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THE CLEVELAND-CLIFFS IRON COMPANY

ORE MINING DEPARTMENT

MANAGER'S ANNUAL REPORT

YEAR 1937

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JPL:MRP
5-23-38

Ishpeming, Mich.
February, 4, 1938

Mr. E. B. Greene, President,
1460 Union Trust Bld.
Cleveland, Ohio

Dear Sir:-

I beg to submit the report of the operations of the Mining Department for the year 1937.

The inventories, maps, statements relative to the 1937 report will go forward to you under separate cover.

The colored portions of the maps show the work for the year. The reports of the different mines of the Company were made by the Superintendents in charge, and the reports of the Engineering, Mechanical, Electrical, Geological, Safety and Welfare Departments by the Heads of these Departments.

On February 23rd all of the Company's mines went on a six day operating basis. The Gardner Mackinaw, however, remained on a five day basis.

On March 8th, all of the soft ore mines went on a forty hour per week schedule, the Cliffs Shaft remaining on a forty eight hour schedule.

On April 6th, all of the soft ore mines went on a forty eight hour schedule, with the exception of the Gardner Mackinaw which remained on a forty hour basis. The schedule of all soft ore mines was again reduced to forty hours per week on October 3rd, the Cliffs Shaft remaining at forty eight hours. On December sixth, all soft ore mines were placed on a thirty two hour schedule and the Cliffs Shaft on a forty hour basis.

On March 16th, common labor was raised from 50¢ to 62½¢ per hour. All other rates were raised approximately 10¢ per hour. In round numbers, the average increase in wages was 15-3/4%.

During the year an extension to the General Storehouse was constructed practically doubling the size of the original building. A new central garage was also authorized but did not go into commission until 1938.

The General Shops and Central Storehouse have continued to function most satisfactorily and in time this centralization of the Compann's work will save a considerable sum of money.

The ruling of the Supreme Court of the United States made it necessary to abandon the Employees Representation Plan. Early in the summer the Marquette Range Industrial Union was formed. This union is made up of employees of The Cleveland-Cliffs Iron Co. and the Cliffs Power & Light Company. There is every reason to assume that it is functioning properly. I have had several meetings with the Executive Committee relative to certain minor actions which they desired the Company to take. All such matters have been settled to the satisfaction of both parties.

The Company has granted no leases on mining property during the year.

A satisfactory safety record has been maintained. It, of course, is not perfect but we are continually exerting all of our power to improve our record. When it is taken into consideration the great increases in the working forces during the year and the fact that these new men had to be trained in safety matters, I think the showing is excellent.

Local politics in the City of Negaunee and the extravagance of the tax-eating public still give me great concern. As I have mentioned many times, it is my opinion that the existing condition will not change until the valuation of property other than mining is restored to a fair basis.

During the year the iron ore business has been exceptionally good and the Mining Department has been called on for maximum production from practically all of its properties. Most of the soft ore mines worked three eight hour shifts, seventeen shifts per week. This is an exceedingly hard schedule, leaving no time for repair work or to keep all moving equipment in proper condition. We, however, got through the season without any very serious delays.

I call your particular attention to the cost sheets. Even in spite of the large increase in wages, time and one half for over time, and increases in the cost of supplies, the total cost has been kept down. We are particularly proud of the showing made at every one of our mines. The 1937 record was made possible only by the close cooperation and hard work of all officials and employees of the Company.

Respectfully submitted,

S. R. Kelly

Manager

SRE:DP

THE CLEVELAND-CLIFFS IRON COMPANY

A COMPARISON OF MINING DEPARTMENT MICHIGAN TAXES FOR THE PAST FIVE YEARS FOR COMPLETE DETAIL SEE THIS AND PREVIOUS TAX STATEMENTS

ASSESSED VALUATION	1937	1936	1935	1934	1933	1932	1931	1930	1929
The Cleveland-Cliffs iron company	11,671,806	10,498,659	10,117,036	10,013,575	10,866,238	12,826,545			
The Negaunee Mine Company.....	3,350,000	2,927,500	3,057,770	3,196,400	3,554,400	4,185,700			
The Athens Iron Mining Company...	2,242,900	1,929,520	1,929,520	2,077,800	2,036,500	2,266,500			
The Cliffs Power and Light Company	1,442,555	1,424,281	1,424,711	1,418,887	1,415,063	1,443,226			
The Cliffs Electric Company.....	--	--	--	--	4,500	4,500			
Total Michigan Mining Department..	18,707,261	16,778,960	16,529,037	16,706,662	17,876,701	20,726,471			
Change From Previous Year.....	1,928,301	149,923	177,625	1,170,039	2,849,770	1,863,753			
Decrease From 1932.....	2,019,210	3,947,511	4,197,434	5,883,562	--	--			
Per Cent Decrease From 1932.....	9.74%	19.05%	20.2%	26%					
TOTAL TAXES PAID									
The Cleveland-Cliffs Iron Company.	348,808.35	315,635.66	286,303.64	267,750.15	283,160.67	378,136.12	507,608.51	523,354.40	476,740.79
The Negaunee Mining Company.....	120,097.50	100,859.97	95,226.14	86,527.53	99,599.60	120,527.71	183,218.38	190,689.79	199,695.33
The Athens Iron Mining Company....	80,366.44	66,477.06	60,089.81	56,246.84	57,065.71	65,264.22	100,251.06	95,122.50	97,739.13
The Cliffs Power and Light Company	30,024.80	30,066.37	29,817.75	31,256.06	35,992.72	46,752.02	65,154.28	61,157.03	55,047.76
The Cliffs Electric Company.....	--	--	--	--	74.54	145.75	189.90	195.08	175.25
Total Michigan Mining Dept Tax....	579,297.09	513,039.06	471,437.34	441,780.58	475,893.24	610,825.82	856,422.13	870,518.80	829,398.26
Increase Over Previous Year.....	66,258.03	41,601.72	29,656.76						
Decrease From Previous Year.....				34,112.66	134,932.58	245,596.31			
Decrease From 1932.....	31,627.63	97,796.76	139,388.48	414,641.55					
Per Cent Decrease From 1932.....	5.18%	16%	22.8%	48.4%					
Average Tax Rate per $100.00.....	3.097	3.035	2.852	2.644	2.662	2.947			

NOTE: - The Negaune Mine Company for the year 1936 does not include the Adams Strip which was paid by the Cleveland-Cliffs Iron Company and transferrred to Negaunee Mine.
Valuation $180,000.00 Taxes $6,201.46

For 1937 Negaunee Mine Company includes Proportion of Adams Strip.

HJA:RN

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

	1934	1935	1936	1937
PRODUCT - Tons	223,245	268,921	456,760	543,567
POWDER				
Pounds - Gelamite "2X"	37,550	--	--	--
50% L. F.	120,600	128,750	396,000	164,650
60% Gelatine	49,650	145,950	58,200	397,850
Total Pounds Powder	207,800	274,700	454,200	562,500
Total Cost	23,426.05	32,531.91	52,098.25	68,309.67
Fuse - Feet	293,600	394,100	702,000	802,600
Caps - Number	70,450	75,350	114,500	138,950
Duplex Shot Wire	--	17,270	1,785	18,180
Connecting Wire Pounds	64	--	--	--
Delay Fuses	925	3,324	3,400	5,875
Fuse Lighters	17,000	21,500	29,500	24,400
Fuse Containers	--	--	30	6
Tamping Bags	--	--	31,000	36,000
TOTAL COST - Fuse, Caps, etc	2,716.81	3,831.04	6,087.44	7,522.05
TOTAL COST - All Explosives	26,142.86	36,362.95	58,185.69	75,831.72
Average Price per pound - Powder	.113	.117	.1147	.1214
Cost per ton - Powder	.1049	.1209	.1141	.1257
" " " - Fuse, etc	.0122	.0143	.0133	.0138
" " " - All Explosives	.1171	.1352	.1274	.1395
Pounds Powder per ton of ore	.9308	1.021	.9943	1.035

1937 Production increased 86,807 tons or 19% over 1936
Average Price for Powder increased 7% over 1936
Cost per ton for all explosives increased 9% over 1936

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

	1934	1935	1936	1937
PRODUCT - Tons	878,514	1,207,924	1,913,242	2,833,554
POWDER				
Pounds.- 40%	1,950	--	--	--
50%	296,050	445,302	746,185	799,770
60%	92,075	86,400	78,995	77,862
1X and 2X Gelamite	50,250	88,535	121,345	438,300
Total Pounds - Powder	440,325	620,237	946,525	1,315,932
Total Cost - Powder	$49,691.73	73,992.18	105,732.20	156,720.63
Fuse - Feet	1,347,997	1,824,134	2,976,430	4,384,364
Caps - Number	213,859	293,882	434,527	622,421
Loading Wire - Feet		1,000	6,000	2,760
Connecting Wire - Pounds	20	64	42	96
Tamping Bags	45,600	43,650	94,150	67,350
Sealing Compound - Pints	20	12	32	35
Powder Bags	54	58	74	115
Fuse lighters	22,600	31,600	54,100	91,487
Electric Exploders	3,325	2,275	11,540	5,733
Blasting Machines	2		1	
Total Cost Fuses, etc	$10,925.17	14,435.57	23,872.40	33,940.53
Total Cost - All Explosives	$60,616.90	88,427.75	129,604.60	190,661.16
Average Price per Lb. Powder	.1129	.1193	.1117	.1191
Cost per ton - Powder	.0566	.0613	.0553	.0553
" " " - Fuse, etc	.0124	.0119	.0124	.0120
" " " - All Explosives	.0690	.0732	.0677	.0673
Pounds of Powder per ton of ore	.5012	.5135	.4947	.4644

1937 Production increased 920,312 tons or 48.1% over 1936
Average Price for Powder increased 6.5% over 1936
Pounds of Powder per ton of ore decreased 6.1% over 1936

