracts was as follows:

	Dec.31st,1948	Dec.31st,1947
Sublevel caving,or developing for sublevel caving	11	17
Sublevel stoping	2	1
Developing for sublevel stoping	2	1
Top-slicing		1
Drifting	1	1
Raising	2	
Repairing	5	
Total	23	21

(2) Detail of Stoping:

Cambria Lease:

Sublevels above the 6th level:

5th Level Orebody:

In general, drifting operations were being carried on in the south crosscut on the 6th level. The drift was advanced 215 feet, to a point 555 feet south of the shaft. A drill-hole cutout was made and three diamond-drill holes were drilled to the south and west. At a point 75 feet north of the cutout a top-timber transfer was driven to the east, and two untimbered rock raises were extended to the 370-foot sublevel (270 feet above). At this elevation a cutout was made and the west raise was extended on to the 5th level, a distance of 55 feet. In December a stope transfer drift was driven to the southeast, where 27 feet of ore was encountered. The drift was extended to a point 78 feet from the raise, where development was then started above to mine this small orebody by the sublevel stoping method. It should be added that a second orebody was located by drilling, further to the east. However, this will not be

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7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

Cambria Lease: (Cont.)

Sublevels above the 6th level: (Cont.)

5th Level Orebody: (Cont.)

developed at this elevation until the limits can be determined by drifting above. Near the end of the year the limits of the first orebody were fairly well defined, and there was no appreciable difference between the drill-hole outline and the development outline. Approximately 65,000 tons are estimated in these two small orebodies.

Jackson Strip:

180' Sublevel - 6th Level South Riser:

Mining operations were being carried on at this elevation in January, 1948. The area is bounded on the north by a branch dike and on the south by the irregular jasper capping which dips to the south. Mining operations were completed in April, and resumed on the 140-foot sublevel.

140' Sublevel-6th Level Orebody,North and South Risers:

This mining area was opened late in 1947, to the north. In January, two contracts were carrying on operations. As previously mentioned the jasper capping is very irregular, and a considerable reduction in size was noted on this elevation south and east of the crossdike. It is rather apparent that the footwall also is very irregular, as it dips to the southwest. Mining operations were completed in July, and resumed on the 120-foot sublevel soon thereafter.

120' Sublevel-6th Level Orebody,North and South Risers:

The opening of this sublevel was marked by a considerable amount of exploratory work adjacent to the crossdikes, which have been used as mining limits for a number of sublevels. Inasmuch as the 7th level development had not been completed in July, it was necessary to open up this sublevel just above the top of the timber of the 6th level. A marked reduction in size was found in the south riser, immediately under the capping. Considerable water was encountered in this area, which has been wet for the past two sublevels. Mining operations were completed in December, from Raises No. 624, No. 620 and No. 604.

6th Level - North and South Risers:

The new raise from the 7th level crosscut was completed to the 6th level elevation in October. This raise is located just north of the dike in the north riser, and a drift was driven north to the 6th level. Near the end of December drifting operations were started to the south, to open the south riser under the jasper capping.

Sublevels above the 7th level:

90' Sublevel - 6th Level Orebody:

In December, Raise No. 770 which had previously been completed to the 6th level elevation, was cut out at a point 25 feet below the level. Near the end of December drifting operations were started, to develop the area for sublevel caving.

60' Sublevel - North-Central Deposit:

Mining operations in this area have been carried on for several years previous, and early in 1948 the orebody was nearing exhaustion. Raise No. 747 has been used for a number of sublevels and on the 60-foot elevation practically all the ore lies to the west, the footwall to the north, and the dike to the south. Mining was completed by sublevel caving in February, and operations were resumed on the 35-foot sublevel immediately thereafter.

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7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

Jackson Strip: (Cont.)

Sublevels above the 7th level: (Cont.)

50' Sublevel - Central Orebody:

Early in 1948 sublevel stoping operations were being carried on south of Raise No. 709 and adjacent to the main crossdike, which divides the east and central orebodies. A long narrow pillar approximately 50 feet in height was being mined to the north, a distance of 250 feet. After completing the stope in May, the transfer drift was caved to the raise. Operations were completed in June.

35' Sublevel - North-Central Orebody:

In February mining operations were continued at this elevation and consisted of caving the extreme west end of the transfer, where approximately 23 feet of ore lay on either side the transfer adjacent to the jasper footwall to the north and the boundary dike to the south. The remaining northeast end of the transfer was in the footwall and was allowed to remain open, to facilitate traveling to the lower sublevels of No. 16 Stope as well as for ventilation.

25' Sublevel - Central Orebody:

Early in January, two gangs were completing the mining of an area near the jasper footwall by the top-slicing method. This area was very irregular and two small dikes intersected the ore from east to west. In March these operations were completed from Raises No. 711 and No. 713, completing the sublevel in this location and ending the top-slicing mining method. During the remainder of the year, mining operations were concentrated adjacent to the main crossdike from Raises No. 709 and No. 711. In December, two gangs were completing operations in small remaining areas.

00' Sublevel - Central Orebody:

In January, four contracts were completing the mining of several small ore pillars along the footwall near Raises Nos. 715, 717 and 741. It might be mentioned that due to a large jasper horse which apparently comes in from the capping, the width of ore has been greatly reduced. This jasper at one point narrows the orebody to approximately 80 feet, as compared with a width of over 250 feet to the west. The gradual undercutting of this jasper on lower sublevels accounted for a considerable amount of ground pressure which came into evidence in October, November and December.

In May, operations were started in opening an area to mining lying between the crossdike to the east and the jasper horse to the west. Two gangs carried on mining operations by crosshauling from a north-south transfer drift. In December operations were completed, and mining was resumed by crosshauling from the connecting drift between Raises No. 711 and No. 713.

-25' Sublevel - Central Orebody:

With the exception of a small area mined the preceding year, this entire sublevel was mined during 1948. The area was approximately 400 feet in length by 200 feet in width. Mining operations were carried on in a north-south direction from small raises, which were extended up from the sub below along the connecting drifts. In December several small areas were being completed in the central portion of the orebody, adjacent to the jasper horse which on this sublevel was considerably reduced in size.

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

Jackson Strip: (Cont.)

Sublevels above the 7th level: (Cont.)

-50' Sublevel - Central Orebody:

In February, Raise No. 736 was completed from the level to the -50-foot sublevel and mining operations were started in the extreme west end of this central deposit. Several caving drifts were driven to the south under the jasper capping which dips to the west, enlarging the area as lower sublevels are opened. All connecting drifts were completed, and mining was started parallel to the footwall from Raise No. 731. In October mining operations on the east side of the deposit adjacent to the jasper horse were stopped, due to the sudden ground pressure which resulted from a partial undercutting of the jasper. This condition was anticipated and Raise No. 720 was cut out so that mining operations could continue from north to south, under improved mining conditions and with less interference from water.

An exploratory drift was also driven from Raise No. 720 to the south, to explore the area south of the dike as well as provide a drill-hole location.

In December, five contracts were located at this elevation, three mining and two developing. It should be mentioned that during the course of mining operations in the central part of the deposit a considerable amount of jasper and lean ore were encountered, which greatly reduced production as well as lowering the grade of ore mined.

West Deposit:

Early in January, one mining gang was caving in the extreme west end of the west deposit. These operations were adjacent to the Mather boundary along the footwall, where the ore is approximately 80 feet in width and 220 feet in length. Operations were completed in June.

-60' Sublevel - Central Deposit (West):

Stoping operations were continued in the area adjacent to the fault dike on sublevels above this elevation. In 1947, a 165-foot transfer was driven west of Raise No. 739. Since that time stoping operations were carried on on the -50-foot, -25-foot, 00-foot, +25-foot and +35-foot sublevels. Near the end of the year, the stope was approximately 120 feet in width and 80 feet in length. Further development was necessary near the end of the year to the south, where some additional ore was found. Late in December a new raise was extended to a point 16 feet above the level, near Raise No. 739 and south of the present transfer. From this raise a new transfer will be driven to the west, in order to mine the ore below the development on the south side of the stope.

West Deposit:

In 1948, the entire west deposit was mined on the -60-foot sublevel. The average width was about 35 feet and the length about 390 feet. This narrow orebody is bounded on the north and south by jasper, and widens to approximately 100 feet as it approaches the Mather Mine boundary to the west. In December mining operations were in progress from Raise No. 767, adjacent to the boundary and immediately under the jasper capping. Inasmuch as this sublevel is within 30 feet of the 7th level, no additional sublevels will be mined. This is due to the need of preventing weight on the level drift, which connects by a rock raise to the Mather Mine and serves as a second outlet for both properties.

In August a cutout was made above the level timber, south of the dike in the No. 750 Crosscut. Drifts were extended to the west and east

7. UNDERGROUND: (CONT.)

c. Stoping: (Cont.)

(2) Detail of Stoping: (Cont.)

Jackson Strip: (Cont.)

Sublevels above the 7th level: (Cont.)

West Deposit: (Cont.)

of the cutout, parallel to the dike. Near the end of the year, a stope was developed east of the cutout. The orebody by this exploration was found to be approximately 60 feet in height and 50 feet in width, and in December mining had progressed to a length of 80 feet.

7th Level:

In May, a new crosscut was started in the vicinity of Raise No. 709 and was driven parallel to the dike in a southwesterly direction for a distance of 310 feet. Near the end of the year two raises had been extended to the 6th level elevation, to be used in mining the ore pillar which had previously been mined from the 6th level.

Near the middle of the year, the No. 720 Crosscut which had been abandoned several years ago was repaired and re-opened. Raise No. 720 was driven to the -50-foot sublevel in August. It was anticipated that this raise could be used in draining the water, which persists adjacent to the main east-west dike. As previously mentioned, it was necessary to use this raise for mining as well as drainage.

Throughout the year all main level drifts were kept in repair, and over 200 4-inch H-beam sets were installed where necessary.

d. Timbering:

There was slightly more timber used in 1948 in proportion to the production, due to the increase in the amount of timber repairs necessary in the central deposit. As previously mentioned the heavy ground pressure was the result of undercutting a large jasper intrusion, and frequently it was necessary to repair two or three times over a raise or in connecting drift before the sublevel was exhausted. The increased cost of all timber was due to the lower production, as well as a rise in the general cost of material.

A large number of steel sets were used in place of timber in the main level drifts. This will greatly reduce the amount of maintenance necessary in the future.

Statement of Timber Used:

	Lineal Feet		Avg. Price per Ft.		Amount	Amount
	1948	1947	1948	1947	1948	1947
8" Stulls	21,008	22,981	.1167	.1012	2,451.31	2,326.15
10" Stulls	31,604	40,906	.1812	.1679	5,728.07	6,868.69
12" Stulls	18,635	12,516	.2237	.2204	4,167.73	2,758.59
14" and Over	5,885	2,001	.2846	.2692	1,674.68	538.68
Total	77,132	78,404	.1818	.1593	14,021.79	12,492.11
Hardwood Cribbing	8,890	19,567	.0423	.0356	375.90	697.40
6" Cribbing	35,702	20,935	.0661	.0598	2,360.87	1,252.63
Lagging - 7'	632,940	609,076	.0153	.0151	9,709.96	9,207.08
Poles - 9½'	224,864	311,203	.0269	.0245	6,047.66	7,622.01
Total	902,396	965,629	.0205	.0196	18,494.39	18,958.93
Grand Total					32,516.18	31,451.04

	1948	1947
Product	491,817	554,105
Feet of timber per ton of ore	.157	.141
Feet of cribbing per ton of ore	.091	.073
Feet of lagging per ton of ore	1.287	1.099
Cost per ton for timber	.0285	.0226
Cost per ton for cribbing	.0056	.0035
Cost per ton for lagging	.0197	.0166
Cost per ton for poles	.0123	.0141
Total cost per ton	.0661	.0568

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7. UNDERGROUND: (CONT.)

e. Drifting and Raising:

A direct comparison by years as to the amounts of drifting and raising in rock and ore has been given under the "b. Development" heading.

f. Explosives, Drilling and Blasting:

Year	Cost per Lb. for Powder	Lbs. Powder per Ton of Ore	Cost per Ton for Powder	Cost per Ton Fuse & Caps	Cost per Ton Total
1948	.1405	.3843	.0539	.0117	.0656
1947	.1344	.4506	.0606	.0105	.0711

