

THE CLEVELAND - CLIFFS IRON COMPANY
Cros Mining Department
ANNUAL REPORT OF GENERAL MANAGER
For Year Ending December 31, 1947

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THE CLEVELAND-CLIFFS IRON COMPANY
ORE MINING DEPARTMENT

Manager's Annual Report Year 1947

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Ishpeming, Michigan
February 12, 1948

Mr. A. C. Brown, President,
Cleveland, Ohio

Dear Sir:-

A brief summary of the Mining Department's operation for 1947 covering the principal subjects is hereby submitted:

GENERAL

Due to the acquisition of the International Harvester properties, the total number of mines operated by the Mining Department increased from fourteen to seventeen. At the end of the year we had ten properties in Michigan and seven in Minnesota. In the Ishpeming area the active producers were Mather "A", Cliffs Shaft, Lloyd and Tilden properties. In Negaunee we operated five mines, the Athens, Cambria Jackson, Maas and Negaunee, with Mather "B" shaft sinking. In the Iron River District development and mining were being carried on at the Spies Mine with the accent on developing.

In Minnesota the three active properties at the west end of the Mesaba Range were the Canisteo, Hill and Holman. In the central west area are located the Sargent, Agnew and Hawkins. The Atkins Mine is in the central east portion of the Range.

ADMINISTRATIVE STAFF

In the Mesaba area, Richard Belliveau, formerly at Steep Rock, was hired as Mr. Sterling's first assistant. E. L. Bemis, who had been Assistant General Superintendent for the International Harvester Company, was first put in charge of the three Harvester properties under Mr. Sterling, and then at the end of the shipping season, transferred to the Canisteo Mine as Superintendent. W. A. Pakkala in turn was shifted from the Canisteo to the Holman. Paul Swanson remained at the Hawkins as Superintendent and the same is true of George Quick who was left in charge of the Agnew. Arnold Hill was transferred from the Engineering Department to the Sargent Mine when Charles Carlson resigned. John Foucault was also shifted from the Holman to the west central area as Superintendent of the Agnew and Sargent and also given supervision of the work at the Atkins after A. T. Soder resigned.

In the Michigan area James Westwater was promoted to Superintendent and put in charge at Mather Mine "B" shaft. At the end of the year three superintendents were shifted, John Trosvig going from the Cambria Jackson to the Athens, W. R. Atkins from the Negaunee to the Cambria Jackson, and C. R. Sundeen from the Athens to the Negaunee. D. Kelly Campbell was hired to act as an assistant to Grover Holt in the fall of 1947.

By the end of the year we had also arranged to get Louis J. Erck to head up our Research Department. R. G. Schaal joined the Company as Asst. Chief Mechanical Engineer early in the spring.

PRODUCTION & SHIPMENTS

Production:

Production from the Michigan and Minnesota mines for the past five years follows:

<u>Year</u>	<u>Michigan Mines</u>	<u>Minnesota Mines</u>	<u>Total</u>
1943	3,953,526*	2,541,933	6,495,459
1944	3,496,534*	2,400,481	5,897,015
1945	3,542,802*	2,376,286	5,919,088
1946	2,730,496*	1,642,184	4,372,680
1947	4,162,545*	3,767,682*	7,930,227

* These figures do not include previous year's stockpile overrun.

If the previous years stockpile overrun tonnages are included the totals for 1947 are as follows:

Michigan Mines	4,177,478 tons
Minnesota Mines	3,807,485 "
Total production - 1947	<u>7,984,963 tons</u>

Shipments:

Shipments for 1947 from our Michigan and Minnesota operations were as follows:

Michigan Mines	4,640,826 tons
Minnesota Mines	3,580,937 "
Total shipments, 1947	<u>8,221,763 tons</u>

Shipments from the Michigan mines established a new record, exceeding the former high in 1942 by 30,248 tons.

ANALYSES

The following data is intended to show the average mine analyses for the various mixtures, the Lake Erie analyses for the same cargos, and also the expected analyses for those mixtures for the past year:

MICHIGAN ORES

<u>GRADE</u>		<u>RAILROAD TONS</u>	<u>IRON DRIED</u>	<u>MOISTURE</u>	<u>IRON NAT'L.</u>
Belden	Mine	655,541	57.61	11.90	50.755
	Lower Lake		57.97	12.07	50.968
	Expected analysis		57.67	11.99	50.76
Cliffs Group Special Escanaba	Mine	598,577	57.38	11.50	50.761
	Lower Lake		57.66	10.74	51.454
	Expected analysis		57.52	10.12	51.07
Cliffs Group Special Marquette	Mine	762,831	57.89	12.11	50.874
	Lower Lake		58.17	11.56	51.438
	Expected analysis		58.25	10.02	51.10
Cliffs Group Bethlehem	Mine	951,603	58.69	11.77	51.790
	Lower Lake		-	-	-
	Expected analysis		-	-	-
Cliffs Group Pickands Mather	Mine	261,373	58.69	11.82	51.752
	Lower Lake		-	-	-
	Expected analysis		-	-	-
Cliffs Group J. & L.	Mine	203,173	58.83	11.78	51.900
	Lower Lake		58.76	11.56	51.979
	Expected Analysis		59.01	11.83	52.03
Cliffs Group Harvester, etc.	Mine	266,039	58.83	12.04	51.747
	Lower Lake		58.64	11.51	51.800
	Expected Analysis		59.01	11.83	52.03
Cliffs Shaft Lump	Mine	347,278	60.82	0.30	60.639
	Lower Lake		60.96	0.35	60.728
	Expected Analysis		60.25	0.42	60.00
Maas Special No. 2	Mine	342,332	58.94	11.85	51.953
	Lower Lake		58.35	11.81	51.451
	Expected Analysis		59.05	11.96	51.99
Virgil	Mine	241,782	57.08	10.00	51.372
	Lower Lake		57.19	10.65	51.105
	Expected Analysis		57.47	10.15	51.64

The foregoing is not a complete list of all of the ores shipped by vessel from the Marquette and Menominee Ranges because we have not tabulated the Tilden Mine silicious ores, Princeton shipments, Negaunee crushed or the straight Negaunee for Bethlehem.

However, the foregoing tabulation is of interest because it proves the Lake Erie analyses are invariably higher than the mine analyses and the bulk of the ore shipped runs higher than guaranteed in iron natural.

MINNESOTA MINES

<u>GRADE</u>		<u>RAILROAD TONS</u>	<u>IRON</u>	<u>PHOS.</u>	<u>MOISTURE</u>	<u>IRON NATURAL</u>
Newberry Bess.	Mine	274,017.44	56.655	.038	7.682	52.303
	Lower Lake		57.176	.038	7.280	53.014
New.Bess-J.& L.	Mine	304,747.72	56.678	.038	7.290	52.542
	Lower Lake		56.958	.038	7.345	52.774
New.Bess-Beth.	Mine	277,347.02	56.751	.038	7.465	52.515
	Lower Lake		57.194	.037	7.151	53.104
Wmson-(GN)	Mine	1,130,791.28	56.527		8.895	51.492
	Lower Lake		57.060		8.600	52.153
Wmson-(J.& L.)	Mine	711,403.30	56.781		8.876	51.741
	Lower Lake		56.995		8.938	51.908
Wmson-Beth.	Mine	125,360.18	56.470		8.883	51.454
	Lower Lake		56.747		8.808	51.749
St. Paul (GN)	Mine	468,148.52	55.886		12.196	49.070
	Lower Lake		56.211		12.123	49.397
Ralph	Mine	101,901.77	50.495		10.219	45.334
	Lower Lake		51.251		9.912	46.171
<u>R.R. Tons-Pounds</u>						
St. Paul (DMIR)	Mine	115,294 - 1540	56.617		13.200	49.144
	Lower Lake		56.770		13.492	49.111
Alstead (DMIR)	Mine	8,512 - 1420	50.540		8.710	46.138
	Lower Lake		50.430		8.221	46.284
Wmson (DMIR)	Mine	9,714 - 1140	57.332		10.572	51.271
	Lower Lake		57.297		10.248	51.425

If the statement showing the comparison between lower lake results and mine analyses for the Mesaba Range shipments is analyzed, it will be noted, as was the case with the Michigan shipments, that invariably - particularly in the case of the larger tonnages involved - the lower lake analyses will average higher than the mine analyses.

TONS PER MAN

A tabulation of the tons per man per day for the years 1946 and 1947 follows. These figures indicate an improvement in efficiency for every one of the soft ore mines

UNDERGROUND MINES

BA

<u>Mine</u>	<u>Tons per Man per day 1946</u>	<u>Tons per man per day 1947</u>
Athens	4.82	5.04
Cambria Jackson	6.71	8.48
Cliffs Shaft	4.24	4.14
Lloyd	5.96	6.93
Maas	5.57	6.44
Mather	6.24	6.93
Negaunee	7.01	7.28
Agnew	-	9.55
Sargent	-	8.27

The tons per man data in this report is based on tons divided by the total man days worked, including administrative staff. The figures in the 1946 report excluded all of the bosses.

OPEN PIT MINES

<u>Mine</u>	<u>Tons per man per day 1946</u>	<u>Tons per man per day 1947</u>
Atkins	-	71.22
Canisteo	32.24	36.08
Hill Trumbull	23.92	24.56
Holman Cliffs	22.10	29.80
Hawkins	-	29.98

In evaluating the foregoing figures, it is necessary to consider the percentage of recovery. The Atkins produced a direct shipping ore. The percentage of recovery for the Canisteo, Holman, Hill Trumbull and Hawkins for 1947 was 54.5%; 63.7%; 44.2%; and 55.2%. On that basis, everything being equal and only considering those mines that have a concentrating plant, the Holman should give us the best tons per man, whereas as a matter of fact the Canisteo headed the list in 1947.

COSTS

Michigan Underground Mines

Mine	Production	1947		TOTAL COST		IDLE EXPENSE* A/C MINE STRIKE	
		COST OF PRODUCTION		Per Ton	Amount	Per Ton	Amount
		Per Ton	Amount				
Athens	508,100	3.122	1,586,302.83	3.559	1,808,040.46		
Cliffs Shaft	546,796	3.705	2,025,819.02	4.170	2,280,139.31		
Cambria Jackson	554,105	1.991	1,103,446.01	2.259	1,251,526.35		
Lloyd	253,976	2.271	576,914.69	2.550	647,667.28		
Maas	722,401	2.554	1,845,036.19	2.950	2,131,161.05		
Mather "A"	729,669	2.569	1,874,786.44	3.087	2,252,429.91		
Negaunee	531,670	2.257	1,169,950.68	2.565	1,329,948.81		
TOTAL	3,846,717	2.647	10,182,255.86	3.042	11,700,913.17		

1946

Athens	367,361	2.811	1,032,758.37	3.248	1,193,082.48	98,611.32	
Cliffs Shaft	401,939	3.051	1,226,072.33	3.485	1,400,491.65	133,652.58	
Cambria Jackson	296,660	2.240	664,579.50	2.501	741,846.00	67,351.60	
Lloyd	247,853	2.244	556,296.35	2.526	626,077.50	51,250.44	
Maas	476,348	2.596	1,236,566.24	3.046	1,451,132.64	128,114.23	
Mather	339,433	2.484	843,446.90	3.017	1,024,080.72	101,323.57	
Negaunee	416,021	2.063	848,410.51	2.311	961,528.56	97,436.54	
TOTAL	2,545,615	2.521	6,418,130.20	2.906	7,398,239.55	677,743.28	.266

1947

Increase in Product	1,301,102				
Increase in Cost Percent	51.1%	.126 5%		.136 4.7%	

* Idle expense account mine strike not included in operating Costs. Mines were idle from February 8th to May 22nd, 1946 due to strike. Wages were increased 18½¢ per hour effective May 22nd, 1946 or approximately 19.6%.

The foregoing figures indicate production in 1947 increased 51.1% over 1946 but that cost increases on the average were held to a little under 5%.

LABOR

The general over-all labor supply both in Michigan and Minnesota on the average would be considered good in 1947 because there were no severe shortages. However, at the Agnew and Sargent we could have used a few more miners to good advantage and the same statement applies to the Michigan underground properties. On the Mesaba Range we would get better

LABOR (Cont.)

efficiency and have fewer accidents, both to men and equipment, if we could get older more matured men to act as truck drivers. By and large the average truck driver is young, with little experience in the handling of the heavy haulage units.

The following tabulation shows the rising trend in number of men employed:

AVERAGE NUMBER OF EMPLOYEES - 1947

	<u>MICHIGAN PROPERTIES</u>			<u>Total for Year</u>
	<u>January</u>	<u>July</u>	<u>December</u>	
Athens Mine	348	346	347	346
Cliffs Shaft Mine	435	439	454	441
Cambria Jackson Mine	222	223	222	221
Lloyd Mine	147	135	122	135
Maas	392	395	371	384
Mather "A"	354	409	500	421
Mather "B"	-	60	80	65
Negaunee	268	242	218	246
Princeton	5	10	6	8
Spies	99	114	114	110
Tilden	3	20	20	12
Miscellaneous *	66	61	62	62
General Storehouse & shops	130	149	141	140
Cliffs Power & Light Co.	73	82	89	83
General Payroll, Ishpeming**	212	225	223	220
Cleveland	22	24	24	23
	<u>2776</u>	<u>2934</u>	<u>2993</u>	<u>2917</u>

* Miscellaneous payroll includes 45 hospital employees - balance laboratory.

** General payroll includes 68 hospital employees

MESABA RANGE

					<u>Total for Year</u>
	<u>March</u>	<u>May</u>	<u>Sept.</u>	<u>Dec.</u>	
Agnew	63	76	83	91	90
Sargent	36	59	79	97	85
Atkins	52	55	57	68	62
Canisteo	160	165	167	172	166
Holman Cliffs	224	222	241	243	231
Hill Trumbull	180	178	192	191	185
Hawkins	55	125	159	115	140
General Role-Hibbing	45	51	55	54	55
Cleveland	15	15	15	14	15
TOTAL	<u>830</u>	<u>946</u>	<u>1048</u>	<u>1045</u>	<u>1029</u>

ORE RESERVES

	<u>MICHIGAN MINES</u>		<u>Increase or Decrease</u>
	<u>Dec.31,1946</u>	<u>Dec.31,1947</u>	
Standard ores	21,772,280	19,304,735	2,467,545
High sulphur ores	6,123,395	6,091,500	31,895
Total	27,895,675	25,396,235	2,499,440

Decreases in ore reserves as reported to the Michigan State Tax Commission were confined mostly to the Athens Mine, Mather and Negaunee Mines and Maas Mine. With the exception of the Negaunee the figures do not truly reflect the probable and possible extension of the known ore bodies. At the Athens we are reasonably sure of developing additional tonnage north of the main dike. This has since been proven by drilling done in January and February of 1948. At the Maas there is undoubtedly a large undeveloped tonnage reserve deeper and to the west of the bottom level. At the Mather in the course of the next few years much new additional tonnage will be added to the present known ore in sight

	<u>MESABA RANGE</u>		<u>Increase or Decrease</u>
	<u>Dec. 31, 1946</u>	<u>Dec.31, 1947</u>	
Agnew	-	1,745,000	-
Atkins	1,544,071	1,379,000	165,071
Canisteo	7,005,000	8,980,000	1,975,000
Hawkins	-	3,999,000	-
Hill Trumbull	2,551,000	2,166,000	385,000
Holman Cliffs	8,407,887	7,579,000	828,887
Sargent	-	1,874,000	-
Wanless	1,251,000	1,251,000	-
Total	20,753,958	28,973,000	

ELECTRIC POWER

In 1947 we reached the highest sales of electric energy and also purchased the greatest quantities of power in the history of the Cliffs Power & Light Company. Total sales for the year were 102,948,245 KWH, and 111,372,320 KWH were generated and purchased. At the beginning of the year the estimated amount of water in storage was equal to 10,526,000 KWH which meant less than one quarter of the total capacity of the reservoirs are filled. Consequently very heavy purchases were made during the first four months of 1947 and immediately after the breakup. Purchases were resumed early in the summer and continued throughout the entire year. Because of fairly normal precipitation, water conditions were fairly good throughout the year and on December 31st we had a total of 17,420,000 KWH in storage, amounting to a little more than one third of our total storage capacity.

ELECTRIC POWER (Cont.)

The latter part of 1946 it was realized that our production facilities were inadequate to supply our customers without making heavy purchases from the Wisconsin Michigan Power Company. About the middle of April of 1947 that company notified us that during the remainder of our contract with them, which contract runs until about the middle of 1950, our purchases would have to be restricted to the amount specified in the contract, or 4,000 KW between 7:00 P.M. and 7:00 A.M. Because the Cliffs Power & Light Company sold more kilowatt hours in 1947 than ever before, and because there is every likelihood of still further increased demands for power in the immediate future, and because the Wisconsin Michigan Power Company are severely restricting our purchases until 1950 and furthermore when that company indicated that our purchase contract would not be renewed in 1950, we were faced with a critical emergency.

This created such an acute situation the Stone & Webster Engineering Company were engaged to make a study of our load conditions and the possibility of the installation of additional generating capacity. The preliminary report recommended the immediate installation of at least 5,000 KW in diesel engine generating capacity, and because this equipment could be purchased second hand, negotiations were started early in May for the purchase of five 1,000 KW generating units. After considerable study it was decided to locate the diesel plant in Ishpeming. The first of the diesel engines were received late in June and deliveries of the power plant building, cooling tower, fuel tanks and other equipment were made during the year but unfortunately the late delivery of the power plant building itself caused serious delays in the installation of the diesel plant.

In addition to retaining Stone & Webster for the purpose of determining the proper solution of the power problem, the Power Company also retained Holland, Ackerman & Holland for the purpose of determining whether or not there was any available water power which might be used to supplement our present hydroelectric plants, in the hope that a hydroelectric development might be undertaken to carry the load and delay the building of a steam generating unit. Holland, Ackerman & Holland reported their investigations revealed no water power available in the immediate territory adjacent to Ishpeming which would provide sufficient capacity to carry the system load in 1950.

The repair work of welding the steel pipe line between the Carp intake dam and the Carp power plant was continued and I am pleased to report that by the end of October all of the welding on the lock weld steel pipe was completed.

Additional work was done repairing the deteriorated surface on the face of the Hoist power plant dam and as might be expected, this proved to be a very tedious and expensive maintenance project. About 25% of the total repairs have now been completed. However, no further work was done on this project the end of the past year because the construction of the diesel power plant used up all of the available labor supply so no further repairs have been made to the dam since the work was stopped early in July of 1947.

SAFETY DEPARTMENT

The year 1946 was the first in the history of the Company (except 1932 when the mines were closed most of the year) when no fatality occurred. However, after almost twenty-three months without a fatal accident, a series of events occurred involving fatalities. Everyone of these, with two exceptions, were preventable and due to man failure. Two of them in particular were due to complete disregard of warnings and could easily have been avoided. The Director of Safety gives complete details in his annual report.

FATAL ACCIDENT RECORD

<u>Year</u>	<u>Number Men Employed</u>	<u>Number of Fatalities</u>	<u>Fatality Rate</u>
1901-1905	7,729 *	41	5.30
1906-1910	13,028	66	5.06
1911-1915	13,332	35	2.70
1916-1920	18,348	43	2.36
1921-1925	12,282	20	1.61
1926-1930	10,438	72	6.90
1931-1935	5,298	11	2.05
1936-1940	12,691	12	0.94
1941	3,570	5	1.40
1942	3,562	2	0.56
1943	3,609	4	1.11
1944	3,584	3	0.84
1945	3,078	1	0.32
1946	2,791	0	0.00
1947	3,942	7	1.78

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The number of man shifts worked and tons of ore produced for each fatal accident is shown by the data which follows:

NUMBER OF MAN SHIFTS WORKED AND TONS OF ORE PRODUCED PER FATALITY

<u>Year</u>	<u>Number of Fatalities</u>	<u>Number man days worked per fatality</u>	<u>Number tons of ore mined per fatality</u>
1931	3	165,137	529,680
1932	-	189,000*	486,750**
1933	2	94,689	398,357
1934	4	80,477	451,046
1935	2	196,883	1,136,215
1936	2	283,945	1,850,898
1937	1	765,702	5,216,879
1938	3	163,434	385,954
1939	1	564,433	3,713,389
1940	5	142,878	1,156,387
1941	5	182,340	1,456,528
1942	2	512,356	3,808,258
1943	4	269,351	1,624,315
1944	3	331,090	1,995,787
1945	1	915,666	5,970,577
1946	0	747,079*	4,416,253**
1947	7	153,031	1,130,679

*Man shifts worked

** Amount of ore mined

SAFETY DEPARTMENT (Cont.)

As a result of the fatalities, both frequency and severity rates are much higher than last year. As mentioned in last year's report, our frequency rate is all out of proportion with our severity rate. This indicates very clearly we are reporting more slight accidents than most other employers in the Lake Superior country.

The tabulation which follows is taken from our records and available statistics of the National Safety Council. These cover compensable non-fatal accidents:

COMPARISON OF FREQUENCY - SEVERITY RATINGS

	<u>Frequency</u>	<u>Severity</u>
1946 National Rating, All Mining, Other than coal	39.13	6.58
1946 " " Underground metal mining	35.04	7.54
1946 " " Open cut Metal mining	22.90	1.99
1946 Lake Superior District, all mines	23.21	3.33
1947 Cleveland-Cliffs Iron Co., Compensable Accidents	17.39	6.062
1947 " " " all accidents	45.04	6.127
1947 " " " open cut mining	24.14	0.647
1947 " " " top slicing	57.46	7.810
1947 " " " Stopping	43.13	13.848
1947 " " " Sub level Caving	74.35	6.003
1947 " " " Low height block caving	68.14	7.392
1947 " " " General Shops	14.75	0.138
1947 " " " General Roll	00.00	0.000
1947 " " " Miscellaneous	7.81	0.250
1947 Cliffs Power & Light Company	0.00	0.000

MEW METHODS OF MINING & BENEFICIATION

New methods of mining were inaugurated in underground properties. Progress was made on the Mesaba to improve beneficiation practices relative to lower grade crude ores, and also in the reduction of stripping costs.

On the Marquette Range after intensive study by the administrative staff, block caving was inaugurated at the Athens Mine. That experience was viewed with interest by most of the other operators in the Lake Superior country as evidenced by the continued requests to visit that property. The experiment fulfilled all of our expectations. Recovery to date is over 90%, possibly close to 95% and dilution was held to a minimum.

A form of modified block caving is also being used at the Mather Mine.

Improvements in using sectional steel and the new practice of radial drilling increases production in sub level stoping, besides reducing the possibility of accident by the elimination of bench mining.

*Refer to
acct 7B & .*

NEW METHODS OF MINING (Cont.)

The introduction of the new type carset drilling bit with the tungsten-carbide (hardest known metallic substance) inserts in some instances cut down drilling time by one half.

Plans are now completed for our first conveyor belt installation in an underground property.

On the Mesaba Range construction will soon start on the conveyor belt installation for surface stripping at the Canisteo. The new Holman plant and set up with minor adjustments operated as planned. At the Hawkins work was started late in the year taking up tracks and excavating for the new conveyor system for delivering ore from the pit bottom to railway cars on surface.

At the Hill Trumbull changes in the retreat plant permitted us to send a lower grade of crude to the mill, thereby prolonging the life of this property.

Plans were finished and construction started on the plant designed to recover the fines from the Holman tailings disposal pond.

Yours very truly



General Manager

CJS:DP

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THE CLEVELAND-CLIFFS IRON COMPANY
MINING DEPARTMENT
A COMPARISON OF MINING DEPARTMENT MICHIGAN ASSESSED VALUATION AND
TOTAL TAXES PAID FROM YEAR 1929 THROUGH 1947.