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

	1934	1935	1936	1937
PRODUCT - Tons	878,514	1,207,924	1,913,242	2,833,554
TIMBER				
Feet 6-8	318,262	289,951	513,514	380,876
8-10	97,544	176,298	222,488	334,236
10-12	169,588	236,489	361,061	470,071
12-14	97,760	84,977	131,705	217,676
14-16	5,321	1,232	5,147	8,225
Treated Timber	2,847	12,607	20,175	15,217
Total Feet	691,322	801,554	1,254,090	1,426,301
Total Cost	$42,142.29	49,854.05	79,567.42	115,460.55
LAGGING				
Feet 5	45,800	31,725	58,275	11,805
7	2,268,496	2,827,973	4,546,086	6,091,424
8	40,973	--	--	--
Total Feet	2,355,269	2,859,698	4,604,361	6,103,229
Total Cost	$16,282.15	20,181.79	32,044.85	49,245.57
Poles - Feet	1,637,522	2,187,074	3,376,027	4,556,540
Poles - Cost	$19,644.23	24,111,30	38,353.17	61,938.50
WIRE FENCING - Rods	665	1,081	1,322	1,515
" " - Cost	$567.77	895.13	1,137.24	1,407.60
Total Cost for all Timber	$78,636.44	95,042.27	151,102.68	228,052.22
Average Cost per foot - Timber	.061	.062	.0634	.0809
" " " 100" - Lagging	.691	.706	.6959	.8068
" " " " - Poles	1,200	1.102	1.136	1.359
" " " Rod - Fencing	.853	.828	.860	.929
Feet of Timber per ton of ore	.787	.664	.655	.503
" " Lagging " " " "	2,681	2,367	2.407	2.154
" " Poles " " " "	1.863	1.811	1.765	1.608
" " Fencing " " " "	.0125	.015	.0114	.0088
Cost per ton for Timber	.0480	.0414	.0416	.0407
" " " " Lagging	.0185	.0167	.0167	.0174
" " " " Poles	.0224	.0199	.0200	.0219
" " " " Wire Fencing	.0006	.0007	.0006	.0005
Total Cost per Ton	.0895	.0787	.0789	.0805

1937 Product increased 920,312 tons, or 48.1% over 1936

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STATEMENT SHOWING TOTAL COST OF SUPPLIES CHARGED TO "COST OF ORE AT MINES"

SOFT ORE MINES

YEAR	1934		1935		1936		1937	
PRODUCT - Tons	878,514		1,207,924		1,913,242		2,833,554	
CLASSIFICATION	AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PERTON
General Supplies	46,160.93	.0525	55,656.09	.0461	85,084.04	.0445	136,971.20	.048
Iron and Steel	10,974.63	.0125	22,174.50	.0184	33,498.59	.0175	55,157.59	.019
Machinery	24,439.92	.0278	55,855.54	.0462	74,403.36	.0389	106,030.76	.037
Explosives	58,938.05	.0671	89,053.60	.0737	129,741.00	.0678	188,141.92	.066
Lumber and Timber	94,709.27	.1078	108,752.97	.0900	174,127.19	.0910	261,372.47	.093
Fuel	12,211.98	.0139	14,960.77	.0124	16,653.38	.0087	19,321.20	.007
Electric power	235,416.12	.2680	255,339.52	.2114	321,282.52	.1679	394,928.05	.140
Miscellaneous	25,464.74	.0290	18,772.50	.0155	24,629.41	.0129	31,468.42	.011
Total	508,315.64	.5786	620,565.49	.5137	859,419.44	.4492	1,193,391.61	.421

HARD ORE MINES

YEAR	1934		1935		1936		1937	
PRODUCT - Tons	223,245		268,921		456,760		543,567	
CLASSIFICATION	AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PER TON
General Supplies	13,095.67	.059	26,797.41	.100	44,369.18	.097	46,825.71	.086
Iron and Steel	8,825.18	.039	16,001.23	.059	28,094.99	.062	37,544.78	.070
Machinery	13,273.54	.059	27,582.16	.102	44,140.79	.096	42,554.99	.078
Explosives	26,142.86	.117	36,362.95	.135	57,638.41	.126	75,831.72	.141
Lumber and Timber	3,943.05	.018	7,776.48	.029	13,026.30	.029	9,473.77	.017
Fuel	2,247.02	.010	4,574.29	.017	5,571.74	.012	5,649.79	.010
Electric Power	53,915.24	.241	58,550.36	.218	75,662.87	.166	88,837.43	.163
Miscellaneous	1,727.36	.008	438.49	.002	1,645.40	.003	6,908.03	.012
Total	123,169.92	.551	178,083.37	.662	270,149.68	.591	313,626.22	.577

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THE CLEVELAND- CLIFFS IRON COMPANY
MINING DEPARTMENT

LABOR SUMMARY - ALL COMPANIES

	1934	1935	1936	1937
PRODUCT - Tons	1,803,120	2,272,451	3,671,223	5,096,705

	DAYS	AMOUNT	DAYS	AMOUNT	DAYS	AMOUNT	DAYS	AMOUNT
Surface	116,526 ½	492,758.23	137,153 ¾	584,992.08	205,213 ¼	895,502.30	267,904 ⅓	1,501,153.07
Cost per Ton		.273		.257		.244		.295
Underground	175,002	834,929.43	220,336 ¼	1,088,540.81	320,594 ¼	1,640,168.13	444,946 ⅓	2,814,705.65
Cost per ton		.463		.479		.447		.552
Superintendence and General Roll	30,447	143,502.86	36,482 ¼	230,965.46	42,071	269,557.92	52,940	371,604.87
Cost per Ton		.080		.102		.073		.073
Grand Total	321,975 ½	1,471,190.52	393,972 ¼	1,904,498.35	567,878 ½	2,805,228.35	765,791	4,687,463.59
Cost Per Ton		.816		.838		.764		.920
Average Rate per Day		4.57		4.83		4.94		6.12
Total Per Man Per Day		5.60		5.77		6.46		6.66

NOTE: The above is the total of all wages and salaries for employee's of the Mining Department, including the Cliffs Power & Light Co.

WAGES:

Effective March 16th 1937 there was an increase in wages of 10¢ per hour, and the minimum wage rate was increased from $4.00 to $5.00 per day. This increase amounted to approximately 15.75%, and time an one half was allowed for overtime - overtime being over 40 hours a week or over 8 hours a day.
The average rate per day for 1937 increased $1.18 per day over 1936 or 23.88%.
The Cost per ton for labor increased $.156 or 20.4% over 1936 cost.

WORKING SCHEDULE - 1937 - MICHIGAN MINES:

Jan. 1st to Feb. 23rd. All mines, excepting Cliffs Shaft, 5 days per week - Cliffs Shaft on 6 day per week.
Feb.23rd to March 8th. All Mines, excepting Gardner-Mackinaw, 6 days per week - Gardner-Mackinaw on 5 day per week.
March 8th to April 6th. All Mines - 5 days per week.
April 6th to October 3rd. All Mines, excepting Gardner-Mackinaw, 6 days per week - Gardner-Mackinaw 5 day per week. To July 9th when it closed down and the men transferred to other properties until it opened on August 30th.
Oct. 3rd to Dec. 6th. All Mines, excepting Cliffs Shaft, 5 days per week - Cliffs Shaft on 6 days per week.
Dec. 6th, to Dec. 31st. All Mines, excepting Cliffs Shaft, 4 days per week - Cliffs Shaft on 6 days per week.
Spies-Virgil Mine resumed operations March 23rd. 1937.
The Tilden Pit operated from early April to Nov. 7th, starting on 1 8hr. shift until necessary to operate on 2 8hr. shift per day basis.

MINNESOTA PROPERTIES:

The Canisteo pit operation for 1937 began April 12th on a 2 - 8hr. shift basis 5 days per week and continued so until the ore season closed Oct. 8th.
The Hill-Trumbull pit resumed operations this year an from April 26th to Oct. 15th it operated 2 - 8 hour shifts per day for 5 days per week.
The Holman-Cliffs property idle during year 1937.

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COMPARISON OF TOTAL DAYS WORKED AND TONS OR ORE MINED FOR THE YEAR 1937 AND 1936

	1937 DAYS	1936 DAYS	1937 DAYS	1936 DAYS
NON-PRODUCTIVE UNITS				
Stephenson Mine	325 1/2	363		
Princeton Mine	538 3/4	311 1/4		
Miscellaneous Pay-Roll	2,126	2,130 1/2		
Shops and Storehouse	3,725	2,861 1/2		
CCICo. Miscellaneous and General	74,908	48,728 3/4		
Negaunee Mine " " "	3,687	2,604 1/2		
Athens Mine. " " "	5,481	952		
Cliffs Power & Light Co.	19,201 3/4	17,532		
Mesaba Range Properties	29,374	20,507 1/2		
General Roll - Undistributed	33,935 1/4	29,597		
Spies-Virgil - Idle	1,965 3/4	2,982 3/4		
Total Deductions	175,268	138,570 3/4		
Grand Total - All Operations.	765,791	567,879 1/2		
Net for Operating Mines	590,523	429,308 3/4	590,523	429,308 3/4
Total Tons	5,096,705	3,671,223		
Tons per man per day	8.631	8.551		
OPEN PIT PRODUCTION - TONS				
Tilden	305,418	291,341	9,216	9,360 3/4
Canistio	606,041	1,009,880	37,309 1/2	40,420 3 /4
Hill-Trumbull	808,125	Idle	27,127 3/4	Idle
Total	1,719,584	1,301,221	73,653 1/4	49,781 1/2
Open Pit Tons per man per day	23.35	26.14		
Net Underground days			516,869 3/4	379,527 1/4
Net Underground Production	3,377,121	2,370,002		
Underground Tons per man per day	6.534	6.245		

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STATEMENT SHOWING OVERTIME FOR YEAR 1937AND EFFECT THE PENALTY COST HAD ON THE YEARS PRODUCTION