Statement of Explosives Used: (Ore Development and Stoping):

	Quantity	Average Price	Amount 1948	Amount 1947
Gelamite #1 - Lbs.	12,700	14.36	1,823.26	135.38
Hercomite #2X - Lbs.	176,300	14.01	24,704.50	31,872.15
Total Powder	189,000	14.04	26,527.76	32,007.53
Primacord - Feet	7,600	32.00	243.20	
Tamptite Shells	5,170	6.49	33.55	2.64
Tamping Bags				25.00
Fuse - Feet	545,882	7.75	4,231.95	4,173.87
Caps - #6	67,285	13.36	898.90	1,115.04
Fuse Lighters-Hot Wire	30,000	8.47	254.24	201.55
Fuse Lighters-Master	500	19.86	9.93	
Detonators - Electric	385	14.02	53.96	
Total Fuse, Etc.			5,725.73	5,518.10
Total All Explosives Stoping,Etc.			32,253.49	37,525.63

	1948	1947
Product	491,817	554,105
Pounds of powder per ton of ore	.3843	.4506
Cost per ton for powder	.0539	.0606
Cost per ton for fuse,caps,etc.	.0117	.0105
Cost per ton for all explosives	.0656	.0711

Statement of Explosives Used: (Sinking,Rock Development,Etc.):

	Quantity	Average Price	Amount 1948	Amount 1947
Gelamite #1 - Lbs.	9,150	14.35	1,312.76	285.00
Hercomite #2X - Lbs.	12,675	13.74	1,741.13	1,075.85
60% Gelatin - Lbs.	1,617	16.67	269.59	
Total Powder	23,442	14.18	3,323.48	1,360.85
Lead Wire - Feet	875	26.00	22.75	
Fuse - Feet	38,268	7.72	295.36	197.61
Caps - #6	4,592	13.72	63.01	49.99
Primacord - Feet	2,000	32.00	64.00	32.00
Tamptite Shells				5.28
Detonators - Electric	2,832	15.78	446.92	
Total Fuse, Etc.			892.04	284.88
Total All Explosives Rock Dev.,Etc.			4,215.52	1,645.73
Total All Explosives Used in Mine			36,469.01	39,171.36
Average Price per Pound for Powder			.1405	.1344
Exp's chgd.to Pumping Mach.(Apr.May,June&Nov.)			239.67	
Exp's chgd.to Exploring in Mine (Dec.)			205.62	
Exp's chgd.to Ventilation (Mar.)				238.10
Total as per Cost Sheet			36,914.30	39,409.46

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7. UNDERGROUND: (CONT.)

g. Mining and Loading:

Near the first of the year, two mining contracts were carrying on top-slicing in the central deposit into the north footwall. By March this work was completed, and no further top-slicing has been done or is anticipated.

With reference to loading, and in particular from raises into tram cars, the general trend has been toward top-timber transfers, reducing the amount of raising from the level in developing various orebodies. Despite this saving, the loading of ore by this method is considerably slower than with chutes. This is due to the need of continuously breaking chunks on the grizzly during loading operations.

h. Ventilation:

All ventilation drifts and raises were maintained throughout the year. The ventilation, in general, has been very good. The five-foot Jeffrey Aerodyne fan was in continuous use during the year, and two booster fans have been used intermittently to ventilate dead-end areas.

In June, a connection with the Mather greatly improved ventilation in the extreme west end, where a small quantity of air is being exhausted from the Mather into the 7th level drift. In the near future steel fire doors will be installed on the various levels, so that the ventilation can be regulated in case of an underground fire in the Mather or Cambria mines.

i. Pumping:

The number of gallons pumped per minute in each month of the year for the past eight years is shown in the following statement:

Month	1948	1947	1946	1945	1944	1943	1942	1941
January	313	281	285	317	333	369	413	374
February	315	294	293	284	285	340	387	342
March	287	279	309	315	328	335	375	340
April	345	319	396	456	344	433	430	392
May	410	538	362	460	425	619	477	435
June	362	471	314	453	389	620	465	424
July	358	460	308	439	378	583	421	407
August	335	376	289	374	347	411	379	390
September	312	359	272	341	410	395	362	382
October	299	343	255	315	408	402	391	386
November	276	323	250	299	423	340	394	419
December	293	323	276	292	397	340	386	459
Avg.G.P.M.	325	364	301	363	372	432	407	396

Figures previous to June, 1943, were taken from Republic Steel Corporation records.

8. COST OF OPERATING:

a. Comparative Mining Costs:

	1948	1947	Increase	Decrease
Product	491,817	554,105		62,288
Underground Costs	1.733	1.495	.238	
Surface Costs	.263	.200	.063	
General Mine Expenses	.335	.296	.039	
Cost of Production	2.331	1.991	.340	
Taxes	.159	.126	.033	
Depletion & Depreciation	.211	.089	.122	
Loading & Shipping	.049	.053		.004
Total Cost	2.750	2.259	.491	

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8. COST OF OPERATING: (CONT.)

a. Comparative Mining Costs: (Cont.)

	1948	1947	Increase	Decrease
No. of Days Operated	283	300		17
Tot.No. of Shifts Operated	560	597		37
Average Daily Product	1,756	1,847		91

Total Cost at Mine:

	1948	Percent	1947	Percent	Increase	Decrease
Labor	1.737	63.2	1.482	65.6	.255	
Supplies	1.013	36.8	.777	34.4	.236	
Total	2.750	100.0	2.259	100.0	.491	

b. Detailed Cost Comparison:

(1) Days and Shifts:

Year	Days Mine Worked	Shifts & Hours	Men Employed	Total Shifts
1948	283	560 - 8 Hr.	224-1/4	64,582-1/2
1947	300	597 - 8 Hr.	218-1/2	65,322
Increase			5-3/4	
Decrease	17	37		739-1/2

(2) Wages:

Increase granted during year, effective July 16, 1948, ranging from 9-1/2 to 16-1/2 cents per hour, inclusive. Salaries in proportion.

(3) Comparison of Production:

Production - 1948	491,817 Tons
Production - 1947	554,105 Tons
Decrease	62,288 Tons

(4) Comparison of Number of Men and Wages:

Year	No. of Men	No. of Days	Amount	Rate per Day
1948	224-1/4	64,582-1/2	804,859.97	12.46
1947	218-1/2	65,322	766,009.39	11.73
Increase	5-3/4		38,850.58	.73
Decrease		739-1/2		

(5) Tons per Man per Day:

	1948	1947	Decrease
Surface	31.94	35.67	3.73
Underground	10.00	11.13	1.13
Total	7.62	8.48	.86

(6) Cost of Production:

1948 -	1,146,581.56	Cost per Ton	2.331
1947 -	1,103,446.01	Cost per Ton	1.991
Increase -	43,135.55		.340

Year	Labor	Percent	Supplies	Percent
1948 -	839,231.30	73.2	307,350.26	26.8
1947 -	802,964.23	72.8	300,481.78	27.2
Increase -	36,267.07	.4	6,868.48	
Decrease -				.4

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8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts:

		1948		1947	
	Days per Week	6		6	
	Shifts and Hours	1-8 6 2-8 277		1-8 3 2-8 297	
	Production, Tons	491,817		554,105	
	Average Daily Production, Tons	1,756		1,847	
	Number of Days Worked	283		300	
	UNDERGROUND COSTS:	Amt.	Per Ton	Amt.	Per Ton
1.	Exploring in Mine	14,543.47	.030	1,546.54	.003
2.	Sinking Shaft	-	-	-	-
3.	Development in Rock	30,271.22	.062	14,940.24	.027
4.	Development in Ore	5,461.59	.011	10,674.21	.019
5.	Stoping	318,728.30	.648	331,362.55	.598
6.	Timbering	200,080.42	.407	189,961.49	.343
7.	Tramming	135,258.05	.275	134,134.99	.242
8.	Ventilation	5,085.59	.010	6,988.17	.012
9.	Pumping	30,861.92	.063	30,032.90	.054
10.	Compressors & Air Pipes	32,488.74	.066	30,475.96	.055
11.	Back Filling	-	-	-	-
12.	Underground Superintendence	27,908.20	.056	22,718.59	.041
13.	Cave-in, or Fire in Mine	61.16	-	29.97	-
14.	Maint.:Comp. & Power Drills	4,137.44	.008	2,596.27	.005
15.	Scrapers & Mech.Loaders	24,531.85	.050	25,936.45	.047
16.	Tramming Equipment	18,452.32	.038	23,761.25	.043
17.	Pumping Machinery	4,324.17	.009	3,205.32	.006
	Total Underground Costs	852,194.44	1.733	828,364.90	1.495
	SURFACE COSTS:				
18.	Hoisting	33,671.97	.068	32,758.74	.059
19.	Stocking Ore	12,577.06	.026	19,910.23	.036
20.	Screening-Crushing at Mine	-	-	-	-
21.	Dry House	9,460.70	.019	9,448.38	.017
22.	General Surface Expense	22,651.24	.046	15,919.60	.029
23.	Maint.: Hoisting Equipment	18,458.47	.038	17,636.82	.032
24.	Shaft	14,879.72	.030	4,558.53	.008
25.	Top Tram Equipment	6,582.15	.013	7,660.45	.014
26.	Docks,Trestles&Pockets	1,707.34	.004	66.20	-
27.	Mine Buildings	9,537.82	.019	3,011.49	.005
	Total Surface Costs	129,526.47	.263	110,970.44	.200
	GENERAL MINE EXPENSES:				
28.	Geological	1,426.46	.003	876.61	.001
29.	Mining Engineering	4,654.28	.010	4,686.45	.008
30.	Mech. & Elect. Engineering	4,161.31	.008	3,789.89	.007
31.	Analysis & Grading	16,975.14	.035	16,405.84	.030
32.	Safety Department	2,328.17	.005	2,291.42	.004
33.	Telephones & Safety Devices	4,790.65	.010	4,822.21	.009
34.	Local & General Welfare	3,189.01	.006	3,332.31	.006
35.	Spec.Exp.,Pensions&Allowances	5,983.24	.012	5,264.94	.010
36.	Ishpeming Office	20,860.02	.042	18,499.86	.033
37.	Mine Office	25,141.96	.051	27,089.11	.049
38.	Insurance	12,876.80	.026	8,338.59	.015
39.	Personal Injury	18,005.90	.037	22,116.98	.040
40.	Social Security Taxes	15,951.40	.032	18,920.70	.034
41.	Employees' Vacation Pay	28,516.31	.058	27,339.96	.049
	Supply Inventory Adjustment	-	-	335.80	.001
	Total General Mine Expenses	164,860.65	.335	164,110.67	.296
	COST OF PRODUCTION	1,146,581.56	2.331	1,103,446.01	1.991

CAMBRIA-JACKSON MINE
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8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

UNDERGROUND COSTS:

1. Exploring in Mine:

The increase in the cost per ton is due to the fact that there was more bortz drilling.

3. Development in Rock:

The increase in the cost per ton is due to the fact that there was more rock development, especially in the Cambria Lease.

4. Development in Ore:

The decrease in the cost per ton is due to the fact that there was a reclassification of footages chargeable to this account.

5. Stoping:

The increase in the cost per ton is due to the fact that there was an increase in wages effective July 16, 1948; also, that there was a general increase in the price of supplies, as well as reduced product.

6. Timbering:

The increase in the cost per ton is due to the fact that there was an increase in the price of timber used.

7. Tramming:

The increase in the cost per ton is due to the fact that there was a smaller production; also, due to the fact that there was an increase in wages.

8. Ventilation:

The decrease in the cost per ton is due to the fact that there was no drifting charged to this account; also, that there was less equipment purchased.

9. Pumping:

Year	Total Gallons Pumped	Gallons per Minute
1948	171,964,375	325
1947	190,950,934	364

The increase in the cost per ton is due to the fact that there was an increase in wages; also, smaller production.

10. Compressors and Air Pipes:

Increase due to raise in wages; also, more miscellaneous supplies, such as hose, etc.

12. Underground Superintendence:

There was more supervision during the year.

14. Compressors and Power Drills:

Two 250-volt, 800-ampere switches 840.00, two R-48 stopehamers 1,003.43, five RB-12 jackhamers (used) 250.00, two JB-4 jackhamers 286.50, and two L-29 pickhamers 310.00, were charged out.