YEAR	The C C I Co	The Negaunee Mine Co	The Athens Ir Mng Co	The C P & L Co	Total Four Companies	Changes From Pre- vious Year
Assessed valuation						
1929	\$ 13,291,521	5,234,600	2,586,500	1,318,198	22,430,319	
1930	14,169,590	4,884,400	2,436,500	1,370,445	22,860,935	I 380,116
1931	13,867,696	4,635,700	2,536,500	1,539,428	22,579,324	I 218,389
1932	12,815,645	4,185,700	2,226,500	1,447,936	20,715,781	D 1,863,543
1933	9,850,359	3,554,400	2,036,500	1,419,565	16,860,824	D 3,854,957
1934	10,002,373	3,196,400	2,077,800	1,418,887	16,695,460	D 165,364
1935	10,062,288	3,057,770	1,929,520	1,424,711	16,474,289	D 221,171
1936	10,263,100	3,107,500	1,929,520	1,424,281	16,724,401	I 250,112
1937	11,589,306	3,350,000	2,242,900	1,442,555	18,624,761	I 1,900,360
1938	12,959,542	3,124,100	2,532,900	1,447,843	20,064,385	I 1,439,624
1939	13,090,541	3,267,300	2,683,400	1,981,982	21,023,223	I 958,838
1940	12,185,132	3,692,700	2,683,400	2,003,335	20,564,567	D 458,656
1941	11,202,237	4,644,430	2,683,400	2,004,379	20,534,446	D 30,121
1942	10,629,836	5,461,800	2,759,000	2,016,245	20,865,931	I 331,485
1943	11,936,427	5,418,800	2,785,300	2,134,715	22,275,242	I 1,409,311
1944	12,326,490	5,022,010	2,868,550	2,134,755	22,351,805	I 76,563
1945	11,949,265	4,809,060	2,446,740	2,135,750	21,340,815	D 1,010,990
1946	11,423,395	4,170,610	2,327,690	2,136,050	20,957,745	D 383,070
1947	11,826,910	4,524,225	2,197,815	2,143,105	20,697,055	D 260,690

Taxes - Paid						
YEAR	The C C I Co	The Negaunee Mine Co	The Athens Ir Mng Co	The C P & L Co	Total	Changes From Pre- vious Year
1929	476,740.79	199,695.33	97,739.13	55,233.01	829,398.26	
1930	522,901.50	190,689.79	95,122.50	61,352.11	870,064.90	I 40,666.64
1931	507,175.34	183,218.38	100,251.06	65,344.18	855,988.96	D 14,075.95
1932	377,700.32	120,527.71	65,264.22	46,897.77	610,390.02	D 245,598.94
1933	261,765.08	99,599.60	57,065.71	36,067.26	454,497.65	D 155,892.37
1934	267,327.80	86,527.53	56,246.84	31,256.06	441,358.23	D 13,139.42
1935	279,734.41	95,226.14	60,089.81	29,817.75	464,868.11	I 23,509.88
1936	302,207.99	107,861.43	66,447.06	30,066.37	505,782.85	I 40,914.74
1937	345,790.20	120,097.50	80,366.44	30,024.80	576,278.94	I 70,496.09
1938	415,719.34	118,534.83	96,103.47	30,227.17	660,584.81	I 84,305.87
1939	415,979.65	120,806.75	99,217.45	37,997.17	674,997.17	I 13,416.21
1940	376,744.89	130,696.88	95,075.43	39,698.46	642,215.63	D 31,781.54
1941	340,282.83	156,845.98	90,003.76	39,846.19	626,978.76	D 15,236.87
1942	321,091.31	182,845.08	91,057.97	37,636.66	632,631.02	I 5,702.26
1943	380,652.40	202,371.63	107,251.69	40,623.07	730,898.79	I 98,217.77
1944	436,214.77	200,703.60	121,015.20	40,577.13	798,510.70	I 67,611.91
1945	425,599.58	191,565.47	104,255.07	40,964.14	762,384.26	D 36,126.44
1946	417,575.92	168,599.05	103,799.44	43,785.56	733,759.97	D 28,624.29
1947	438,298.87	178,769.39	98,262.27	47,743.90	763,074.43	I 29,314.46

Notes: The 15-Mill Tax Amendment went into effect in 1933.
The Michigan State Sales Tax became effective in July 1933,
practically replacing the State Ad Valorem Taxes.
The drop in C C I Co 1933 valuation is due to the Inland Steel Co
taking over the Morris Mine

STATEMENT SHOWING COMPARATIVE COST FOR ALL EXPLOSIVES
USED AT HARD ORE MINES.

	1 9 4 4	1 9 4 5	1 9 4 6	1 9 4 7
PRODUCT - Tons	587,051	550,169	401,939	546,796
<u>POWDER</u>				
Pounds - Gelamite "2X"	585,750	523,450	360,550	
60% Gelatine		350	7,550	
Gelamite #1				52,250
Hercomite 2X.....				449,650
Hercomite 2KA.....				47,600
Total Pounds Powder	585,750	523,800	368,100	549,500
Total Cost	\$ 67,367.00	60,549.00	45,329.42	74,587.53
Fuse - Feet	836,561	791,194	561,500	814,864
Caps - Number	136,500	124,160	86,865	131,140
Duplex Shot Wire	26,480	7,760	11,115	15,435
Electric Caps	15,498	12,358	23,500	15,435
Fuse Lighters	35,000	35,000	11,900	42,500
Connecting Wire	637	637	347	768
Tamping Bags	35,000	11,700	8,300	10,200
No. 18 Shot Wire - Feet				13,081
Total Cost- Fuse, Caps, etc \$	9,562.74	8,323.06	6,584.20	12,050.74
Total Cost - All Explosives \$	76,929.74	68,872.06	51,913.62	86,638.27
Average Price per Pound - Powder \$	.1150	.1150	.1231	.1357
Cost per ton - Powder	\$.1148	.1100	.1127	.1364
Cost per ton - Fuse, etc	\$.0163	.0151	.0164	.0220
Cost per ton - All Explosives ..	\$.1311	.1251	.1291	.1584
Pounds Powder per ton of ore ...	.9980	.952	.916	1.005

1947 The production increased 144,857 tons or 36% in 1947, compared with 1946. Production in 1946 was low due to the work stoppage account of strike - February 8th to May 22nd 1946.

The average price per pound for Powder increased \$.0126 or 10.2% compared with 1946 and .0207 or 18% over 1945.

The cost per ton for all explosives increased \$.0293 or 22.7% over 1946.

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STATEMENT SHOWING COMPARATIVE COST OF ALL EXPLOSIVES
USED AT SOFT ORE MINES

	1 9 4 4	1 9 4 5	1 9 4 6	1 9 4 7
PRODUCT - Tons	2,700,228	2,562,695	2,143,676	3,286,638
<u>POWDER</u>				
Pounds - 40%.....		150	100	7,897
50%	815			
60%	74,070	37,457	33,125	13,325
80%				3,206
1X and 2X Hercomite ...	1,092,650	1,093,650	896,138	1,195,381
1X and 2X Gelamite				137,100
Total Pounds - Powder	1,168,535	1,094,659	929,363	1,356,909
Total Cost - Powder	\$ 134,423.51	125,861.91	113,896.57	184,282.70
Fuse - Feet	4,190,851	3,824,987	3,082,459	4,377,420
Caps - Number	599,138	541,726	421,489	550,703
Leading Wire - Feet	4,000	4,500	17,750	112,510
Connecting Wire - Pounds	172	72	62	96
Tamping Bags - Number	96,450	86,295	62,350	36,000
Tamptite Shells				38,950
Powder Bags	93	127	137	170
Fuse Lighters	121,084	105,700	96,900	124,300
Electric Exploders	11,619	4,074	9,381	15,291
Master Fuse Lighters	1,548	2,000	1,000	
Total Cost, Fuse , Caps, etc	\$ 31,530.09	28,557.13	25,792.30	45,871.33
Total Cost, All Explosives	\$ 165,953.60	154,419.04	139,688.87	230,154.03
Average Price per Pound - Powder	\$.1150	.1150	.1226	.1358
Cost per Ton - Powder	\$.0498	.0491	.0531	.0561
Cost per Ton - Fuse, Caps, etc ..	\$.0117	.0112	.0121	.0139
Cost per Ton - All Explosives ..	\$.0615	.0603	.0652	.0700
Pounds of Powder per ton of Ore	.4328	.4271	.4335	.4128

1947 The mines included in 1947 figures are Athens, Cambria Jackson, Lloyd, Maas, Mather A and Negaunee.

The Production increased 1,142,962 tons or 53% in 1947, compared with 1946 - Production in 1946 was low due to mines being idle February 8th to May 22nd.

The average price per pound for Powder increased .0132 or 10.7% compared with 1946, and .0208 or 18% over 1945.

The cost per ton for all explosives increased .0048 or 7.3% over 1946

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STATEMENT SHOWING COMPARATIVE COST FOR ALL MINE TIMBER
USED IN SOFT ORE MINES

	1944	1945	1946	1947
PRODUCT - Tons	2,700,228	2,562,695	2,143,676	3,286,638
<u>TIMBER</u>				
Feet - 6-8"	533,365	345,704	339,912	418,939
8-10"	266,988	179,170	191,462	202,301
10-12"	495,188	390,086	345,818	361,575
12-14"	274,828	233,952	160,846	174,390
14-16"	21,906	16,714	5,237	12,835
Treated Timber	250	8,389	9,807	13,499
Total Feet	1,592,471	1,174,015	1,052,081	1,183,539
Total Cost	\$174,030.56	136,629.67	126,217.36	163,655.34
<u>LAGGING</u>				
Feet - 7	7,508,090	6,458,823	4,828,872	6,186,393
Total Feet	7,508,090	6,458,823	4,828,872	6,186,393
Cost	\$106,325.33	90,743.61	68,795.03	94,068.34
Poles - Feet	5,616,789	5,479,330	3,485,770	3,196,555
Poles - Cost	\$113,484.62	115,326.82	80,753.58	77,184.65
Wire Fencing - Rods	1,147	208	63	90
Wire Fencing - Cost	\$ 1,159.38	240.12	73.29	10.52
Steel Sets	\$ 14,491.68			14,491.68
GRAND TOTAL COST	\$394,999.89	342,940.22	275,839.26	349,410.44
Average Cost per foot - Timber	\$.1093	.1164	.1199	.1383
" " " 100' - Lagging	\$ 1.416	1.405	1.424	1.521
" " " 100' - Poles	\$ 2.020	2.104	2.316	2.414
" " " Rod - Fencing	\$ 1.011	1.150	1.16	1.18
Feet of Timber per ton of ore ..	.590	.458	.491	.360
" " Lagging " " " ..	2.780	2.520	2.252	1.882
" " Poles " " " ..	2.080	2.138	1.626	.972
" " Fencing " " " ..	.007	.0013		
Cost per ton for Timber	\$.0644	.0533	.0589	.0498
" " " Lagging	\$.0394	.0354	.0321	.0286
" " " Poles	\$.0420	.0450	.0376	.0235
" " " Fencing	\$.0005	.0001		
" " " Structural Steel ..				.0044
Total Cost per ton .....	.1463	.1338	.1286	.1063

1947 The Mines included in 1947 figures are Athens, Cambria-Jackson, Lloyd, Maas, Mather A, and Negaunee.

The Production increased 1,142,962 tons or 53% in 1947 - compared with 1946. Production in 1946 was low due to mines being idle February 8th to May 22nd account of strike. The total cost per ton for all timber decreased \$.0223 or 17.3% compared with 1946.

STATEMENT SHOWING TOTAL COST OF SUPPLIES CHARGED TO "COST OF ORE AT MINE".

SOFT ORE MINES

	1944		1945		1946		1947	
PRODUCT - Tons	2,700,228		2,562,695		2,143,676		3,286,638	
<u>CLASSIFICATION</u>	<u>AMOUNT</u>	<u>PER TON</u>	<u>AMOUNT</u>	<u>PER TON</u>	<u>AMOUNT</u>	<u>PER TON</u>	<u>AMOUNT</u>	<u>PER TON</u>
General Supplies	137,163.65	.0507	118,680.10	.046	130,768.63	.061	263,751.82	.080
Iron & Steel	52,197.63	.0198	38,150.87	.015	48,990.40	.023	93,845.90	.029
Machinery	61,542.27	.0228	56,165.00	.022	111,045.43	.052	184,861.63	.056
Explosives	167,982.88	.0622	155,417.06	.061	139,771.78	.065	237,793.22	.072
Lumber and Timber	432,768.85	.1601	373,091.09	.145	300,772.30	.140	395,918.94	.120
Fuel	34,429.02	.0127	30,192.55	.012	24,354.23	.011	36,880.91	.011
Electric Power	494,302.75	.1831	452,656.12	.177	363,012.67	.169	570,798.56	.174
Miscellaneous	185,608.31	.0686	163,071.12	.063	57,565.92	.028	72,979.68	.023
Total	1,565,995.36	.5800	1,387,423.91	.541	1,176,281.36	.549	1,856,830.66	.565

HARD ORE MINES

	1944		1945		1946		1947	
PRODUCT - Tons	587,051		550,169		401,939		546,796	
<u>CLASSIFICATION</u>	<u>AMOUNT</u>	<u>PER TON</u>	<u>AMOUNT</u>	<u>PER TON</u>	<u>AMOUNT</u>	<u>PER TON</u>	<u>AMOUNT</u>	<u>PER TON</u>
General Supplies	40,688.16	.069	37,900.25	.068	36,551.28	.092	69,518.09	.127
Iron and Steel	39,443.60	.068	33,933.08	.062	25,785.43	.064	59,216.76	.108
Machinery	23,556.93	.040	17,083.10	.031	42,003.20	.104	74,426.64	.136
Explosives	76,929.74	.131	68,872.06	.125	51,913.62	.129	86,642.60	.158
Lumber and Timber	15,980.43	.027	15,546.68	.028	12,306.75	.031	29,023.34	.053
Fuel	5,988.68	.010	6,111.06	.012	3,205.94	.008	5,853.67	.012
Electric Power	111,649.01	.190	102,385.23	.186	74,927.89	.186	113,591.74	.208
Miscellaneous	60,069.89	.103	69,252.06	.126	5,154.82	.014	13,044.77	.024
Total	374,306.44	.638	351,083.52	.638	251,848.93	.628	451,317.61	.826

NOTE: 1947 Soft Ore Mines included in statement, Athens, Maas, Negaunee, Loyd, Mather and Cambria Jackson.

THE CLEVELAND-CIFFS IRON COMPANY
ORE MINING DEPARTMENT
LABOR SUMMARY -- ALL COMPANIES

	<u>1944</u>		<u>1945</u>		<u>1946</u>		<u>1947</u>	
PRODUCTION - TONS	5,958,102		5,926,724		4,402,437		7,970,030	
	DAYS	AMOUNT	DAYS	AMOUNT	DAYS	AMOUNT	DAYS	AMOUNT
Surface	384,372	\$2,879,649.20	359,951	\$ 2,874,020.12	321,987	\$3,025,895.78	484,004	\$5,129,821.26
Cost per Ton .....		.483		.485		.687		.644
Underground	546,173	4,510,435.55	495,916	4,539,430.56	361,865 $\frac{1}{2}$	3,749,800.17	530,893 $\frac{1}{2}$	6,108,235.82
Cost per Ton .....		.757		.766		.852		.766
Superintendence & General Roll	62,007	523,995.29	61,504 $\frac{1}{2}$	585,781.08	55,709 $\frac{1}{2}$	596,572.89	58,401 $\frac{1}{2}$	795,466.17
Cost per Ton .....		.088		.099		.136		.100
GRAND TOTAL	992,552	\$7,914,080.04	917,371$\frac{1}{2}$	\$7,999,231.76	739,562	\$7,372,268.84	1,073,299$\frac{1}{2}$	\$12,033,523.25
COST PER TON		1.328		1.350		1.675		1.510
Average Rate per Day		7.97		8.72		9.97		11.21
Tons per Man per Day		6.00		6.46		5.95		7.43

NOTES: The above is the total of all wages and salaries for employees of the Mining Department, including the Cliffs Power & Light Company.
The Mines were idle in 1946 from February 8th to May 22nd, account of work stoppage due to Union Strike.

WAGES:

Wages were increased 18 $\frac{1}{4}$ % per hour, effective May 22nd, 1946.

WORKING SCHEDULE - 1947 - MICHIGAN PROPERTIES:

Michigan Mines were operated on 2-8 hour shifts 6 days per week.

MINNESOTA PROPERTIES:

Effective March 1, 1947 three properties of International Harvester Company were taken over by the C. C. I. Co. - Two underground mines and one open pit mine.

The Agnew and Sargent Mines, underground mines taken over by The C. C. I. Co. were operated 2-8 hour shifts 6 days per week during 1947.

Hawkins Pit - Operations were carried on after acquisition of the property on a 2-8 hr. shift per day, 6 days per week schedule until closing season Oct. 11, 1947.

Holman-Cliffs Mine - Pit and washing plant operations began July 12th on a 3 shift per day, 5 days per week basis. Ore operations brought to a close Nov. 6, 1947.

Hill-Trumbull Mine - Ore operations started May 5th, working 3-8 hour shifts per day, 5 days per week. Ore operations closed October 30th, 1947.

Canisteo Mine - Ore operations started May 5th, working 2 - 8 hour shifts per day, 5 days per week. Ore operations closed October 30th.

Atkins Mine - Ore operations started May 5th, working 2 - 8 hour shifts per day, 5 days per week. Operations closed October 30th, 1947.

COMPARISON OF TOTAL DAYS WORKED AND TONS OF ORE MINED
FOR THE YEARS 1947 AND 1946

	1947 DAYS	1946 DAYS	1947 DAYS	1946 DAYS
NON-PRODUCTIVE UNITS:				
Miscellaneous Payroll	15,987	12,195 $\frac{1}{2}$		
Shops and Storehouse	3,587 $\frac{1}{4}$	3,856 $\frac{1}{2}$		
C. C. I. Co. Miscellaneous & General	70,776 $\frac{1}{4}$	51,516 $\frac{1}{2}$		
Mesaba-Cliffs Miscellaneous & General	91,250	50,728		
The Cliffs Power & Light Company	20,208	17,011 $\frac{1}{4}$		
General Roll - Undistributed.....	55,823 $\frac{1}{2}$	49,288 $\frac{3}{4}$		
Work Stoppage - account of strike		22,667 $\frac{1}{4}$		
Princeton	230			
Total Deductions	257,862	207,293$\frac{1}{2}$		
Grand Total - All Operations	1,073,299$\frac{1}{2}$	739,563$\frac{1}{4}$		
Net Operating Mines	815,437$\frac{1}{2}$	532,269$\frac{3}{4}$	815,437$\frac{1}{2}$	532,269$\frac{3}{4}$
Total Tons	7,970,030	4,402,437		
Tons per Man per Day	9.77	8.27		
OPEN PIT PRODUCTION				
	<u>TONS</u>			
Tilden Mine	168,669	101,968	4,347	4,511 $\frac{1}{4}$
Canisteo Mine	854,638	547,398	23,689 $\frac{1}{2}$	18,176 $\frac{3}{4}$
Hill-Trumbull Mine	785,604	590,040	39,602 $\frac{1}{4}$	24,690 $\frac{3}{4}$
Holman-Cliffs Mine	768,192	534,503	25,773	24,178 $\frac{1}{4}$
Hawkins Mine	620,416	--	24,495 $\frac{1}{2}$	--
Atkins Mine	432,705	--	6,081	--
Total	3,630,224	1,773,909	123,988$\frac{1}{4}$	71,559$\frac{1}{2}$
Open Pit - Tons per Man per Day	29.28	24.79		
Net Days - Underground Mines			691,449$\frac{1}{4}$	460,710$\frac{1}{4}$
Net Tons - Underground Mines	4,339,806	2,628,528		
Underground Mines - Tons per Man per Day..	6.28	5.71		
	<u>PERCENTAGE OF TOTAL PRODUCTION</u>			
	<u>1947</u>		<u>1946</u>	
	<u>TONS</u>	<u>PER CENT</u>	<u>TONS</u>	<u>PER CENT</u>
Underground Mines	4,339,806	54.45	2,628,528	59.71
Open Pit Mines	3,630,224	45.55	1,773,909	40.29
Total	7,970,030		4,402,437	

THE CLEVELAND-CLIFFS IRON COMPANY

STATEMENT SHOWING PENALTY COST OF OVERTIME

WORKED BY EMPLOYEES DURING YEAR 1947

AND EFFECT THE PENALTY COST HAD ON THE YEAR'S PRODUCTION COST

	MICHIGAN PROPERTIES	MINNESOTA PROPERTIES	TOTAL
<u>YEAR 1947</u>			
January	37,754.03	2,371.36	
February	39,098.89	2,640.21	
March	49,250.69	5,287.91	
April	39,557.96	9,334.67	
May	52,860.26	16,079.73	
June	46,339.46	22,087.02	
July	37,455.82	23,456.22	
August	48,075.07	26,604.01	
September	50,218.98	20,803.91	
October	48,639.56	20,877.83	
November	54,189.24	12,204.72	
December	41,968.24	6,537.64	
Total 1947	545,408.20	168,285.23	713,693.43
Total 1946	321,195.04	36,265.96	357,461.00
<u>PRODUCTION</u>			
Tons - Year 1947	4,162,545	3,807,485	7,970,030
Year 1946	2,730,496	1,671,941	4,402,437
<u>EFFECT THE PENALTY COST HAD ON YEAR'S PRODUCTION COST</u>			
Increased 1947 by .....	.1310	.0442	.0895
Increased 1946 by .....	.1176	.0217	.0811

NOTE: *

Mines were idle from February 7th to May 22, 1946 due to strike. Wages were increased $18\frac{1}{2}\%$ per hour effective May 22nd, 1946.

Three mines on Mesaba Range taken over from Harvester in March 1947.

CLIFFS SHAFT MINE
ANNUAL REPORT
YEAR 1947

1. GENERAL:

The production estimate for the year 1947 was originally set at 597,500 tons and provided that there should be a shut-down of 13 days to provide for repairs to the shafts and the rebuilding of the pockets in both Shaft Houses. This proved to be a too optimistic guess as to the time required for the repair work partly because the timbers in "B" Shaft started to actually fail before we had completed our preparations for the repairs. Therefore more product was lost through delay than estimated. "B" Shaft retimbering between the 8th and 10th levels and construction of a new steel pocket in "B" Shafthouse took from April 20th to May 24th. "A" Shaft retimbering between the 8th and 9th levels and construction of a new steel pocket in the shafthouse took from July 12th to July 23rd. In June a new estimate of production was made that totalled 571,580 tons. The total production was 546,796 tons. The mine operated a total of 305 days but during 39 days of this period only one shaft was in use. There was an average of 90.5 gangs working in the mine during the year. Including October to the end of the year, 18 of these crews employed two miners and no miner's helpers. The remainder were staffed by one miner and one miner's helper. An average of 12.6 or 13.9% of the gangs were engaged in development drifting or raising.

Shipments of ore from stockpile were completed on October 25th when the last of the lump pile was loaded. The crushed ore in stock had all been shipped prior to this date. Total shipments from the mine of ore from pocket and stockpile equalled 539,717. Current year overrun on stockpile ore amounted to 4,528 tons or 3.08% and on pocket shipments it was 10,297 tons or 2.62%.