MICHIGAN PROPERTIES	TOTAL			SURFACE			UNDERGROUND			PRODUCTION TONS FOR YEAR 1937	LOST PER TON FOR PENALTY COST OF OVER TIME
	AVERAGE NO. OF MEN	TOTAL NO. OF HOURS	COST	AVERAGE NO. OF MEN	TOTAL NO. OF HOURS	COST	AVERAGE NO. OF MEN	TOTAL NO. OF HOURS	COST		
Cliffs Shaft Mine.....	340	81,991	92,091.62	70	17,345	17,393.30	270	64,646	74,698.32	543,567	.0565
General Storehouse.....	112	19,216½	19,859.49	112	19,216½	19,859.49	--	--	--	--	--
Gardner-Mackinaw.....	34	2,429½	2,541.99	26	1,978½	2,050.93	8	451	491.06	172,823	.0049
Lloyd Mine.....	169	22,550	25,593.60	23	3,152	3,341.87	146	19,398	22,251.73	545,274	.0156
Maas Mine.....	380	56,306	61,473.19	88	15,070	15,940.41	292	41,236	45,532.78	780,189	.0263
Spies-Virgil Mine.....	33	3.087	3,229.20	18	1,773	1,793.54	15	1,314	1,435.66	71,255	.0151
Tilden Mine.....	35	3,214	3,368.60	35	3,214	3,368.60	--	--	--	305,418	.0037
General Roll.....	4	205	241.56	4	205	241.56	--	--	--	--	--
Total CCICo.	1,107	188,999	208,399.25	376	61,954	63,989.70	731	127,045	144,409.55		
Athens Iron Mining Co.	213	28,374	31,764.39	33	4,454	4,467.56	180	23,920	27,296.83	443,098	.0239
Negaunee Mine Company.....	287	38,144½	42,707.43	40	5,279½	5,374.77	247	32,865	37,332.66	820,915	.0173
Cliffs Power and Light Co.....	26	3,515½	3,561.81	26	3,515½	3,561.81	--	--	--	--	--
Grand Total.....	1,633	259,033	286,432.88	475	75,203	77,393.84	1,158	183,830	209,039.04	3,682,539	.0259
Penalty cost of above * 1/3 of Totals			95,477.63			25,797.95			69,679.68		
Effect the penalty cost had on the years product.											
Cost per Ton			.0259			.007			.0189		
MESABA RANGE - PENALTY COST											
Canestio.....			13,379.46							606,041	.0221
Hill-Trumbull.....			18,572.35							808,125	.0229
Holman-Cliffs.....			145.54								
Total Mesaba Range..			32,097.35							1,414,166	.0227
GRAND TOTAL - PENALTY COST			127,574.98							5,096,705	.0250

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CLIFFS SHAFT MINE

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1. GENERAL:

The Cliffs Shaft Mine broke all production records by hoisting 543,567 tons in 1937 and despite the large tonnage produced the ore estimate made at the end of the year shows that we finished the year with 62,794 more tons in sight than we started with. In 1936 the gain in developed tonnage aggregated 58,794 tons, in fact, we have consistently added to the ore reserves every year since 1929 with the exception of 1935 which showed a loss of only 13,603 tons.

The mine was not operated to full capacity the entire year because we did not work Saturdays for the period March 15th to April 17th. Also, we were down for one week in August to give the entire crew a week's vacation with pay.

Development work underground was continued by adding new miners, over half the contractors working in drifts, raises, or advancing headings. Actually we kept 57% of all the mining contractors on the developing program. The favorable results have already been mentioned.

We added quite a lot of new equipment to the mine inventory in order to speed up and maintain the increased product. Twenty-one new stoping drills, five new Jackhammers, and eight new scraper hoists were bought or built. A new semi-automatic Jackbit grinder was installed in the shop and the 2400 cu. ft. Ingersoll-Rand compressor that we had left in storage at the Morris Mine was moved to the Cliffs Shaft Mine. Air and water lines and the electric distribution system furnishing power to the scraper hoist motors were expanded and enlarged. Motor haulage tracks were rebuilt and all of the old steel cars repaired and new automatic couplers added. The top tram tracks leading to the crusher building were relaid and part of the permanent stocking tracks and trestles completely rebuilt.

The surface crew moved into the new surface dry and lockers and equipment added to take care of the new men hired to work underground. The size of the underground force was increased by 38 men so that at the end of the year we were employing about 390 men, which does not include the chemists and assistants working in the laboratory who are carried on the Cliffs Shaft payroll.

The average daily rate paid to the miners and other labor was much higher than any other previous year due to rate increase on March 15th and also because of the overtime paid for the Saturday operation.

It might also be noted that our 1937 estimate of production, which, by the way, was what we hoped but hardly dared anticipate, totaled 539,873 tons compared with an actual production of 543,567 tons.

2. PRODUCTION SHIPMENTS & INVENTORIES:

a. Production by Grades

Grade	Tons	% of Total
Cliffs Shaft Lump	308,641	
" " Crushed	142,529	
Total Cliffs Shaft Ore	451,170	83.0
Bancroft Lump	60,127	
" Mine Run	3,237	
" Crushed	29,033	
Total Bancroft Ore	92,397	17.0
GRAND TOTAL ORE	543,567	100.0

CLIFFS SHAFT MINE
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Production by grades for the past ten years follows:

Year	Lump Ore Tons	Crushed Ore Tons	Run-of-Mine Ore Tons	Total Tons
1927	288,804	113,728		402,532
1928	275,018	116,844		391,862
1929	295,600	125,714		421,314
1930	226,059	94,910	86,956	407,925
1931	153,717	65,113	72,227	291,057
1932	57,104	24,449	566	82,119
1933	39,101	16,838		55,939
1934	156,776	66,469		223,245
1935	189,883	79,038		268,921
1936	315,731	140,650	379	456,760
1937	368,768	171,562	3,237	543,567

The 1937 product exceeds the previous high figure established in 1936 by 86,807 tons. There is, however, one regretable fact and that is that the percentage of lump ore, which the Sales Department finds the most desirable for the market, is lower than it has been for the past few years. That can be accounted for in part by the fact that, for instance, it was very noticeable that the ore broken by No. 73 contract in "B" Shaft carried a larger proportion of fines than usual. This pargang produced 14,000 tons during 1937, their production being 2.6% of the total. This is exactly double the average product per gang on ore.

Another factor that contributes toward a lesser amount of lump ore is the picking belt. Because in order to fulfill the Sales Department's requirements we had to mine ore in stopes in 1937 that carried a lot of banded Jasper, we had to pick out the rock on the belt, which meant slowing up the belt and feeding it a thin stream of ore. If the ore surges through the crusher onto the revolving screen then more or less fines are discharged with the lump. If, however, the stream of ore entering the screen is regular and thin, the separation of fines and lumps is more thorough and we get a smaller percentage of lump. The tabulation that follows gives the percentage of lumps and fines or crushed ore for the past six years.

	Lump		Crushed	
Year	Tons	% of Total	Tons	% of Total
1932	57,500	69.97	24,619	30.03
1933	39,101	69.89	16,838	30.11
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

The annual report would not be complete if we did not show the proportion of ore mined from the fee and leased land since 1931.

Year	Cliffs Shaft Ore (Fee)	% of Total	Bancroft Ore (Lease)	% of Total
1932	71,155 tons	86.6	10,964 tons	13.4
1933	48,891 "	87.4	7,048 "	12.6
1934	195,258 "	87.5	27,987 "	12.5
1935	241,474 "	89.8	27,447 "	10.2
1936	383,014 "	83.9	73,746 "	16.1
1937	451,170 "	83.0	92,397 "	17.0

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Just as a matter of interest, the following table shows how much Bancroft or lease ore has been mined since production started from the Oliver Iron Mining Co's lands to the North of Section 10-47-27.

Year	Bancroft Ore Tons
1925	15,658
1926	37,529
1927	38,372
1928	34,730
1929	65,889
1930	61,385
1931	43,303
1932	10,964
1933	7,048
1934	27,987
1935	27,447
1936	73,746
1937	92,397
Total	536,455

b. Shipments

Grade	Pocket Tons	Stockpile Tons	Total Tons	Last Year
Cliffs Shaft Lump	196,651	105,003	301,654	304,265
" " Crushed	89,003	36,950	125,953	153,738
" " Mine Run				165
Bancroft Lump	40,892	18,261	59,153	48,565
" Crushed	18,311	7,532	25,843	31,716
" Mine Run	3,237		3,237	214
Total	348,094	167,746	515,840	538,663
Total Last Year	275,510	263,153	538,663	
Incr. in Shipments	72,584			
Decr. in Shipments		95,407	22,823	

Shipments for the past ten years follow:

	CLIFFS SHAFT GRADE			BANCROFT GRADE			
Year	Lump	Crushed	Run-of-Mine	Lump	Crushed	Run-of-Mine	Grand Total
1928	267,781	93,078	-	20,049	8,315	-	388,733
1929	305,278	133,433	-	43,472	28,747	-	510,930
1930	126,231	30,460	73,881	27,178	4,436	13,075	275,261
1931	17,999	12,099	70,541	10,210	285	1,686	112,820
1932	25,505	3,727	574	-	-	-	29,806
1933	135,303	45,162	-	10,105	-	-	190,570
1934	142,891	47,607	-	30,238	16,703	-	237,439
1935	251,246	91,596	-	35,137	20,523	-	398,502
1936	304,265	153,738	165	48,565	31,716	214	538,663
1937	301,654	125,953	-	59,153	25,843	3,237	515,840

Although the tonnage of lump shipped exceeded the figures for 1936 by about 8,000 tons, establishing an all time high, there was less crushed ore used in the Cliffs Group mixtures and very little crushed ore shipped straight.

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c. Stockpile Balances

Stockpile balances for the years ending December 31st since 1931 follow:

Balance in stock - Dec. 31,	1931	-	342,860 tons
" - " "	1932	-	395,173 "
" - " "	1933	-	299,585 "
" - " "	1934	-	275,391 "
" - " "	1935	-	145,810 "
" - " "	1936	-	82,072 "
" - " "	1937	-	109,799 "

The tonnage on hand at the end of 1937 was made up as follows:

Cliffs Shaft	Lump	33,830 tons
" "	Crushed	61,494 "
Bancroft	Lump	6,277 "
"	Crushed	8,198 "
Total		109,799 "

d. Division of Product by Levels

Level	"A" Shaft Tons	"B" Shaft Tons	Total Tons
First	13,640	20,850	34,490
Second	5,210	-	5,210
Third	11,925	29,945	41,870
Fourth	24,305	2,515	26,820
Fifth	17,935	13,295	31,230
Sixth	44,315	16,505	60,820
Seventh	60,380	27,525	87,905
Eighth	30,620	5,785	36,405
Ninth	59,475	16,812	76,287
Tenth	55,430	-	55,430
Eleventh	32,665	5,090	37,755
Twelfth	2,960	9,260	12,220
Thirteenth	-	3,165	3,165
Fourteenth	-	33,260	33,260
Fifteenth	70	630	700
Total	358,930	184,637	543,567
Rock			41,082
Total Ore & Rock			584,649

The following tabulation gives the division of product between "A" and "B" Shaft since 1930:

Year	"A" Shaft Tons		"B" Shaft Tons		Total Tons
1931	193,747	66.5%	97,310	33.5%	291,057
1932	56,533	68.7%	25,586	31.3%	82,219
1933	39,816	71.3%	16,123	28.7%	55,939
1934	157,835	70.8%	65,410	29.2%	223,245
1935	194,847	72.3%	74,074	27.7%	268,921
1936	309,555	67.6%	147,205	32.4%	456,760
1937	358,930	66.2%	184,637	33.8%	543,567

It will be noted that the amount of ore coming from the "B" Shaft territory has again been increased over the percentage shown last year. This is a good sign for the better because it proves that the "B" Shaft ore reserves are more than holding their own.