15. Scrapers and Mechanical Loaders:

No new equipment was charged to this account during the year.

16. Tramming Equipment:

Decrease due to less repairs; also, less equipment charged out.

17. Pumping Machinery:

Gould pump parts 543.90, and Ingersoll-Rand pump 508.25, were charged out.

CAMBRIA-JACKSON MINE
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8. COST OF OPERATING: (CONT.)

b. Detailed Cost Comparison: (Cont.)

(7) Detail of Accounts: (Cont.)

SURFACE:

18. Hoisting:

Increase due to smaller production.

19. Stocking Ore:

Decrease due to less expense of dismantling and erecting trestles.

21. Dry House:

Charges to this account approximately the same in 1948 as in 1947.

22. General Surface Expense:

Increase due to more surface improvements during the year.

23. Hoisting Equipment:

Skip-cage hoist motor rewind 3,541.10, was charged out.

24. Shaft:

Repairs made during January, February and vacation period.

25. Top Tram Equipment:

Less repairs during the year.

26. Docks, Trestles and Pockets:

Increase due to more expense for permanent trestle and pocket repairs.

27. Mine Buildings:

Increase due to more expenditures for building construction and repairs.

GENERAL MINE EXPENSES:

28. Geological:

More expense on account of increased bortz drilling.

29. Mining Engineering:

Charges to this account approximately the same in 1948 as in 1947.

31. Analysis and Grading:

The cost to this account is made up as follows:

Year	Sampling at Mine	Central Laboratory	Shipping Dept. Expense	Trucking Samples,Etc.
1948	620.37	12,996.40	2,338.91	1,019.46
1947	1,105.69	11,804.57	2,565.85	929.73
Increase		1,191.83		89.73
Decrease	485.32		226.94	

36. Ishpeming Office:

1948 - 20,860.02 Cost per Ton - .042
1947 - 18,499.86 Cost per Ton - .033

37. Mine Office:

The detail of charges to this account were as follows:

Year	Salaries Supt.&Clerks	Central Warehouse	Misc.	Total
1948	18,749.81	4,556.14	1,836.01	25,141.96
1947	19,806.00	5,531.39	1,751.72	27,089.11
Increase			84.29	
Decrease	1,056.19	975.25		1,947.15

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

GENERAL MINE EXPENSES: (CONT.)

38. Insurance:

This account is made up as follows:

	Property Insurance	Group Health & Life	Group Annuity	Catastrophe Insurance	Total
1948 -	2,235.97	10,216.22	-	424.61	12,876.80
1947 -	1,407.52	4,797.18	1,521.77	612.12	8,338.59
Increase -	828.45	5,419.04			4,538.21
Decrease -			1,521.77	187.51	

39. Personal Injury:

The detail of charges to this account were as follows:

	Compensation & Doctors	Compensation Department
1948 -	17,116.20	889.70
1947 -	21,296.04	820.94
Increase -		68.76
Decrease -	4,179.84	

40. Social Security Taxes:

	Unemployment Tax	Old Age Benefit Tax
1948 -	9,015.69	6,935.71
1947 -	11,166.85	7,753.85
Decrease -	2,151.16	818.14

41. Employees' Vacation Pay:

1948 -	28,516.31	Cost per Ton -	.058
1947 -	27,339.96	Cost per Ton -	.049

Supply Inventory Adjustment:

1948 -	93.28	Cost per Ton -	.000
1947 -	335.80	Cost per Ton -	.001

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

Diamond drill explorations were carried on at the Cambria-Jackson Mine during the entire year. Eleven holes were drilled from various locations, on and above the 6th and 7th levels. All holes were drilled using bortz bits, varying in length from 589 feet to 148 feet.

Holes Nos. 181, 182 and 183 were drilled south and west of the new 6th level south crosscut, to explore the general structure and possible ore extension to the east.

Holes Nos. 184, 185 and 186 were drilled from the No. 750 crosscut in the west sulphur ore area, to determine the extension, depth and amount of ore below the 7th level.

Hole No. 187 was drilled south of Raise No. 737 on the -60-foot sublevel, to explore the area adjacent to the fault dike on the north side of the east-west main dike.

Holes Nos. 188, 189, 190 and 191 were drilled from the south end of the No. 770 crosscut, to determine the downward extension of ore.

In general, the results of the drilling were very disappointing and less ore was found than was expected. Hole No. 191, however, showed a run of 187 feet of ore lying horizontally between two dikes near the No. 770 crosscut.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS:

Logs of Holes Drilled:

D.D.Hole No.	Location	Dip	Elev.	Course	Footage	Material
181	6th Lev.	∠2°	103.2'	S0°26'W	0' to 104'	Trans.Jasp.&Slate
(Started 4-15-48 -					104' to 112'	Lean Ore
Stopped 5-17-48.)					112' to 150'	Soft Ore Jasper
					150' to 165'	Lean Ore
					165' to 368'	Soft Ore Jasper
					368' to 374'	Lean Ore
					374' to 405'	Soft Ore Jasper
					405' to 409'	Dike
					409' to 589'	Soft Ore Jasper
182	6th Lev.	-29°30'	104'	S0°44'W	0' to 174'	Trans.Jasp.&Slate
(Started 5-25-48 -					174' to 270'	Soft Ore Jasper
Stopped 6-21-48.)					270' to 300'	Ore
					300' to 315'	Lean Ore
					315' to 377'	Soft Ore Jasper
					377' to 381'	Dike
					381' to 498'	Soft Ore Jasper
183	6th Lev.	-18°	103.5'	S53°30'W	0' to 226'	Trans.Jasp.&Slate
(Started 6-26-48 -					226' to 337'	Soft Ore Jasper
Stopped 7-20-48.)					337' to 341'	Ore
					341' to 422'	Soft Ore Jasper
184	7th Lev.	-70°	-92.4'	S27°08'W	0' to 88'	Sulphur Ore
(Started 8-24-48 -					88' to 124'	Soft Ore Jasper
Stopped 8-31-48.)					124' to 149'	Trans.Jasp.&Slate
185	7th Lev.	-68°	-92.4'	S26°21'W	0' to 72'	Sulphur Ore
(Started 9-2-48 -					72' to 105'	Soft Ore Jasper
Stopped 9-9-48.)					105' to 148'	Trans.Jasp.&Slate
186	7th Lev.	-40°	-92.8'	S1°07'W	0' to 32'	Sulphur Ore
(Started 9-10-48 -					32' to 54'	Dike
Stopped 9-15-48.)					54' to 70'	Soft Ore Jasper
					70' to 97'	Lean Sulphur Ore
					97' to 120'	Soft Ore Jasper
					120' to 146'	Trans.Jasp.&Slate
					146' to 157'	Slate
187	-60' Sub	∠2°	-59'	S2°51'E	0' to 170'	Soft Ore Jasper
(Started 9-20-48 -					170' to 180'	Dike
Stopped 9-28-48.)					180' to 219'	Soft Ore Jasper
188	7th Lev.	-48°	-98.5'	S47°15'W	0' to 14'	Lean Ore
(Started 11-5-48 -					14' to 55'	Soft Ore Jasper
Stopped 11-11-48.)					55' to 137'	Dike
					137' to 174'	Soft Ore Jasper
189	7th Lev.	-49°	-98'	S43°24'E	0' to 25'	Soft Ore Jasper
(Started 11-13-48 -					25' to 40'	Lean Ore
Stopped 11-19-48.)					40' to 142'	Soft Ore Jasper
					142' to 157'	Trans.Jasp.&Slate
190	7th Lev.	-21°	-97'	N20°23'W	0' to 10'	Dike
(Started 11-22-48 -					10' to 46'	Soft Ore Jasper
Stopped 11-27-48.)					46' to 56'	Dike
					56' to 75'	Sulphur Ore
					75' to 86'	Dike
					86' to 88'	Lean Ore
					88' to 101'	Dike
					101' to 135'	High Sulphur Ore
					135' to 160'	Soft Ore Jasper
					160' to 179'	Trans.Jasp.&Slate
191	7th Lev.	∠5°	-95.6'	N77°55'W	0' to 2'	Dike
(Started 11-29-48 -					2' to 17'	Ore
Stopped 12-4-48.)					17' to 50'	Soft Ore Jasper
					50' to 58'	Dike
					58' to 245'	Sulphur Ore
					245' to 252'	Dike

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10. TAXES:

	1948 Valuation	1948 Taxes	1947 Valuation	1947 Taxes
Cambria Realty: S½ of SE¼ of Sec. 35, 48-27) Lots 7 & 8 of Sec. 35,48-27) Lots 5,6 & 7 of Sec.36-48-27) - 222.09 Acres)	125,000	5,539.41	125,000	5,533.30
Jackson Strip: N660' of N½ of NW¼ of Sec.1,) 47-27 - 40 Acres)	930,000	41,213.23	650,000	28,773.16
Personal Property:				
Stockpile,Supplies & Eqt.	620,000	27,475.49	730,000	32,314.47
Tot. by Mich.State Tax Com.	1,675,000	74,228.13	1,505,000	66,620.93
Lillie Mine Loc.,1 House-Lot 5	100	4.43	100	4.43
Total	1,675,100	74,232.56	1,505,100	66,625.36
Collection Fees		742.33		666.25
Total Taxes, Negaunee		74,974.89		67,291.61
Division of Payments:				
Cambria-Jackson Taxes,Ishpeming*	75,000	2,980.08	75,000	2,685.50
Cambria-Jackson Taxes,Neg.	1,675,100	74,974.89	1,505,100	67,291.61
TOTAL	1,750,100	77,954.97	1,580,100	69,977.11

*Cambria-Jackson Mine-Ishpeming:
N660' of NE¼ of NE¼ of Sec. 2,)
47-27 - 20 Acres)

Tax Rate per $100 of Valuation:	1948	1947
City of Negaunee	4.43153	4.42664
City of Ishpeming	3.97344	3.58067
Total Taxes, City of Negaunee:	512,641.46	526,260.15
Cambria-Jackson Percent of Taxes:		
City of Negaunee	14.48	12.66

11. ACCIDENTS AND PERSONAL INJURY:

Following is a list of the number of accidents, classified as to time lost:

	1948	1947
Fatal	1	1
Time lost - over 4 months	1	1
Time lost - 1 to 4 months	5	6
Time lost - less than 1 month	9	7
Total Compensable Accidents	16	15

On December 31, 1948, payments were being made on three accidents which occurred prior to January 1, 1948. One is a death claim and two are receiving full compensation.

No.	Date	Name	Injury	Days Lost
59	1-17-48	John White	Fractured 2 bones,right foot	54
60	3-13-48	Nestor Blomquist	Fractured bone, right foot	7
61	4-2-48	John Nelson	Lacerated finger	51
62	4-7-48	Wm. Bond, Sr.	Severed tendon,left little finger	26
63	4-23-48	Francis Conway	Fractured bone, left foot	19
64	6-11-48	Carl R. Austin	Contused both legs	22
65	7-2-48	Walter Prusi	Fracture, left clavicle	135
66	7-15-48	Rolland J. Toms	Contusion, both legs	18
67	7-26-48	Russell Johnson	Corneal ulcer, right eye	17
68	8-16-48	Oscar Pulkinen	Fractured bone, right hand	30
69	8-19-48	Wm. Thexton	Contused left ankle	9
70	8-19-48	Lloyd Erickson	Bruised back.Fracture,left lit.fgr.	27
71	8-30-48	Russell Anderson	Dislocation, left shoulder	71
72	9-30-48	Eino Wainio	Lacerated finger	9
73	10-4-48	James LaCombe	Lacerated left hand	12
74	12-10-48	Leonard Hellier	Amputation, left leg	Fatal

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

a. Steel Storage Building:

In May 1948, E. & A. No. CC-241 was issued for a total of $6,000 to cover the cost and erection of a 24x96' Truscon steel building. This building will replace the present temporary storage facilities which are available in the old shop buildings, north of the shaft. The storage building is located 44 feet west of and parallel to the shop building. The floor is elevated approximately 44 inches above the road level, so that equipment can be loaded and unloaded from trucks more easily. At the south end of the storage building a 24x16' garage was built in, to be used in housing the hydrocrane. The building was completed in October, and was immediately put into use. During the coming year minor changes will be made inside the building, to concentrate various machinery parts and tools.

b. Oilhouse:

A new concrete-block building 22x22' was erected east of the shop building, in line with the truck garage. There was no E. & A. issued for this construction, inasmuch as the concrete blocks were purchased at the time the new shop building was built. The oilhouse is completely fireproof, with a 4-inch concrete roof supported by steel rails.