The skip weight factor was not changed from 5.10 tons during the year. A slightly larger skip was installed in "A" Shaft during September and in "B" Shaft during December. The back and two sides of the skip have been raised six inches and this deeper box prevents much of the spillage that was previously troublesome. No change was occasioned in skip weight net load by this change in design because we continue to dump one haulage car for each skip load.

The screening ratio at the mine was not changed during the year. The upper section of the three parts has $1\frac{1}{2}$ " holes whereas the two lower sections have 2" holes. The product division was calculated at 73% lump and 27% crushed ore. Actual tonnages showed 396,561 tons of lump and 150,235 tons of crushed or 72.52% and 27.48% respectively.

As mentioned above, the surface plant was improved by the erection of two new steel pockets in the shaft houses. New skips were also installed which are slightly deeper to prevent spillage.

For the Bit Shop a new Ingersoll-Rand Drill Sharpener was purchased and installed to replace a smaller old unit. A new temperature controlled furnace for heating drill steel was ordered for the Bit Shop in order to permit the use of alloy drill steel and possibly also the use of hard tipped bits. This furnace was not received in 1947.

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CLIFFS SHAFT MINE
ANNUAL REPORT
YEAR 1947

1. GENERAL:

The aftercooler ordered in 1946 was installed in the Engine House in 1947. This will greatly improve drilling conditions underground by removal of moisture from the compressed air. It was also necessary to get a new centrifugal pump to supply water for this aftercooler and the compressors. This was installed in late 1947. We also had the interior of the Engine House painted during the year after removal of the old whitewash which was constantly scaling from the ceiling and walls.

A new complete crusher shaft with mantle and an extra mantle was ordered for the crusher. The extra mantle was received but the new shaft will not be delivered until 1948.

Other miscellaneous improvements made were the purchase of a Barber-Greene Coal loader and revamping of the coal dock for use of the loader; installation of a cab and starter system on the International TD-14 tractor; extension of the pipe on our mine discharge drainage system by more than 400 feet to prevent flooding of yards south of the stockpile grounds; erection of a steel fume stack for the laboratory and the start of construction on a room within the frame of the old boiler house which is to house some experimental concentrating equipment.

For the Underground operations we purchased, in 1947, 3 D-25 hand cranked Cleveland Drifters, 3 CF-79 Gardner Denver automatic 3" drifters, 3 CF-89 Gardner Denver hand cranked 3½" drifters, 11 DA-35 Ingersoll-Rand hand cranked drifters, 3 R-58 Ingersoll-Rand stopers, 1 Cleveland stoper, 15 JB-4 Ingersoll-Rand jackhammers for a total of 39 drilling machines. We also purchased a Model 40 Eimco Shovel Loader and one Sullivan B-frame 313 three drum hoist. This latter is the first three drum hoist to be tried in the Cliffs Shaft Mine. For the underground electrical distribution system we purchased one 50 K.W. transformer.

We continued to operate the microseismic listening station on the 12th level "B" Shaft throughout the year. In October, Dr. Obert brought new machines which were installed to replace the old equipment. Two pillars were mined during the year. Pillar "J" at 125 S - 1090 W was blasted down in March. Very little ore was recovered from this pillar because about 2' of rock came down from the back on top of the blasted pillar. We moved to the west side of the stope and mined Pillar "K" at 140 S - 1225 W during April. Since that time we have been mining bench made available in the bottom of Pillar "K". There is no evidence, microseismically, that the roof arch is under strain of any significance.

CLIFFS SHAFT MINE
ANNUAL REPORT
YEAR 1947

2. PRODUCTION,
SHIPMENTS, &
INVENTORIES:

a. Production by Grades:

<u>Grade</u>	<u>Tons</u>	<u>% of Total</u>
Cliffs Shaft Lump	338,509	
Cliffs Shaft Crushed	126,646	
Total	465,155	85.0
Bancroft Lump	32,001	
Bancroft Crushed	13,029	
Total	45,030	8.2
Section 10 Lump	26,051	
Section 10 Crushed	10,560	
Total	36,611	6.8
GRAND TOTAL FEE & LEASE ORE	546,796	100.0

Production by grades for the past ten years follows:

<u>Year</u>	<u>Lump Ore</u> <u>Tons</u>	<u>Crushed Ore</u> <u>Tons</u>	<u>Run-of-Mine</u> <u>Ore - Tons</u>	<u>Total Tons</u>
1938	222,672	102,361	2,128	327,161
1939	259,517	123,883	3,858	387,258
1940	371,745	177,469	3,384	552,598
1941	464,802	162,132	31,813	658,747
1942	225,759	56,510	431,261	713,530
1943	200,616	50,732	383,280	634,628
1944	443,123	137,701	6,227	587,051
1945	430,193	119,976		550,169
1946	294,264	107,675		401,939
1947	396,561	150,235		546,796

The percentage of lumps and fines since 1934 is shown by the following figures:

<u>Year</u>	<u>LUMP</u>		<u>CRUSHED</u>	
	<u>Tons</u>	<u>% of Total</u>	<u>Tons</u>	<u>% of Total</u>
1934	156,776	70.23	66,469	29.77
1935	189,883	70.61	79,038	29.39
1936	315,996	69.18	140,764	30.82
1937	368,768	68.24	171,562	31.76
1938	222,672	68.51	102,361	31.49
1939	259,517	67.69	123,883	32.31
1940	371,745	67.68	177,469	32.32
1941	464,802	74.14	162,132	25.86
1942	225,759	79.98	56,510	20.02
1943	200,616	79.82	50,732	20.18
1944	443,123	76.29	137,701	23.71
1945	430,193	78.19	119,976	21.81
1946	294,264	73.21	107,675	26.79
1947	396,561	72.50	150,235	27.50

CLIFFS SHAFT MINE
ANNUAL REPORT
YEAR 1947

2. PRODUCTION, ETC.: (Cont'd)

No change was made in the revolving trommel during 1947. The top section of screens had 1½" holes and the bottom two sections had 2" holes.

The division of the product between fee ore and Bancroft and Section 10 Lease ore for the past ten years is shown by the table below:

<u>Year</u>	<u>Cliffs Shaft Ore (Fee)</u>	<u>% of Total</u>	<u>Bancroft Ore (Lease)</u>	<u>% of Total</u>	<u>Sec. 10 Ore (Lease)</u>	<u>% of Total</u>
1938	277,602 tons	84.8	49,559 tons	15.2		
1939	323,647 "	83.6	63,611 "	16.4		
1940	479,060 "	86.7	73,538 "	13.3		
1941	555,525 "	84.3	103,222 "	15.7		
1942	629,661 "	88.2	83,869 "	11.8		
1943	563,006 "	88.7	69,943 "	11.0	1,679 tons	0.3
1944	506,520 "	86.3	64,742 "	11.0	15,789 "	2.7
1945	463,897 "	84.3	64,664 "	11.8	21,608 "	3.9
1946	336,603 "	83.7	47,998 "	11.9	17,338 "	4.4
1947	465,155 "	85.0	45,030 "	8.2	36,611 "	6.8

Nearly all of the Bancroft Lease production during 1947 came from the 9th, 10th and 11th levels. With fewer places to work, the Bancroft production dropped off but has been offset by the increased production from the Section 10 Lease.

All of the ore produced to date from the Bancroft Lease and Section 10 Lease since they were acquired by the Company is shown by years in the following table:

	<u>Bancroft Ore Tons</u>	<u>Section 10 Ore Tons</u>
From the Years 1925 to 1935	370,312	
1936	73,746	
1937	92,397	
1938	49,559	
1939	63,611	
1940	73,538	
1941	103,222	
1942	83,869	
1943	69,943	1,679
1944	64,742	15,789
1945	64,664	21,608
1946	47,998	17,338
1947	45,030	36,611
Total	1,202,631	93,025

CLIFFS SHAFT MINE
ANNUAL REPORT
YEAR 1947

2. PRODUCTION, ETC.:b. Shipments:

<u>Grade</u>	<u>Pocket Tons</u>	<u>Stockpile Tons</u>	<u>Total Tons</u>	<u>Total Last Year</u>
Cliffs Shaft Lump	218,128	107,911	326,039	257,287
Cliffs Shaft Crushed	109,464	24,360	133,824	80,268
Bancroft Lump	24,480	7,657	32,137	35,751
Bancroft Crushed	11,296	1,825	13,121	13,299
Section 10 Lump	20,314	4,443	24,757	12,400
Section 10 Crushed	9,126	713	9,839	4,345
Total 1947	392,808	146,909	539,717	403,350
Total 1946	310,051	93,299	403,350	
Increase	82,757	53,610	136,367	

Shipments for the last ten years are tabulated below:

<u>Year</u>	<u>CLIFFS SHAFT GRADE</u>			<u>BANCROFT GRADE</u>			<u>SEC. 10 GRADE</u>			<u>Grand Total</u>
	<u>Lump</u>	<u>Crushed</u>	<u>Mine Run</u>	<u>Lump</u>	<u>Crushed</u>	<u>Mine Run</u>	<u>Lump</u>	<u>Crushed</u>	<u>Mine Run</u>	
1938	95,983	42,240	171	19,254	3,416	1,957				163,021
1939	310,673	176,302	430	54,927	45,610	3,428				591,370
1940	358,099	179,018	55	44,913	26,477	3,329				611,891
1941	373,951	150,730	14,381	58,253	23,549	17,382				638,246
1942	230,566°	57,985	375,540	27,086	616	55,771				747,564
1943	177,951	30,182	328,139	12,829	380	53,640			1,501	604,622
1944	417,769	89,043	137	46,349	24,084	4,246	9,542	3,134	1,844	596,148
1945	364,959	154,993		49,319	14,654		17,207	5,012		606,144
1946	257,287	80,268		35,751	13,279		12,400	4,345		403,330
1947	326,039	133,824		32,137	13,121		24,757	9,839		539,717

(°) Contains 4,541 tons of Incline Pit Lump.

c. Stockpile Balances:

Ore in stock as of December 31, 1947:

Cliffs Shaft Lump	33,191
Cliffs Shaft Crushed	14,122
Bancroft Lump	2,064
Bancroft Crushed	1,202
Section 10 Lump	2,169
Section 10 Crushed	1,275
Total	54,023

CLIFFS SHAFT MINE
ANNUAL REPORT
YEAR 1947

2. PRODUCTION, ETC: (Cont'd)

Stockpile balances at the end of the year are shown for the past ten years in the following table:

Balance in stock - Dec. 31, 1938	273,939 tons
1939	76,540 "
1940	47,208 "
1941	81,533 "
1942	60,562 "
1943	90,568 "
1944	95,663 "
1945	48,355 "
1946	46,944 "
1947	54,023 "

d. Division of Product by Levels:

<u>Level</u>	<u>"A" Shaft</u> <u>Tons</u>	<u>"B" Shaft</u> <u>Tons</u>	<u>Total</u> <u>Tons</u>
1st	14,021	44,403	58,424
2nd	9,814	26,759	36,573
3rd	13,484	-	13,484
4th	25,943	24,229	50,172
5th	26,425	15,684	42,109
6th	31,924	14,076	46,000
7th	37,248	11,683	48,931
8th	24,210	4,654	28,864
9th	65,813	12,023	77,836
10th	44,859	22,560	67,419
11th	39,424	8,645	48,069
12th	3,854	6,323	10,177
13th	-	-	-
14th	-	15,116	15,116
15th	-	3,622	3,622
Total	337,019	209,777	546,796
Rock			20,420
Total Ore & Rock			567,216

e. Division of Product between Shafts:

The ten year table below shows where the ore has been broken and the percentage from each shaft:

<u>Year</u>	<u>"A" Shaft</u>		<u>"B" Shaft</u>		<u>Total</u>
	<u>Tons</u>	<u>%</u>	<u>Tons</u>	<u>%</u>	
1938	228,370	69.9	98,791	30.1	327,161
1939	254,133	65.5	133,125	34.5	387,258
1940	372,428	67.4	180,170	32.6	552,598
1941	408,342	62.0	250,405	38.0	658,747
1942	445,460	62.4	268,070	37.6	713,530
1943	391,455	61.6	243,173	38.4	634,628
1944	382,934	65.2	204,117	34.8	587,051
1945	374,864	68.1	175,305	31.9	550,169
1946	240,945	59.9	160,994	40.1	401,939
1947	344,114	62.9	202,682	37.1	546,796

CLIFFS SHAFT MINE
ANNUAL REPORT
YEAR 1947

2. PRODUCTION, ETC.: (Cont'd)

The production from the two shafts returned to what might be considered a more normal ratio when compared to the majority of the years since 1941. This was predicted after last year's abnormally high "B" Shaft production and the trend for "B" Shaft will necessarily continue downward. The imbalance in production requires us to transfer more ore from "A" Shaft to "B" Shaft for hoisting because the only efficient way to operate the Cliffs Shaft is to keep the hoist as nearly balanced as possible between the two shafts. Much of the ore mined in "A" Shaft territory tributary to the 5th level is transferred to "B" Shaft for hoisting. Product tributary to the 10th level can now be hoisted from either shaft since the completion this year of the interconnecting drift on the 10th level. As in the past, ore can be hoisted in either shaft on the 15th level. The table below shows how the product was hoisted through the 12 months of the year.

<u>Month</u>	<u>1947 Product as Hoisted</u>		<u>Total Tons</u>
	<u>"A" Shaft Tons</u>	<u>"B" Shaft Tons</u>	
January	23,379	25,195	48,574
February	21,609	24,486	46,095
March	23,802	25,714	49,516
April	31,476	16,527	48,003
May	33,493	8,774	42,267
June	20,264	22,044	42,308
July	12,545	22,115	34,660
August	20,745	22,003	42,748
September	21,347	23,220	44,567
October	22,608	25,978	48,586
November	20,067	21,998	42,065
December	20,249	22,333	42,582
Total without			
Overrun	271,584	260,387	531,971
Pocket Overrun	5,151	5,146	10,297
Stockpile "	2,309	2,219	4,528
Grand Total Tons	279,044	267,752	546,796
% of Total	51.0	49.0	100.0

CLIFFS SHAFT MINE
ANNUAL REPORT
YEAR 1947

2. PRODUCTION, ETC.: (Cont'd)

f. Production by Months:

Month	Optg. Days	<u>CLIFFS SHAFT</u>		<u>BANCROFT</u>		<u>SECTION 10</u>		Total
		Lump	Crushed	Lump	Crushed	Lump	Crushed	
Jan.	26	30,770	11,729	3,025	1,118	1,766	643	49,051
Feb.	24	28,781	11,096	3,037	1,211	1,900	754	46,779
March	26	30,886	11,398	3,396	1,345	2,057	812	49,894
April	26	30,741	11,226	3,066	1,197	2,031	801	49,062
May	26	25,554	9,727	3,095	1,244	2,008	766	42,394
June	25	25,959	9,756	2,762	1,078	2,343	963	42,861
July	25	22,511	7,819	1,560	738	1,940	863	35,431
Aug.	26	28,331	9,439	1,876	1,096	2,009	1,160	43,911
Sept.	25	27,948	11,327	2,032	783	2,505	961	45,556
Oct.	27	30,946	11,591	2,911	1,242	2,949	1,227	50,866
Nov.	24	26,664	10,630	2,653	892	2,250	730	43,819
Dec.	25	26,284	9,694	2,593	952	2,293	828	42,644
Current Years								
Stkpl. Overrun		<u>3,134</u>	<u>1,214</u>	<u>5</u>	<u>133</u>	<u>-</u>	<u>52</u>	<u>4,528</u>
Total	305	<u>338,509</u>	<u>126,646</u>	<u>32,001</u>	<u>13,029</u>	<u>26,051</u>	<u>10,560</u>	<u>546,796</u>

g. Ore Statement:

Grade	On Hand	Output	Total	Shipments	Balance	Inc. or Dec.
	Jan. 1, 1947	for Year					On Hand	in Output
C. S. Lump	20,721	338,509	359,230	326,039	33,191	
C. S. Crushed	21,300	126,646	147,946	133,824	14,122	
Banc. Lump	2,200	32,001	34,201	32,137	2,064	
Banc. Crushed	1,294	13,029	14,323	13,121	1,202	
Sec. 10 Lump	875	26,051	26,926	24,757	2,169	
Sec. 10 Crushed	<u>554</u>	<u>10,560</u>	<u>11,114</u>	<u>9,839</u>	<u>1,275</u>	
Total 1947	<u>46,944</u>	<u>546,796</u>	<u>593,740</u>	<u>539,717</u>	<u>54,023</u>	<u>144,857</u>
Total 1946	48,355	401,939	477,294	403,330	46,944	148,230

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2. PRODUCTION, ETC.: (Cont'd)

h. Delays:

<u>Date</u>	<u>Time Lost</u>	<u>Tons Lost</u>	<u>Remarks</u>
Jan. 11	8 hr.	1100	Receiver blew out head
21	1½ "	150	Trouble with picking belt
Mar. 26	2 "	150	Large chunks
Apr. 21-30	9 Days	3795	Rep. "B" Shaft & Pocket in Shafthouse
May 1-23	19 Days	8825	" " "
July 14-31	10 Days	8000	Rep. "A" Shaft & Pocket in Shafthouse also Vacations
Aug. 1	1 hr.	150	Air cylinder in Surface pocket broken
2	1 "	150	Repairing Crusher
26	1½ "	200	" "
27	1¼ "	150	" "
28	2 "	300	Contact on Top Tram stuck
Sept. 2	1¼ "	150	Large chunks
5	5½ "	500	Skip went through 8th Level Gate - "A" Shaft
11	1 "	150	Repairing Top Tram Hoist
12	1 "	175	Large chunks
Oct. 21	2 "	300	" "
22	1 "	150	" "
Nov. 7	1½ "	250	" "
19	1 "	150	" "
24	1 "	150	" "
Dec. 8	1¼ "	100	"B" Shafthouse pocket
15	2 "	200	Repairing Crusher
27	1½ "	75	No current
30	1½ "	150	Large chunks
Total 1947	-	26020	
Total 1946	-	176341	

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3. ANALYSIS:

a. Average Analysis of 1947 Output:

	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>
Cliffs Shaft Lump	60.45	.100	8.28
Cliffs Shaft Crushed	51.46	.098	19.19
Bancroft Lump	61.23	.105	7.26
Bancroft Crushed	52.58	.109	17.15
Section 10 Lump	60.68	.107	8.56
Section 10 Crushed	51.97	.109	17.45

The analyses of the lump and crushed ore grades are much closer to the analyses of 1945 than those of 1946. The most significant feature, I believe, is the upward trend in the silica content. Under the urge to secure more production we have perhaps kept some stopes in operation that might have been more selectively mined.

c. Complete Analysis of 1947 Ores as Shipped From Mine:

<u>Grade</u>		<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>
Lump Ore	(x)	60.80	.102	7.86	.28	1.97	.79	.69	.011	.98
Crushed Ore	(x)	51.60	.095	19.00	.38	2.74	1.04	.85	.015	1.57

(x) Cliffs Shaft, Bancroft & Section 10 ore combined

d. Analysis of Ore in Stock Dec. 31, 1947:

		<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Cliffs Shaft Lump	Dried	59.08	.102	10.34	.28	1.97	.79	.69	.011	.98	-
	Natural	58.87	.102	10.30	.28	1.96	.79	.69	.011	.98	.35
Cliffs S. Crushed	Dried	51.14	.104	19.60	.39	2.75	1.04	.85	.015	1.57	-
	Natural	50.32	.102	19.29	.38	2.71	1.02	.84	.015	1.55	1.60
Ban.&Sec.10 Lump	Dried	59.05	.098	9.46	.28	2.48	1.10	.70	.011	.98	-
	Natural	58.84	.097	9.43	.28	2.47	1.10	.70	.011	.98	.35
Ban. & Sec. 10 Crushed	Dried	51.86	.105	17.77	.39	3.05	1.20	.85	.015	1.87	-
	Natural	51.03	.103	17.49	.38	3.00	1.18	.84	.015	1.84	1.60

e. Analysis of Ore Reserves: (Run-of-Mine Ore)

		<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Cliffs Shaft Ore	Dried	56.52	.108	10.89	.49	2.42	.97	.81	.018	1.21	-
	Natural	56.04	.107	10.80	.49	2.40	.96	.80	.018	1.20	.85
Bancroft & Sec. 10 Ore	Dried	57.68	.125	9.88	.50	2.35	1.13	.95	.019	1.84	-
	Natural	57.25	.124	9.81	.50	2.33	1.12	.94	.019	1.83	.75

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4. ESTIMATE
OF ORE
RESERVES:

Assumption: Factor used is 8, 9 and 10 cu. ft. per ton of ore in place.
The factor 9 is most commonly used.
10% deduction for rock and loss in mining.