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e. Production by Months

Month	Optg. Days	Cliffs Shaft Lump	Cliffs Shaft Crushed	Bancroft Lump	Bancroft Crushed	Bancroft Mine Run	Total
January	25	23,565	10,782	4,734	2,209	137	41,427
February	24	22,119	10,021	4,967	2,257	158	39,502
March	25	25,734	11,711	5,519	2,480	-	45,444
April	24	24,708	12,041	5,619	2,835	-	45,203
May	26	25,842	12,874	5,433	2,641	658	47,448
June	25	25,756	11,819	3,837	1,933	1,204	44,549
July	26	28,473	13,372	4,178	2,265	506	48,794
August	20	19,259	8,973	4,132	1,859	480	34,703
September	25	26,085	12,552	5,070	2,517	94	46,918
October	26	34,370	13,746	5,810	2,842	-	56,818
November	25	26,881	12,439	5,083	2,460	-	46,863
December	26	25,849	12,199	5,341	2,509	-	45,898
Total	297	308,641	142,529	60,127	29,033	3,237	543,567

f. Ore Statement

	Cliffs Shaft Lump	Cliffs Shaft Crushed	Bancroft Lump	Bancroft Crushed	Bancroft Mine Run	Total	Last Year
On Hand Jan. 1st, 1937	26,843	44,918	5,303	5,008	-	82,072	145,810
Output for Year	303,480	142,529	60,323	28,837	3,237	538,406	451,760
Transfers			- 196	196			
Overruns	5,161					5,161	23,165
Total	335,484	187,447	65,430	34,041	3,237	625,639	620,735
Shipments	301,654	125,953	59,153	25,843	3,237	515,840	538,663
Balance on Hand	33,830	61,494	6,277	8,198	-	109,799	82,072
Increase in Output						86,646	[illegible]

g. Delays

Date	Hours	Tons Lost	Cause
Aug. 2 to 7, incl.	48	10,500	Vacation holiday
" 12th	8	1,300	Main Crusher broken down
" 24th	1	100	8th Level haulage system blocked
" 30th	2	200	Power Shortage
Oct. 2nd	4	450	Wine bores blocked
" 28th	2	200	Top Tram motor shorted
Nov. 29th	4	500	Top Tram control out of order
Year	69	13,250	

3. ANALYSIS

a. Average Analysis of 1937 Output

	Iron	Phos.	Silica
Cliffs Shaft Lump	58.17	.109	9.06
" " Crushed	53.28	.108	14.96
Bancroft Lump	60.07	.112	6.95
" Crushed	55.28	.114	11.78
" Run-of-Mine	61.09	.115	6.43

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b. Average Analysis on Straight Cargoes

Grade	Mine Analysis Iron	Phos.	Silica	Lake Erie Analysis Iron	Moist.
Cliffs Shaft Lump	59.44	.113	7.91	58.69	.35
" " Crushed	53.46	.109	14.65	53.63	2.69

c. Complete Analysis of 1937 Ores shipped from Mine

Grade	Iron	Phos.	Sil.	Alum	Mang	Lime	Mag.	Sul.	Loss
Lump Ore - Cliffs Shaft & Bancroft	58.90	.108	8.55	2.18	.44	1.26	.92	.013	1.75
Crushed Ore - Cliffs Shaft & Bancroft	53.85	.107	14.30	2.56	.50	1.40	1.03	.015	2.20

d. Analysis of Ore in Stock Dec. 31, 1937:

Grade		Iron	Phos.	Sil.	Mang	Alum	Lime	Mag.	Sul.	Loss	Moist.
Cliffs Shaft Lump	Dried	58.30	.102	8.90	.50	2.24	1.48	1.03	.013	2.06	
" Lump	Natural	58.01	.101	8.85	.50	2.23	1.47	1.02	.013	2.05	.50
Cliffs Shaft Crush.	Dried	54.33	.108	14.15	.46	2.61	1.46	1.19	.017	2.36	
" Crush.	Natural	53.47	.106	13.93	.45	2.57	1.44	1.17	.017	2.32	1.58
Bancroft Lump	Dried	59.93	.113	6.67	.47	2.60	1.56	1.15	.014	2.32	
"	Natural	59.63	.112	6.64	.47	2.59	1.55	1.14	.014	2.31	.50
Bancroft Crushed	Dried	55.97	.116	10.79	.35	3.06	1.40	1.11	.017	2.00	
"	Natural	55.14	.114	10.63	.34	3.01	1.38	1.09	.017	1.97	1.49

e. Analysis of Ore Reserves
Run-of-Mine Ore - Natural Analysis

	Iron	Phos.	Sil.	Mang.	Alum	Lime	Mag.	Sul.	Loss	Moist
Cliffs Shaft Ore	56.50	.109	8.79	.39	2.40	1.47	1.17	.018	2.20	2.20
Bancroft Ore	57.02	.106	6.56	.39	2.40	1.47	1.17	.018	2.20	2.20

4. ESTIMATE OF ORE RESERVES:

Assumptions: Factor used is 8, 9, and 10 cu. ft. Most of the ore estimated with factor of 9.
10% Deduction for Rock
10% " " loss in mining

Ore in Sight Dec. 31, 1937
Available ore in Bancroft area "A" Shaft

Level	Developed Floors Tons	Pillars Tons	Prospective Breasts Tons	Total Tons
1st	-	1,800		1,800
2nd	7,400	-		7,400
3rd	5,100	800		5,900
4th	9,200	3,000	2,000	14,200
5th	-	800		800
6th	6,700			6,700
7th			2,000	2,000
8th		6,900		6,900
9th	18,700	10,200	4,000	32,900
10th	23,400	138,500		161,900
11th	78,400			78,400
12th			2,000	2,000
Total	149,700	161,200	10,000	320,900

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Summary

Bancroft Ore Available	320,900	tons
Less 10% for rock and less 10% for loss in mining	61,000	"
Difference	259,900	"
Less December production	7,850	"
Net Total Bancroft Ore	252,050	"

Available Cliffs Shaft Ore "A" Shaft

	Developed		Prospective	
	Floors	Pillars	Breasts	
Level	Tons	Tons	Tons	Total Tons
1st		7,500		7,500
2nd	11,700			11,700
3rd	3,000			3,000
4th			6,000	6,000
5th	12,600	16,100	4,000	32,700
6th	72,700	79,300	6,000	158,000
7th	175,400	20,800	10,000	206,200
8th	139,100	25,100	8,000	172,200
9th	180,900	1,800	8,000	190,700
10th	63,400	141,600	14,000	219,000
11th	52,300	146,000		198,300
12th	69,600	73,700		143,300
15th	40,400			40,400
Total	821,100	511,900	56,000	1,389,000

Available Cliffs Shaft Ore "B" Shaft

	Developed		Prospective	
	Floors	Pillars	Breasts	
Level	Tons	Tons	Tons	Total Tons
1st	9,700		4,000	13,700
2nd	24,600			24,600
3rd	11,500	31,500		43,000
5th	5,300	6,600		11,900
6th	2,000	11,200		13,200
7th	25,400	6,800	2,000	34,200
8th	48,600	23,100	2,000	73,700
9th	25,100			25,100
10th	26,300			26,300
11th	20,300	3,000		23,300
12th	4,600	5,500	4,000	14,100
13th	16,400		4,000	20,400
14th	17,500	2,000	2,000	21,500
15th	29,600	15,300		44,900
Total	266,900	105,000	18,000	389,900

Summary

Cliffs Shaft Ore Available "A" Shaft	1,389,000	tons
" " "B" "	389,900	"
Total Available Cliffs Shaft Ore	1,778,900	"
Less 10% for Rock and 10% for loss in Mining	338,000	"
Difference	1,440,900	"
Less December production	38,048	"
Net Total Cliffs Shaft Ore 12-31-37	1,402,852	"

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Recapitulation

Cliffs Shaft Ore Available	1,402,852 tons
Bancroft " "	252,050 "
Grand Total Ore Available	1,654,902 "

The following tabulation shows increase in ore reserves for the past year:

	1937	1936
Cliffs Shaft Ore Available	1,402,852 tons	1,345,449 tons
Bancroft " "	252,050 "	246,659 "
Total	1,654,902 "	1,592,108 "
Increase for year 1937	62,794 "	

A comparison of the ore estimates for the past two years shows that the increase of 62,794 tons is not confined to any one area in the mine but is actually divided between the Bancroft, "A" Shaft, and "B" Shaft territories as shown, viz:

Increase in Bancroft territory	5,391 tons
" " "A" Shaft "	42,469 "
" " "B" Shaft "	14,934 "
	62,794

It is of interest to note how the available ore in the mine at the end of each year has shown no great variation since 1920:

Available Ore in Mine at end of each year:

1937	1,654,902 tons
1936	1,592,108 "
1935	1,533,314 "
1934	1,546,917 "
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 "

5. LABOR & WAGES

a. General

The Cliffs Shaft crew was fortunate to be employed full time on the 48 hour per week plan nearly all of the entire year. From March 15th to April 17th we did not operate on the 6th day of the week. When we resumed the full time schedule on April 17th the men received time and a half for Saturday's work to conform with the new wage rates effective March 15th. That increase amounted to an average 24% increase for our surface employees and 20% for the underground men. When you consider that time and a half is paid for all work over 8 hours per day and over 40 hours per week, the increase in earnings to surface men actually amounts to 27% and for the underground crew 24%.