A small frame oilhouse was moved to a point south of the steel storage building, to be used for the storage of ladders, charging sticks, air doors, chute stoppers, etc.

c. Garage Addition:

A new addition was added to the truck garage, 24x20', for use in housing the tractor and mine truck. The entrance to this garage was made on the south side of the building. The general construction is frame covered by galvanized sheet metal, with a composition roof. The tractor garage has a greasing pit, to facilitate maintenance and repairs to the tractor.

d. Track Siding:

In October, a 700-foot railroad track siding was replaced on the old D. S. S. & A. right-of-way, terminating at a point south of the shop building. A strip 25 feet in width on either side of the track was graded, so that lagging and poles could be stored with space between the pile and railroad car for the hydrocrane. During the coming year the storage of this material will be concentrated along this track, and in the summer similar grading will be done on either side of the present timber yard tracks.

13. EQUIPMENT AND PROPOSED EQUIPMENT:

a. Hydrocrane:

In December 1947, a used H-2 hydrocrane was purchased under E. & A. No. CC-224. This machine was used for unloading timber and other purposes during the winter and spring. However, it was found to be too light for all-around mine use with the result that in August a second E. & A. No. CC-267 was issued to cover the cost of a new machine, less the tradein value of the H-2 model. The total cost of the new hydrocrane was $10,000, and a tradein of $4,000 was allowed for the used H-2 model. The new crane was in continuous use throughout the remainder of the year, and it was possible to reduce the surface crew by three men during the year.

b. Shaft Hoist:

On April 23rd, two coils burned out on the 500-H.P. Westinghouse skip-and-cage motor. Previously, it had been necessary to cut out two

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13. EQUIPMENT AND PROPOSED EQUIPMENT: (CONT.)

b. Shaft Hoist: (Cont.)

other coils. At that time E. & A. No. CC-201 was issued to cover the cost of a new pinion, and it was decided to use a 750-H.P. motor presently at the Maas Mine. After the burnout in April it was decided that the present motor would be rewound and put back into service, inasmuch as the Maas motor was not available. The motor was sent to Milwaukee for rewinding in June and returned late in July, and put into service. During this interval a 400-H.P. motor was used and the skip factor and load was reduced to 4.8 tons, as compared with 5.1 tons.

c. Diesel Shovel:

The No. 65 Diesel shovel (54-B) was in continuous use during the shipping season. Its operation was very satisfactory, and it was frequently possible to load between 70 and 80 cars per shift. At the close of shipping season the shovel was used in loading out gravel, as well as excavating for the foundation and footings of the storage building. Late in the year, the shovel maintenance crew spent approximately two weeks time in making necessary repairs and adjustments.

d. Scraper Hoists:

There were no new scraper hoists purchased during 1948. However, six 15-H.P. Sullivan hoists were purchased from the Princeton Mine equipment account.

The following is a list of scraper hoists at the mine, and costs of repairs:

		1948		1947	
Company	Total Machines	Total Machines Repaired	Avg. Cost of Ea.Mach. Repaired	Total Machines Repaired	Avg. Cost of Ea.Mach. Repaired
Ing.-Rand 15-H.P.Elec.	17	4	260.32	3	120.82
Ing.-Rand 20-H.P.Elec.	2	4	174.28		
Ing.-Rand 25-H.P.Elec.	2				
Ing.-Rand Air Hoists	2				
Sullivan 15-H.P. Elec.	15				
Sullivan 25-H.P. Elec.	6	2	236.42		
Total	44	10	2,211.20	3	362.46

e. Underground Tram Cars:

During the year, three used 65 cubic-foot rocker dump cars were purchased from the Negaunee Mine. These cars were built for 30-inch gauge track and were rebuilt in the mine shops, to fit the 24-inch gauge in use at the Cambria-Jackson Mine. At the present time, there are twenty-six 65 cubic-foot rocker dump cars in use at the mine.

f. Skips and Cages:

There are two combination skips and cages in use at the mine, together with one spare skip and cage. During the fall of the year new shoe-holders were installed on all skips and cages, so that a thicker wearing shoe could be used. These shoes were also tapped and bolted from the outside, to facilitate their change.

g. Haulage Tracks:

The following is a comparison of costs of materials for haulage tracks for 1948 and 1947:

	1948	1947
40-Lb. Rail	363.93	1,048.22
Ties and Tie Plates	156.46	448.58
Total	520.39	1,496.80

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13. EQUIPMENT AND PROPOSED EQUIPMENT: (CONT.)

h. Mine Trucks:

The new Chevrolet 1-1/2-ton truck, which was purchased in 1947, operated satisfactorily throughout the year. No major repairs were necessary. The Dodge truck which was purchased second-hand in 1943 was also in continuous use, and near the end of the year it was necessary to overhaul the motor and make other minor repairs.

14. MAINTENANCE AND REPAIRS:

The maintenance and repair costs listed under "Underground Costs" were as follows:

	1948		1947	
	Amt.	Cost per Ton	Amt.	Cost per Ton
Compressors & Power Drills	4,137.44	.008	2,596.27	.005
Scraper Equipment	24,531.85	.050	25,936.45	.047
Electric Tram Equipment	18,452.32	.038	23,761.25	.043
Pumping Machinery	4,324.17	.009	3,205.32	.006
Total	51,445.78	.105	55,499.29	.101

The following is a list of purchases and repair costs for 1948, as compared with 1947:

	1948	1947
Filing cabinet	70.14	
Paving road	711.84	
Tractor repairs	1,312.23	
Hydrocrane repairs	1,009.97	
Grapple for hydrocrane	585.53	
Shovel repairs	223.37	
Truck repairs	798.83	
Skip-cage hoist motor rewind	3,541.10	
Gould pump parts	543.90	
Goodman locomotive(used,from Princeton Mine)	2,002.70	
110 gals. Stontite	563.41	
2 Hydraulic jacks	25.54	
Fir and hemlock for shaft	588.62	
1,882 lbs. 1/2" plate	67.70	
Shaft sets	3,555.00	
Tram car (used, from Negaunee Mine)	100.00	
2 250-volt 800-ampere Switches	840.00	
M-2 Joy spader	155.00	
2 L-29 Pickhamers	310.00	
2 R-48 Stopehamers	1,003.43	
52,631 ft. Scraper rope	6,265.30	
5 RB-12 Jackhamers (used, from Lloyd Mine)	250.00	
2 JB-4 Jackhamers	286.50	
15-H.P. Scraper hoist(used,from Princeton Mine)	300.00	
3 Scraper hoist motors	546.00	
Impact wrench	269.50	
Ingersoll-Rand pump	508.25	
5,728 lbs. 3/8" Plate, for shaft pocket	197.04	
1,050 lbs. 1/4" Plate, for shaft pocket	39.17	
Total Purchases	26,661.07	22,157.11

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14. MAINTENANCE AND REPAIRS:

	1948	1947
Repairs to Compressors & Power Drills	1,292.51	
Repairs to Scraper Hoists	17,420.55	
Repairs to Locomotives	3,251.11	
Repairs to Trolley Wire	2,260.66	
Repairs to Tracks	6,064.60	
Repairs to Cars	3,812.79	
Repairs to Pumping Machinery	3,272.02	
Total Repairs	37,374.24	41,586.57

The maintenance and repair costs listed under "Surface Costs" were as follows:

	1948	1947
Hoisting Equipment	18,458.47	
Shaft	14,879.72	
Top Tram Equipment	6,582.15	
Docks, Trestles & Pockets	1,707.34	
Mine Buildings	9,537.82	
Total	51,165.50	32,933.49

	1948	1947
Inspection of Hoisting Ropes	801.11	
Repairs to Electric Hoists	3,578.06	
Repairs to Skips, Cages, Etc.	10,036.67	
Repairs to Sheaves & Pulley Stands	101.53	
Repairs to Shaft	10,373.36	
Repairs to Larry Cars & Tracks	5,763.32	
Trestle Trolley Line	818.83	
Repairs to Permanent Trestles	1,094.85	
Repairs to Pockets, Chutes, Etc.	376.28	
Repairs to Mine Buildings	8,974.41	
Total	41,918.42	32,425.86

15. POWER:

Following is a detail of electric current purchased in 1948 and 1947, distribution of charges to various accounts, and other data:

	1948		1947	
	Cost	Per Ton	Cost	Per Ton
Stoping	846.85	.002	1,291.62	.002
Tramming	294.12	.001	242.22	.001
Ventilation	3,038.63	.006	3,176.71	.006
Pumping	13,119.98	.027	13,383.00	.024
Compressors	17,198.64	.035	18,399.77	.033
Hoisting	16,700.72	.034	17,407.44	.031
Stocking Ore	507.58	.001	1,081.94	.002
Dry House	382.75	.001	333.79	.001
General Surface	368.95	.001	408.38	.001
Telephones & Safety Devices	1,331.24	.003	1,588.35	.003
Mine Office	150.17	.000	86.25	.000
Electric Haulage	10,560.01	.021	11,555.81	.021
Shops	588.00	.001	205.55	.000
Heating	64.56	.000	61.47	.000
Tractor & Truck	37.38	.000	37.62	.000
Loading at Pocket	20.70	.000	22.00	.000
Total	65,210.24	.133	69,281.92	.125
Power charged to Mather "B"*	140.00		1,408.44	

* Included above.

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15. POWER: (CONT.)

	1948	1947
Main Line Meter - K. W.	4,668,800	4,987,200
Separate Meter Readings	4,668,800	4,985,610
Line Loss - K. W.	-0-	1,590
Product - Tons	491,817	554,105
K. W. per Ton (Inc. Line Loss)	9.49	9.00
Cost per K. W. (Average)	.0140	.0139
15 Min. Demand - K. W. (Average)	1,017	1,057
Average Load Factor	52%	54%

17. CONDITION OF GROUNDS:

Many improvements were made in the general appearance of the surface plant during the year. The road which approaches the property from the east was relocated near the engine house, and a tar surfacing was applied later in the year. The two large areas south of the highway were surfaced and converted into a lawn. The parking grounds were enlarged and regraded and bordered on the north by a row of cedar trees. The roadway in the vicinity of the shops and office was regraded with gravel to improve the drainage.

18. NATIONALITY OF EMPLOYEES:

The nationality record of employees is submitted in two forms, one as to parentage, the other as to country of birth:

As to Parentage:	1948	Percent	1947	Percent
Finnish	80	35.1	84	36.7
Italian	39	17.1	38	16.6
English	38	16.7	40	17.5
Swedish	31	13.6	29	12.7
French (France)	12	5.3	12	5.2
French (Canadian)	8	3.5	7	3.0
Danish	6	2.6	5	2.2
German	4	1.8	5	2.2
Irish	3	1.3	3	1.3
Norwegian	3	1.3	3	1.3
Austrian	3	1.3	3	1.3
Slovanian	1	.4	-	-
Total	228	100.0	229	100.0

	American Born		Foreign Born	
As to Birth:	1948	1947	1948	1947
Finnish	52	57	28	27
English	32	33	6	7
Swedish	29	27	2	2
Italian	20	19	19	19
French (France)	12	12	-	-
French (Canadian)	8	7	-	-
Danish	6	5	-	-
German	4	5	-	-
Irish	3	3	-	-
Norwegian	2	2	1	1
Austrian	1	1	2	2
Slovanian	1	-	-	-
Total	170	171	58	58
Percent	74.6%	74.7%	25.4%	25.3%

MAAS MINE
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1. GENERAL

The Maas Mine operated on two 8-hour shifts, six days per week from January 1st to December 31st. There was also a small tramming and hoisting crew on the third shift to remove the excess ore which was produced on the two previous shifts. It was possible to obtain the maximum number of men required, but there were no skilled miners available for hire. There continued to be a decrease in the number of working places as the upper areas became worked out and also one large inclusion of jasper cut out a considerable volume which had previously been estimated as ore. The very large quantity of water above the footwall on the 4th. Level made it necessary to temporarily abandon mining in that area, but it is expected that this can again be reopened at some later date when some of the water may possibly drain to other worked-out areas.