Ore in Sight December 31, 1947:

<u>Level</u>	<u>Available Ore in Bancroft Area "A" Shaft</u>			
	<u>Developed</u>		<u>Prospective</u>	<u>Total</u>
	<u>Floors</u>	<u>Pillars</u>	<u>Breasts</u>	
	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>
2nd			2,000	2,000
3rd		800		800
4th	6,900			6,900
8th		9,300		9,300
9th	9,800	1,800		11,600
10th	36,500	100,500	2,000	139,000
11th	101,200	4,600	4,000	109,800
12th	2,200	2,900	2,000	7,100
Total	156,600	119,900	10,000	286,500

Summary:

Bancroft Ore Available	286,500
Less December Production	<u>3,545</u>
Gross Tonnage as of Dec. 31, 1947	282,955
Less 10% for Mining & Rock	<u>28,650</u>
Net Total Bancroft Ore Available	254,305

<u>Level</u>	<u>Section 10 Lease</u>			
	<u>Developed</u>		<u>Prospective</u>	<u>Total</u>
	<u>Floors</u>	<u>Pillars</u>	<u>Breasts</u>	
	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>
1st	4,100	5,500		9,600
2nd	4,200			4,200
3rd			2,000	2,000
4th			4,000	4,000
5th	15,400	68,200		83,600
6th	68,200		2,000	70,200
7th		13,800	2,000	15,800
8th	13,800	124,900		138,700
9th	<u>121,200</u>			<u>121,200</u>
Total	226,900	212,400	10,000	449,300

Summary:

Section 10 Ore Available	449,300
Less December Production	<u>3,121</u>
Gross Tonnage as of Dec. 31, 1947	446,179
Less 10% for Mining & Rock	<u>44,930</u>
Net Total Section 10 Ore Available	401,249

Net Total Bancroft & Section 10 Lease 655,554

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

Available Cliffs Shaft Ore "A" Shaft

<u>Level</u>	<u>Developed</u>		<u>Prospective</u>	<u>Total</u> <u>Tons</u>
	<u>Floors</u> <u>Tons</u>	<u>Pillars</u> <u>Tons</u>	<u>Breasts</u> <u>Tons</u>	
1st		2,500		2,500
2nd	2,000	1,200		3,200
3rd	4,700	1,100	4,000	9,800
4th	8,300		10,000	18,300
5th	18,600	3,700	8,000	30,300
6th	39,700	42,000	10,000	91,700
7th	93,500	9,900	6,000	109,400
8th	69,000	3,200	4,000	76,200
9th	139,800	1,800	8,000	149,600
10th	37,100	113,600	4,000	154,700
11th	71,700	100,200	2,000	173,900
12th	37,400	61,900	2,000	101,300
15th	<u>31,600</u>			<u>31,600</u>
Total	553,400	341,100	58,000	952,500

Available Cliffs Shaft Ore "B" Shaft

<u>Level</u>	<u>Developed</u>		<u>Prospective</u>	<u>Total</u> <u>Tons</u>
	<u>Floors</u> <u>Tons</u>	<u>Pillars</u> <u>Tons</u>	<u>Breasts</u> <u>Tons</u>	
1st	40,100	5,400	4,000	49,500
2nd	30,000	1,300	2,000	33,300
3rd	2,200	23,500	2,000	27,700
4th			6,000	6,000
5th	25,600		4,000	29,600
6th	5,400	11,400	4,000	20,800
7th	26,700			26,700
8th	26,800	5,700	4,000	36,500
9th	11,000		2,000	13,000
10th	17,500		2,000	19,500
11th	27,500	3,000		30,500
12th	4,600		4,000	8,600
13th	5,500			5,500
14th	5,900		2,000	7,900
15th	<u>13,700</u>	<u>15,200</u>	<u>4,000</u>	<u>32,900</u>
Total	242,500	65,500	40,000	348,000

Section 9 Development

<u>Level</u>	<u>Developed</u>		<u>Prospective</u>	<u>Total</u> <u>Tons</u>
	<u>Floors</u> <u>Tons</u>	<u>Pillars</u> <u>Tons</u>	<u>Breasts</u> <u>Tons</u>	
9th		11,600	2,000	13,600
10th	2,900	13,200		16,100
Total	2,900	24,800	2,000	29,700

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

Summary:

Cliffs Shaft Ore Available "A" Shaft	952,500
Cliffs Shaft Ore Available "B" Shaft	348,000
Cliffs Shaft Ore Available Section 9	29,700
Total	<u>1,330,200</u>
Less December Production	35,978
Gross Tonnage as of Dec. 31, 1947	<u>1,294,222</u>
Less 10% for Mining & Rock	133,020
Net Total Free Ore Available	<u>1,161,202</u>

Recapitulation:

Net Cliffs Shaft Ore Available	1,161,202
Net Bancroft Ore Available	254,305
Net Section 10 Ore Available	<u>401,249</u>
Grand Total	<u>1,816,756</u>

Ore reserves for the past two years are shown for comparison:

	<u>Dec. 31, 1947</u>	<u>Dec. 31, 1946</u>
Cliffs Shaft Ore Available	1,161,202 tons	1,181,962 tons
Banc. & Sec. 10 Ore Available	<u>655,554 "</u>	<u>522,590 "</u>
Total	<u>1,816,756 "</u>	<u>1,704,552 "</u>
Increase for 1947	112,204 "	

New Ore Developed in 1947 546,796 & 112,204 = 659,000 tons

The following table shows the variations in ore reserves in "A" and "B" Shafts since 1931:

Year	<u>Net Available Ore in Sight</u>			
	<u>Sec. 10 Ore</u> Tons	<u>Bancroft Ore</u> Tons	<u>Cliffs Shaft Ore</u>	
			<u>"A" Shaft</u> Tons	<u>"B" Shaft</u> Tons
1931		182,600	1,099,778	255,922
1932		210,864	1,055,384	245,483
1933		198,916	995,211	227,565
1934		204,730	1,091,100	251,087
1935		210,429	1,090,540	232,345
1936		246,659	1,055,621	289,828
1937		252,050	1,099,090	303,762
1938		243,512	1,105,663	307,991
1939		246,726	1,139,349	283,644
1940		231,402	1,105,158	288,482
1941		232,298	1,047,360	288,650
1942		257,758	977,345	278,567
1943	17,043	267,301	898,787	297,362
1944	107,904	272,351	834,801	305,530
1945	191,458	287,382	879,956	326,764
1946	254,811	267,779	851,107	330,855
1947	401,249	254,305	834,584	299,888

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

For the fourth consecutive year the ore reserves increased over the preceding year. The development of ore in the Section 10 Lease area is responsible for the overall increase although the reserves on fee lands and the Bancroft Lease did not decrease markedly.

The table below shows reserves since 1920 with a rather sharp increase of 112,204 tons in 1947 as compared to 1946. The increase of 146,438 net tons available from Section 10 Lease is the big factor responsible.

The 1945 increase is due primarily to the change in method of figuring the estimate whereby only one deduction of 10% is made as compared to two 10% deductions in previous years.

Total Ore Available in Mine at the End of Each Year:

1947	1,816,756	Tons
1946	1,704,552	"
1945	1,685,560	"
1944	1,520,586	"
1943	1,480,493	"
1942	1,513,670	"
1941	1,568,308	"
1940	1,625,042	"
1939	1,669,719	"
1938	1,657,166	"
1937	1,654,902	"
1936	1,592,108	"
1935	1,533,314	"
1934	1,546,917	"
1933	1,421,692	"
1932	1,511,731	"
1931	1,541,050	"
1930	1,506,700	"
1929	1,388,216	"
1928	1,358,000	"
1927	1,392,000	"
1926	1,436,000	"
1925	1,444,000	"
1924	1,453,000	"
1923	1,361,000	"
1922	1,364,000	"
1921	1,386,000	"
1920	1,404,000	"

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5. LABOR
AND
WAGES:

a. General:

Five more men were employed on surface and eight more men underground for a total increase of 13 men in 1947 as compared to 1946. This is close to the minimum for surface but for the underground the next year's total will be about 10 to 15 men higher.

For several years there has been one miner and a helper in each contract in the Cliffs Shaft Mine. In July we started with a few contracts and substituted for the helper another miner. By October, 18 out of the 90 contracts were so-called double miner crews. Several of the stopes in the mine are large enough to permit the operation of a second drill machine at such times as the broken ore has been removed from the face. With both men in the contract on an incentive system, we find that there is more stimulus for production from such stopes. In some working places it may be difficult because of the physical characteristics of the stope to derive any benefit from a two miner arrangement and for this reason a gradual selective process of change has been employed. Results are mixed and shifts in places and personnel are still being made to try to find the optimum conditions. In general, however, the plan favors its continuance.

The following tables compare 1947 to the 8½ months of 1946 that constituted the actual operating period.

b. Comparative Statement of Wages and Product:

	<u>1947</u>	<u>1946</u>
PRODUCT	546,796	401,939
No. of Shifts & Hours	2-8 hr.	2-8 hr.
No. of Days Operated	305	217
<u>Average Number of Men Employed</u>		
Surface	95	90
Underground	<u>323</u>	<u>315</u>
Total	418	405
<u>Average Wages Per Day</u>		
Surface	9.90	8.96
Underground	<u>10.81</u>	<u>9.84</u>
Total	10.60	9.60
<u>Product Per Man Per Day</u>		
Surface	16.54	17.76
Underground	<u>5.53</u>	<u>5.85</u>
Total	4.14	4.40
<u>Labor Cost Per Ton</u>		
Surface	.615	.518
Underground	<u>1.958</u>	<u>1.670</u>
Total	2.573	2.188

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5. LABOR
AND
WAGES: (Cont'd)

The increased cost of labor is attributable to two factors. The first of these is the \$.12½ per hour increase in wages effective as of May 1, 1947. As can be seen above, this raised average wages from 9.60 to 10.60 or a 10.4% jump. This factor alone would have increased the per ton cost nearly 0.23. The remaining .155 cents of the increase is directly due to the reduction in tons per man of production. In the last twenty years the tons per man has dropped to 4.30 or below only in 1931, 1932, 1933, 1938 and 1944 and the past year, 1947. There can be several factors responsible for this. There are two that were important for 1947. The loss of product entailed in the building of new pockets in "A" and "B" Shafts and the retimbering of two levels in "B" and one level in "A" shaft was a vital reason for the low tons per man. From the day to day list describing delays in a preceding section of this report we see a loss of tonnage of 26,000 tons. This is, we believe, a conservative figure and it is probable that the loss in tonnage occasioned by the repair jobs was closer to 35,000 tons. That much additional tonnage would have reduced the cost per ton of labor by 0.15 per ton.

The second important factor is less easily defined or proved. We believe the pay rates for contract miners at the Cliffs Shaft mine offers too little incentive to stimulate the miners to high individual productivity. A new schedule of contract rates has been developed which we believe will correct this situation. We hope this can be put into effect early in 1948.

Penalty earnings are shown below for the years 1947 and 1946. For 1946 the figure includes from \$600.00 to \$800.00 of penalty payments made during the 3½ months of the strike period. In spite of the increase in absenteeism, a corollary of the fact that many of the men took vacations in 1947, the penalty earnings also increased sharply. This is due to the fact that wages increased in 1947 by .125 per hour and that we compare a full year of operation in 1947 against 8½ months in 1946.

1947	\$101,291.02
1946	<u>63,136.83</u>
Increase	\$ 38,154.19

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5. LABOR
AND
WAGES: (Cont'd)

Surface and underground labor costs per ton for the past ten years are as follows:

Year	Surface Labor	Underground Labor	Total Labor
1947	.615	1.958	2.573
1946	.518	1.670	2.188 °
1945	.442	1.353	1.795
1944	.405	1.404	1.809
1943	.396	1.399	1.795
1942	.301	1.170	1.471
1941	.297	1.173	1.470
1940	.241	.936	1.177
1939	.253	1.033	1.286
1938	.310	1.110	1.420

(°) Costs for 8½ operating months.

	Shifts	Earnings	Avg. Wages 1947	Avg. Wages 1946
Contract Miners				
Dev. in Rock	2,384	30,947.68	12.97	11.95
Dev. in Ore	2,309	27,234.63	11.79	10.90
Stopping	25,262	276,584.56	10.95	10.02
Total Contract Miners	29,955	334,766.87	11.17	10.26
Contract Trammers	576	9,097.76	15.80	14.84
Total Contract Labor	30,531	343,864.63	11.26	10.35
<u>Total Number of Days</u>				
Surface	33,064		22,637¾	
Underground	98,932		68,674	
Total	131,996		91,311¾	
<u>Amount for Labor</u>				
Surface	236,146.49		208,071.88	
Underground	1,070,573.74		671,408.49	
Total	1,406,710.23		879,480.37	

Proportion of Surface to Underground Men

1947	1 to 3.40
1946	1 to 3.54
1945	1 to 2.74
1944	1 to 3.20
1943	1 to 3.19
1942	1 to 3.36
1941	1 to 3.32
1940	1 to 3.43
1939	1 to 3.73
1938	1 to 3.22

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6. SURFACE:

a. Buildings and Repairs:

The following figures show cost of repairs to mine buildings for the years 1943 - 1947:

	<u>1947</u>	<u>1946</u>	<u>1945</u>	<u>1944</u>	<u>1943</u>
Office & Warehouse	394.80	67.57	537.42	1200.83	1611.05
Shops	1224.02	1726.31	1679.64	719.73	1786.50
Shaft House	1463.91	1380.98	567.28	822.60	956.90
Engine House	5624.90	1717.91	1052.36	553.86	1078.09
Dry House	1353.76	1352.63	1569.07	2597.53	1125.87
Coal Dock & Trestle	1754.31	279.96	419.37	258.24	821.71
Crusher Building	200.84	145.77	878.57	628.19	4390.68
Miscellaneous	<u>1416.61</u>	<u>342.65</u>	<u>967.27</u>	<u>3997.94</u>	<u>1086.06</u>
Total	<u>13434.15</u>	<u>7013.78</u>	<u>7670.98</u>	<u>10778.92</u>	<u>12856.86</u>

Total cost for buildings and repairs increased \$6,420.37 in 1947 as compared to 1946.

Shafthouse expense remained high in 1947 because of revamping of stairways and floors necessitated by the building of new pockets. Engine house expense accounts for the principal part of the 1947 increase. For several years there has been a bother in the Engine House caused by the scaling of water soluble paint and plaster from the walls and ceiling. During 1947 this paint was removed, the plaster repaired and an oil base paint applied. The wainscoting was replaced with new material. The reconditioning of the coal dock increased cost in that category by \$1,474.00 compared to 1946. The dock now opens to the north where we can use the Barber-Greene coal loader with much better effectiveness. The principal expense under miscellaneous buildings in 1947 was the erection of a chute which permits easy removal of sample ore by bulldozing rather than hand shoveling.

7. UNDERGROUND:

a. Development:

1. Section 10 Lease:

Production from the Section 10 Lease more than doubled in 1947 compared to 1946. On the average, we had eight crews working in the Section 10 Lease with three of these engaged in drifting or raising and the remaining five stopping ore. This fact explains the increased productivity of the Section 10 Lease.

In previous annual reports the known ore occurrences of the Section 10 Lease were divided into 3 categories for convenience of discussion. They are No. 1: The syncline between the 1st and 3rd levels in the area 300' south from the north boundary of the Section 10 Lease between coordinates 0 and 600 E. No. 2: The anticlinal structure between 1600 E and 3000 E lying adjacent to the Cliffs Shaft fee property along its south boundary. No. 3: The main ore bearing syncline

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7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

1. Section 10 Lease: (Cont'd)

which constitutes the westward extension of the Moro Mine structure. During 1947, Contract No. 1 worked in the No. 1 area where they breast stoped both east and west on the 1145' sub-level at coordinates 1260 S - 125 E. The ore vein here strikes east-west and dips south under slate hanging wall. The downward extension of this ore vein below the 1st level elevation will be developed by raises which are to be put up from a 5th level "B" Shaft drift that we are currently driving under this territory.

In the No. 2 area on the 4th level, Contract No. 2 breast stoped west along the strike of the ore vein and near its contact with the southward dipping slate hanging wall. The breast of this stope was located at 1390 S - 2220 E by the end of the year. West of this breast at 1380 S - 2170 E, Contract No. 21 cut the 4th level with a raise which they extended up to the 2nd level elevation. This raise was in ore all the way from the 5th level. The ore vein is 120' wide in this part of the No. 2 area. It is anticlinal in structure and overlain by slate hanging wall.

Seven crews worked in the No. 3 area during 1947. This area is the north limb of the so-called Moro Mine or Section 10 syncline which strikes approximately east and west. On the 5th level, Contract 21 put up a short raise at 1500 S - 2350 E and Contract No. 80 extended the 5th level drift east to coordinates 1520 S - 2390 E. West of this activity, Contract No. 21 completed the raise mentioned in the discussion of the No. 2 area and stoped ore in the back and south rib of the 5th level drift at coordinates 1430 S - 2140 E. Still farther to the west at 1400 S - 1900 E, Contract No. 25 stoped ore from along the hanging wall slate contact on the south side of the 5th level drift and breast stoped north toward the footwall. At coordinates 1360 S - 1775 E, Contract No. 74 raise stoped north under the slate hanging wall. Contract No. 96 drifted west extending the 5th level drift a total of 300' by the end of the year to reach coordinates 1400 S - 1500 E. Contracts 74 and 96 also completed two raises from the 8th to the 5th levels. These were later intercepted by the 5th level drift later driven by Contract No. 96. The raises were in ore most of the distance from the 8th to the 5th levels. They are located at 1400 S - 1680 E and 1430 S - 1570 E. On the 7th level, Contract No. 80 stripped ore from their drift connecting their two raises and cut a breast stope north to coordinates 1440 S - 2170 E. This stope across the strike of the ore vein establishes a width of ore slightly in excess of 100'. On the 8th level, Contract No. 4 put up a raise that passes from dike to ore at about the 7th level elevation at coordinates 1600 S - 2340 E. This raise will serve Contract No. 80 on the 7th level although we expect to continue the raise in ore to the 5th level elevation. Contract No. 41, which is a drifting crew, did not spend all year on the 8th level Section 10 Lease. They drove a drift south parallel to Diamond Drill Hole No. 564 which had cut ore and this drift encountered nearly twice as much ore as the drill hole. The drift was stoped in slate hanging wall at coordinates 1930 S - 2400 E. This ore body is

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7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

1. Section 10 Lease: (Cont'd)

separated from the ore vein which we have been developing by sideritic chert and yet this new ore vein is also overlain by slate hanging wall that dips south. It would appear from this that it is a faulted repetition of the north limb of the syncline. Contract No. 41 also drifted east along the footwall contact and partly in the footwall to reach coordinates 1600 S - 2500 E by the end of the year. This last drift is to be extended east to 2700 E in order to put raises up to the 5th level ore shown in old Diamond Drill Hole 392.

In the last part of 1947 we started drifting south on the 10th level, Section 10 Lease, to get in position for drilling a hole to the Moro Mine for drainage purposes. This drift should be completed by July of 1948.

In 1948 we expect to extend the 8th level drift on Section 10 Lease to the west and start additional raises to the 5th level where we now have ore extending 200' west of the last raise. We also expect to develop the new ore vein on the 8th level by stoping.

2. "B" Shaft Pillar Area:

From studies in the Cliffs Shaft Mine and other open stope mines, Dr. Leonard Obert of the U. S. Bureau of Mines has concluded that the Cliffs Shaft stopes are, in general, smaller than they need to be kept and the pillars larger than necessary. In order to test this theory we instituted a program of pillar removal in a territory in "B" Shaft where we could cut down pillars without danger to any of the active workings. The place is on the 11th level about 1200' west of "B" shaft on the north limb of the "B" Shaft syncline. It is about 200' in diameter and contained about a dozen pillars. It was worked out about 20 years ago. Starting in April of 1945 we removed 3 pillars while the Bureau of Mines conducted listening tests with Geophone equipment. This equipment records microseismic movements of rock under stress. Throughout 1945 and 1946, local spalling of rock loosened in the back by pillar removal was predicted by the Geophone equipment but no major strain became evident. In 1947 we removed two additional pillars - namely "J" and "K" and mined floor adjacent to and in the roof of Pillar "K". All this time no indication has developed that the roof stresses are increasing to a point that even remotely approaches the rupture point of the roof arch. By the end of 1947 we had mined approximately 20,175 tons of ore from this area.

3. Cliffs Shaft and Bancroft Lease:

The table below shows the number and percentages by months of developing gangs in the mine.

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7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

3. Cliffs Shaft and Bancroft Lease: (Cont'd)

<u>Month</u>	<u>Total No. of Gangs</u>	<u>Gangs Dev. Incl. Raising and Drifting Crews</u>	<u>% of Total</u>	<u>Gangs Drifting & Raising</u>	<u>% of Total</u>
January	92	44	47.8	15½	16.9
February	92	45	48.9	16	17.4
March	91	38	41.7	18½	20.3
April	90	35	38.9	17	18.8
May	90	41	45.5	12	13.3
June	90	42	46.6	12	13.3
July	89	37	41.6	10	11.2
August	91	41	45.1	12½	13.7
September	91 - 5°	46	50.5	11	12.1
October	91 - 18°	45	49.4	8	8.8
November	90 - 18°	43	47.8	7	7.7
December	90 - 18°	43	47.8	12	13.3
Monthly Average	90.6	41.7	46.0	12.6	13.9
Year 1946			42.7		
Year 1945			45.7		
Year 1944			49.8		
Year 1943			54.9		
Year 1942			53.5		
Year 1941			61.0		

(°) Indicates number of double gangs.

The table above shows that in 1947 we had a sharp increase in the number and percentage of development crews working in the mine. Those engaged in drifting and raising remained at a nearly constant level with 12.6 gangs or 13.9% of the total.

On Cliffs Shaft fee property or the Bancroft Lease no new ore areas were discovered during 1947. A small amount of ore was found in the two diamond drill holes 574 and 576, drilled southwest from the west end of the 15th level "B" Shaft workings. This discovery indicates that there is some ore extending southwest along the hanging wall contact beyond our present workings but the narrowness of the veins makes it questionable that commercial quantities are available in this area.

No work was done in the Section 9 territory of "B" Shaft during 1947 with the exception of the drilling of 2 holes by the Geological Department for structural information.

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YEAR 1947

7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

3. Cliffs Shaft and Bancroft Lease: (Cont'd)

"A" SHAFT
1st Level

In the first part of 1947, Contract No. 30 breast stoped east at coordinates 300 S - 700 E thereby forming a pillar after connecting this stope to pre-existing workings. This development made available some ore reserves in the floor of the new stope. Generally speaking, however, the work on the 1st level has been depleting in character.

2nd Level

In the Bancroft Lease, Contract 29 drove an exploratory drift west which encountered a vein of ore about 20' wide. This ore vein strikes north and south and dips steeply to the east. During the latter part of 1947 this crew raise stoped in this ore vein both to the north and to the south at coordinates 400 N - 1150 E. Although the year 1947 has increased the ore reserves in this particular territory we probably will not realize as much ore as we originally expected from the results of diamond drilling conducted in the area.

3rd Level

Throughout 1947, Contract No. 27 breast stoped east at coordinates 300 S - 800 E and developed two cross cut stopes; one to the north and one to the south from this main east-west stope. All of this work was done on an elevation about 20' below the 3rd level floor and beneath rock filled 3rd level stopes. In the last part of the year Contract 27 started to mine floor from this stope which they have developed in the past two years.

4th Level

There were 3 crews that did development work on the 4th level during 1947. The easternmost was Contract 26 which completed a raise from the 8th level to the 4th level at coordinates 175 S - 3600 E. There is good ore around the top of this raise at the 4th level elevation and Contract 26 used the last part of the year to stope this ore at the coordinate location mentioned above. We believe there is considerable possibility that these east end workings will eventually be connected to the old No. 3 mine workings which may also produce additional ore.

In the Southwest Vein, Contract No. 91 breast stoped north from old workings to the coordinate location 1150 S - 2310 E. At this point they encountered slate hanging wall dipping north across the breast of the stope. We do expect to find ore continuing east along this hanging wall contact, however, and 91 crew will continue their efforts to develop stopes to the east.

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YEAR 1947

7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

3. Cliffs Shaft and Bancroft Lease: (Cont'd)

At coordinates 180 S - 1480 E, Contract No. 92 spent the major portion of the year breast stoping northeast in a vein of ore that strikes nearly east and west and dips north beneath slate hanging wall.

5th Level

A glance at the 5th level map shows that there were two contracts engaged in development stoping on this elevation during the year 1947. In the Southeast Vein, Contract 45 advanced two raise stopes; one to the east and one to the southeast near the coordinate location 1160 S - 2830 E. The ore vein here strikes east and west and dips north beneath slate hanging wall. A dike footwall bounds the ore vein on the south side. As yet we have not encountered any limitations to the ore along the strike to the east. The other stoping crew is located at 530 S - 1380 E where No. 66 gang advanced a raise stope from the 5th level to the 3rd level elevation. At that elevation they encountered jasper in the breast. This is a hanging wall ore vein lying directly beneath the southward dipping slate.

In addition to the stoping crews the map shows 4 new raises and a short drift as development work performed during 1947. Contract No. 50 completed a raise to old 5th level workings at 170 S - 1325 E. Contract No. 104 put up a new raise to 27 stope on the 3rd level at coordinates 310 S - 700 E and Contract No. 63 drove 125' of drift from which they put up a raise to 57 stope on the 4th level at coordinates 190 S - 500 E. The 4th raise is in the east end of the mine located at coordinates 170 S - 3550 E. This raise was put up by No. 26 Contract from the 8th level to the 4th level.

6th Level

At coordinates 420 S - 2770 E, Contract No. 67 developed a breast stope by mining to the northwest. The ore vein in which they worked strikes northwest-southeast and dips southwest underneath slate hanging wall. There is at least 150' of unmined ground northwest of the present stope location and we are hopeful that additional reserves may be found in this area.

In the eastern part of the mine, Contract No. 31 drifted 150' from the end of an old 6th level drift to the top of their ore raise and then proceeded to stope raise east to the 4th level elevation at coordinates 250 N - 3600 E. This contract is located in a recently opened territory of the mine in which we expect to develop considerable ore reserves. In fact, this is the most promising new area in the Cliffs-Shaft Mine with the exception of the Section 10 Lease.

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YEAR 1947

7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

3. Cliffs Shaft and Bancroft Lease: (Cont'd)

7th Level

The only crew that did development work on the 7th level during the past year was Contract No. 61 located at coordinates 150 N - 3550 E. This is in the same general territory with Contracts No. 31 and 26, namely, the northeast part of the mine between the 8th and 4th levels. This crew drifted in ore approximately 100' east and then proceeded to mine back and floor in the stope from which they had advanced the drift. We know that there are additional ore reserves south of this territory behind a dike that separates the two ore veins.