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The crews were so arranged, however, that no one is paid for working over 8 hours per day. For instance, we hoisted ore overtime on three nights and sometimes four nights per week. The skeleton crew needed both on surface and underground to operate the motors, trams, and surface equipment on the overtime hoisting days reported for work at 12 noon and ended their shift at 8 P. M.

The regular day shift crew always started to work on surface at 7:30 A. M., quitting at 4:00 P. M., with a half hour for dinner. The regular underground crew went down at 7:30 A. M. and came up at 4:00 P. M.

The overtime crew reported at 12 noon, quitting at 8:00 P. M. The night shift, or rock tramming shift, started at 7:00 P. M. and quit at 3:00 A. M. on the days we did not hoist overtime. On the overtime hoisting days they worked from 8:00 P. M. to 4:00 A. M. On Saturdays the rock tramming shift worked from 4:00 P. M. to 12:00 midnight, thereby avoiding any Sunday time. A small select crew needed to look over the skips, cages, and crusher and picking belt equipment always come on duty at 7:00 A. M. every day in the week. The skiptenders worked from 7:00 A. M. to 3:00 P. M. and 3:00 P. M. to 11:00 P. M. That schedule was arranged to eliminate as far as possible paying overtime for cleaning the skip pit because the skip pits would be cleaned between hoisting periods or directly after the overtime crew finished hoisting ore.

We also tried to enforce a general rule applying to all men to the effect that if men had to be called out to work on Sunday they would have to stay home one week day. We tried to keep everybody within the 48 hour per week limit.

b. Comparative Statement of Wages and Product

	1937	1936	Increase	Decrease
PRODUCT	543,567	456,760	86,807	
No. of Shifts & Hours	2 8-hr	2 8-hr		
No. of Days Operated	297	269	28	
AVERAGE NUMBER OF MEN EMPLOYED				
Surface	93	78	15	
Underground	293	255	38	
Total	386	333	53	
AVERAGE WAGES PER DAY				
Surface	5.52	4.20	1.32	
Underground	6.34	5.11	1.23	
Average	6.22	4.89	1.33	
WAGES PER MONTH OF 25 DAYS				
Surface	138.00	105.00	33.00	
Underground	158.50	127.75	30.75	
Average	155.50	122.25	33.25	
WAGES PER MONTH OF 22 DAYS				
Surface	121.44	92.40	29.04	
Underground	139.48	112.42	27.06	
Average	136.84	107.58	29.26	

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WAGES PER MONTH OF 17 DAYS

	1937	1936	Increase	Decrease
Surface	93.84	71.40	22.44	
Underground	107.78	86.87	20.91	
Average	105.74	83.13	22.61	

WAGES PER MONTH OF 13 DAYS

Surface	71.76	54.60	17.16	
Underground	82.42	66.43	15.99	
Average	80.86	63.57	17.29	

PRODUCT PER MAN PER DAY

Surface	20.72	19.67	1.05	
Underground	6.54	6.46	.08	
Total	4.97	4.86	.11	

LABOR COST PER TON

Surface	.267	.214	.053	
Underground	.985	.791	.194	
Total	1.252	1.005	.147	

Following are comparative figures for the past ten years:

Year	Surface Labor	Underground Labor	Total Labor	Labor Index *
1937	.267	.985	1.252	199.96
1936	.214	.791	1.005	164.29
1935	.232	.809	1.041	149.79
1934	.194	.728	.922	138.05
1933	.379	.861	1.240	129.78
1932	.303	.908	1.211	132.27
1931	.232	.888	1.120	157.44
1930	.222	.890	1.112	161.70
1929	.213	.843	1.056	161.70
1928	.214	.861	1.075	161.70

* Labor index compares yearly wage rate with that in effect June 30, 1916, which is assumed as 100.

We have added the labor index figures to make the comparison of labor costs clearer.

	1937	1936	Increase	Decrease
Average Product Stoping and Tramming (Tons per shift)	13.88	14.05		0.17
Average Product Stoping and Tramming, including haulage crews (Tons per shift)	11.82	12.01		0.19
Average Wages - Cont. Miners	6.92	5.59	1.33	
" " - " Trammers	8.92	6.73	2.19	
" " - " Labor	7.17	5.76	1.41	

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TOTAL NUMBER OF DAYS	1937	1936	Increase	Decrease
Surface	26,238¾	23,220½	3,018¼	
Underground	83,173¼	70,715¾	12,457½	
Total	109,412	93,936¼	15,475¾	

AMOUNT FOR LABOR				
Surface	$144,953.20	97,575.45	47,377.75	
Underground	535,719.13	361,494.59	174,224.54	
Total	$680,672.33	459,070.04	221,602.29	

PROPORTION OF SURFACE TO UNDERGROUND MEN	
1937	1 to 3.15
1936	1 to 3.28
1935	1 to 3.72
1934	1 to 4.05
1933	1 to 4.00
1932	1 to 4.60
1931	1 to 3.66
1930	1 to 3.76
1929	1 to 3.66

6. SURFACE

a. Buildings & Repairs

Shaft Houses

Because we believed they were definite hazards that might lead to accidents, all of the ladders have been removed from both "A" and "B" shaft houses and stairways constructed. One of the new stairs leads to the angle sheaves to make it safer for the oiler to grease the 8 ft. sheaves. Another set of stairs goes to the skip dump and to the landing floor near the top of the dump. The third set of stairways is provided for the oiler to reach the bearings of the top 12 ft. diameter sheave located in the peak of the shaft house.

At "B" Shaft a pipe rack was also constructed to obviate the necessity of digging pipes out of the snow before taking them underground.

We also installed a new 8 ft. diameter steel lined angle sheave replacing the old cast iron one that was in bad shape. At present all of the large sheaves, which are six in number - three in each shaft house - are of the improved steel lined type.

Engine House

During 1937 we finished covering the underside of the main roof over the engine and compressor rooms with Flex-Board. This job was started late in 1936. It is a fire prevention measure. It will not classify as a strictly fire proof job but with the asbestos lining underneath and asbestos sheating on top no fire will spread very fast.

During the summer months we also moved and installed the 2400 cu. ft. per minute Ingersoll-Rand compressor from the Morris Mine to the Cliffs Shaft property. The idea behind this move was to insure at all times a plentiful supply of air for the underground drills and all the air cylinders used to dump all the tram cars both underground and surface.

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Dry House

The surface crew was moved into the new surface dry during January 1937. The new building relieves the congestion in the old dry as we moved some of the underground employees such as pumpmen, helpers, chain gang, diamond drill crew, etc. into the new building.

We also rearranged some of the lockers in the old dry, taking out, for instance, those in the main boiler room. This room was always more or less dusty and draughty and a poor place to change clothes in.

A new stack was also provided for the main heating plant and while we were engaged in erecting it the surface foreman was unfortunate enough to break his right leg.

Crusher Building

A new stairway was built from the ground to the main landing floor upon which the top tram cars operate during the winter months. The old stairway was located under the rock chute over on the West side and the steam used in the winter time to thaw out the chute caused ice to form on the steps. The new stairway is over on the East side of the building.

We also installed gates and fences around the base of the building to prevent employees coming in contact with the top tram ropes.

During the first week in August when the employees took their paid vacation, the permanent trestle leading to the crushed ore pile was completely rebuilt. This old trestle was at least 25 years old and could no longer be patched or repaired. At the same time having in mind that the crushed ore stocking cars would be rebuilt we raised the new trestle up about 4 ft. above the elevation of the old one, reducing the grade to 1½%. The two new cars delivered in the Fall have roller bearing wheels and will run on a much flatter grade than the old brass bearing type wheels on the old cars. That allows us to raise the height of the crushed ore pile providing thereby more stocking roo m.

In years past we always had trouble with axles breaking on the main 5 ton cars carrying the ore from both shafts up the inclined tram to the top of the crusher building. We therefore rebuilt the three cars we had, taking one over to the main shops at a time. New "Agathon" steel axles much larger in diameter and with a longer horizontal bearing surface were placed on all these cars. We figure the new bearings provide at least 150% more wearing surface.

Bit Grinding Shop

An improved type of detachable bit grinder was purchased and added to the equipment. The new grinder is semi-automatic, it handles twice as many bits as the old grinders and is cheaper to operate. The grinding wheels used at the speeds designed for the new machine last much longer than they do on the old Jackbit grinders.

Trestles

The old 40 lb. rail used on the main inclined tram leading to the crusher building was replaced with new 50 lb. rail. We were never able to keep the old 40 lb. rail in shape because the flanges on the top tram car wheels cut off the heads of the bolts running through the splice bars.

During the summer the bottoms or legs of the vertical members supporting the main trestle were encased with concrete, forming concrete blocks or pillars. We found in some instances corrosion had started at the base of the legs but the new concrete bases will prevent further damage.

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Laboratory

Because of the additional men that had to be put on to the laboratory crew, it was necessary to rearrange the ground floor. First, Mr. Maloney, Chief of Police, was moved into the Cliffs Shaft Mine office. The wall between the Chief's office and the toilet room was torn out, making a large room for the Chief Chemist and Chief Sampler. The wall between the office formerly occupied by Mr. Hawes and Mr. Linn and the old balance room was torn out, doubling the size of the balance and weighing room. A new concrete table was built along the East wall for the balance. The second floor was cleaned up, a new floor put down and cabinets and shelving provided for chemicals and for stocking envelopes for powders of samples. The basement was rearranged, shelving provided for all the acids and heavy carboys.

Old Boiler House

In the old boiler room after the old steam boilers and fuel economizer were scrapped, the brick settings were leveled off and a platform about 50 ft. long and 30 ft. wide provided for heavy supplies. This platform was built so as to be level with the deck on the trucks in order to make it easy to handle the scraper backs, wire rope, air pumps, car couplers, etc. In former years all these supplies were placed on platforms out of doors and in the winter months all those supplies had to be dug out of the snow.

Following is comparative data showing cost of repairs on the mine buildings for the past five years:

	1937	1936	1935	1934	1933
Office & Warehouse	375.24	411.83	280.72	590.14	46.15
Shops	50.15	743.92	410.10	1.80	65.34
Shaft Houses	952.41	857.16	404.32	127.51	120.91
Engine House	823.26	1708.73	66.97	114.71	61.46
Dry Houses	2738.45	4956.23	823.32	224.16	202.34
Coal Dock & Trestle	45.31	11.21	146.79	892.50	27.82
Crusher Building	864.60	677.10	-	-	-
Miscellaneous	338.38	1077.39	506.90	428.70	163.48
Total	6187.80	10443.57	2639.12	2379.52	687.50

Costs in 1937 were considerably under the 1936 figure because in the latter year we did so much repairing that had been deferred during the depression period.