The total production for the year was 673,126 tons as compared with 722,401 tons last year and this decrease was altogether due to the afore mentioned mining conditions. It is not expected that a larger production can be obtained until the 7th. Level is developed and block caving started.

The tons per man per day for 1948 were only 5.93 as compared with 6.44 in 1947 and this decrease was due to there being more company account men in proportion to the miners. There were less places available for mining in 1948 and also considerable more timbering was required. The cost per ton was 3.415 in 1948 as compared with 2.950 in 1947 and this increase was due partly to the increase in wages that became effective on July 16th and also to the afore mentioned lack of mining places with a corresponding decrease in tonnage.

The shipments for the year 1948 showed a still greater reduction when compared with 1947 as there was approximately 100,000 tons left in stock at the end of the 1946 season and only 26,000 tons in 1947. All of this ore in stock, with the exception of a small amount which was too wet to ship, was cleaned up with a resulting overrun of approximately 5%.

Practically the only main level development for the year was the driving of the 5200 Cross-cut on 5th. Level and a few raises put up in various areas, but it will be necessary to start the 7th. Level early next year. The auxiliary winze will be sunk 100 feet and all of the remaining ore below the 6th. Level on the Maas Mine property will be handled here by hoisting the ore in cars on two cages in balance. There will be no connection with the main shaft on the 7th. Level as the present hoisting equipment is not adequate for any further depth. The deepest ore found in the drill holes is only 80 feet below the 6th. Level and therefore the ore on the Maas Lease can be completely exhausted from the 7th. Level.

The Negaunee Mine has nearly completed mining the ore available to their 14th. Level in the Maas area and undoubtedly the balance below this elevation will then have to be mined through the Maas Shaft and this will necessitate more development on the 5th. Level.

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2. PRODUCTION, SHIPMENTS & INVENTORIES

a. Production by Grades

	1948	1947
Maas	297,504	393,913
Maas Special	176,753	179,325
Race Course	55,512	48,892
Race Course Special	143,357	100,271
Total	673,126	722,401
Rock	26,660	15,970
Total Hoist	699,786	738,371

b. Shipments

Grade Of Ore	Pocket Tons	Stockpile Tons	Total Tons	Total Last Year
Maas	164,436	151,843	316,279	430,518
Maas Special	72,291	96,823	169,114	201,062
Race Course	32,075	15,083	47,158	64,405
Race Course Special	79,196	53,604	132,800	103,430
Total	347,998	317,353	665,351	799,415
Total Last Year	370,290	429,125	799,415	
Decrease	22,292	111,772	134,064	

c. Stockpile Inventories

Grade of Ore	12-31-48	12-31-47
Maas	25,387	44,162
Maas Special	27,792	20,153
Race Course	14,518	6,164
Race Course Special	19,600	9,043
Total	87,297	79,522

d. Division of Product by Levels

	1948	%	1947	%
Fourth Level	179,224	26.6	227,092	31.3
Fifth Level	264,710	39.4	376,911	51.9
Sixth Level	229,192	34.0	120,536	16.8
Total	673,126	100.0	724,539	100.0

Ore mined on 4th. Level was all standard grade.
Ore mined on 5th. Level was 60% standard grade.
Ore mined on 6th. Level was 95% special grade.

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2. PRODUCTION, SHIPMENTS & INVENTORIES (Cont.)

e. Production by Months

Month	Maas	Maas Spcl.	Race Course	R.C. Spcl.	Total	Rock
January	29,185	12,623	372	9,472	51,652	3,040
February	25,004	14,013	1,004	8,089	48,110	2,940
March	21,069	20,038	1,802	10,600	53,509	3,160
April	25,955	18,423	3,465	8,215	56,058	3,685
May	23,644	11,172	4,633	10,451	49,900	3,880
June	27,766	17,234	4,421	16,602	66,023	2,325
July	24,139	11,065	3,361	11,920	50,485	1,335
August	31,839	11,010	5,640	15,416	63,905	2,580
September	20,155	10,014	8,263	13,665	52,097	1,435
October	24,659	14,244	4,640	12,379	55,922	1,155
November	20,539	8,848	5,450	13,194	48,031	440
December	17,771	20,999	12,149	9,803	60,722	685
Total	291,725	169,683	55,200	139,806	656,414	26,660
Transferred To & From Cur. Year's Overrun	2,442	2,442	1,201	1,201		
	8,221	4,628	1,513	2,350	16,712	
Grand Total	297,504	176,753	55,512	143,357	673,126	

The product was distributed by leases as follows:

	1948	1947
George Maas Lease	471,448	575,106
Race Course Lease	198,869	149,163
Baldwin Kiln Road Lease	2,809	270
Total	673,126	724,539

f. Ore Statement

	Maas	Race Course	Maas Spcl.	R. C. Spcl.	Total	Total Last Year
On Hand 1-1-48	44,162	6,164	20,153	9,043	79,522	154,398
Product for Year	291,725	55,200	169,683	139,806	656,414	704,081
Transfers	2,442	1,201	2,442	1,201		
Prev. Year's Overrun						2,138
Cur. Year's Overrun	8,221	1,513	4,628	2,350	16,712	18,320
Total	341,666	61,676	196,906	152,400	752,648	878,937
Shipments	316,279	47,158	169,114	132,800	665,351	799,415
Balance on Hand	25,387	14,518	27,792	19,600	87,297	79,522

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2. PRODUCTION, SHIPMENTS & INVENTORIES (Cont.)

g. Schedule of Operations

1948	January 1st to December 31st, 2 8-hour shifts, six days per week, with a small tramming and hoisting crew on the third shift with the exception that the mine was idle the week of July 3rd for vacation.
1947	January 1st to December 31st, 2 8-hour shifts, six days per week, with a small tramming and hoisting crew on the third shift with the exception that the mine was idle the week of August 25th.
1946	January 1st to February 8th, 2 8-hour shifts, six days per week. February 8th to May 21st mine idle on account of the strike. May 21st to December 31st same as before strike. On July 15th a small tramming and hoisting crew was added and continued to the end of the year.

h. Delays

There were no major delays during 1948.

3. ANALYSIS

a. Average Mine Analysis on Output

	1948				1947			
	Iron	Phos.	Sil.	Sul.	Iron	Phos.	Sil.	Sul.
Maas	59.19	.111	8.90	.056	59.53	.113	8.95	.036
Maas Special	59.35	.097	8.78	.160	60.00	.092	8.06	.216
Race Course	59.34	.104	8.58	.055	59.81	.109	8.48	.044
Race Course Special	59.39	.097	8.28	.150	59.79	.092	7.82	.218

b. Average Mine Analysis on Ore Shipped

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Maas & Race Course	59.10	.118	8.90	.21	3.11	.77	.39	.045	1.87	13.03
Maas & R.C. Special	59.10	.093	8.60	.22	3.34	.77	.23	.164	2.02	13.47

c. Average Natural Analysis of Ore in Stock - December 31, 1948

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Maas	25,387	52.28	.095	6.82	.18	2.35	.67	.34	.053	1.63	13.03
Maas Special	27,792	51.47	.087	7.06	.19	2.80	.67	.20	.131	1.75	13.47
Race Course	14,518	52.12	.087	6.80	.18	2.51	.67	.34	.075	1.63	13.03
Race Course Spcl.	19,600	51.91	.086	6.98	.19	2.63	.67	.20	.120	1.66	13.47

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4. ESTIMATE OF ORE RESERVES

a. Developed Ore

Assumption: 12 Cu. Ft. equals one ton.
10% Deduction for loss in mining and rock.

Standard Location	Race Course Lease	Maas Lease	B. K. Road City of Neg. Lease	Total Tons
3rd to 4th Levels	81,634	1,060,802	4,777	1,147,213
4th to 5th Levels	96,004	309,544		405,548
Gross Total 11-30-48	177,638	1,370,346	4,777	1,552,761
Less Dec. 1948 Product	12,149	17,771		29,920
Gross Total 12-31-48	165,489	1,352,575	4,777	1,522,841
Less 10% for Mining & Rock	17,764	137,035	478	155,277
Net Total Standard Grade	147,725	1,215,540	4,299	1,367,564
Special				
4th to 5th Levels	161,735	454,602	30,300	646,637
5th to 6th Levels	766,277	2,109,442		2,875,719
Below 6th Level	18,542	1,214,792		1,233,334
Gross Total 11-30-48	946,554	3,778,836	30,300	4,755,690
Less Dec. 1948 Product	9,803	20,999		30,802
Gross Total 12-31-48	936,751	3,757,837	30,300	4,725,888
Less 10% for Mining & Rock	94,655	377,884	3,030	475,569
Net Total Special Grade	842,096	3,379,953	27,270	4,250,319
Total All Grades	989,821	4,595,493	31,569	5,616,883

In the Maas Area leased to Negaunee Mine, including N 1/3 and N 1/6 of right-of-way, there were 191,501 tons as of December 31, 1948, of which 65,625 tons were of special grade.

There was a total increase of 347,631 tons in the developed ore reserves, after the production for 1948 had been deducted. The distribution of the increase is as follows:

	Maas	Race Course	Total
Standard Grade	160,539 Tons	18,698 Tons	141,841 Tons
Special Grade:			
Above 6th Level	59,008 "	39,260 "	19,748 "
Below 6th Level	186,042 "		186,042 "
Total	405,589 Tons	57,958 Tons	347,631 Tons

The small decrease in the Race Course Standard is due to a decrease in ore areas above the 4th Level proved by the development of #5 Stope; while the decrease in Race Course Special is due to being able to grade out as Standard some of the ore below 5th Level which was estimated to be all Special.

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4. ESTIMATE OF ORE RESERVES

a. Developed Ore (Cont.)

The increase in the Maas Standard was also due to grading out more of the estimated Special ore into the Standard grade. There would have been a corresponding decrease in the Maas Special grade but development of the North Footwall Drift on the 6th Level extended the limits of the known hanging. This increased the tonnage both above and below the 6th Level by approximately 70,000 and 186,000 tons respectively, the final increase above the 6th Level being reduced to 59,000 tons by the afore mentioned grading.

There was also a large decrease in the ore area previously estimated between the 5th and 6th Levels along the Western boundary of the Race Course Lease. This was occasioned by the continuation of the jasper hanging toward the footwall rather than a flatening out at depth as has been the customary characteristic of the rolls in the hanging heretofore.

c. Estimated Natural Reserve Analysis

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Maas & Race Course Standard	51.20	.100	7.70	.17	2.50	.430	.20	.050	1.60	13.50
Maas & Race Course Special	51.30	.090	7.20	.18	2.45	.600	.10	.200	1.40	13.50

d. Estimated Production
January 1st to December 31st, 1949

Grade	Estimated Production 12 Shifts Per Week
Maas & Race Course Standard	330,000
Maas & Race Course Special	340,000
Plus 4% Overrun on Ore Stocked	10,000
Total	680,000

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Maas & Race Course Standard	59.00	.110	9.00					.050		13.00
Maas & Race Course Special	59.20	.100	8.60					.200		13.00

5. LABOR & WAGES

a. Comments

There was practically no increase in the number of employees for the year as it was only necessary to hire new men to replace some 30 who were lost for various reasons. In most cases these new men were quite young with little or no experience in mining.

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5. LABOR & WAGES

a. Comments (Cont.)

The men received an increase in wages, effective July 16th, which was on a sliding scale starting with 9½ cents per hour for the lowest rate and increasing approximately 1 cent per hour for each 4 cent advance in hourly rate. The raise for contract miners was based on their company account, or base rate, so that they would all be treated equally. There was a proportional raise for the salaried employees and at the end of the year the bosses received a $100.00 bonus.

There were five men who had attained the age of 65 or more retired about the middle of the year. The average age of all employees was 44 with 48 men being 60 years of age or older and 16 of these latter had worked 40 years or more for the Company. The mine was shut down for one weeks' vacation on the 3rd of July and the men's vacation pay was distributed as follows:

19 Men, or 5% of the total, received one week's pay.
237 Men, or 63% of the total, received two weeks' pay.
100 Men, or 27% of the total, received three weeks' pay.
20 Men, or 5% were ineligible, having worked less than one year.