8th Level

There were 3 crews that developed stopes on the 8th level during 1947. The first of these, located at 220 S - 1825 E, was Contract No. 54 which breast stoped west to that coordinate location at an elevation slightly below the 8th level floor. The ore vein, in which this crew worked, strikes east and west and is a so-called footwall type of ore body. The second stoping crew was Contract No. 78 located at 35 N - 3200 E. This gang mined ore from the south side of an old stope and also breast stoped to the east near the coordinate location shown above. We believe there is a fair possibility that ore will continue to be found to the east of the present workings in the direction of 81 stope located at 150 N - 3275 E. The latter location was the site of development for the 3rd stoping crew on the 8th level during the year. Starting from old 81 raise they cut out a stope about 80' long north and south and one cross cut to the east at about the center of this north-south stope. On the north side the ore vein is bounded by dike whose thickness we have not yet determined. The dike also delineates the strike of the ore vein which is nearly east and west. In the last month of 1947 we started a drift from the 8th level which is expected to connect to 81 stope and thereby facilitate ventilation and improve the traveling road. This drift has been in ore from its start.

In addition to the stoping development on the 8th level there were 3 raises put up, one by No. 4 Contract into 82 stope at coordinates 225 S - 1750 E; one by 95 Contract from the 8th to the 7th level at coordinates 320 S - 2700 E and the last by No. 26 Contract from the 8th level into the floor of 61 stope at 150 N - 3550 E.

The only other development work performed on the level during the year was by 41 gang which consisted primarily of the improvement of haulage roads through the elimination of poor curves. This was done either by stripping a drift as was done at 600 S - 1560 E and 950 S - 1700 E or by the development of new haulage drifts such as was driven at 400 S - 2700 E. This latter haulage drift not only eliminated the poor curves in the old track system but also made available ore in the back and floor of approximately 100' of stope which will be depleted by No. 95 Contract.

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YEAR 1947

7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

3. Cliffs Shaft and Bancroft Lease: (Cont'd)

9th Level

In the Bancroft Lease area, Contract No. 16 mined floor during the first part of 1947 but in the latter part of the year they drove a breast stope underneath their old floor to coordinates 230 N - 1600 E. They expect to raise stope from the end of this breast stope and mine additional ore from their old workings to the west.

The only other development work performed on the 9th level was by 101 Contract which advanced a breast stope east 100' to coordinates 310 N - 3570 E. This stope is 25 to 30' wide and is bounded on the north side by slate hanging wall and on the south side by dike. Both rock members dip steeply to the north.

10th Level

Two contracts were engaged in development work on the Bancroft Lease territory during the past year. Contract No. 10 breast stoped east to coordinates 0 - 2170 E and then put up two raise stopes to the 9th level elevation where they holed to old workings. Both raise stopes were advanced from the north rib of the breast stope and both of them make available ore reserves in the floor of old workings. The other development crew, Contract No. 89, raised in ore at coordinates 380 N - 1780 E reaching an elevation about 50' above the 10th level. In order to be able to mine this ore and preserve a traveling road, Contract 89 put up a short raise at coordinates 300 N - 1800 E and from this raise drifted northeast into their stope. During the remainder of the year this crew mined back around their original development raise.

On the Cliffs Shaft fee lands there were 6 crews that performed development work. Three of these were engaged primarily in stope development and they were Contracts 3, 7 and 55. Contract No. 3, working in an ore vein near the west end of the "A" Shaft syncline, breast stoped 70' north to coordinates 680 S - 2030 E. This work practically exhausted the ore at this elevation in that territory although at a later date it will be possible to mine the floor reserves from these workings. This crew was then moved to coordinates 1000 S - 2490 E where they started a small raise stope to the west that will eventually hole to 9th level stopes. Contract No. 7 raise stoped from the 11th level to the 9th level at coordinates 390 S - 2310 E. A cross cut was driven to the west from this raise stope to connect with old 10th level workings and a second cross cut was advanced east into virgin ground as yet unexplored. In the Southeast Vein, Contract No. 55 mined some floor from an old 10th level stope and then drifted north-east at this lower elevation to coordinates 970 S - 2670 E. This drift is 100' long and all of it is in ore. Much additional reserves should be developed by this exploration in the Southeast Vein.

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YEAR 1947

7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

3. Cliffs Shaft and Bancroft Lease: (Cont'd)

In addition to the stoping development, Contract No. 23 drove 130' of drift in the Northeast Vein to connect two cross cuts at 20 N - 2920 E. Most of this drift was advanced in ore which the crew will develop by raises in order to determine its upward limit. Contract 28 spent the first part of the year stripping the drift between "A" and "B" shafts on the 10th level in order to provide haulageway between the two shafts. This drift now permits us to transfer lease ores to "B" Shaft on the 10th level elevation. In the latter part of the year Contract 28 drifted southeast from coordinates 250 N - 2950 E for a distance of 140'. With the exception of a narrow seam of ore about midway in this drift all of the work was in rock. The drift, however, provided access to ore in the floor of 64 stope on the 9th level.

11th Level

There was development work done on the 11th level during 1947 by two crews. Both of these worked in the Bancroft Vein where No. 62 Contract drifted west in the Bancroft Vein to reach coordinates 220 N - 2500 E. There is ore remaining in the breast of this development which we expect to explore in the future. At the opposite end of 62 stope, on the Cliffs Shaft fee property, this crew stoped east to coordinates 320 N - 2810 E. At this point the ore vein became too narrow to continue stoping and practically too narrow for any further exploration. The other Bancroft crew, No. 84, drifted from their stope at 240 N - 2200 E toward the raise that 53 Contract uses as their ore chute. This drift was about 330' long. Approximately the first 75' and the last 40' of the drift was in ore. In the future we expect to develop the ore in the neighborhood of 84 stope and 53 Contract will undoubtedly develop the ore at the other end of the drift where it connects to their raise.

12th Level

One contract, No. 24, worked on the 12th level during 1947. This crew did some depleting work but also raise stoped northwest from an old drift thereby establishing a connection with old stopes and forming a new pillar. This work is located at 610 S - 2330 E.

"B" SHAFT
4th Level

Contract No. 13 breast stoped approximately 100' east to coordinates 230 S - 100 W. The ore vein in this area is part of the hanging wall deposit which strikes northeast-southwest and dips north under slate hanging wall. About 400' south of this location, Contract 33 developed two cross cuts to the north; one at 520 S - 230 W and the other at 540 S - 170 W. Both of these were in hard steel ore similar to the material mined by this contract for the past several years. Ultimate limits of the ore in this territory are not yet determined but inasmuch as this is a footwall ore vein it may be cut off very abruptly by jasper or unoxidized material.

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7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

3. Cliffs Shaft and Bancroft Lease: (Cont'd)

5th Level

The only development work of any significance performed on the 5th level was that of 63 Contract which drove 500' of drift through siderite and dike to reach coordinates 1090 S - 270 W. This drift, which is being advanced south and southeast, is headed for the area lying beneath the Southwest Vein which is developed on the 1st level elevation. From diamond drill explorations we know that ore extends downward to the 3rd level elevation in the Southwest Vein. The 5th level drift is being developed in order to permit the mining of this ore below the 1st level in that vein.

6th Level

Here too, there was but one development contract working during the past year. This crew, No. 49, drifted 250' southwest in the hanging wall ore vein to connect with the top of an old raise put up by 14 Contract at coordinates 840 S - 1580 W. Practically all of the drift was in good quality ore which we will eventually develop and probably remove through the raise mentioned above. In the latter part of the year Contract 49 stripped ore from the footwall ore vein which apparently connects to the hanging wall ore vein at the coordinate location indicated above.

9th Level

On this level Contract No. 14 developed a new breast stope at coordinates 725 S - 1250 W. This crew was moved to the 9th level elevation in order to drive a short traveling road drift that would provide access to scraper blocks in the old transfer stope. In doing this work they exposed a hitherto unknown vein of ore in which they continued to mine by breast stoping to the west. It now appears probable that this ore vein will connect with old 14 workings about 50' west of the present location.

10th Level

Two crews performed development work on the 10th level during the year. Contract No. 19 developed a breast stope 70' long and 35' wide on a sub-level midway between the 9th and 10th levels at coordinates 575 S - 1375 W. In one sense this might be considered depleting because there are old workings both below and above this sub-level stope. It is a part of the hanging wall ore vein. The other crew which did development work is Contract No. 28 mentioned under the discussion of 10th level "A" Shaft development as having stripped the connecting drift between the two shafts. They also advanced the footwall drift at coordinates 800 S - 1500 W and put up two short raises from this drift to facilitate removal of ore from No. 14 stope and No. 38 stope. They also drove 50' of connecting drift to improve the haulage system at coordinates 325 S - 950 W.

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7. UNDERGROUND: (Cont'd)

a. Development: (Cont'd)

3. Cliffs Shaft and Bancroft Lease: (Cont'd)

12th Level

Contract No. 40 engaged in some depleting work but they did develop two cross cut stopes along the south side of their old workings at coordinates 60 S - 1000 W. Actually, this work is more nearly akin to stripping the south rib than development of new breast stopes.

15th Level

Two of the 3 crews performing development work on the 15th level during 1947 were stoping gangs. The first of these, Contract 36, developed a new breast stope between the 13th and 14th level at coordinates 30 S - 1600 W. This stope was started in the back of the old transfer drift and advanced south and then east. The ore vein strikes east and west and should produce ore to the west as well as to the east because we know of ore in a diamond drill hole about 100' west of this location. The other stoping crew, No. 43, removed 2' of rock which was considered to be the footwall of their old workings and then breasted south a distance of 60' before encountering the true footwall limit to the ore vein. This new stope is located at 460 S - 1425 W.

Contract 47 started to work on the 15th level in the latter part of 1947 where they drifted southwest along the course of Diamond Drill Hole 574 in an attempt to develop the 60' of ore shown in the first part of this hole. The results of the drifting were disappointing because the ore occupies the lower half of the drift with a flat lying rock occurring above the ore. The crew was moved back to the east where they attempted a second drift on the theory that by moving up the dip of the ore vein the drift could be advanced in ore but this, too, proved to be disappointing because the ore is mixed with several dike seams which makes it almost impossible to mine a clean product.

3. Cliffs Shaft, Bancroft and Section 10 Lease:

The following table shows the gangs that did development work during 1947. The tonnage after each is the amount broken by these crews in development and allocated to the proper level.

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YEAR 1947

7. UNDERGROUND: (Cont'd)a. Development: (Cont'd)3. Cliffs Shaft, Bancroft and Section 10 Lease: (Cont'd)

<u>"A" SHAFT</u>	<u>Contract Number</u>	<u>Mine Tally</u>		<u>Shifts Mining</u>	<u>Shifts Barring While Developing</u>
		<u>Ore</u>	<u>Rock</u>		
1st Level	30	1,326	77	137	
2nd "	29	2,468	352	355	1
3rd "	27	4,942		335 $\frac{1}{2}$	7
4th "	2	5,595		350 $\frac{1}{2}$	12
	26	1,219		153	
	91	7,086		281	25
	92	3,529	127	272	10
5th "	21	3,845	135	296	
	25	4,988	82	293	4
	45	7,074		279	16
	66	5,600	20	293	2
	74	1,862		120	51
	96	2,157	500	324	9
6th "	11		1,204	107	
	31	2,744	627	291	
	67	3,417		181	2
7th "	61	3,121		181 $\frac{1}{2}$	18
	80	8,303		300	4
8th "	4	66	418	101	
	26	179	694	202 $\frac{1}{2}$	
	41	3,840	1,515	772 $\frac{1}{2}$	
	44	163	5	47	
	54	5,569	10	290	5
	74	632	56	153 $\frac{3}{4}$	12
	78	8,563		290 $\frac{1}{2}$	9
	95	337		62	
	96	663	13	103	
9th "	16	1,663		101	
	35	724		62	
	46	2,479	41	180	
	55	3,236		131	
	81	5,544		350	7
	101	5,615	71	288 $\frac{1}{2}$	10 $\frac{1}{2}$
10th "	3	5,138	5	270	7
	7	3,070	5	279	35
	10	3,534		261	36
	23	2,504	1,130	467	
	28	61	954	172 $\frac{1}{2}$	
	53	4,141	10	112	3
	70	2,616		103	6
	89	3,585	26	277	21
11th "	62	5,258	61	326 $\frac{1}{2}$	1
	84	3,555	1,214	443 $\frac{1}{2}$	4
12th "	24	3,733		449	
Total "A" Shaft		145,744	9,352	10,844 $\frac{1}{2}$	317 $\frac{1}{2}$

CLIFFS SHAFT MINE
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YEAR 1947

7. UNDERGROUND: (Cont'd)a. Development: (Cont'd)3. Cliffs Shaft, Bancroft and Section 10 Lease: (Cont'd)

<u>"B" SHAFT</u>	<u>Contract Number</u>	<u>Mine Tally</u>		<u>Shifts Mining</u>	<u>Shifts Barring While Developing</u>
		<u>Ore</u>	<u>Rock</u>		
1st Level	1	4,582		354	17
	38	2,943	51	96	
4th "	13	1,306		67	8
	33	7,742		509	
	83	1,540	26	80	
5th "	63	831	2,744	748½	
6th "	49	4,080	61	364	
9th "	19	3,973		173	11
	36	1,163	418	87	
10th "	14	4,335		178	
	28	546	5,607	376½	
12th "	40	1,260		63	7
14th "	43	1,785		126	
15th "	36	3,040	77	183	
	47	469	92	81	
Total "B" Shaft		39,595	9,076	3,486	43
Grand Total Dev.		185,339	18,428	14,330½	360½

The contract sheet tonnage exclusive of overrun equals 529,670 tons. The 185,339 tons mined by developing gangs is 35% of the total.

The table below gives the mine tally production totals without overrun for the past six years:

1942	(1) 690,266 Tons
1943	629,555 "
1944	569,871 "
1945	535,454 "
1946	386,160 "
1947	531,971 "
Total	3,343,277 "

(1) Actual tally is 694,807 tons which includes 4,541 tons of Incline Lump.

Developing gangs have mined the following tonnages during the past six years:

1942	310,365 Tons
1943	252,869 "
1944	206,926 "
1945	184,510 "
1946	119,649 "
1947	185,339 "
Total	1,259,658 "

From 1942 to 1948, developing gangs mined 1,259,658 tons (37.7%) per the contract sheet tally and depleting gangs mined 2,082,636 (62.3%) making a total of 3,342,294 tons. Total mine tally by skip count for the same period is 3,343,277 tons without overrun.

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7. UNDERGROUND: (Cont'd)a. Development: (Cont'd)3. Cliffs Shaft, Bancroft and Section 10 Lease: (Cont'd)

The following table gives the average number of development gangs, the tonnage mined by them, the shifts involved and the tons per gang per shift for the past six years:

<u>Year</u>	<u>Avg. No. of Gangs on Ore Development</u>	<u>Tonnage Mine Tally</u>	<u>Shifts Worked</u>	<u>Tons Per Gang Per Shift</u>
1947	41.7	185,339	14,690 $\frac{3}{4}$	12.62
1946	36.8	119,649	8,727 $\frac{1}{4}$	13.71
1945	38.5	184,510	11,395	16.19
1944	48.1	206,926	14,786 $\frac{1}{2}$	13.99
1943	56.2	252,869	16,836 $\frac{1}{2}$	15.02
1942	55.4	310,365	16,946 $\frac{1}{2}$	18.31

b. Stoping:

<u>"A" SHAFT</u>	<u>Contract Number</u>	<u>Location by Coordinates at Approx. Center of Operations</u>	<u>Character of Work</u>
1st Level	30	300 S - 600 E	Mining Floor
	34	200 S - 535 E	" "
2nd Level	5	70 S - 790 E	" "
	12	350 S - 1350 E	" "
3rd Level	9	20 S - 1200 E	" "
	104	750 S - 650 E	" "
4th Level	8	375 S - 3370 E	" "
	22	130 S - 1270 E	" Pillar
5th Level	50	180 S - 1330 E	Barring Back
6th Level	6	1220 S - 2050 E	Mining Floor
	51	200 S - 2675 E	" "
	67	380 S - 2820 E	" "
	98	480 S - 1640 E	" " & Pillar
7th Level	20	130 S - 2130 E	" Pillar
	59	450 S - 1875 E	" Floor
	61	150 N - 3550 E	" "
	82	220 S - 1775 E	" "
8th Level	95	320 S - 2700 E	" "
9th Level	16	300 N - 1620 E	" "
	46	620 S - 1450 E	" "
	55	1060 S - 2660 E	" "
	64	230 N - 2960 E	" "
	65	980 S - 2160 E	" "
	68	730 S - 2980 E	" "
	69	110 N - 1950 E	" "
10th Level	15	580 S - 1690 E	" "
	35	560 S - 2980 E	" "
	53	70 N - 2475 E	" "
	70	275 N - 2750 E	" Back
11th Level	39	570 S - 2000 E	" Floor
	60	670 S - 2690 E	" "
	79	660 S - 2180 E	" "
	83	570 S - 2515 E	" "

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7. UNDERGROUND: (Cont'd)b. Stoping: (Cont'd)

	<u>Contract Number</u>	<u>Location by Coordinates at Approx. Center of Operations</u>	<u>Character of Work</u>
<u>"B" SHAFT</u>			
1st Level	17	800 S - 75 E	Mining Floor-1205' sub.
	18	900 S - 425 E	" " -1145' sub.
	58	880 S - 170 W	" " -1205' sub.
	75	1200 S - 200 W	" " -1145' sub.
	85	1200 S - 130 E	" " -1165' sub.
2nd Level	38	910 S - 1400 W	" "
	72	450 S - 370 W	" "
	73	425 S - 270 W	" Back
4th Level	13	240 S - 200 W	" Floor
	57	230 S - 550 E	" "
5th Level	32	100 S - 300 W	" " & Pillar
	71	440 S - 660 W	" "
6th Level	77	130 N - 100 W	" Back
	87	75 S - 375 W	" Floor
7th Level	42	25 S - 360 E	" "
	56	525 S - 780 W	" "
8th Level	100	580 S - 980 W	" "
9th Level	19	540 S - 1280 W	" "
	36	110 N - 675 W	" "
	77	260 S - 580 W	" "
10th Level	14	680 S - 1475 W	" Back
	93	320 S - 780 W	" Floor
	100	580 S - 1000 W	" Back
12th Level	40	20 S - 1070 W	" "
	86	130 S - 1220 W	" Pillar & Back
14th Level	37	230 S - 1450 W	" Floor
	43	420 S - 1460 W	" "
	48	270 S - 1550 W	" Back

The table below shows the ore broken by the stoping gangs mining developed reserves:

	<u>Contract Number</u>	<u>Mine Tally</u>		<u>Shifts Mining</u>	<u>Shifts Barring While Depleting</u>
		<u>Ore</u>	<u>Rock</u>		
<u>"A" SHAFT</u>					
1st Level	30	3,993		105	46
	34	8,262		275	27
2nd Level	5	658		148	59
	12	6,380		286	6
3rd Level	5	1,688		61	
	9	2,734	2,652	119	2
	104	3,698	99	222	3
4th Level	8	7,492		293	8
	22	209		151	185
5th Level	50	71	133	13	11
6th Level	6	8,405	66	301	
	51	10,361	15	304	
	67	2,402	82	108	5
	98	3,595		183	110

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7. UNDERGROUND: (Cont'd)b. Stoping: (Cont'd)

	<u>Contract Number</u>	<u>Mine Tally</u>		<u>Shifts Mining</u>	<u>Shifts Barring While Depleting</u>
		<u>Ore</u>	<u>Rock</u>		
<u>"A" SHAFT</u>					
7th Level	20	7,385		249	27
	59	6,727		239	65
	61	2,647	5	102 $\frac{1}{2}$	
	82	7,900		289 $\frac{1}{2}$	14
8th Level	95	3,440		177	2
9th Level	4	92		3	
	16	5,013	5	192	5
	35	2,785	10	215	28
	46	2,450	148	112	
	55	9,828		173	
	64	5,998	10	276	26
	65	5,753	20	255	6
	68	4,261		292 $\frac{1}{2}$	8
	69	8,313		252	26
10th Level	15	8,257		295	9
	53	6,997		188	5
	70	3,550	5	123	39
11th Level	39	9,986	15	282	
	60	6,745		435	
	79	6,620		297	7
	83	6,026		419 $\frac{1}{2}$	7
Total "A" Shaft		180,721	3,265	7,436	736
<u>"B" SHAFT</u>					
1st Level	17	9,272		363	
	18	3,710	54	235 $\frac{1}{2}$	37
	58	8,930	61	363	
	75	5,108		275	
	85	8,469	10	302 $\frac{1}{2}$	
2nd Level	38	6,069	10	167	
	72	12,273	41	276	22
	73	7,579		273	28
4th Level	13	7,650	61	279	12
	57	5,233	102	184	16
5th Level	32	9,001	138	285 $\frac{1}{2}$	
	71	5,360	23	318	20
6th Level	77	1,255		141 $\frac{1}{2}$	25
	87	8,300	20	291 $\frac{1}{2}$	9
7th Level	42	4,029		270 $\frac{1}{2}$	3
	56	7,288	36	289	8
8th Level	100	4,508		98	
9th Level	19	2,468	352	100 $\frac{1}{2}$	10
	36	796		25	
	77	3,246	235	125	2
10th Level	14	5,518		122	
	93	10,684		345 $\frac{1}{2}$	21
	100	770		143 $\frac{1}{2}$	
11th Level	86	8,374		273	30
12th Level	40	4,865	56	195	11

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7. UNDERGROUND: (Cont'd)b. Stoping: (Cont'd)

<u>"B" SHAFT</u>	<u>Contract Number</u>	<u>Mine Tally</u>		<u>Shifts Mining</u>	<u>Shifts Barring While Depleting</u>
		<u>Ore</u>	<u>Rock</u>		
14th Level	37	6,365	5	298	
	43	3,840		161½	7
	48	2,652		264	19
Total "B" Shaft		163,612	1,204	6,465	280
Grand Total Dep.		344,333	4,469	13,901	1,016

The mine tally from the contract sheets was 529,670 tons of which the depleting gangs broke 344,333 tons or 65%.

The following table gives a six year comparison:

<u>Year</u>	<u>Avg. No. of Gangs Stopping</u>	<u>Tonnage Mine Tally</u>	<u>Shifts Worked</u>	<u>Tons Per Gang Per Shift</u>
1947	49	344,333	14,917	23.08
1946	49	266,278	10,505½	25.35
1945	46	350,312	13,619½	25.72
1944	48	364,650	13,984	26.07
1943	46	377,262	13,569½	27.80
1942	48	379,801	14,250	26.65

c. Drifting and Raising:

<u>Year</u>	<u>Rock Drifts and Raises</u>	<u>Ore Drifts and Raises</u>	<u>Total</u>
1947	3,221'	2,952'	6,173'
1946	1,873'	2,557'	4,430'
1945	1,969'	3,153'	5,122'
1944	3,814'	4,108'	7,922'
1943	5,180'	4,059'	9,239'
1942	2,855'	3,166'	6,021'
1941	2,196'	3,411'	5,607'
1940	1,756'	3,242'	4,998'
1939	2,130'	2,270'	4,400'
1938	2,337'	1,955'	4,292'

d. Explosives, Drilling and Blasting:

Powder consumption per ton of ore increased .0625 lbs. per ton over 1946 usage. For bulldozing of chunks we found it necessary to return to the use of Gelamite No. 1 in order to get good fragmentation. The average price of this type of powder was 4.07 higher per cwt. in 1947 compared to 1946. This factor together with an increase of \$1.18 per cwt. in the price of the Hercomite 2X raised the per ton cost for powder .0094.