7. UNDERGROUND

a. Development

When the mine is being crowded for production as it was during the past year, it is exceedingly difficult to find new ore fast enough to replace the reserves being mined out. We always try to keep at least half of all the gangs in the mine on development work. The following table shows how the various contracts were split between developing and stoping.

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1937	No. of Gangs Developing	No. of Gangs Mining Developed Reserves	Total Number of Gangs Employed
January	47	37	84
February	51	34	85
March	51	34	85
April	53	36	89
May	50	38	88
June	52	37	89
July	55	35	90
August	47	45	92
September	47	45	92
October	43	45	88
November	52	40	92
December	49	42	91
Average for year	49.7	39	88.7
% of Total for year 1937	56.5	43.5	100.0
% " " 1936	55.2	44.8	100.0

The table indicates that over half the total gangs employed were kept on development work and the ore estimate shows that the development program was successful in adding more than enough ore to offset the amount mined during the year.

Development Program "A" Shaft

1st Level

Directly South of "A" Shaft on the 1st Level, but in the Southeast Vein tributary to "B" Shaft, contract No. 1 discovered a new lens between Diamond Drill Hole #101 and the North-South 600 East coordinate line. To avoid cross hauling a new stub drift was driven on the 1st level, a new raise put up, and stoping started on a sub level above the level. There is not much chance of finding a large ore body here because we are very close to the South boundary of the mine, but the ore is very high grade and helps to keep up the iron content in the crushed grade.

4th Level

On the 4th Level in the Main Vein between coordinate lines 1600 East and 1800 East Contract #74 put up a new raise from the 5th level, holing to the floor of an old stope mined out in the late 90's. What prompted us to go into this territory was the ore shown up in some old diamond drill holes drilled by the Iron Cliffs Company after the mine was unwatered in 1897. We did discover ore in the raise but could do little stoping until we built a new track over from the Bancroft area on the 5th level. That required us to fill in some old floors to bring the track up to grade.

In the North Vein territory on the 4th level and above, a double contract known as No. 8 continued to drive two developing breasts East and Northeast towards the Southwest corner of the old New York Mine. Neither one of the lenses being followed is very large but we pulled 8,770 tons of ore out of these two working places in 1937.

5th Level

On the 5th level over on the West side of the North Vein and a short distance South of the Southwest corner of the Bancroft area Contract #40 put up a stope raise hoping to hit the downward extension of the ore mined out by No. 30 on the 2nd, 3rd, and 4th levels. The raise hit the

hanging before it holed to the 4th level and so apparently the top ore is cut off.

6th Level

On the 6th and 7th levels in the West end of the Main Vein Contract #81 is exploring for ore near the intersection 500 South and 1500 West. First this contract drifted North on the 6th towards Diamond Drill Hole No. 54. When it appeared that we might find something worth while and in order to eliminate hand shoveling a stope raise was started on the 7th to hole to the breast on the 6th. The story behind the finding of this particular ore lens is indicative of how new ore bodies are sometimes discovered. No. 81 was started raising to provide a new rock dump. We were merely going to raise from the 8th to the 7th levels and finally to the 6th so that rock broken on the 6th and 7th could be dropped to the 8th level and used for filling in the old stopes in the South lens. While raising, the miner passed through a seam of rock we supposed to be the foot and hit ore. This ore proved to exist on both the 7th and 6th levels and may be quite extensive in area.

Over on the East end of the North Vein #67 ran into something new while following the hanging just North of the 400 South and 3000 East intersection. Near the close of the year we put a second miner in this gang because conditions were so very favorable.

Contract #74 on the 6th in the extreme East end drove their footwall drift a short distance farther to the Northeast and then crosscutted and holed into a sub level between the 4th and 5th levels in the old No. 3 mine. This doubles the amount of fresh air flowing into the mine and has made a vast improvement on the 6th, 7th, and 8th levels. Areas that were formerly usually hazy following blasting are now very clear. A dam will now have to be constructed in the drift connecting with the sub level because during the Spring breakup the water rises very fast in the bottom of old No. 3 Mine and the in-flow may tax the capacity of our pumping plant.

7th Level

On the 7th Level three gangs - Nos. 44, 57, and 77 - added to the ore reserves. The first named, consisting of two miners, stoped both East and West along the main fault in the West end of the North Vein between the 1600 East and 1800 East coordinates. This gang produced 7,325 tons of ore which made it one of our best developing contracts. The second contract, #57, stoped on a sub below the 6th in the North Vein a short distance to the Southwest of the Southwest corner of the Bancroft Lease. The other gang, No. 77, did some exploring in the Northeast corner of the level. They had previously been breasting in ore on a sub above the 8th and their raise was so crooked due to following the hanging that it was decided to put up a second raise in the footwall. Both raises are now holed to the 7th level and eventually we hope to find the ore shown in Diamond Drill Hole #406 on the 6th level.

8th Level

Every miner working on the 8th level was doing development work. In the Bancroft area #53 continued breast stoping West towards Diamond Drill Hole #385. In the North Vein #79 over on the West side opened up rather an extensive stope. Near the end of the shipping season though, because the ore in the breast was lean, we moved the miner over to the

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North side of the stope where the ore appears to be going up over the back of the motor drift. In the central portion of the North Vein #79 connected their main drift with the old stope to the South and cut through the ore shown in Diamond Drill Hole #223. A new raise was put up to the 7th level and stoping started at the latter elevation late in the year. In the early part of 1937 this same miner raised in ore near the 200 South and 1700 East intersection and later Contract #12 was put to work in the top of the raise to outline the ore. We now find this new ore to extend from above the 7th level to a short distance above the 8th and apparently there is only a thin seam of rock between the new ore and the ore being developed by #44. Over on the East side of the 8th Level #25 not only breasted West along the 100 South coordinate but they also put up two stope raises near the intersection 000 South and 3000 East. Contract #41 in the West end of the Southeast Vein drifted and crosscutted near the South boundary of the property. Some ore was found in the crosscut but apparently most of the ore lies below the 8th level. A raise was also holed to the old 6th level workings and mining begun on the 6th the latter part of the year.

9th Level

On the 9th level all of the developing was done over on the North side of the mine in the Bancroft area and our own lands to the East of the Bancroft Lease. Two contracts - Nos. 10 and 70 - breasted East and West following the hanging in the Southeast portion of the leased lands. Contract #64, consisting of two miners, on our own fee lands breasted and raised on both sides of Diamond Drill Hole #418. We believe that the three gangs just mentioned are in the same ore body which has a probable length East and West of 1,000 feet. In places we have found the width to be 150 ft. Furthermore, No. 10's ore undoubtedly extends up 50 ft. to #53 and down at least 100 ft. below #84 on the level below. Expressing the figures in tonnage, there is a possibility of mining from 1,600,000 to 1,750,000 tons from this area alone.

In the Southeast end of the Main Deposit to the Southeast of the Bancroft area #68 developed the ore found in Diamond Drill Hole #419. To reach this ore a branch raise was put up to the South of the original raise and a raising stope started to the East.

10th Level

On the 10th level a very extensive development campaign was carried on in the Bancroft Vein, in the North Vein, Southeast and Main Veins. In the Bancroft area over on the West side #76 drove a stope 175 ft. to the West and then raised up to the 9th level elevation and started crosscutting North in ore over to old #10's workings. In the Southwest corner of the Bancroft Area #82 drove West in ore and then turned to the Southwest after crossing the 1400 East coordinate line until rock cut off the ore. A raise was then started which is planned to come up under old #62 stope on the 8th level. Contract #84 breasted South along the 2000 East coordinate line and there is every indication to believe that the main portion of the Bancroft lens is 125 ft. wide at this point and that the footwall of this ore is the hanging of another lens now being developed by #76. The Easterly extension of the main Bancroft ore body was proven by No. 5 to extend 300 ft. further to the Northeast. #5 drove in ore the entire year connecting the stope found by Diamond Drill Hole #429 with the ore found by old #44 in the extreme Northeast corner of the level. #5 also raised in ore from the East end of their new drift to the floor

of #64's stope on the 9th level, proving a connection exists between #5, #10, #64, and #70. It would now appear that #53 on the 8th, #10, #70, and #64 on the 9th, and #5 and #84 on the 10th are all mining in the same ore lens. There is, however, still another ore body to the East of the Bancroft Lease on the 10th level because #12, #23, and #83 developed and proved a connection from the 10th level to the North Vein being explored by #25 on the 8th level. The crosscut driven South parallel with the 2900 East coordinate line cut a nice seam of ore which we raised in to the 8th level. The main footwall drift going East parallel with the 100 South coordinate line was in footwall dike and siderite for the entire 250 ft. and a diamond drill station was cut on the 3200 East coordinate line because we believe there are possibilities for ore both North and South of the drift.

In the North Vein Contract #4 drifted West for 400 ft. exploring the territory South of the Bancroft area. The material drifted through was dike mixed with some siderite. In December drifting was stopped and two raises started which are planned to hit the downward extensions of the ore lenses discovered by old #4 and #79 on the 8th level.

In the Main Vein most of the exploratory work was in the nature of breast stoping. Contract #24 on the extreme West end of the vein extended the known limits close to the 1600 East coordinate line. In the central portion of the Main Vein #11 pushed South and #26 East, greatly increasing the developed ore area between the 2400 East and 2600 East coordinate lines. Contract #50 likewise proved a connection between their breast and the ore in the North-South crosscut near Diamond Drill Hole #208. Contract #68 drove a connecting drift between the ore they discovered in the East end of the level and #50's stope. Part of this drift uncovered a new seam of magnetite.

In the Southeast Vein Contract #55 extended the known limits of that vein East and also up on the footwall on the Southwest side to the 9th level.

Summarizing the development work done on this level there was more new ore developed on the 10th level "A" Shaft than any other place in the mine and we feel quite confident that 1938 will show still further new extensions.