The following table shows a comparison in labor turnover for the last three years:

	1948	1947	1946
Died	2	1	0
Fatal Accident	0	2	0
Retired on Account of Age or Total Disability	5	0	7
Unable to Continue Work on Account of Ill Health	2	5	5
Transferred to Other C.C.I.Co. Properties	4	12	4
Quit to go to School or other Occupations	19	23	26
Discharges & Lay-Offs	4	2	1
Total Loss	36	45	43
Hired or Transferred to Maas	42	22	75
Net Loss		23	
Net Gain	6		32
Experienced Miners Included in Total Loss	3	18	13

Proportion of surface to underground men:

1948	1947	1946	1945	1944
1 - 5.0	1 - 5.0	1 - 5.1	1 - 4.5	1 - 5.1

b. Comparative Statement of Wages & Product

	1948	1947	Increase
Product	673,126	722,401	49,275
Number of Shifts & Hours	302	300	2
1 8-hour	3	4	1
2 8-hour	299	296	3

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5. LABOR & WAGES

b. Comparative Statement of Wages & Product (Cont.)

	1948	1947	Increase	Decrease
AVERAGE NO. MEN WORKING				
Surface	61	61		
Underground	306	307		1
Total	367	368		1
AVERAGE WAGES PER DAY				
Surface	10.97	10.11	.86	
Underground	12.49	11.35	1.14	
Total	12.23	11.14	1.09	
AVERAGE WAGES PER MONTH				
12 Shifts per Week				
Surface	274.25	252.75	21.50	
Underground	312.25	283.75	28.50	
Total	305.75	278.50	27.25	
PRODUCT PER MAN PER DAY				
Surface	32.42	35.88		3.46
Underground	7.25	7.85		.60
Total	5.93	6.44		.51
LABOR COST PER TON				
Surface	.345	.288	.057	
Underground	1.724	1.449	.275	
Total	2.069	1.737	.332	
AVERAGE PRODUCT MINING				
Stoping	22.95	22.72	.23	
Ore Development	13.79		13.79	
Total	22.82	22.72	.10	
AVERAGE WAGES CONTRACT LABOR	13.22	11.90	1.32	
TOTAL NUMBER OF DAYS				
Surface	20,765 1/4	20,134	631 1/4	
Underground	92,787 1/4	92,028 3/4	758 1/2	
Total	113,552 1/2	112,162 3/4	1,389 3/4	
AMOUNT FOR LABOR				
Surface	232,412.91	207,832.97	24,579.94	
Underground	1,160,772.84	1,046,996.34	113,776.50	
Total	1,393,185.75	1,254,829.31	138,356.44	
AVERAGE WAGES PER MONTH BASED ON MEN CARRIED ON MINE PAYROLL				
Surface	261.35	251.85	9.50	
Underground	300.74	282.70	18.04	
Total	294.09	277.58	16.51	

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5. LABOR & WAGES

c. Nationality of Employees

As to Parentage	1948	%	1947	%
Finnish	142	37.1	153	40.5
American	77	20.1	56	14.9
English	74	19.3	75	19.8
Italian	34	8.9	35	9.3
Swedish	22	5.7	22	5.9
French (Canadian)	17	4.5	18	4.9
Norwegian	6	1.6	6	1.6
German	5	1.3	6	1.6
Austrian	3	.8	2	.5
Danish	2	.5	3	.8
Irish	1	.2	1	.2
Total	383	100.0	377	100.0

As to Birth	American Born		Foreign Born	
	1948	1947	1948	1947
Finnish	102	106	40	47
American	77	56		
English	44	46	30	29
Italian	13	14	21	21
Swedish	18	18	4	4
French (Canadian)	17	18		
Norwegian	5	5	1	1
German	4	6	1	
Austrian	2	1	1	1
Danish	2	3		
Irish	1	1		
Total	285	274	98	103

6. SURFACE

a. Buildings & Repairs

There were no repairs to any of the buildings at the Maas Mine during 1948 nor were there any new buildings erected.

A considerable amount of replacement was made on the Shaft House and pockets where steel members were found to be badly rusted. While the mine was idle during the vacation week a crew of steel workers changed the steel in the dump and South pocket. Since that time they have worked intermittently when not needed on emergency jobs elsewhere.

During the vacation week a central spider was installed on the skip hoist drum as it was found that the new type of bracing, used when the new drum was put on last year, was not adequate to relieve the strain on the two end key ways.

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6. SURFACE

b. Location Buildings & Repairs

The crew repairing rented houses was held to a minimum of two carpenters and one painter with occasional helpers and the work for the most part consisted of minor repairs. Houses were painted during the year and an extra room was added to one other.

No houses were sold or purchased during 1948 and on December 31st those remaining were classified as follows:

Single-Family Houses	38
Two-Family Houses	5
Legion Club	1
Stores	1
Church	1
Total	46

c. Stockpiles

Loading from stockpile was started on April 17th with the No. 45 Caterpillar and the new No. 67 shovels. The No. 67 is a 54-B Bucyrus Erie Electric Shovel which only requires one man to operate together with an oiler and sampler as compared with 8 men needed on a railroad type shovel. It was necessary to do considerable blasting from April to June as the wet ore freezes very hard and subsequent stocking prevents the rain and sun from doing any appreciable thawing. The fact that the ore has to be stocked in four separate piles due to grade and royalty increases this freezing as there is more ore exposed to the weather.

A new steel trestle was erected West of the shaft for which the girders were salvaged from the dismantled trestle at the Athens Mine and it was only necessary to purchase steel columns from outside sources. This trestle is 680 feet in length and was equipped with a single track only as the capacity of this type is four-fifths that of a double trestle and with the girders available it would only have been 340 feet in length. Stocking started on this trestle in the fall after all the ore had been cleaned up; the last day of loading being on October 30th.

The following overruns of approximately 5% were developed and credited during the year.

	Maas	Race Course	Maas Spcl.	R. C. Spcl.	Total
Current Year	8,221	1,513	4,628	2,350	16,712

e. Timber Yard

There was sufficient timber of all types on hand throughout the year, the only difficulty being that of obtaining stull timber in the spring which was green enough to peel for treating. This timber was either cut the fall before or too late in the summer after the sap had dried. It was possible to use a considerable amount of steel sets in place of the treated timber, but in some cases the ground is too heavy and timber works to a better advantage. The treating plant was only used for treating trestle decking and wood for a few other small jobs.

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6. SURFACE

f. Drainage

No. 1 Well operated continuously during 1948 but No. 2 Well was idle due to the shutter screen becoming broken and allowing sand to enter in sufficient amount to cut the pump impellers very rapidly and also clog up the pipes in boiler, heaters, etc. As there was no apparent increase in the amount of water entering the mine it was thought best not to go to the expense of rehabilitating this well.

7. UNDERGROUND

a. Shaft-Sinking

There was no shaft sinking at the Maas Mine during 1948 but an Estimate and Authorization has been approved to sink a winze from the 6th to the 7th Level 100 feet below and use this as a permanent installation to handle all the product from the 7th Level.

b. Development

There was some main level development on all three levels in 1948 which consisted mostly of drifting with a small amount of raising. About 200 feet of rock drift was driven in the North footwall in the Race Course Lease from which a sub-level stope was opened. On the 5th Level, the 5200 Cross-cut was extended in rock to the Maas area boundary and two raises put up to the 75' elevation. Two drifts were also extended on the 6th Level, where the North footwall drift was continued 200 feet to the West in ore to provide access to the ore above as far as the Western limit of mining until more surface rights are acquired.

The South footwall drift was also advanced about 40 feet to the Northwest to provide tail room beyond a transfer raise which will be used in mining the small pillar between the dike and the South footwall.

A trench was excavated on the 6th Level plat to facilitate loading of ore into the skips and also a new method for cleaning the skip pit was put into use. These will both be described in detail under "Mining and Loading" later in the report.

Table of Main Level Development

Location	Drifting		Raising	
	Ore	Rock	Ore	Rock
4th Level	0	231	0	0
5th Level	35	394	22	177
6th Level	383	16	82	24
Total	418	641	104	201

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7. UNDERGROUND

c. Stoping
General

There was an average of 33 contracts engaged in mining during 1948 of which 3 were sub-level stoping, although more time was spent on development rather than actual stoping, 6 top slicing and the remainder sub caving.

Mining was scattered over practically all the ore areas in the mine and consequently there was considerable more moving of contracts than in any recent year. This was occasioned by having to temporarily abandon several places for various reasons such as too wet and heavy, mining too close to a main level, large horses of jasper intruding and decreasing the size of the ore pillar, etc. The number of available working places in the Maas Mine is rapidly decreasing due to less ore being found under the hanging to the West above the 6th Level than is being mined out on the footwall above. Also, a large block of ore between the 5th and 6th Levels is being left to mine in the future by block caving methods from the 7th Level.

After an extensive drainage development in the North footwall above the 4th Level, covering almost 2 years, attempts were made to mine the ore above to the West and South, but this proved too hazardous as the water started to flow in these new areas bringing rushes of rock and mud that sometimes almost filled the working places. Still another method will be tried later and there is also the possibility of finding this source of water on surface and an authorization may be obtained to do some more exploring by drilling in an attempt to find sufficient coarse sand or gravel to warrant another surface well pump.

Four contracts have been employed continually in the Northeast footwall above the 4th Level and by the end of next year it will be necessary to use transfer systems in the rock footwall above the 5th Level to finish this area. The footwall is much too flat and it would not be economical to drive a new cross-cut and put up raises direct from the 5th Level and therefore it is hoped that these transfer drifts can be maintained although heretofore transfer drifts have been quite costly on account of heavy weight and consequent repairs.

By the end of the year mining was almost completed in the 5300 Block and this area will then be temporarily abandoned until a new cross-cut is driven on the 6th Level. As the last sub-level is only 40 feet above the 5th Level, mining in the area West of the Race Course above the 5th Level was also discontinued for the same reason and also to keep the 5th Level North footwall drift open for ventilation.

Several new areas were opened or reopened during 1948 to take the place of those just previously mentioned. A sub-level stope was started between the North footwall and the dike above the 4th Level and another narrow pillar to the East was also reopened, both in the Race Course Lease. Four new sub-level stopes were started just above the 6th Level and by the end of the year one of these had started to produce. Still one more area, that of a small pillar lying between the South limit of mining and the dike was opened up late in the year, and the method of mining here will be sub caving.

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7. UNDERGROUND

c. Stoping
General (Cont.)

Mining in the ore body in the Race Course Lease and the adjacent area to the West between the 5th and 6th Levels has employed the largest number of contracts, almost all of whom have been mining the sub caving method. Approximately 20 contracts were mining continuously during the year in this part of the mine.

Detail

280' Sub Level

Upon the completion of a very elaborate development for draining the water on the North footwall, the pillar adjacent to the old winze was opened last year at this elevation and was completed in February of this year. Despite the fact that this area was some 50 feet above the drainage development, a large amount of water started to flow as soon as mining started. It was then decided that the only way this ore could be mined was to leave a pillar in the back to hold back the water and therefore a sub level was cut at a 25 foot vertical interval on the 255' Sub Level and only 12 feet of the ore mined. The water pressure was too great however, and kept breaking through causing mud runs which not only caused delays but were quite dangerous and therefore mining here was stopped temporarily until some new scheme could be devised.

270' Sub Level

Two contracts were mining by sub caving in this Northeast footwall pillar. One was moved to the 245' Sub Level in the same pillar in February while the other continued until April when all mining was completed.

255' Sub Level

As was mentioned above under the 280' Sub Level heading, this sub level was opened in March and mining continued until September with only fair results. The two contracts working here were then moved to the 6th Level to start sub level stopes.

245' Sub Level

Mining was carried on in two areas at this elevation during the year. #6 Contract cut out in the Northeast footwall pillar in February and sub caved until September with excellent results. Upon completion of mining they were moved to a transfer raise from the 150' Sub Level and cut out at the 215' elevation. All of the work mentioned so far was carried out in the Maas Lease.