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7. UNDERGROUND: (Cont'd)

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

The powder consumption per foot of rock development increased .8 of a lb. per foot of development over 1946 practice as shown in the table below:

<u>Year</u>	<u>Pounds of Powder Per Foot of Rock Development</u>
1943	17.8 Gelamite
1944	18.7 Gelamite
1945	21.6 Gelamite
1946	17.0 Hercomite 2X
1947	17.8 Hercomite 2X

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7. UNDERGROUND: (Cont'd)d. Explosives, Drilling and Blasting: (Cont'd)Statement of Explosives Used: (Stopping and Development in Ore)

	<u>Quantity</u>	<u>Average Price</u>	<u>Amount 1947</u>	<u>Amount 1946</u>
Gelamite No. 1 - Cwt.	51,950	14.250	7465.41	401.97
Hercomite 2 X - Cwt.	396,150	13.500	53698.87	40956.31
Hercomite 2 X-A - Cwt.	44,050	13.014	5733.00	-
Total Powder	492,150	13.593	66897.28	41358.28
Fuse - Ft.	783,923	8.387 M	6574.44	3467.47
No. 6 Caps	127,134	13.364 M	1699.05	1100.04
Electric Caps	8,389	14.950 C	1254.20	825.15
Fuse Lighters	38,750	7.403 M	286.88	154.86
No. 18 Shot Wire - Ft.	7,634	17.753 M	135.53	72.18
Tamping Bags	9,500	6.600 M	62.69	58.80
Connecting Wire - Lbs.	437	.800	347.78	118.75
Miscellaneous			71.54	84.20
Total Fuse, Etc.			10432.11	5881.45
Total Stopping & Dev. in Ore			77329.39	47239.73
Product - Tons			546,796	401,939
Lbs. Powder Per Ton Ore			.9000	.8365
Cost Per Ton For Powder			.1223	.1029
Cost Per Ton For Fuse, Etc.			.0191	.0146
Cost Per Ton For All Explosives			.1414	.1175

(Development in Rock)

Gelamite No. 1 - Cwt.	300	13.500	40.50	414.00
Hercomite 2 X - Cwt.	53,500	13.436	7188.25	3557.14
Hercomite 2 X-A - Cwt.	3,550	13.000	461.50	-
Total Powder	57,350	13.409	7690.25	3971.14
Fuse - Ft.	30,941	8.387 M	259.50	83.32
No. 6 Caps	4,006	13.679 M	54.80	24.46
Electric Caps	7,046	13.148 C	926.41	412.82
Fuse Lighters	3,750	6.749 M	25.31	16.88
No. 18 Shot Wire - Ft.	5,447	16.637 M	90.62	46.57
Tamping Bags	700	6.600 M	4.62	12.60
Connecting Wire - Lbs.	331	.778	257.37	77.60
Miscellaneous			-	28.50
Total Fuse, Etc.			1618.63	702.75
Total Rock Development			9308.88	5874.72
Feet Rock Development			3,221	1,873
Cost Per Foot Rock Development			2.890	2.495
GRAND TOTAL ALL EXPLOSIVES			86638.27	51913.72
AVERAGE COST PER LB. FOR POWDER			.136	.123

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8. COST OF
OPERATING:

a. Comparative Mining Costs:

	<u>1947</u>	<u>1946</u>
Product - Tons	546,796	401,939
Underground Costs	2.694	2.298
Surface Costs	.479	.330
General Mine Expense	<u>.531</u>	<u>.423</u>
Cost of Production	3.704	3.051
Taxes	.331	.310
Depreciation	.041	.006
Loading and Shipping	<u>.093</u>	<u>.084</u>
Total Cost at Mine	4.170	3.485
Budget Estimate at Mine	3.811	3.480
No. of Days Operating	305	217
No. of Shifts and Hours	2-8 hr.	2-8 hr.
Average Daily Product	1793	1852

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8. COST OF
OPERATING: (Cont'd)

b. Detailed Cost Comparison
Details of Accounts

	<u>Total 1947</u>		<u>Total 1946</u>	
	<u>Amount</u>	<u>Per Ton</u>	<u>Amount</u>	<u>Per Ton</u>
<u>Underground Costs</u>				
Exploring in Mine	19487.79	.036	13040.59	.032
Development in Rock	82185.74	.150	49505.48	.123
Development in Ore	74540.36	.137	53922.56	.134
Stoping	759081.65	1.389	470533.52	1.172
Timbering	46199.83	.084	23854.40	.059
Tramming	163033.98	.298	110534.22	.275
Ventilation	1016.88	.002	595.60	.002
Pumping	37594.61	.069	25784.80	.064
Comp. & Air Pipes	65322.12	.119	37766.30	.094
Back Filling	1513.99	.002	1723.65	.004
Underground Suptce.	49361.15	.090	32587.85	.082
Comp. & Power Drills	23397.57	.043	13990.82	.034
Scraper & Mech. Loaders	88742.09	.162	50602.02	.126
Tramming Equipment	53608.02	.098	33895.11	.084
Pumping Machinery	7781.51	.014	5285.91	.013
Total Undg. Costs.	1472867.29	2.694	923622.83	2.298
<u>Surface Costs</u>				
Hoisting	48344.91	.088	31399.26	.077
Stocking Ore	25616.28	.047	14580.61	.036
Screening, Crushing at Mine	54779.65	.100	30632.47	.076
Dry House	16076.48	.029	14708.24	.037
General Surface Expense	21985.26	.040	13055.80	.033
Maint. Hoisting Equipment	18808.23	.034	9650.92	.024
Shaft	25236.06	.046	2862.17	.007
Top Tram Equipment	6917.70	.013	2769.78	.007
Docks, Trestles & Pockets	30948.79	.057	5948.71	.015
Mine Buildings	13433.15	.025	7013.78	.018
Total Surface Costs	262146.51	.479	132621.74	.330
<u>General Mine Expense</u>				
Geological	3083.99	.005	-	-
Mining Engineering	7273.91	.014	3997.82	.010
Mech. & Elec. Engineering	4175.32	.008	1673.04	.004
Analysis and Grading	29546.65	.054	18487.35	.046
Safety Department	4091.93	.007	2322.83	.006
Tel. & Safety Devices	8410.01	.015	5461.37	.014
Local & Gen. Welfare	6092.63	.011	3880.34	.010
Spec. Exp. Pens. & All.	9861.92	.018	6613.32	.017
Ishpeming Office	33962.28	.062	23279.61	.057
Mine Office	32492.24	.060	20179.60	.050
Insurance	14515.73	.027	5627.37	.014
Personal Injury	54220.23	.099	24801.53	.062
Social Security Taxes	33274.13	.061	18253.30	.045
Employees Vacation Pay	54474.79	.100	35250.28	.088
Use & Occupancy - Ins. Rec'd.	4670.54	.009	-	-
Total Gen. Mine Expense	290805.22	.531	169827.76	.423
Cost of Production	2025819.02	3.704	1226072.33	3.051

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8. COST OF OPERATING: (Cont'd)

b. Detailed Cost Comparison
Details of Accounts

	<u>L A B O R</u>				<u>S U P P L I E S</u>			
	<u>1947</u>	<u>Per</u>	<u>1946</u>	<u>Per</u>	<u>1947</u>	<u>Per</u>	<u>1946</u>	<u>Per</u>
	<u>Amount</u>	<u>Ton</u>	<u>Amount</u>	<u>Ton</u>	<u>Amount</u>	<u>Ton</u>	<u>Amount</u>	<u>Ton</u>
<u>Underground Costs</u>								
Exploring in Mine	13723.91	.025	9516.87	.024	5763.88	.011	3523.72	.008
Development in Rock	65283.16	.119	42521.61	.106	16902.58	.031	6983.87	.017
Development in Ore	60498.16	.111	44270.37	.110	14042.20	.026	9652.19	.024
Stopping	641252.90	1.173	400496.72	.996	117828.75	.216	70036.80	.175
Timbering	24571.40	.044	14015.99	.035	21628.43	.040	9838.41	.025
Tramming	154100.16	.282	104484.35	.260	8933.82	.016	6049.87	.015
Ventilation	490.63	.001	337.98	.001	526.25	.001	257.62	-
Pumping	14551.84	.027	10569.28	.026	23042.77	.042	15215.52	.038
Comp. & Air Pipes	10892.42	.019	5812.30	.015	54429.70	.100	31954.00	.079
Back Filling	1357.58	.002	1723.65	.004	156.41	-	-	-
Underground Suptce.	48986.73	.090	32485.26	.081	374.42	-	102.59	-
Comp. & Power Drills	4041.89	.007	674.27	.001	19355.68	.036	13316.55	.033
Scrapers & Mech. Loaders	34762.07	.064	19749.87	.049	53980.02	.098	30852.15	.078
Tramming Equipment	34246.75	.063	22344.78	.056	19361.27	.035	11550.33	.029
Pumping Machinery	4125.32	.007	3533.87	.009	3656.19	.007	1752.04	.004
Total Udg. Costs	1112884.92	2.035	712537.17	1.773	359982.37	.658	211085.66	.525
<u>Surface Costs</u>								
Hoisting	28144.87	.051	16915.24	.042	20200.04	.037	14484.02	.036
Stocking Ore	22575.99	.041	12939.47	.032	3040.29	.006	1641.14	.004
Screening, Crushing-Mine	39659.69	.072	24502.50	.061	15119.96	.028	6129.97	.015
Dry House	11459.39	.019	10727.32	.027	4617.09	.008	3980.92	.010
General Surface Expense	20001.28	.036	12081.78	.030	1983.98	.004	974.02	.002
Hoisting Equipment	10668.78	.019	5781.61	.014	8139.45	.015	3869.31	.010
Shaft	19033.31	.035	2383.87	.006	6202.75	.011	478.30	.001
Top Tram Equipment	3923.94	.008	1634.52	.004	2993.76	.005	1135.26	.003
Docks, Trestles & Pckts.	17064.93	.032	3629.86	.009	13883.86	.025	2318.85	.006
Mine Buildings	9109.74	.017	5126.63	.013	4323.41	.008	1887.15	.005
Total Surface Costs	181641.92	.332	95722.80	.238	80504.59	.147	36898.94	.092
<u>General Mine Expenses:</u>								
Geological	1349.75	.002	-	-	1734.24	.003	-	-
Mining Engineering	5764.82	.011	3195.57	.008	1509.09	.003	802.25	.002
Mech. & Elec. Engr.	2761.42	.005	1124.95	.003	1413.90	.003	548.09	.001
Analysis & Grading	26181.38	.048	16491.01	.042	3365.27	.006	1996.34	.005
Safety Department	2914.85	.005	1888.72	.005	1177.08	.002	434.11	.001
Tel. & Safety Devices	2115.41	.004	1245.27	.003	6294.60	.011	4216.10	.011
Local & Gen. Welfare	2737.58	.005	1902.53	.005	3355.05	.006	1977.81	.005
Spec. Exp. Pens. & All.	1751.93	.003	1857.36	.005	8109.99	.015	4755.96	.013
Ishpeming Office	20207.07	.037	13467.93	.034	13755.21	.025	9811.68	.024
Mine Office	27804.87	.051	17255.20	.044	4687.37	.009	2924.40	.007
Insurance	-	-	-	-	14515.73	.027	5627.37	.014
Personal Injury	1361.28	.002	799.33	.002	52858.95	.097	24002.20	.060
Social Security Taxes	-	-	-	-	33274.13	.061	18253.30	.045
Employees Vacation Pay	54474.79	.100	35250.28	.088	-	-	-	-
Use & Occupancy-Ins. Rec'd.	-	-	-	-	4670.54	.009	-	-
Total Gen. Mine Exp.	149425.15	.273	94478.15	.235	141380.07	.259	75349.61	.188
Cost of Production	1443951.99	2.640	902738.12	2.246	581867.03	1.064	323344.21	.805
Taxes	-	-	-	-	181298.27	.332	124622.16	.310
Total Cost	1443951.99	2.640	902738.12	2.246	763165.30	1.396	447966.37	1.115
	65.4%		66.8%		34.6%		33.2%	

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8. COST OF OPERATING: (Cont'd)

b. Comparative Mining Costs: (Cont'd)

The cost of production increased .653 over that for 1946. Of this amount, .395 is an increase in labor cost and .258 is an increase in supply costs. The labor cost could have been expected to rise .23 per ton because of the \$.12½ per hour wage increase. The remaining .165 cents is due to decreased tonnage. Supply costs are higher because of general increases in prices and some unusual repairs.

In the following pages, only those categories will be discussed that show appreciable divergences in costs not attributable to the general wage increase or price of supplies.

Exploring in Mine

	<u>1947</u>	<u>1946</u>
Labor for Undg. Drilling	\$10,714.24	\$ 6,222.61
Prop. of D.D. Supt.'s Time	721.87	929.84
Carbon Loss	-	341.98
Bortz Loss	6,355.82	2,482.07
Pipe and Fittings	17.14	121.58
Drill Equipment & Repairs	560.14	229.20
Rental of Drill Equipment	987.50	675.00
Miscellaneous Supplies	216.72	181.53
Compressor Expense	800.00	645.00
Credit on Bortz Bits	2,287.18	1,937.18
Blank Bits, Shells & Corebarrels	320.01	552.17
Fuel & Trucking	-	3.82
Diamond Setters	63.10	864.31
Total	18,469.36	11,311.93
Geological Expense for Drill	883.50	825.72
Analysis Expense	93.38	217.07
Auto Mileage Expense	41.55	-
Total Underground Drilling Cost	19,487.79	12,354.72
Geological Dept. Exp. for Mine Mapping	3,083.99	1,368.61
Total as Per Cost Sheet (1946 Total includes \$682.74 of Idle Period Exp.)	22,571.78	13,723.33
Feet drilled underground with carbon	4,865	2,997
Cost Per Foot	4.005	4.122

This category was itemized to show the total cost and cost per foot of exploring in the mine by diamond drilling.

The cost per foot decreased nearly \$.12 compared to 1946.

The table below gives the footage and percentage of each type of material drilled by the diamond drills during 1946 and 1947.

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8. COST OF OPERATING: (Cont'd)

b. Comparative Mining Costs: (Cont'd)

Exploring in Mine: (Cont'd)

	<u>1946</u>		<u>1947</u>	
Soft Ore Jasper	162'	5.4%	195'	4.0%
Ore	160'	5.3%	144'	3.0%
Dike	907'	30.3%	2,769'	56.9%
Slate	511'	17.1%	601'	12.4%
Cong. & Lean Ore	298'	9.9%	151'	3.1%
Quartzite	587'	19.6%	775'	15.9%
Siderite	292'	9.7%	101'	2.1%
Jasper	80'	2.7%	129'	2.6%
Total	<u>2,997'</u>	<u>100.0%</u>	<u>4,865'</u>	<u>100.0%</u>

There is \$7,988.09 of unexpended balance in E & A account CC-93. No work was done under this surface exploration authorization in Section 9 - 47 - 27 during 1947, but when crews are available it is likely that some additional work will be carried on in Section 9.

Development in Rock

Comparative costs for the past five years are shown below:

<u>Year</u>	<u>Footage</u>	<u>Labor Cost</u>		<u>Supply Cost</u>		<u>Total Cost</u>	
		<u>Total</u>	<u>Per Ft.</u>	<u>Total</u>	<u>Per Ft.</u>	<u>Total</u>	<u>Per Ft.</u>
1947	3,221	65,283.16	20.27	16,902.58	5.25	82,185.74	25.51
1946	1,873	42,521.61	22.70	6,983.87	3.73	49,505.48	26.43
1945	1,969	36,203.46	18.39	8,663.01	4.40	44,866.47	22.79
1944	3,814	76,810.49	20.14	16,081.03	4.21	92,891.52	24.35
1943	5,180	90,353.18	17.44	19,488.14	3.76	109,841.32	21.20

The cost per foot decreased nearly a dollar in spite of a sharp increase in the supply cost. Labor cost dropped over \$2.00 per foot mainly due to the increased use of jumbo equipped crews for drifting.

The table below shows footage in different categories for the last five years:

	<u>1947</u>	<u>1946</u>	<u>1945</u>	<u>1944</u>	<u>1943</u>
Rock Raises	665'	550'	493'	1678'	1124'
10' x 10' Main Haulage Drifts	2556'	1176'	1304'	1533'	2855'
8' x 8' Main Haulage Drifts	-	147'	172'	603'	1201'
Total	<u>3221'</u>	<u>1873'</u>	<u>1969'</u>	<u>3814'</u>	<u>5180'</u>

The next table helps to explain unit cost per foot, because the type of material has a marked effect on costs.

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8. COST OF OPERATING: (Cont'd)

b. Comparative Mining Costs: (Cont'd)

Development in Rock: (Cont'd)

	<u>Jasper or Lean Ore</u>	<u>Siderite</u>	<u>Dike or Slate</u>	<u>Total</u>
Rock Raises	103'	189'	373'	665'
10' x 10' Rock Drifts	197'	785'	1574'	2556'
8' x 8' Rock Drifts	-	-	-	-
Total	300'	974'	1947'	3221'

Development in Ore and Stopping

These two accounts are combined in this discussion because there is no accurate separation of costs into these two categories on the cost sheet.

Comparative costs for the last two years follows:

<u>Year</u>	<u>Labor Cost</u>	<u>Supply Cost</u>	<u>Total Cost</u>
1947	701,751.06	131,870.95	833,622.01
1946	444,768.09	79,687.99	524,456.08

The detailed cost for the two years are shown below:

	<u>1947</u>		<u>1946</u>	
	<u>Total</u>	<u>Cost Per Ton</u>	<u>Total</u>	<u>Cost Per Ton</u>
<u>Labor</u>				
Miner's Labor	303,819.19	.556	176,910.67	.440
Other Labor	397,931.87	.728	267,857.42	.667
Total	701,751.06	1.284	444,768.09	1.107
<u>Supplies</u>				
General	5,926.03	.010	2,266.04	.006
Iron and Steel	20,454.55	.037	14,150.14	.035
Oils	1,025.51	.002	586.90	.001
Machinery	10,825.83	.020	3,018.19	.008
Explosives	77,301.65	.141	47,351.67	.118
Lumber	1,151.64	.002	340.33	.001
Electric Power	7,929.63	.015	5,241.69	.013
Sundries & Clearing Acct.	1,501.88	.003	2,347.70	.006
Shop Expense Accounts	5,754.23	.011	4,385.33	.011
Total	131,870.95	.241	79,687.99	.199
Total Labor & Supplies	833,622.01	1.525	524,456.08	1.306
Tons Hoisted	546,796		401,939	

The increase in labor cost per ton of ore is due to the combined effect of the \$.12½ per hour wage increase and the lower tons per man productivity.

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8. COST OF OPERATING: (Cont'd)

b. Comparative Mining Costs: (Cont'd)

Tramming

<u>Year</u>	<u>Labor</u>		<u>Supplies</u>		<u>Total</u>	
	<u>Total</u>	<u>Per Ton</u>	<u>Total</u>	<u>Per Ton</u>	<u>Total</u>	<u>Per Ton</u>
1947	154,100.16	.282	8,933.82	.016	163,033.98	.298
1946	104,484.35	.260	6,049.87	.015	110,534.22	.275
Increase	49,615.81	.022	2,883.95	.001	52,499.76	.023

Tramming costs are .023 per ton higher in 1947 than in 1946. This increase arises almost entirely in the labor increase and is due to the wage rise.

Pumping

Costs in this category remained nearly constant.

The average number of gallons of water pumped per minute for each month during the last five years is given in the table below:

<u>Month</u>	<u>1947</u>	<u>1946</u>	<u>1945</u>	<u>1944</u>	<u>1943</u>
January	723	785	826	663	613
February	762	750	804	694	603
March	739	744	808	750	644
April	679	786	913	751	720
May	830	766	835	815	762
June	874	783	907	829	838
July	888	787	909	840	861
August	865	735	848	882	798
September	905	769	861	995	731
October	843	714	834	998	686
November	808	732	828	962	688
December	798	664	799	1033	674
Avg. For Year	808	758	846	831	710

Compressors, Air Pipes & Power Drills

Costs increased .025 in 1947 compared to 1946. This was primarily due to supplies with increased prices and the increase in number of drills purchased.

During 1947, we purchased 39 drills at a cost of \$15,448.54. The table below shows the types and makes of machines purchased in the last five years.

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8. COST OF OPERATING: (Cont'd)

b. Comparative Mining Costs: (Cont'd)

Compressors, Air Pipes & Power Drills: (Cont'd)

	<u>1947</u>	<u>1946</u>	<u>1945</u>	<u>1944</u>	<u>1943</u>
Cleveland Stoper	1	-	-	-	-
R-58 Stopping Machine	3	5	-	1	-
DA-35 Automatic Ingersoll-Rand Drifters	-	3	1	-	-
DA-35 Ingersoll-Rand Drifters	11	6	6	6	11
D-12 Automatic Cleveland Drifters	-	-	2	-	-
D-12 Cleveland Drifters	-	-	1	3	6
D-25 Cleveland Drifters	3	4	-	-	-
Automatic Gardner-Denver Drifters	3	2	-	-	-
Gardner-Denver Drifters	3	1	1	1	-
JB-4 Ingersoll-Rand Blockholders	<u>15</u>	<u>-</u>	<u>-</u>	<u>2</u>	<u>3</u>
Total	39	21	11	13	20

Scrapers & Mechanical Loaders

Of the .036 increase in this category's cost .02 is due to increased supply costs. Again the sharp price rises of 1947 are largely responsible.

	<u>1947</u>		<u>1946</u>	
	<u>Amount</u>	<u>Cost</u>	<u>Amount</u>	<u>Cost</u>
3/8" Wire Rope	1,750 ¹	153.13	2,825 ¹	239.08
1/2" Wire Rope	3,340 ¹	347.61	5,991 ¹	631.55
5/8" Wire Rope	81,212 ¹	14,969.85	72,638 ¹	12,778.28
No. 2 & 4 Electric Cable	7,808 ¹	4,997.52	4,280 ¹	2,143.53
Scraper Blocks	156	5,526.87	87	2,291.55
Gen. Electrical Reprs. & Renew.		5,8685.50		31,488.23
Loader Motors	2	1,075.40		928.80
Circuit Breaker		-		101.00
3-Drum Sullivan Scraper Hoist	1	2,986.18		-
Total		<u>88,742.06</u>		<u>50,602.02</u>

The tonnage and unit cost for the past five years for 5/8" Wire Rope are compared below:

<u>Year</u>	<u>Product</u>	<u>Type of 5/8" Rope Used</u>	<u>Purchased</u>	<u>Cost</u>	<u>Cost Per Ton</u>	<u>Feet Per Ton Ore</u>
1947	546,796	"Trulay"	81,212 ¹	14,969.85	.0274	.149
1946	401,939	"	72,638 ¹	12,778.28	.0317	.180
1945	550,169	"	84,145 ¹	14,449.76	.0263	.153
1944	587,051	"	103,746 ¹	17,760.31	.0303	.177
1943	634,530	"	83,032 ¹	14,693.88	.0231	.131

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8. COST OF OPERATING: (Cont'd)

c. Comparative Mining Costs - Surface:

Two categories should be discussed under surface costs - namely, the shaft and docks, trestles and pockets. In the first category costs are divided as follows:

1947		1946	
Labor	Supplies	Labor	Supplies
19,033.31	6,202.75	2,383.87	478.30

The retimbering of two levels from the 8th to 10th in "B" Shaft and one level from 8th to 9th in "A" Shaft was the operation responsible for the large increase in this category.