11th Level

On the 11th Level two gangs in the Main Deposit, Nos. 7 and 62, increased the area of that deposit by advancing their stopes West into unknown territory. Contract #62 also developed some of the highest grade Red Specular ore ever seen in the mine. Over on the East side of the level #68 drove a short distance East in the footwall and then cut out a diamond drill station.

12th Level

On the 12th level in the Bancroft area #80 contract opened up a new breast stope from the top of their new branch raise. We know absolutely nothing about this territory. There are no drill holes to guide us but we are following the hanging to the Southwest. This ore has no connection as far as we know with anything we have so far discovered on the 10th level 100 ft. above #80. We hope, however, it will eventually prove to connect with #76's ore on the 10th level.

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15th Level

Between the 11th, 12th, and 15th levels Contract #75 spent the entire year raising, the bottom of the raise being located a short distance Northwest of the 600 South and 2800 East intersections. This raise has three branches, the East branch holing into 68's stope on the 11th level. The Southwest branch holed to the 11th Level floor near the intersection 650 South and 2700 East. The Northwest branch was nearly holed to the North limb of the main deposit near Diamond Drill Hole #332 by the end of the year. When the third branch holes we will have three new working places from which ore can be trammed over to "B" Shaft.

In the Bancroft area #58 gang put up a new raise from the 15th to the 10th level and drove a short crosscut at the latter elevation where #84 stope was located at the end of the year. The raise was in rock with the exception of the last 60 ft. below the 10th level. This portion of the raise proved a part of the Bancroft ore body, which we choose to call the "Middle Lens", to go quite a distance below the 10th level.

"B" Shaft

3rd Level

More new ore was added to the reserves in the area between the 1st and 3rd levels 400 ft. Northwest of "B" Shaft than anywhere else in "B" Shaft. Two gangs, with three miners employed in them - #63 and #72 - opened up additional territory 175 ft. long by 80 ft. wide. We have, however, not yet exhausted the possibilities in this territory because we still have ore along all of the South and East sides of the new stope and the breast on the 3rd level still shows ore at least 50 ft. wide over on the West side.

5th Level

On the 5th level in the Fault Vein 450 ft. to the Southwest of "B" Shaft Contract #33 opened up a new ore area that has good possibilities of amounting to something worth while. The extensions will have to go to the Southwest.

6th Level

On the 6th level two contracts - #42 and #85 - did development work. The first named in the North Vein directly North of "B" Shaft opened up a new lens after drifting South through dike and there is a chance of eventually finding a new lens here at least 300 ft. long. Contract #85 in the Fault Vein followed some ore along the hanging towards the 600 South and 600 West intersection but the ore pinched out and a new crosscut was then started Northwest towards ore shown in Diamond Drill Hole #247. At the close of the year ore was showing up in the breast of the crosscut.

7th Level

On the 7th Level #13 gang 450 ft. Northwest of "B" Shaft extended the limits of their sub stope farther to the West.

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8th Level

On the 8th level two gangs - Nos. 36 and 69- increased our ore reserves during 1937. The first gang raised in ore to the Northwest of their old stope and got all the way up to 6th level in ore. We did not expect this ore to run in that direction. Contract #69 also raised on the footwall 600 ft. Northwest of the shaft and finally followed the ore all the way up to the 7th level.

9th Level

On the 9th level in the Fault Vein in the Southwest corner of the mine No. 49 opened up quite a lot of new territory and there is still a chance of finding much more ore along the hanging to the Southwest. We also feel quite sure that the ore will extend down to the 10th level.

10th Level

On the 10th level No. 14 breast stoped to the Southwest towards #49's raise but the ore was lean and after the shipping season closed No. 14 was moved to do some exploratory work along the hanging 600 ft. to the East of their old working place.

In the West drift on the 10th level Contract #47 drifted through 700 ft. of jasper iron formation and on the last day of December hit ore. Up to date we have cut ore at least 20 ft. wide. This find opens up a new field for exploration and we hope to be able to report very interesting developments in 1938.

12th Level

On the 12th Level #56 raise stoped up on the footwall in the Fault Vein while #86 breasted East along the hanging in the same vein. This territory looks so promising that a new raise was planned from the 15th level which will be branched to avoid cross hauling in the two gangs.

13th Level

On the 13th Level two gangs - Nos. 31 and 43 - breasted in ore all of 1937. From the latter gang we hoisted very little tonnage because the ore is being allowed to accumulate so that we can follow it up on the footwall. Both gangs are employed in the South-Central portion of the Fault Vein.

14th Level

On the 14th level #48, one of the best producing gangs in the mine, increased the area of the main deposit in the Southwest corner by breasting in ore both to the North and West.

15th Level

On the 15th level Contract #58 drove a short crosscut in the footwall 1300 ft. due West of "B" shaft and then started the branch raise already referred to as being planned to hole to the Fault Vein stopes on the 12th level.

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The following table shows the ore tonnage produced and hoisted from the development gangs during the year. The contracts in rock are not included.

"A" Shaft--	1st	Level -	No. 1	Contract	-	7,355	Tons of Ore
--	4th	" -	" 8	"	-	8,770	"
--	5th	" -	" 40	"	-	4,755	"
--	6th	" -	" 81	"	-	1,605	"
--	6th	" -	" 67	"	-	3,105	"
--	7th	" -	" 44	"	-	7,325	"
--	7th	" -	" 57	"	-	6,805	"
--	7th	" -	" 77	"	-	1,095	"
--	8th	" -	" 25	"	-	5,415	"
--	8th	" -	" 41	"	-	580	"
--	8th	" -	" 53	"	-	7,655	"
--	8th	" -	" 78	"	-	3,010	"
--	8th	" -	" 79	"	-	7,960	"
--	9th	" -	" 10	"	-	11,320	"
--	9th	" -	" 64	"	-	8,775	"
--	9th	" -	" 68	"	-	1,960	"
--	9th	" -	" 70	"	-	9,405	"
--10th	"	-	" 4	"	-	230	"
--10th	"	-	" 5	"	-	2,550	"
--10th	"	-	" 11	"	-	9,630	"
--10th	"	-	" 24	"	-	8,745	"
--10th	"	-	" 26	"	-	8,130	"
--10th	"	-	" 50	"	-	7,050	"
--10th	"	-	" 55	"	-	2,450	"
--10th	"	-	" 76	"	-	7,575	"
--10th	"	-	" 82	"	-	2,380	"
--10th	"	-	" 84	"	-	2,645	"
--11th	"	-	" 7	"	-	7,825	"
--11th	"	-	" 62	"	-	8,105	"
--12th	"	-	" 80	"	-	2,780	"
	Total "A" Shaft - - - - --					166,990	"
"B" Shaft--	3rd	Level -	No.63	Contract	-	5,845	"
--	3rd	" -	" 72	"	-	11,000	"
--	5th	" -	" 33	"	-	7,375	"
--	6th	" -	" 42	"	-	6,155	"
--	6th	" -	" 85	"	-	1,195	"
--	7th	" -	" 13	"	-	5,145	"
--	8th	" -	" 36	"	-	5,620	"
--	8th	" -	" 69	"	-	8,685	"
--	9th	" -	" 49	"	-	7,015	"
--10th	"	-	" 14	"	-	5,160	"
--12th	"	-	" 56	"	-	3,285	"
--12th	"	-	" 86	"	-	1,380	"
--13th	"	-	" 31	"	-	4,335	"
--13th	"	-	" 43	"	-	3,075	"
--14th	"	-	" 48	"	-	10,185	"
	Total "B" Shaft - - - - --					85,455	"
	Grand Total "A" & "B"Shaft					252,445	"
	Add 5.42% Overrun					13,695	"
	GRAND GRAND TOTAL					266,140	"

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It will be noted that nearly half of the entire tonnage produced in 1937 came from developing contracts. In addition to the tonnage hoisted from these gangs, 343,816 tons of additional ore were put in sight, or we might say that for every ton hoisted from a developing gang another 1½ tons was added to the reserves. In the final analysis, however, the depleting or stoping gangs mined enough of our old reserve tonnage left over from 1936 that the net amount left to add to our reserves was only 1/4 of a ton for every ton hoisted from the advancing drifts, raises, and stopes.

b. Stoping

Tons per man per day stoping:

Year 1937	-	22.52
1936	-	22.61
1935	-	22.98
1934	-	23.25
1933	-	18.90
1932	-	21.80
1931	-	20.55

Note:

Because of the difficulty of differentiating between developing stoping and mining floors and backs because so many gangs perform both operations during the same month, the above tabulation includes all miners on ore, even those in ore drifts and raises.

"A" Shaft Contracts

The following contracts spent most of the year mining developed reserves, that is, they took out floors or backs.

1st. Level

Two gangs - Nos. 30 and 34 - mined out floors on the Bancroft Lease. No. 30, 600 ft. Northeast of "A" Shaft, took out the ore shown in Diamond Drill Hole #1007 (L. S. I. Co's drilling). This particular lens was badly mixed with rock but we picked the lean material out as carefully as we could because the ore was very high grade. In the Southwest corner of the Bancroft Lease #34 mined out the floor at the foot of all the footwall raises and by the end of 1937 this territory was pretty well mined out.

2nd Level

We employed three contracts in three separate lenses during the past year. In the Bancroft area #30 went up on the footwall between the 2nd and 1st levels. A short distance to the South, in the North Vein, Contract #9 took out most of the available floor between the 900 East and the 1100 East coordinate lines. Over in the Main Vein along the South side between "A" and "B" Shaft Contract #27 mined out some floor but also made some new tonnage available by raise stoping. However, despite the fact that part of the tonnage mined by #27 should be classified as developing, most of the ore actually came from the old 1st and 2nd level floors.

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4th Level

Three gangs - Nos. 22, 29, and 30 - took out floors and in the case of #29 actually increased the known ore area, but again as in the case of #27 on the 2nd level it is difficult to estimate how much new ore #29 developed and how much was taken from floors. This fact is certain, however, and that is that #29 mined out all the new ore they found and for that reason they are not classified as a developing gang.

Contract #29 worked between the 3rd and 4th levels on a sub level between the 1000 East and 1200 East coordinate lines on the Bancroft Lease. Contract #22 took out floors in both the Bancroft and North Veins, the ore body being one and the same but on different sides of the boundary line. Near the end of the year #22 spent two months barring the back. Over on the West end of the North Vein #30 finished taking floors down to a short distance above the 5th level.