The narrow ore body, lying to the West of the Shaft cross-cut and in the Race Course Lease was reopened in February by #16 Contract and in April #3 Contract was started. Mining continued here throughout the rest of the year with only fair results as the ground is very hard and blocky and it is too small an area to cave readily. The Eastern end of the pillar was stoped while the other contract was top slicing with some caving near the old stope to the West. While most of the ore came from the Race Course Lease, there was also some recovered from the City of Negaunee strip and also in the Maas Lease.

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7. UNDERGROUND

c. Stoping

Detail (Cont.)

230' Sub Level

An attempt was made to open a sub level at this elevation in the winze pillar but it was considered too hazardous on account of the large volume of water, and in October, the contracts were moved elsewhere and this pillar was temporarily abandoned.

A contract also worked on this elevation early in the year completing the drainage development along the central part of the North footwall above the 4th Level. A large volume of water was flowing here but as soon as mining started above and to the West, this flow partially dried up which was contrary to expectations. It will be necessary to attack this problem in some other manner in the future to enable the recovery of this very wet pillar of standard ore.

215' Sub Level

Mining of the East footwall pillar, from raises put up from the #422 Transfer on the 150' elevation, was started in August and by the end of the year three contracts were developing and sub caving.

185' Sub Level

An attempt was made to mine the pillar between #416 and #422 Raises South of the drained area but this was also unsuccessful on account of too much water and after about three months' work the contract was moved elsewhere.

170' Sub Level

Sub caving of the pillar above the 4200 Cross-cut on the 4th Level was completed in May of this year on the 170' elevation and the contracts were moved to the sub level below.

160' Sub Level

The contracts mentioned just previously mined on this sub level from May to the end of the year but were under a considerable handicap as the 4th Level Cross-cut became very heavy and it was almost impossible to maintain sufficient clearance for tramming. It has been necessary to keep two crews of timbermen continuously in this cross-cut the entire year and therefore this is the last sub level that will be mined until raises are put up from the 5th Level.

150' Sub Level

Two transfers were driven during the year at this elevation; one from #422 Raise to mine the East footwall pillar and the other in the Race Course Lease from which the pillar lying on the North footwall above this transfer will be mined by a sub level stope. Two of the mill raises in the West end were completed in October and stoping started. The stope was so narrow at this point that it was necessary to put up more raises to the East and connect them with dog drifts on the 200' and 175' elevations. Stoping was resumed in December.

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7. UNDERGROUND

c. Stoping

Detail (Cont.)

130' Sub Level

Toward the last of the year a connection was made between the two transfer riases put up from the 75' Sub Level into the pillar to the East of the Race Course Lease and North of the old 5300 Block. In December, two contracts had started development drifts to the East from these raises preparatory to sub caving.

4th Level

#5 Contract drifted 200' in the North footwall on the Race Course Lease and put up a raise to the 150' Sub Level through which the ore from the new sub level stope is being transferred.

75' Sub Level

After completing #5210 Raise about the middle of the year #26 Contract cut out at this elevation and after driving a transfer drift, from which the pillar above will be sub caved, continued on a slight insline to hole to the 4th Level for traveling and ventilation.

65' Sub Level

One contract was occupied nearly the entire year mining the small deposit in the Race Course Lease between the North footwall and the dike. Mining was completed here in October and they started to cut out on the 40' Sub Level.

Three contracts completed the mining of the 5300 Block, lying East of the Race Course Lease, in April and moved to the sub level below. The mining was partly by top slicing and partly sub caving with the ore being of standard grade as has all of the product mentioned earlier in this report.

50' Sub Level

#28 Contract sub caved in the Southeast end of the 5300 Block along the Maas area boundary from January to April. Their production record was excellent and the grade of the ore was divided about equally between special and standard.

40' Sub Level

#27 Contract cut out at this elevation in the Race Course Lease North of the dike in October and in December were mining adjacent to the old workings to the West. The ore here is still of standard grade.

Three contracts were sub caving in the 5300 Block on this sub level for almost the entire year but in December only one contract remained to mine the small pillar South of #5300 Raise. At this elevation almost one-half of the ore lying to the Northeast of the raises had been cut off by the footwall.

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7. UNDERGROUND

c. Stoping

Detail (Cont.)

25' Sub Level

One contract started mining by sub caving in the 5300 Block along the Maas area boundary in April and by December only had one more slice to mine. They will have to be moved elsewhere as another sub level would be too close to the 5th Level. It has been possible to recover considerable standard grade ore from this and the three contracts mentioned just above although they are below the standard horizon.

Two contracts completed mining in the area on the North footwall just West of the Race Course Lease in May and were then moved to another territory as it was necessary to maintain the 5th Level North footwall drift for ventilation.

#39 Contract was also mining in the sub level stope further to the West during January and February and were then moved to the 6th Level to start a new stope below their previous one.

10' Sub Level

One contract cut out at this elevation in the 5300 Block in October of this year and in December was caving near the East Mining Limit. Some of the development was in lean ore as the footwall cuts off part of the North half of this area. There is ore on the hanging side, however, and also ore in the back on the footwall side.

00' Sub Level

In the area just South of the dike in the Race Course Lease three contracts, 2 top slicing and 1 sub caving, mined during the first half of the year. This area is very wet and there was one pillar which could not be recovered from the 6th Level raises on that account. A new raise was put up from the 5th Level and mining has been continuous for the remainder of the year. In December there was still one small pillar yet to be mined.

5th Level

In May #32 Contract advanced a short stub from the curve on the 5400 Cross-cut through the dike in the Race Course Lease in order to put up a raise to take out the pillar just previously mentioned.

#14 Contract, on single shift, was drifting in 5200 Cross-cut until December. They drifted about 400 feet in the slate footwall and started three transfer raises. The ground was very slabby and had to be timbered the entire distance.

Three contracts were sub caving in the Race Course Lease from January to June. This block was from 100 feet to 300 feet South of the North dike and was quite wet causing decreased production. The ore was entirely of special grade.

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7. UNDERGROUND

c. Stoping

Detail (Cont.)

-25' Sub Level

About the middle of the year three contracts started to open the area adjacent to the North dike in the Race Course Lease and in December they were still mining here. This area is also quite wet and especially heavy near the Western boundary of the lease.

In the Maas Lease, further to the West, there have been five contracts sub caving almost the entire year. In December there were three left and mining should be completed early next year. These contracts have had excellent production as the ground is fairly dry and not very hard to drill.

In December one contract was opening a new area for sub level caving from the two raises put up from the transfer drift in the -100' Sub Level along the South Mining Limit.

-40' Sub Level

Six contracts have been employed since February in sub caving the central and Southern area of the Race Course Lease and four of these still remained in December.

To the West of these workings a large dropper from the jasper hanging has cut off a block approximately 300' by 150' and two diamond drill holes were put in this fall to test for possible inclusions of ore between the mining areas but with negative results.

In the past as mining descended under the hanging to the West, it was always possible to encounter ore in increasing amounts at each lower elevation but in this case the hanging apparently extends all the way into the footwall thus eliminating approximately 200,000 tons which had heretofore been expected to be ore.

-50' Sub Level

One contract has been sub caving along the Western boundary of the Race Course Lease and to the North of the large jasper horse. In December their second slice to the North had reach the dike.

One contract also connected #6407 and #6409 Raises in December.

-65' Sub Level

Early in the year the permanent connection in rock was completed to the 14th Level, Negaunee Mine. Part of the raise and drift was lined with steel sets and this should eliminate maintenance. A large volume of air comes through this opening and is directed through all the cross-cuts and sub levels above by control doors and supplies ample ventilation.

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7. UNDERGROUND

c. Stoping

Detail (Cont.)

-75' Sub Level

In October mining was started at this elevation above the 6400 Cross-cut by a transfer drift being driven to the West and a raise put up to the -50' Sub Level to shorten the long haul from #6409 Raise to the dike to which the ore had finally extended.

#17 Stope being mined by sub level stoping and lying parallel and above the 6700 Cross-cut was completed in January and the contract moved elsewhere.

-100' Sub Level

The sub level stope running to the East from the 6700 Cross-cut and parallel to the dike was started last year and mining was completed in July. Another transfer was then started between the former stope and the dike and by December stoping had been resumed.

After extending the #600 Drift on the 6th Level a short didtance to the West for tail room, a raise was put up to this elevation in March and a transfer drift completed to the dike 200' to the Northwest. It had been expected that this drift would be in ore for the entire distance as the footwall contact was in the drift on the level below. However, a dropper in the jasper hanging extended to the footwall and ore was only encountered in the last 60', adjacent to Drill Hole #54 which had shown ore at this elevation and was the principal reason why mining was started in this area. It had been planned to mine by sub level stoping but after the jasper was encountered it was evident that this would necessitate too much rock development and therefore this area will be sub caved from the inside raises where mining can extend to the East above the jasper.

When the wet area above 4th Level had to be abandoned it was necessary to provide new working places for these contracts in an already decreasing ore body and the only remaining area was above the North footwall drift on the 6th Level as the large pillar to the South is being reserved for block caving from the 7th Level. Therefore, three contracts started transfer raises in October and by December had cut out on this elevation and practically completed their drifts. Raises will be put up early next year and three sub level stopes should be in production by shipping season.

6th Level

The North footwall drift was extended to the West about 200' and exploration of the pillar above was carried out with dog drifts and raises. This proved that there was no ore North of the dike and also that the hanging jasper was too near the elevation of the 6th Level to warrant any further exploration to the West for the present. A limit of mining would have to be set in any event to protect the surface West of the 2400 East-West co-ordinate and therefore it was decided to move to the East 175' and start a stope.

The development at the Shaft on the 6th Level has been described previously and therefore no further mention is made here.

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7. UNDERGROUND

d. Timbering

TIMBER STATEMENT FOR THE YEAR 1948

Kind	Lineal Ft.	Avg. Price Per Ft.	Amount 1948	Amount 1947
6" x 8" Cribbing Timber	69,993	.0699	4,899.47	2,238.09
8" x 10" Stulls	36,111	.1578	5,699.78	6,468.14
10" x 12" Stulls	102,845	.1919	19,737.01	15,098.78
12" x 14" Stulls	30,564	.2514	7,684.77	10,741.38
Treated Timber	2,595	.3241	841.06	1,960.28
Total 1948	242,108	.1605	38,862.09	
Total 1947	227,933	.1602		36,506.67
		Per 100 Ft.		
7' Lagging	1,744,930	1.660	28,970.11	24,171.60
9½' Poles	895,320	3.084	27,608.17	20,562.72
Total 1948	2,640,250	2.143	56,578.28	
Total 1947	2,339,833	1.912		44,734.32
Grand Total 1948			95,440.37	
Grand Total 1947				81,240.99

Product, Tons	673,126	722,401
Feet of Timber per Tons of Ore - Stulls & Cribbing	.3597	.3155
Feet of Stull Timber Only per Ton of Ore	.2557	.2604
Feet of Lagging per Ton of Ore	2.59	2.13
Feet of Poles per Ton of Ore	1.330	1.109
Feet of Lagging per Foot of Timber	7.2072	6.7521
Feet of Poles per Foot of Timber	3.6980	3.5133
Cost per Ton for Timber	.0577	.0505
Cost per Ton for Lagging	.0431	.0335
Cost per Ton for Poles	.0410	.0285
Cost per Ton for All Timber	.1418	.1125
Equiv. of Stull Timber to Board Measure	505,643	523,053
Feet of Board Measure Per Ton of Ore	.7512	.7240

Total Cost for Timber, Lagging, Poles, Etc. and Cost per Ton

Year	Amount	Cost per Ton
1948	95,440.37	.1418
1947	81,240.99	.1125
1946	70,147.24	.1473
1945	85,769.70	.1535
1944	100,622.46	.1740

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7. UNDERGROUND

f. Explosives, Drilling and Blasting

EXPLOSIVES STATEMENT FOR THE YEAR 1948

Stoping and Ore Development

Kind	Quantity	Average Price		Amount 1948	Amount 1947
1¼" Gelamite #1	17,750	.1474	lb.	2,616.90	3,633.77
1¼" 60% Hi-pressure Gelatin	100	.2000	"	20.00	
1¼" 60% Gelatin	550	.1764	"	97.00	
1¼" Hercomite 2X	292,469	.1398	"	40,899.41	34,716.45
Total Powder 1948	310,869	.1403		43,623.31	
Total Powder 1947	283,733	.1352			38,350.22
Fuse	1,129,500	7.88	M'	8,897.95	7,227.87
#6 Blasting Caps	132,689	13.91	M	1,845.97	1,646.81
Electric Blasting Caps	144	16.96	C	24.42	540.95
Powder Bags	43	4.25	Ea.	182.90	167.93
Tamping Bags	4,400	2.25	M	9.90	25.00
Fuse Lighters	30,000	8.83	"	265.02	202.54
Primacord	32,000	32.00	"	1,024.00	1,248.00
Miscellaneous					74.89
#20 Connecting Wire	48	8.00		38.40	
Total Fuse, Caps, Etc.				12,288.56	11,133.99
Total All Explosives				55,911.87	49,484.21
Product, Tons				673,126	722,401
Pounds Powder per Ton of Ore				.4618	.3927
Cost per Ton for Powder				.0648	.0531
Cost per Ton for Fuse, Caps, Etc.				.0183	.0154
Cost per Ton for All Explosives				.0831	.0685

Rock Development

Hercomite 2X	16,557	.1376	lb.	2,277.54	503.82
Total Powder 1948	16,557	.1376		2,277.54	
Total Powder 1947	3,732	.1350			503.82
Fuse	41,220	7.66	M	315.78	57.89
#6 Blasting Caps	4,580	13.85	"	63.42	11.41
Total Fuse, Caps, Etc.				379.20	69.30
Total All Explosives				2,656.74	573.12
Total Explosives Used at Mine				59,456.37	50,057.33
Average Price per Pound for Powder				.1403	.1352

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f. Explosives, Drilling and Blasting, (Cont.)