Two new steel pockets were constructed, one in each of the shaft houses, during 1947. This job raised the per ton cost of this category by .042 over that for 1946. The cost is apportioned as follows:

1947		1946	
Labor	Supplies	Labor	Supplies
17,064.93	13,883.86	3,629.86	2,318.85

9. EXPLORATIONS:

Diamond drill holes drilled during the year 1947 were as follows:

	Footage Drilled	Feet of Ore
D. D. Hole No. 369	354	No Ore
488	480	No Ore
523	324	No Ore
571	88	No Ore
572	63	No Ore
573	386	No Ore
574	395	77'
575	689	No Ore
576	500	18'
577	828	No Ore
578	157	No Ore
579	29	No Ore
580	45	No Ore
581	125	No Ore
582	180	12'
583	222	37'
Total	4865	144' 3.0%

On the 2nd level "A" Shaft, Hole No. 523 was deepened from 352' to a total depth of 676'. This hole is located at coordinates 189 N - 1251 E. It was deepened in order to cut the north limb of the Bancroft Vein syncline and to thereby test that area for possible ore occurrence. The hole passed from hanging wall quartzite into soft ore jasper without encountering any hard ore formation. It seems likely that the hard ore formation has been truncated from its normal position under the hanging wall by erosion or faulting.

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9. EXPLORATIONS: (Cont'd)

To test this same syncline at a lower elevation, Hole No. 488 was deepened on the 5th level elevation. This hole, located at 361 N - 1393 E, is a horizontal hole drilled N 6° E. It was deepened from 75' to 555' and passed through hanging wall material followed by soft ore jasper. Here, too, the hard ore formation is missing on the north limb of the syncline. Three short holes, Nos. 578, 579 and 580, were drilled on the 5th level Bancroft Lease at coordinates 125 N - 1287 E, 20 N - 1424 E and 13 N - 1408 E respectively. All of these horizontal holes were drilled from the hard ore horizon toward the slate contact along the south side and west end of the Bancroft Vein syncline. We were looking for ore along this contact but found none.

In 1946, a drainage hole was started on the 8th level in the east end of the mine to augment the flow from some smaller holes that penetrate to the bottom level of the No. 3 mine. This 3½" hole was completed in early 1947 at a depth of 135'. The collar of the hole is located at 419 S - 3514 E.

Two holes were drilled on the 10th level in the "A" Shaft workings. Hole No. 581 was drilled horizontally south from 111 N - 1490 E. No ore was found by this hole. The other hole, No. 582, was drilled horizontally N 23° E from 307 N - 3235 E. Twelve feet of first class ore was cut by this hole from 99' to 111'.

In the "B" Shaft territory, Holes No. 571 and 573 were drilled horizontally north from coordinate locations 13 N - 83 E and 269 S - 237 W to test the north limb of the "B" Shaft syncline for ore formation. A small amount of ore was cut by 1946 drilling in hole No. 571 but no ore was encountered by hole No. 573. The latter hole passed through hanging wall slate into dike and soft ore jasper. This is a relationship similar to that encountered on the 2nd level and 5th level in the Bancroft Vein.

On the 10th level, Hole 583 was drilled horizontally S 25° E from 572 S - 1192 W. This hole crosses a large pillar or unmined area. Good ore was encountered from 108' to 145'.

On the 10th level in the west area of "B" Shaft, two long holes were drilled, namely 575 and 577. These were drilled down at angles of -45° and -65° respectively from the coordinate location 942 S - 2726 W. No ore was encountered in either of these holes but they were drilled primarily to determine the structural position of a fault that was believed to cut this area. In order to more intelligently locate a surface drill hole prospecting for soft ore it was desirable to know the dip of this fault and consequently these two underground holes were drilled to determine that dip.

Near the west end of the 15th level, Holes 369, 574 and 576 were drilled to explore for continuation of ore around the hanging wall contact of the syncline. Hole 369 was deepened to 513' without encountering any ore. This hole, located at 201 N - 1889 W, was drilled north and explored the north limb of the syncline which proved barren as in other places where it has been cut. Holes 574 and 576 were horizontal holes drilled S 45° W from 10 N - 1914 W and 58 N - 2038 W. Hole 574 encountered 77' of first class ore in two veins and Hole 576 cut 18'

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9. EXPLORATIONS: (Cont'd)

of ore in 3 veins. It seems likely that the longest run of ore of 60' in Hole 574 was a case where the hole was drilled nearly parallel to the strike of a narrow ore vein.

10. TAXES:

Comparative data for 1947 and 1946 follows:

	<u>1947</u>		<u>1946</u>	
	<u>Valuation</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Taxes</u>
Realty	2,575,000	92,202.25	2,600,000	93,373.80
Minerals under NW $\frac{1}{4}$ of Sec. 9-47-27	160,000	5,729.07	175,000	6,284.78
Personal	621,100	22,239.54	406,100	14,584.26
Lot 2, Sec. 3-47-27 (Bancroft)	750,000	26,855.03	800,000	28,730.40
SE $\frac{1}{4}$ of NE $\frac{1}{4}$ of Sec. 9-47-27 (Barnum)	57,000	2,040.98	52,000	1,867.48
Lot 174, Nelson Addition	100	3.58	100	3.59
South 35.91 ft. of Lot 179	50	1.79	50	1.80
S $\frac{1}{2}$ of NW $\frac{1}{4}$ of Sec. 10-47-27	900,000	32,226.03	850,000	30,526.05
Total	5,063,250	181,298.27	4,883,250	175,372.16
Taxes per ton produced		.3315		.4363
Taxes per ton shipped		.3360		.4348

Valuations and taxes for the past ten years are shown below:

<u>Year</u>	<u>Taxes</u>	<u>Valuation</u>	<u>Tax Rate</u>
1947	181,298.27	5,063,250	35.8067
1946	175,372.16	4,883,250	35.913
1945	178,544.98	4,968,250	35.9372
1944	159,909.45	4,443,250	35.9893
1943	146,539.81	4,268,250	33.9926
1942	143,225.85	4,093,250	34.6443
1941	144,195.60	4,042,150	35.3198
1940	137,284.25	3,982,150	34.4748
1939	141,248.04	4,007,150	34.8999
1938	140,789.79	3,852,150	36.1865

Valuations and taxes both increased slightly from 1946 figures.

City of Ishpeming Tax Levy

	<u>1947</u>		<u>1946</u>	
	<u>Amount</u>	<u>Rate</u>	<u>Amount</u>	<u>Rate</u>
Valuation	12,691,075.00		11,678,285.00	
<u>Tax Levy by Funds</u>				
County Tax	92,010.29	7.250	71,821.45	6.15
County Road Tax	20,940.27	1.650	8,758.72	.75
School Tax	77,415.56	6.100	94,594.11	8.1
School Debt Serv. Tax	10,237.50	.8067	10,662.50	.913
Gen'l Optg. Debt Serv.	190,366.13	15.000	175,174.28	15.00
Capital Improvement	63,455.37	5.000	58,391.42	5.00
Total Taxes	454,425.12	35.8067	419,402.48	35.913

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11. ACCIDENTS
AND
PERSONAL
INJURY:

The accident record for the year is shown below:

	<u>Cliffs Shaft Mine</u>	<u>C. C. I. Co.</u> <u>Undg. Mines</u>	<u>C. C. I. Co.</u> <u>All Operations</u>
Tons of Ore Mined	546,796	4,284,531	7,914,755
Hours of Labor	1,033,830 $\frac{1}{2}$	5,752,116 $\frac{1}{4}$	8,569,754 $\frac{3}{4}$
No. of Fatalities	3	7	7
No. of Compensable Accidents	16	134	149
No. of Non- " " "	18	197	230
Total Lost Time Accidents	37	338	386
No Lost Time Accidents	74	618	937
Days Lost-Compensable Injuries	3815	8818	9946
Days Lost-Non- " " "	54	480	557
Total Days Lost	21869	51298	52503
Frequency Rate	35.79	58.74	45.04
Severity Rate	21.156	8.918	6.127

Frequency Rate - Number of accidents for every 1,000,000 man hours.
Fatalities 6,000 days.

Severity Rate - Number of days lost per 1,000 man hours.

12. NEW
CONSTRUCTION
ORE EQUIPMENT:

The following E. & A.'s were continued from 1946 or authorized during 1947:

E. & A. No. CC-150

This E. & A. was for the purchase and installation of a fan to provide forced ventilation in the Cliffs Shaft Mine.

E. & A. No. CC-169

This E. & A. covers the cost of one Model 40 Eimco, authorized in 1946. This was received and charged in June of 1947, costing \$10,877.50.

E. & A. No. CC-171

This E. & A. covers the cost and installation of an aftercooler for the Compressor. It was authorized in 1946 and completed this year costing \$3,323.93.

E. & A. No. CC-179

This E. & A. covers the cost of a new Ingersoll-Rand Drill Sharpener installed in the Drill Shop this year at a total cost of \$2,792.88.

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14. MAINTENANCE
AND REPAIRS:

Dwellings

	<u>Labor</u>	<u>Supplies</u>	<u>Total</u>
Hard Ore Location	\$ 2,289.83	\$1,675.08	\$ 3,964.91
Barnum Location	295.78	74.14	369.92
Outhwaite Purchase	958.08	229.65	1,187.73
Hyde Purchase No. 1	131.06	31.21	162.27
Hyde Purchase No. 2	1,316.91	1,502.39	2,819.30
Smith Purchase	1,739.44	545.30	2,284.74
Nelson Purchase	50.39	13.01	63.40
Berg Purchase	4,515.70	1,959.93	6,475.63
Ramsdell Purchase	745.16	432.20	1,177.36
Grand Total	<u>\$12,042.35</u>	<u>\$6,462.91</u>	<u>\$18,505.26</u>

Comparative figures for the past six years follows:

Total for Year 1947	-	\$18,505.26
1946	-	8,559.19
1945	-	10,772.98
1944	-	12,771.58
1943	-	18,006.43
1942	-	7,708.55

15. POWER:

The following five year comparison shows power consumption, cost and rate per K.W.H.:

<u>Year</u>	<u>K. W. H.</u>	<u>Cost</u>	<u>Rate Per K.W.H.</u>
1947	8,119,492	113591.74	.0139889
1946	5,824,429	83288.58	.014299
1945	7,097,196	102385.23	.014426
1944	7,800,360	111649.01	.014313
1943	7,431,998	107603.42	.0144783

The detail of distribution of power at the mine follows:

	<u>K. W. H.</u>	<u>Cost</u>
Scraping Ore & Rock	619,136	8,661.71
Pumping	1,572,876	22,004.54
Hoisting	1,280,410	17,912.94
Stocking Ore	11,036	154.40
Crushing Ore	216,581	3,029.97
Dry House Expense	81,842	1,144.97
Surface	27,267	381.46
Telephone & Safety Devices	79,570	1,113.18
Mine Office	10,575	147.95
Machine & Carpenter Shops	4,042	56.55
Drill & Jackbit Shops	52,204	730.33
Heating Plants	11,565	161.80
Compressors	3,527,888	49,355.16
Electric Haulage	609,571	8,527.91
Ventilation	14,929	208.87
Total	<u>8,119,492</u>	<u>113,591.74</u>

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15. POWER: (Cont'd)

Comparative data for 1947 and 1946 follows:

	<u>1947</u>	<u>1946</u>	<u>Difference</u>	<u>Inc.%</u>	<u>Dec.%</u>
Production - Tons	546,796	401,939	144,857	36.04	
	<u>K.W.H.</u>	<u>K.W.H.</u>			
Scraping Ore & Rock	619,136	446,378	172,758	38.7	
Pumping	1,572,876	1,398,094	174,782	12.5	
Hoisting	1,280,410	943,652	336,758	35.7	
Stocking Ore	11,036	10,221	815	7.9	
Crushing Ore	216,581	166,300	50,281	30.2	
Dry House Expense	81,842	71,738	10,104	14.1	
Surface	27,267	33,915	6,648		19.6
Telephone & Safety Devices	79,570	89,008	9,438		10.6
Mine Office	10,575	11,099	524		4.7
Machine & Carpenter Shops	4,042	4,048	6		0.1
Drill Shop	52,204	36,937	15,204	41.1	
Heating Plants	11,565	9,878	1,687	17.1	
Compressors	3,527,888	2,197,261	1,330,627	49.1	
Electric Haulage	609,571	394,400	215,171	54.5	
Ventilation	14,929	11,500	3,429	29.8	
Total	<u>8,119,492</u>	<u>5,824,429</u>	<u>2,295,063</u>	<u>39.4</u>	

18. NATIONALITY
OF EMPLOYEES:

The following table shows the various nationality groups employed at the mine as of December 31, 1947:

	<u>American</u>	<u>Foreign</u>	<u>Total</u>
	<u>Born</u>	<u>Born</u>	
English	91	19	110
Finnish	124	42	166
Swedish	49	7	56
Italian	27	10	37
French	53	2	55
Norwegian	18	1	19
Irish	9	0	9
German	8	0	8
Austrian	2	0	2
Czechoslovakian	2	0	2
Total	<u>383</u>	<u>81</u>	<u>464</u>

Comparison for 1947, 1946 and 1945 follows:

	<u>1947</u>		<u>1946</u>		<u>1945</u>	
	<u>Number</u>	<u>% of</u>	<u>Number</u>	<u>% of</u>	<u>Number</u>	<u>% of</u>
English	110	23.7	106	24.6	109	25.7
Finnish	166	35.7	153	35.4	143	33.8
Swedish	56	12.1	54	12.5	57	13.5
Italian	37	7.9	34	7.7	30	7.1
French	55	12.1	44	10.7	42	10.0
Norwegian	19	4.1	27	6.3	24	5.7
Irish	9	1.9	7	1.6	9	2.1
German	8	1.7	6	1.5	7	1.7
Austrian	2	0.4	0	0.0	1	0.2
Czechoslovakian	2	0.4	1	0.2	1	0.2
	<u>464</u>	<u>100.0</u>	<u>432</u>	<u>100.0</u>	<u>423</u>	<u>100.0</u>

LLOYD MINE
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1. General

The production in 1947 was 253,976 tons compared with 247,853 tons in the previous year when production was affected by the prolonged strike. The steady decline that has occurred in production in the past five years is due to the gradual depletion of reserves which were practically exhausted above the 8th Level at the close of the year. As ore areas were worked out and the size of the underground operation became smaller the labor force was reduced a total of 30% between the beginning and the end of the year. An operating schedule of two shifts hoisting and three shifts mining for six days a week was continued until March and for the balance of the year a schedule of two shifts hoisting and two shifts mining six days a week was in effect.

The plan to resume development of the 9th Level will result in extending the life of the mine for at least three more years. This program was abandoned after the strike in 1946 due to the fact that higher costs indicated that a profitable operation could not be conducted by reason of the limited tonnage of reserves that can be recovered from the 9th Level. The subsequent increase in the price of ore together with the fact that increased production and more favorable cost can be obtained by employing caving and stoping methods more extensively led to a review of the project and on the basis of the new cost factors the study indicated that a better than marginal operation is possible from the new level. Work was resumed on this development in June and the winze was nearly completed to the 9th Level at the end of the year.

Some additional drilling was done from the 8th Level into the area to the south of the main deposit but no new ore was added to the reserves. Exploration has been encouraged during the past several years by the disclosure of favorable formation and structure to the south and west of the main deposit but whenever concentration was encountered it was limited to very short runs of ore indicating insufficient tonnage to warrant development for mining. Drilling has definitely eliminated the possibility of ore occurring in merchantable amounts in this area above the 8th Level but the same structure still offers favorable possibilities for a new find of ore at lower elevations. Only two holes were drilled but after headings on the 9th Level have been driven into the orebody further exploration is warranted.

Shipments from the mine totaled 418,112 tons which represents a large increase over the previous years. There was a considerable increase in the tonnage of Silica grade shipped over the previous three years due to including a substantial portion of this grade in the Cliffs Group cargoes. Shipments of this grade exceeded the tonnage of Lloydale grade shipped for the first time and amounted to 65.2% of the total. The large inventory of this grade in stock was reduced considerably by the heavy shipments. All the Lloydale grade in stockpile was loaded out before the close of the shipping season and a small overrun was realized. The stockpile inventory at the close of the year showed only 5,543 tons of Lloydale grade and 88,494 tons of Silica grade.

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1. General (Cont.)

Mining has been confined to areas in the main deposit and the small orebody south of the dike between the 7th and 8th Levels. Caving and stoping methods have been employed more extensively and have resulted in more favorable cost and production. At the east end of the main deposit and in the small deposit south of the dike sub level stope operations have been conducted and in each case the ore in these areas was depleted above the 8th Level by the end of the year. The conversion to a sub caving operation wherever stoping could not be employed resulted in a very favorable rate of extraction and in some cases it approached the production obtained from a good stope operation. Top slicing has been continued only in areas that had reached the lower limit of mining from 8th Level raises and where the vertical height of the ore was not sufficient to employ either of the other methods. At the close of the year the mineable ore above the 8th Level was nearly depleted and a small production was being obtained from two small areas in the central part of the deposit and another at the east end. In the latter area an attempt was being made to recover some ore directly from the 8th Level by sub caving.

Development of the 9th Level was resumed with crews organized on a three shift schedule. A large amount of rock excavation was first required at the winze plat on the 8th Level to provide room for installation of the auxiliary hoist and construction of a head frame above the winze. Sinking was then started and the winze was completed to a depth of 164' below the 8th Level early in 1948. The 9th Level development will be mostly in rock and it will comprise a plat and footwall drift east to the orebody where two crosscuts will be driven to the south. The block of ore between the 8th and 9th Levels in the main deposit will be developed for sub caving and the small orebody south of the dike for sub level stoping.

A wage increase of 12½¢ per hour was granted the hourly paid labor and became effective on May 9th in accordance with the new contract that was negotiated with the union. In addition to the six regular holidays that were observed during the year a one week vacation was allowed all eligible employees during the week of August 25th and there was no production during this period.

2. PRODUCTION, SHIPMENTS
AND INVENTORIES

a. Production by Grades

<u>Grade</u>	<u>Tons</u>	<u>Percent</u>
Lloyddale	131,354	51.7
Lloyd Silica	122,622	48.3
	<u>253,976</u>	<u>100.0</u>

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2. PRODUCTION, SHIPMENTS
AND INVENTORIES (Cont.)

a. Production by Grades (Cont.)

The production was 6,123 tons more than in the previous year when the mine was idle for a period of three and one-half months because of the strike. The tonnage of Lloydale grade represents only 51.7% of the total product compared to 70.7% in 1946. In the previous year operations were based on a ratio of 70% Lloydale and 30% Silica grade, but due to the decline in the productive capacity of the mine it was inadvisable to hold production by grades to a set ratio in 1947. The increased demand for Silica grade was another reason for producing this grade with no limitation but the quality of the material.

b. Shipments

Total shipments exceeded production by a large margin due to the large tonnage of Silica grade that was shipped from the stockpile. Shipments of Lloydale grade decreased due to the smaller production. All this grade in stockpile was loaded out by the close of the shipping season and an overrun of 407 tons was realized.

The following table shows the shipments during the past six years:

<u>Year</u>	<u>Lloydale</u>	<u>Silica</u>	<u>Total</u>
1942	366,505	214,352	580,857
1943	289,257	283,254	572,511
1944	260,472	16,577	277,049
1945	238,045	101,423	339,468
1946	182,664	17,711	200,375
1947	145,480	272,632	418,112

c. Stockpile Inventories

<u>Grade</u>	<u>Tons</u>
Lloydale	5,543
Lloyd Silica	88,494
Total	94,037

The inventory of ore on hand at the end of the year showed 164,136 tons less than at the end of 1946 and it represents the smallest inventory in many years.

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2. PRODUCTION, SHIPMENTS
AND INVENTORIES (Cont.)

d. Division of Product by Levels

The ore produced above various levels was as follows:

	<u>Lloydale</u> <u>Tons</u>	<u>Lloyd Silica</u> <u>Tons</u>	<u>Total</u> <u>Tons</u>
Seventh Level	-	-	-
<u>Eighth Level</u>	<u>131,354</u>	<u>122,622</u>	<u>253,976</u>
Total	131,354	122,622	253,976

The entire product was mined between the 7th and 8th Levels as the ore above the 7th Level was depleted in the latter part of 1946.

e. Production by Months

<u>Month</u>	<u>Days</u>	<u>Lloydale</u> <u>Ore</u> <u>Tons</u>	<u>Lloyd</u> <u>Silica</u> <u>Tons</u>	<u>Total</u> <u>Ore</u> <u>Tons</u>	<u>Rock</u> <u>Tons</u>	<u>Tons Per</u> <u>Man Per</u> <u>Day</u>
January	26	17,527	8,909	26,436	4	6.74
February	24	14,699	10,036	24,735	96	7.35
March	26	14,125	11,131	25,256	342	6.91
April	26	19,489	9,282	28,771	56	8.04
May	26	15,374	11,122	26,496	45	7.45
June	25	8,130	14,104	22,234	158	7.06
July	25	11,077	6,915	17,992	263	6.07
August	20	6,341	8,695	15,036	966	6.05
September	25	9,128	13,333	22,461	546	7.55
October	27	8,255	10,448	18,703	1,524	6.70
November	24	4,392	13,536	17,928	1,466	7.79
December	24½	2,203	5,318	7,521	3,339	3.76
Total	298½	130,740	122,829	253,569	8,805	6.93
Transfers		207	207			
		130,947	122,622	253,569	8,805	6.93
Current Year Stockpile						
Over-run		407		407		
Grand Total		131,354	122,622	253,976	8,805	

LLOYD MINE
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2. PRODUCTION, SHIPMENTS
AND INVENTORIES (Cont.)

f. Ore Statement

	<u>Lloyddale</u>	<u>Lloyd Silica</u>	<u>Total</u>	<u>Total</u>
	<u>Tons</u>	<u>Tons</u>	<u>Tons</u>	<u>Last</u>
				<u>Year</u>
On Hand January 1, 1947	19,669	238,504	258,173	206,866
Output for Year	130,740	122,829	253,569	238,272
Transfers	207	207		
Over-runs	407		407	13,410
Total	<u>151,023</u>	<u>361,126</u>	<u>512,149</u>	<u>458,548</u>
Shipments	145,480	272,632	418,112	200,375
Balance on Hand	5,543	88,494	94,037	258,173
Increase in Output			6,123	
Increase in Shipments			217,737	
Decrease in Ore on Hand			164,136	

The operating schedule for the past five years follows:

- 1943 3-8 hr. shifts 5-2/3 days per week Jan. 1, to Feb. 1, 1943. 3-8 hr. shifts 5-1/3 days per week Feb. 1 to Dec. 31, 1943.
- 1944 3-8 hr. shifts 5-1/3 days per week January 1, to July 1, 1944. Effective July 1, 1944, three shifts per day, 5 days per week, and effective October 30th, hoisting on two shift schedule.
- 1945 2-8 hr. shifts hoisting and 3-8 hr. shifts mining, 5 days per week, January 1st to January 27th. Effective January 27th, 2-8 hr. shifts hoisting and 3-8 hr. shifts mining, 6 days per week to December 31, 1945.
- 1946 2-8 hr. shifts per day hoisting and 3-8 hr. shifts per day mining, 6 days per week.
- 1947 Hoisting operations 2-8 hr. shifts per day, 6 days per week and mining 3-8 hr. shifts per day 6 days per week, January 1st to March 1st. Effective March 1st, hoisting and mining operations 2-8 hr. shifts per day, 6 days per week.

g. Delays

There was one delay of a minor nature that occurred to operations during the year and resulted in some loss in production. In the late afternoon of August 22nd a heavy rainfall resulted in flooding the basement of the enginehouse to a depth of two feet. The resistor grids for the cage hoist electrical controls were partly submerged so that the hoist could not be operated for about two hours. This caused a delay in hoisting the day shift crew to surface at the end of the shift and getting the afternoon shift down. The loss in product on this account was estimated at 150 tons.

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3. ANALYSISa. Average Mine Analysis on Output

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Silica</u>
Lloyddale	131,354	58.75	.189	7.85
Lloyd Silica	122,622	51.38	.138	19.56

753 976

b. Analysis of Ore in Stock December 31, 1947

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Lloyddale Dried	5,543	58.73	.161	9.17	.250	2.65	.81	.56	.011	2.62	
Lloyddale Nat'l.		51.45	.141	8.03	.219	2.32	.71	.49	.010	2.30	12.40
Lloyd Sil. Dried	88,494	51.91	.130	18.27	.231	2.55	.57	.32	.011	2.96	
Lloyd Sil. Nat'l.		45.94	.113	16.17	.204	2.26	.50	.28	.010	2.62	11.50

c. Complete Analysis of Ores Shipped

<u>Grade</u>	<u>Tons</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>
Lloyddale	145,480	59.15	.199	7.29	.25	2.65	.81	.56	.011	3.46
Lloyd Silica	272,632	52.25	.122	18.20	.23	2.35	.57	.32	.011	3.34

d. Complete Analysis of Straight Cargoes

There were no straight cargo shipments.

4. ESTIMATE OF ORE RESERVESa. Developed Ore

The following is an estimate of ore reserves as of December 31, 1947 using a factor of 12 cubic feet per ton.

	<u>No. 1 Deposit</u>	<u>No. 2 Deposit</u>	<u>Total Tons</u>
Above 8th Level	80,992	14,312	95,304
Below 8th Level	197,986	88,281	286,267
Total Gross as of Nov. 30, 1947	278,978	102,593	381,571
Less December, 1947 Production	2,203	-	2,203
Total Gross as of Dec. 31, 1947	276,775	102,593	379,368
Less 10% for Mining & Rock	27,898	10,259	38,157
Net Total as of Dec. 31, 1947	248,877	92,334	341,211

The following table shows a comparison of developed ore during the past three years:

	<u>1945</u>	<u>1946</u>	<u>1947</u>
Reserves on January 1st	726,938	846,119	354,156
Production	244,273	175,280	131,354
Balance	482,665	670,839	222,802
Reserves on December 31st	846,119	354,156	341,211
New Ore Developed	363,454	316,683	118,409

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4. ESTIMATE OF ORE RESERVES (Cont.)

a. Developed Ore (Cont.)

The increase in the reserves is due to including ore below the 8th Level in both the main deposit and the orebody south of the dike in contrast to the previous year when no reserves were estimated below this level. The mineable reserves above the 8th Level were practically depleted in 1947 and the tonnage indicated above this level represents a block of ore that extends to a height averaging 20' vertically above the floor of the level. This ore can be recovered from the 9th Level. The reserves in both the No. 1 and No. 2 deposits below the 8th Level are well delineated by a known structure and several drill holes so the 9th Level development is not expected to disclose any significant ore extensions beyond the assumed limits.

High sulphur ore has been proven by drilling in the No. 2 deposit below the 9th Level elevation but standard grade was mined in the same orebody above the 8th Level. An increase in sulphur content in the ore is expected to reach objectionable proportions near the 9th Level elevation and on this account the reserves in this deposit have not been estimated to this elevation. The top horizon of the sulphurous ore has been assumed at an elevation of 90' above the 9th Level and the estimate of reserves does not include ore below this elevation. There is, however, a good possibility that a substantial tonnage below the arbitrary limit can be mined and mixed with the ore from the main deposit without raising the sulphur on the output beyond the allowable limits.

The proven ore at the end of the year indicates about three years of operation remaining to deplete the reserves above the 9th Level. In comparison to former years a much smaller scale operation is only possible in these last years due to the small size of both deposits below the 8th Level.

b. Estimated Analysis of Ore Reserves

<u>Grade</u>	<u>Iron</u>	<u>Phos.</u>	<u>Sil.</u>	<u>Mang.</u>	<u>Alum.</u>	<u>Lime</u>	<u>Mag.</u>	<u>Sul.</u>	<u>Loss</u>	<u>Moist.</u>
Lloyddale Dried	58.80	.179	8.50	.22	2.32	.68	.34	.011	3.17	
Lloyddale Nat'l.	51.89	.158	7.50	.19	2.05	.60	.30	.010	2.80	11.75

The above analysis applies to Lloyddale grade only as the reserves of Silica grade are not estimated.

5. LABOR AND WAGES

a. General

There has been a decided improvement in relations with employees since most of the bitter feeling engendered by the strike has been dispelled. A better attitude appears to be quite general among the men. One explanation for this is the large reduction in the labor force what has resulted in breaking up a group that in other years was responsible for fostering discontent. Membership in the union has remained at practically 100% but there has been no arrogant display of this strength. The supervisory force has very ably promoted harmony among the men by their fair but firm attitude to everyone.

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5. LABOR AND WAGES (Cont.)

a. General (Cont.)

Evidence of better relations is reflected in the small number of complaints that have been submitted by the grievance committee. The few complaints were minor in nature and in each case were settled in Step 2 of the grievance procedure. One grievance in which the final decision was pending at the close of the previous year was carried to the last step and the final decision was handed down by an arbitrator. This grievance followed a disciplinary action against an employee for insubordination and it is gratifying to report that our action in this matter was upheld by the arbiter.

A large reduction was made in the size of the labor force to keep it in line with the reduced size of the underground operation. The number of men on the payroll at the end of the year was 119 compared with 169 a year ago. A total of 35 men were transferred to other mines and 32 were laid off but nearly all of these men were later hired at other mines. Three men were retired, one died and one quit and there were 21 hired, making a net decrease of 50 men on the payroll.

In addition to the wage increase granted employees under the new contract the benefits under the vacation plan were enlarged. One year, five year, and twenty five year service became compensated at the rate of one week, two weeks and three weeks vacation pay respectively. Effective September 1 the group hospitalization together with a new group insurance plan was also put into effect and employee subscription to it was 100%.

b. Comparative Statement of Wages & Product

	<u>1 9 4 7</u>	<u>1 9 4 6</u>	<u>Incr.</u>	<u>Decr.</u>
Product	253,976	247,853	6,123	
No. of Shifts & Hours				
Jan. 1 to March 1				
March 1 to Dec. 31				

AVERAGE NO. OF MEN WORKING

Surface	34 $\frac{1}{2}$	34	$\frac{1}{2}$	
Underground	96 $\frac{1}{2}$	122		25 $\frac{1}{2}$
Total	131	156		25

AVERAGE WAGES PER DAY

Surface	10.32	9.31	1.01	
Underground	11.86	10.46	1.40	
Total	11.40	10.16	1.24	

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5. LABOR AND WAGES (Cont.)

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

The following table shows a comparison of the average wages per day for surface and underground for the past five years:

	<u>YEAR</u>	<u>SURFACE</u>	<u>UNDERGROUND</u>		
	1943	7.15	8.10		
	1944	7.06	7.99		
	1945	7.63	8.86		
	1946	9.31	10.46		
	1947	10.32	11.86		
<u>WAGES PER MONTH OF 24 DAYS</u>	<u>1 9 4 7</u>	<u>1 9 4 6</u>	<u>Incr.</u>	<u>Decr.</u>	
Surface	247.68	223.44	24.24		
Underground	284.64	251.04	33.60		
Total	273.60	243.84	29.76		
<u>WAGES PER MONTH OF 22 DAYS</u>					
Surface	227.04	204.82	22.22		
Underground	260.92	230.12	30.80		
Total	250.80	223.52	26.28		
<u>PRODUCT PER MAN PER DAY</u>					
Surface	23.16	23.38		.22	
Underground	9.90	8.01	1.89		
Total	6.93	5.96	.97		
<u>LABOR COST PER TON</u>					
Surface	.446	.398	.048		
Underground	1.197	1.307		.110	
Total	1.643	1.705		.062	
<u>AVERAGE PRODUCT STOPPING</u>	40.86	24.58	16.28		
<u>AVERAGE WAGES CONTRACT MINERS</u>	13.62	10.98	2.64		
<u>TOTAL NUMBER OF DAYS</u>					
Surface	10,963 $\frac{1}{4}$	10,601 $\frac{3}{4}$	361 $\frac{1}{2}$		
Underground	25,651	30,957 $\frac{3}{4}$		5,306 $\frac{3}{4}$	
Total	36,614 $\frac{1}{4}$	41,559 $\frac{1}{2}$		4,945 $\frac{1}{4}$	
<u>AMOUNT OF LABOR</u>					
Surface	113,188.60	98,691.49	14,497.11		
Underground	304,150.18	323,925.83		19,775.65	
Total	417,338.78	422,617.32		5,278.54	

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5. WAGES AND LABOR (Cont.)

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

PROPORTION OF SURFACE TO UNDERGROUND MEN

1943 - 1 to 3.40
1944 - 1 to 3.24
1945 - 1 to 2.88
1946 - 1 to 3.59
1947 - 1 to 2.80

6. SURFACE

a. Buildings

There was no new construction or additions erected to the mine buildings during the year. The existing buildings have required very little repairs to maintain them in good condition.

The composition roof on the engine house was showing signs of weathering but it was put in good condition again by giving it a coat of asphalt.

Some alterations were made in the central heating plant room which houses the boiler and stoker. The old stoker was replaced with a new one and some changes were made in the size of the coal bin to facilitate loading the hopper.

b. Stocking Ground

The heavy shipments of Silica grade from stockpile enabled cleaning out nearly all the large pile of this grade east of the shaft. About 2/3 of the pile of the same grade to the west of the shaft was also loaded out by the close of the season. No trestle was re-erected in the latter area at the close of the year but to the east of the shaft fifteen bents of wood trestle were erected to replace the north trestle for stocking Silica grade. The south trestle to the east of the shaft was not dismantled for the loading operations excepting the easterly end where Lloydale grade is stocked.

All the Lloydale grade in stockpile was loaded out before the close of the shipping season and eight bents of trestle were re-erected in this area after the close of the season. Due to the small production that will be obtained during the winter of 1947 and 1948 while development of the 9th Level is in progress one trestle will provide sufficient stocking room for this grade.

Stockpile loading in the early spring at the start of the shipping season was hindered due to the depth that freezing penetrated the piles. Loading conditions were again improved by drilling and blasting long holes put down from the crest of the pile ahead of the loading operation.

When development of the 9th Level was resumed it became necessary to provide additional storage capacity for dumping the rock that is hoisted from this project. A large bull-dozer was hired to move a portion of the old rock pile into the adjacent cave enabling extension of the wood trestle to the south of the shaft. Three additional bents were erected and this will provide sufficient dumping capacity for waste material for a year or more.

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6. SURFACE (Cont.)

c. Roads

There were no new roads constructed around the mine surface plant. A small amount of grading was done on existing roads and an occasional load of mine rock was hauled for filling to maintain the roads and parking lot in good condition.

7. UNDERGROUND

a. Shaft Sinking

Sinking the winze to the 9th Level in the footwall west of the orebody comprises the major development during the year. Before actual sinking could be started a large amount of rock excavation was required near the winze site to provide room for installation of the auxiliary hoist and also for erection of the head frame above the winze. The preliminary work was completed so that sinking could be started early in October and the winze was sunk to a depth of 161' below the level. The first 5' had been sunk below the collar at the 8th Level in the previous year. The desired depth of 164' was reached early in 1948 and development of the 9th Level was begun at this elevation. The outside dimensions of the winze are 14'-8" x 11'-9" and this is divided into two compartments, a cage and ladder road. Due to the shallow depth of the winze, sinking was done in the conventional manner using buckets to hoist the broken rock and a compartment in the ladder road was cased to serve as a bucket road. The cage road will be larger than standard size to allow clearance when handling the loaded and empty tram cars between the 8th and 9th Levels. A large size cage has been constructed for this purpose and it will be counter-balanced by a weight that will travel in a portion of the ladder road compartment. The following table shows the monthly advance in sinking the winze:

October	-	45'
November	-	50'
December	-	61'

b. Development

The development, excluding the work under E & A cc-159, was confined mostly to sub level stopes and sub level caving. The amount of this work has decreased with a reduction in the size of the operation and the major portion of it again was in ore. There were no extensions driven to the main level drifts and there was only a small amount of raising done from the main level.

Due to the favorable vertical height of ore above the 8th Level in the east half of the main deposit this block of ore was developed for sub level stopes and sub caving. At the east end sub level stoping was underway at the start of the year and as the stope was enlarged additional drifting was done on intermediate sub levels above the transfer and additional mill raises were put up so that mining could progress west to an established limit. Directly to the west of this area a second stope was developed but due to the softer character of the ore it was soon proven that stoping could not be conducted satisfactorily here. A sub caving system was then substituted and a 50' vertical interval of ore was mined above the scraping sub. In this case mill sub drifts were driven at an elevation 20' above the scraping sub and as in sub level stoping, radial deep hole drilling was employed.

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7. UNDERGROUND (Cont.)

b. Development (Cont.)

Whenever the width of the ore exceeded the limits to which recovery could be made from one scraping sub drift parallel or radial scraping drifts were driven from the raise to the limits of the block that was caved. In another area in the west half of the deposit sub level caving was substituted early in the year for a top slicing system. The development here also consisted of driving radial and parallel scraping drifts from the raise to the ore limits and above each drift a mill sub was driven at an elevation of 20' above the sub. Short mill raises were then put up from the scraping sub drift to the mill sub and in each case mining started at the end of the drift near the ore limits and retreated to the raise. On the 285' sub level in this area 30' of drift was advanced to the northeast from the raise in the slate footwall and then 30' of small raise was advanced in rock from the end of the drift to connect to the 7th Level for ventilation purposes.

In the west half of the orebody an area at the west end where slicing was formerly employed was also converted to sub level caving. Due to less vertical height of ore mining was conducted by driving radial scraping drifts from the raise to the limits of the ore and then caving the pillar directly above in the conventional manner.

In the central part of the deposit a small area along the north footwall side was also developed for sub caving and the work here consisted of driving a scraping drift for a distance of 130' east of No. 808 Raise and a mill sub drift was advanced at an elevation 20' above the sub. A number of mill raises were also put up along the north side to complete the development.

The development in the orebody south of the dike consisted of putting up a number of additional mills from the transfer at the west end of the deposit and driving additional sub level drifts as mining retreated east to the ore limits. At the east end of this deposit a small scam stope was developed adjacent to the dike and the development here consisted of putting up three mills to a height of 20' above the transfer drift and a connecting drift was then driven between the mills. Mining was completed in the south deposit in the first half of the year and no further development was conducted in this area.

Development on the 8th Level consisted of a short raise that was put up from the south side of the main drift and a diamond drill station was excavated in rock at the end of the southeast crosscut. No. 816 Raise was put up from the south side of the drift nearly opposite to No. 815 Raise and advanced 20' in ore to reach a total height of 30' above the level. To provide a drill station, 20' of rock drift was advanced from the end of the southeast crosscut and 20' of rock raise was put up in the back of the drift to provide head room for drilling an angle hole.

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7. UNDERGROUND (Cont.)

b. Development (Cont.)

Development under E & A cc-159

Before sinking of the winze was started some additional rock stripping was done on the winze plat on the 8th Level to provide a room for the auxiliary hoist. The back of the drift over the winze was also excavated to a height of 36' above the floor to enable construction of the timber head frame. The slate formation around the winze site is badly fractured and this made it necessary to timber the engine house and also the plat east and west of the winze. A concrete base was constructed for the hoist and also to support the panel board and switches and a concrete floor about 4" thick was laid in the hoist room. To reduce the amount of rock excavation in the fractured formation near the winze a small size raise was put up directly over the hoist drum extending to a point near the top of the head frame so the hoisting ropes between the head sheave and the drum could pass through this opening. From the south side of the hoist room a short drift was advanced in slate to connect with the 8th Level haulage drift to provide another means of access and also for ventilation purposes.

In the footwall slate west of the orebody a rock drift is being driven to the southeast from the powder house and this drift will comprise a part of the ventilation connection between the 8th and 9th Levels. Work was started on this project in December and 350' of drifting will be done and later this will connect with a raise that will be put up from the 9th Level.

The following table shows the footage of the rock development that was advanced under E & A cc-159:

	<u>Drifting</u>	<u>Raising</u>	<u>Stripping</u>
8th Level	166'	51'	29'

c. Stoping

The bulk of the product was mined by caving and stoping methods that were employed wherever conditions permitted. During the past two years sub caving has been substituted for top slicing to the extent that the latter method is being employed only where the vertical height of ore is so limited that other methods can not be employed. The conventional caving system has been modified in some cases to enable recovery of a larger block of ore above each scraping sub and a very favorable rate of extraction was realized. Vertical block heights up to 50' were caved with good results. Stoping was conducted in the small orebody south of the dike until the reserves above the 8th Level were depleted and a block of ore in the main deposit at the east end was also mined by stoping. Due to the fact that the south footwall dike caves readily stope mining cannot be conducted satisfactorily on a large scale in the main orebody. Sub caving has proven to be a good substitute and it is intended to develop the block of ore between the 9th and 8th Level for this method. Another aid to higher production from both stoping and caving methods is the practice of drilling and blasting vertical rings of holes up to 30' in depth. The conventional bench mining has been replaced to a large extent by this practice.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Mining and development was conducted on a total of twelve different sub levels ranging from the 7th down to the 8th Levels. A reduction from eleven to five contracts was made during the year as ore areas were depleted. The following is a detailed description of the mining operations on the various sub levels:

7th Level - Main Deposit

Two contracts were mining at this elevation at the beginning of the year in the west half of the deposit. The mining in each area consisted of recovering small pillars by sub level caving that was conducted east of No. 821 Raise and northeast of No. 817 Raise. Mining was completed here in the first quarter and both contracts were disbanded at that time due to depletion of ore areas.

Subs Above the 8th Level

325' Sub Level

Early in the year three contracts were mining at this elevation in the east half of the deposit. An area 350' x 70' was mined by caving and stoping at the east end. To the west of this area two small pillars were recovered by top slicing operations conducted from No. 811 Raise.

315' Sub Level

In the east half of the orebody two contracts mined an area 350' x 70' by sub caving and stope operations that were conducted from a lower sub level similarly as on the sub level above. To the west of this area a third contract mined a small pillar by top slicing from No. 811 Raise. A sub level caving method was substituted in the latter area on lower sub levels.

300' Sub Level

Similarly as on the sub level above three contracts mined an area in the east half of the orebody 500' x 70' by sub caving and stoping that was conducted from a lower sub level. The most easterly portion was mined by stoping that was started in the crotch near the east limits of the ore and retreated west to a pillar line. Later the pillar itself was recovered by sub caving. The central part of this area was mined by sub caving operations that were conducted from an intermediate sub level that was driven at this elevation. Three separate sub level drifts roughly parallel to each other were driven along the strike of the orebody and these served as a means of drilling the vertical rings of deep blast holes permitting recovery of a pillar that extended to the 7th Level. The most westerly part of this area was mined by sub caving that was conducted from the next lower sub level.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Subs Above the 8th Level (Cont.)

285' Sub Level

In the east half of the main orebody three contracts were employed for a part of the year similarly as on the sub levels above. An area about 500' x 70' was again mined by both sub caving and stoping. This is the highest elevation to which the development for the stope at the east end was driven and the pillar that extended to the 7th Level elevation was recovered by drilling vertical rings of deep blast holes. In both caving areas to the west of the stope the scraping drifts were driven at this elevation from No. 815 and 811 Raises. Each raise served an area in which parallel and radial scraping drifts were driven from the raise to the limits of the block to be mined. Numerous mills were put up from the drift to an intermediate sub that was driven at an elevation of 20' above. In the central area a 50' vertical interval and in the adjacent area to the west a 30' interval was developed for mining under old workings.

275' Sub Level

An area 460' x 60' was again mined in the east half of the orebody by both sub caving and stoping that was conducted from a lower sub level.

At the west end of the deposit an area 110' x 70' was mined by one contract by sub caving that was conducted from a lower sub level. The mining extended from the crotch at the west end to the jasper hanging on the east side.

260' Sub Level

One contract mined an area at the west end 100' x 90' by sub caving that was conducted from No. 802 Raise. In this area radial scraping drifts were driven from the raise to the limits of the ore and in each case caving started from the far end of the drift and retreated to the raise.

Three contracts mined an area in the east half 450' x 60' by sub caving and stoping. Operations in the stope were interrupted several times by caving of lean material from old workings above. Each time a narrow pillar was left in place on the west side to confine the caving and a new stope developed. It was necessary to leave several small pillars on this account but these were later recovered by caving that was conducted from the transfer sub level.

250' Sub Level

Three contracts mined an area 470' x 55' in the east half of the orebody by sub caving and stoping. In both of the caving areas sub drifts were driven at this elevation above a scraping sub and numerous mill raises were put up to connect the drifts.

At the west end another contract mined a triangular area by sub caving operations that were conducted from a lower sub level.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

Subs Above the 8th Level (Cont.)
235' Sub Level

In the main orebody a total of six contracts conducted mining at this elevation during the year. Two contracts mined an irregular shaped area at the west end by sub caving that was conducted from a lower sub level. The extent of the ore at this end of the deposit decreased rapidly as lower elevations were reached due to the converging footwalls and inclusions of jasper within the ore and a reduction in the number of contracts was necessary when mining reached this elevation. In the central part of the orebody a small area was mined by a scam stope operation along the north footwall side. The stope was developed in lean ore and the bulk of the product was Silica grade. Directly to the south of the small stope a small amount of mining was done to the southwest of No. 809 Raise where an old slice was advanced to recover a small pillar. Three contracts again mined the large area in the east half by sub caving and stoping. Mining was completed in the stope in December upon recovery of a small remaining pillar at this elevation.

In the small orebody south of the dike one contract enlarged the stope at this elevation by mining an area 40' x 15'. The bulk of the mining was conducted in a small extension of this deposit to the west where the ore did not extend to this elevation above the 8th Level and operations were completed here about the middle of the year.

225' Sub Level

Seven contracts did some mining at this elevation during the year in the main orebody. At the west end two contracts mined an area in the crotch formed by the north footwall and the fault. In the most westerly portion sub caving was conducted from the next lower sub level to recover a triangular area of ore similarly as on the sub level above. Directly to the east another contract conducted sub caving operations from No. 805 and No. 807 Raises and radial scraping drifts were advanced from each of the raises to the limits of the ore. Near the middle of the deposit a small area was mined on the south footwall side by slicing operations that were conducted by one contract from No. 809 and 810 Raises. Adjoining this area along the north side another contract mined a small area by a scam stope operation that was conducted from a transfer that was driven to the east of No. 808 Raise. In two areas in the east half of the deposit scraping drifts for caving were driven at this elevation to the east of No. 811 Raise and to the east of No. 819 Raise. After the pillar above was recovered the ore lying along the north and south sides of the drifts was mined. The transfer drift for the stope at the east end was driven at this elevation in the previous year to the east of No. 820 Raise. Additional mills were put up on both sides of the transfer as mining progressed to the limits of the block of ore that was developed for stoping. In December a small amount of mining was done near No. 820 Raise and a portion of the pillar around the raise was recovered by caving.