Statement showing cost per ton for explosives, exclusive of rock development, for the period 1944 to 1948, is as follows:

Year	Cost per Ton	Production
1948	.0831	673,126
1947	.0685	722,401
1946	.0632	476,348
1945	.0624	558,633
1944	.0562	578,307

Although the price of powder and other explosive supplies uncreased from 3% to 10%, there was also more powder required per ton of ore and this latter cause was mostly responsible for the increase of .0146 in the cost per ton for all explosives. There was considerably more hard ground encountered in 1948 which not only required more time to drill but also more powder to break. It was necessary to purchase Gelamite for charging the long holes drilled above the horizontal in sub caving and stoping as the Hercomite is too dry and granular.

h. Mining & Loading

The ore produced in 1948 was mined by three different methods and the following table shows a comparison with last year.

	Percentage Based On Number of Contracts		Percentage Based On Product	
	1948	1947	1948	1947
Sub Level Stoping	2%	5%	4%	15%
Sub Level Caving	71%	45%	78%	50%
Top Slicing	27%	50%	18%	35%

There was a considerable increase in the number of contracts using the sub caving method of mining during 1948 which increased the tons per man for these places and cut down the amount of timber used. On the other hand, the three sub level stopes in production during 1947 were all completed early this year and the new ones only started to stope in the last two months. There will be three more that will be active in 1949 and these will offset the loss of some of the mining places in other areas which have been stopped for various reasons.

A new type of jackbit was developed late in 1947 by the Ingersoll Rand Company and this bit, which is only 1 3/4" in diameter and has four carbide inserts pressed into the cutting face, was used quite extensively on development work or where the ore was very hard and it was necessary to drill fairly long holes. These bits were found to be exceptionally valuable in the excavation of the trench where the ground was composed of a very hard quartzite. Formerly, a regular jackbit did not drill over a few inches before becoming useless, while the new bits drilled over 200 feet before they had to be discarded. Their cost is about $13.00 as compared with $.13 for the jackbits but the increase in life plus the time saved when drilling, more than offset the extra cost.

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h. Mining & Loading (Cont.)

The most noteworthy improvement during the year was in loading ore at the shaft where a trench was put into operation on the 6th Level. The trench was excavated for a distance of 150 feet from the shaft and was 8' wide by 6' deep at the shaft end and was driven on an incline to a depth of 11' at the far end to allow for water to collect and be pumped out. Two extra measuring pockets were installed directly above the regular measuring pockets and these are loaded by a scraper from the trench and this allows the former pockets to be used for other grades and rock or if the trench equipment is out of order. The wet and dry ore being transported to the shaft could be dumped into trench and the mixture was then dry enough to scrape directly into the skip, filling the same, where heretofore all the wet dirt had to be dumped through an open pocket into the skip which not only resulted in a short skip load but also kept the train at the shaft while the skip made a trip to surface for each car. With an eight car train this took almost one-half hour as compared with only a few minutes required to dump a train into the trench. A 25 h.p. scraper unit was installed using a 60" scraper pulled by 3/4" rope. A 40 h.p. unit has been ordered as it was found necessary to purchase more 25 h.p. units for the long transfers in the mine and it was thought advisable to use this hoist inside and obtain a more powerful one for the trench.

Formerly, all the material that fell into the skip pit when loading had to be loaded into two ton buggies and hoisted on the cage to an upper level to be dumped into the pocket. A raise was put up from the back of the skip pit plat 80' below the 6th Level and holed into the side of the trench. A hoist and small skip was installed in this raise and now one man working intermittently when not required on other work at the plat can clean the skip pit easily. Formerly, it took three men one shift every 24 hours and the very wet material was difficult to handle in the pockets.

i. Ventilation

A very extensive program to increase ventilation was carried on last year and completed in the spring of 1948. This was a permanent connection in rock from the 6th Level to the 14th Level, Negaunee Mine and when completed allowed approximately 26,000 cu. ft. of air to enter on the 6th Level and be directed through the working places above. Formerly, all the air available to these contracts had to be brought through various raises from the 4th and 5th Levels and by the time it reached the contracts it had become quite contaminated with smoke and dust. With about an equal amount of very fresh air coming from the Negaunee Mine to the 4th Level, the ventilation of the Maas Mine is now adequate except during the completion of a place and here auxillary fans are installed to boost the pressure and afford more volume.

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7. UNDERGROUND

j. Pumping

The volume of water being pumped from underground remained about the same although No. 2 well pump was idle all year due to an apparent breaking of the shutter screen which allowed a large amount of fine sand to enter the well. This was so abrasive that it cut the impellers of the pump very rapidly besides filling all the pipes on surface with sand. As the discontinuation of this pump did not increase the amount of water in the mine, it was decided not to go to the expense of cleaning out and regravelling this well. Due to the very fine sand adjacent to the well it had apparently not been draining the water from a very large area but it is still thought that there may be some other place on surface where gravel exists and if this can be found it will be well worth while to install another pump as there is a very large volume of water coming into the workings on the North footwall above the 4th Level. No. 1 well was active throughout 1948.

The number of gallons per minute pumped underground is shown below:

Month	1948	1947
January	975	1,084
February	1,123	1,030
March	1,156	1,017
April	1,121	1,069
May	1,143	1,168
June	1,102	1,087
July	1,132	1,048
August	1,069	1,087
September	1,037	1,222
October	1,069	1,080
November	1,024	1,075
December	1,020	1,075
Total Average	1,081	1,073

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8. COST OF OPERATING

a. Comparative Mining Cost

	1948	1947
Product	673,126	722,401
Underground Cost	2.372	1.972
Surface Cost	.243	.205
General Mine Expense	.402	.377
Cost of Production	3.017	2.554
Depletion - Original Cost	.036	.060
Depreciation - Plant & Equipment	.021	.044
Development	.047	.047
Movable Equipment	.014	.002
Taxes	.209	.173
Loading & Shipping	.072	.069
Total Cost at Mine	3.416	2.950
Budget, Estimated Cost per Ton	3.468	3.040
Number of Days Operated	302	300
Number of Shifts & Hours:		
1 8-hour	3	4
2 8-hour	299	296
Average Daily Product	2,229	2,408

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8. COST OF OPERATING

b. Detailed Cost Comparison

	1948 Amount	1948 Per Ton	1947 Amount	1947 Per Ton
Underground Costs				
1. Exploring in Mine	1,366.20	.002	43.34	.000
2. Development in Rock	18,051.11	.027	3,521.05	.005
4. Development in Ore	7,636.71	.011		
5. Stoping	543,290.35	.807	485,621.92	.672
6. Timbering	502,736.09	.746	441,963.31	.612
7. Tramming	196,371.30	.291	196,648.89	.272
8. Ventilation	19,928.50	.030	23,284.14	.032
9. Pumping	66,409.79	.099	69,305.88	.096
10. Compressors & Air Pipes	65,954.42	.096	62,928.79	.087
12. Underground Superintendence	49,035.17	.073	43,514.97	.060
14. Maintenance, Compr. & Drills	6,752 60	.010	2,822.43	.004
15. Scrapers & Mechanical Loaders	59,186.24	.088	46,531.66	.064
16. Electric Tram Equipment	41,569.01	.062	32,806.92	.045
17. Pumping Machinery	18,584.83	.028	15,953.39	.022
Total Underground Costs	1,596,872.32	2.372	1,424,860.01	1.972
Surface Costs				
18. Hoisting	53,284.15	.079	52,447.29	.073
19. Stocking Ore	24,957.37	.037	22,159.01	.031
20. Screening-Crushing at Mine	232.90			
21. Dry House	16,939.17	.025	15,343.32	.021
22. General Surface	12,653.66	.019	13,004.44	.018
23. Maintenance Hoisting Equipment	17,117.94	.025	23,744.22	.033
24. Shaft	23,274.93	.034	11,783.84	.016
25. Top Tram Equipment	4,855.00	.007	3,345.43	.005
26. Docks, Trestles, & Pockets	7,347.55	.011	4,517.17	.006
27. Mine Buildings	4,068.42	.006	1,522.39	.002
Total Surface Costs	163,431.09	.243	147,867.11	.205
General Mine Expense				
Geological	1,548.46	.002	897.14	.001
28. Insurance	18,328.18	.027	13,049.66	.018
29. Mining Engineering	9,594.33	.014	7,072.97	.010
30. Mechanical & Electrical Engineering	3,949.43	.006	3,662.33	.005
31. Analysis & Grading	32,719.19	.049	31,644.03	.044
32. Personal Injury	28,275.74	.042	48,965.89	.068
33. Safety Department	4,082.02	.006	4,051.97	.006
34. Telephones & Safety Devices	4,728.69	.007	4,407.40	.006
35. Local & General Welfare	5,520.29	.008	5,459.17	.008
36. Sp. Exp., Pensions & Allowances	10,385.42	.015	8,460.59	.012
37. Ishpeming Office	36,107.69	.054	30,292.89	.042
39. Mine Office	33,341.44	.050	30,559.68	.042
Social Security Taxes	27,625.77	.041	30,311.55	.042
Employees' Vacation Pay	54,135.00	.081	53,473.80	.074
Total General Mine Expense	270,341.65	.402	272,309.07	.377
Cost of Production	2,030,645.06	3.017	1,845,036.19	2.554

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8. COST OF OPERATING

b. Detailed Cost Comparison (Cont.)

(1) Days and Shifts

Year	Days Worked	Shifts & Hours	Men Employed	Total Days Worked
1948	302	1 & 2-8	370	113,552 3/4
1947	300	1 & 2-8	368	112,162 3/4
Increase	2		2	1,390

Total Men Employed in December of Each Year

	1948	1947	1946
Surface	59½	59½	57
Underground	295 3/4	301½	304
Total	355¼	361	361

(2) Wages

There was an increase in wages effective July 16th based on a sliding scale of 9½¢ per hour to the lowest rate with 1¢ per hour increase for each 4 cents in rate. The salaried employees also received approximately a 9% increase effective August 1st and the operating supervisors received $100.00 as a bonus at Christmas.

(3) Comparison of Production

Year	Production	Average Daily Product
1948	673,126	2,229
1947	722,401	2,408
Decrease	49,275	179

(4) Comparison of Number of Men & Wages

Year	No. Men	No. Days	Amount	Rate Per Day
1948	370	113,552 3/4	1,393,185.75	12.27
1947	368	112,162 3/4	1,254,829.31	11.19
Increase	2	1,390	138,356.44	1.08

(5) Tons Per Man Per Day

	1948	1947	Increase	Decrease
Surface	36.22	35.88	.34	
Underground	7.01	7.85		.84