5th Level

All of the gangs mining in the 5th level area were depleting gangs because all their efforts were directed towards mining floors or backs.

In the Southeast corner of the Bancroft area #61 and #66 mined floors. No. 61 also did some breast stoping but most of the year he was working on floors.

In the North Vein to the East of the Bancroft Lease #32 and #51 spent the entire year depleting that portion of the mine. #32 also extended the known area of the North Vein further South along the hanging.

Over on the West end of the North Vein #40 mined out floors between the 5th and 6th, going down as deep as practicable towards the old 6th level stope. The back was mined out up to the jasper which also forms the foot of #30's stope below the 4th level and a raising stope was started by #40 on the 800 East coordinate line. #40 is an example of another gang that developed some new ore but is being classified as a depleting contract.

Over in the Southeast Vein #74 started taking the back between the 5th level and the old sub above near the 2700 East coordinate line. No ore was trammed from this stope although the miner was employed there steadily for the last eight months of 1937. His broken ore falls down to the floor of old #45's stope and probably we will continue to accumulate ore here during the early months of 1938.

6th Level

There were six depleting gangs mining in the North and Southeast Veins - Nos. 15, 28, and 52 in the former, and Nos. 2, 41, and 45 in the latter. #15 took out the floor between the 6th and 7th levels near the 2900 East coordinate line. About 300 ft. further Southeast along the hanging #28 after barring for four months in old #67's stope finally made the back safe and started to take out the floor. Prior to this job #28 finished their old stope located 600 ft. due West from the Southwest corner of the old New York Mine. The breast of this raising stope pinched out and then two small pillars left behind in the central part of the stope were robbed out. We usually don't mine pillars but in this case the ore area is isolated, no stopes being over or under us and the ore lens was only 15 ft. thick and not over 40 ft. wide.

Contract #52 took out a floor between the 6th and 7th levels South of the 200 South and 2400 East intersection.

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In the Southeast Vein over on the West side #41 just got started mining the floor in the North Lens of the Southeast Vein near the 1300 East line. Over on the East end of the same vein #2 and #45 mined floors. #2 also increased the 6th level ore area and then took out some of the back between the 5th and 6th levels after holing their new raise to the 5th level. #45 over on the extreme East end of the vein accumulated ore for six and one-half months and it was not until December that we were able to tram any ore from the large pile.

In the extreme Southeast corner of the level in the Incline Mine territory #60, although apparently breast stoping into new ground, actually mined the floor of old #14's sub and so is being called a depleting gang. This territory is now pretty well mined out and the miners employed there were very glad to be moved before winter because this end of the mine gets very cold.

7th Level

Four contracts - #54 in the Bancroft and North Vein areas, #20 in the North Vein, #59 in the Main Vein, and #6 in the Southeast Vein - spent most of the year mining floors. The first named also breasted North to the hanging near the 2000 East coordinate line but concentrated most of their work on the developed ore area near the intersection 000 South and 1800 East. Contract #20 took out a sizeable floor centered at South 200 and 1900 East. Contract #59, one of our best mining gangs, mined out a floor over 200 feet long in the East end of the Main Vein between 2000 East and 2200 East. In the West end of the Southeast Vein contract #6 took out a "U" shaped floor between the 7th and 8th levels.

9th Level

Three gangs - Nos. 3, 35, and 65 - mined developed reserves in the South Lens, North Vein, and Southeast Vein. We will probably resume raising towards the ore shown up in Diamond Drill Hole #125 on the 7th level. Contract #65 started the raise several years ago and then had to stop until we found a place to store rock. We had planned to put the rock in the West end of the Southeast Vein but found ore in the floor and we have since mined out 23,485 tons of high grade ore.

10th Level

There is a lot of mining being done on the 10th level, but with the exception of #55 contract all of the miners are on development work. #55, however, finished taking the floor on the sub between the 9th and 10th levels in the South Lens.

11th Level

In the North Central portion of the Main Vein Nos. 21 and 39 took out two floors. Late in the year #21 started breasting North towards #7. Contract #39 also had a lot of trouble with loose in the back and spent two months barring.

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"B" Shaft

1st. Level

Two contracts - Nos. 17 and 18 - continued to mine known reserves on the subs above the 1st level. No. 18 took out a floor on the 1205 ft. sub Southwest of the South 800 and 000 West intersection. They also extended the known ore area a little farther West on the 1145 ft. sub 400 ft. Southwest of "B" Shaft. Contract #17,also in the Main Vein, took out a part of the ore known to exist along the hanging on the 1180 ft. sub level 600 ft. Southeast of "B" Shaft.

3rd Level

Contract #73, the most productive gang in the mine, exhausted the floors from the 2nd all the way down to the 4th level 300 ft. North-West of "B" Shaft. The reasons for the large production were nice breaking ore and a downhill pull for the scraper.

4th Level

Contract #71 is being classified as a stoping gang because they mined floors. As a matter of fact, but little of the ore mined was included in the 1936 ore estimate because the area was isolated and the ore in the floor did not become available until #71 put up a new raise from the 5th level. Their stope was located in the North Vein 350 ft. North of "B" Shaft.

6th Level

Between the 6th and 7th levels in the Fault Vein #38 found an extension to the Vein and although this gang mined floors all year as a matter of fact they were a developing gang. They also mined almost as much ore as #73 in the area between 800 West and 1000 West.

7th Level

Contract #19 took out floors between the 7th and 8th levels in the North Central part of the Main Vein between 1000 West and 1200 West.

13th Level

Two gangs - Nos. 37 and 46 - took out floors in the North Central part of the Main Vein. No. 37 finished before the end of the year and was moved to the 15th level to crosscut for the ore found by diamong drilling on the 14th level.

The tabulation following gives the tonnages produced and actually hoisted as enumerated. It might be well to add that in many cases the tonnage broken by a gang is in excess of the cars actually trammed to the shaft and in some cases the reverse is true because we may have hoisted ore in 1937 that was broken in the previous year. There are a few places in the mine where some of the broken ore remains for 8 or 10 years due to mining out of floors between the working place and the shaft. We eventually, however, recover all the broken tonnage.

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"A" Shaft -	1st	Level - No.	30	Contract -	5,060	tons	of ore
-	1st	" - "	34	" -	6,640	"	"
-	2nd	" - "	9	" -	6,605	"	"
-	2nd	" - "	27	" -	11,590	"	"
-	4th	" - "	22	" -	4,520	"	"
-	4th	" - "	29	" -	5,270	"	"
-	4th	" - "	30	" -	5,060	"	"
-	5th	" - "	32	" -	10,215	"	"
-	5th	" - "	40	" -	4,755	"	"
-	5th	" - "	51	" -	6,900	"	"
-	5th	" - "	61	" -	8,780	"	"
-	5th	" - "	66	" -	4,800	"	"
-	5th	" - "	74	" -	325	"	"
-	6th	" - "	2	" -	8,026	"	"
-	6th	" - "	15	" -	5,820	"	"
-	6th	" - "	28	" -	5,025	"	"
-	6th	" - "	41	" -	1,115	"	"
-	6th	" - "	45	" -	5,675	"	"
-	6th	" - "	52	" -	7,410	"	"
-	6th	" - "	60	" -	4,315	"	"
-	7th	" - "	6	" -	8,690	"	"
-	7th	" - "	20	" -	6,850	"	"
-	7th	" - "	54	" -	6,585	"	"
-	7th	" - "	57	" -	10,050	"	"
-	9th	" - "	3	" -	7,725	"	"
-	9th	" - "	35	" -	7,350	"	"
-	9th	" - "	65	" -	7,580	"	"
-	10th	" - "	55	" -	2,765	"	"
-	11th	" - "	21	" -	8,050	"	"
-	11th	" - "	39	" -	7,780	"	"
	Total "A" Shaft				191,325	"	"
"B" Shaft -	1st	Level - No.	17	Contract -	6,865	"	"
-	1st	" - "	18	" -	5,845	"	"
-	3rd	" - "	73	" -	12,305	"	"
-	4th	" - "	71	" -	2,445	"	"
-	6th	" - "	38	" -	12,755	"	"
-	7th	" - "	19	" -	9,375	"	"
-	13th	" - "	37	" -	10,240	"	"
-	13th	" - "	46	" -	12,000	"	"
	Total "B" Shaft				71,830	"	"
	Grand Total "A" & "B" Shaft				263,155	"	"
	Add 5.42% Overrun				14,275	"	"
	GRAND GRAND TOTAL				277,430	"	"

c. Drifting and Raising

Year	Rock Drifts and Raises	Ore Drifts and Raises	Total
1937	4,292 ft.	2,895 ft.	7,187 ft.
1936	4,122 "	2,724 "	6,846 "
1935	3,043 "	2,646 "	5,689 "
1934	2,061 "	1,109 "	3,170 "
1933	615 "	372 "	987 "
1932	1,357 "	585 "	1,942 "
1931	3,577 "	3,212 "	6,789 "

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The totals for 1937 indicate that we did more drifting and raising than the previous high years 1931 and 1936. The figures again reflect the desire to keep up the ore reserves by doing ample development work and prove the point that drifting and raising was not neglected in 1937 despite the pressure brought upon the mine to produce a maximum tonnage.

d. Explosives, Drilling and Blasting:
Explosives Statement for Year 1937

Stoping and Development in Ore

	Quantity	Average Price	Amount 1937	Amount 1936
50% L. F. Extra Gelatin	162,050	11.03	17878.18	15887.50
60% L. F. Extra Gelatin	329,800	12.63	41648.00	28888.25
Total Powder	491,850	12.10	59526.18	44775.75
Fuse - Feet - Eagle Brand	723,900	5.65 M	4091.73	3511.97
#6 Caps	126,850	11.92 M	1512.48	1135.81
Electric Caps	1,075	11.59 C	124.58	131.90
Fuse Lighters	19,250	7.73 M	148.73	140.39
Wire (Shot Cord)	4,890'		45.53	83.57
Fuse Cans, etc.	4		10.36	75.00
Tamping Bags	29,500		99.82	54.20
Miscellaneous			50.00	
Total			6083.23	5132.84
Total All Explosives for Stoping			65609.41	49908.74
PRODUCT			543,567	456,760
Lbs. of Powder per Ton of Ore			.9050	.8575
Cost per Ton for Powder			.1095	.0980
" " " Fuse, etc.			.0112	.0112
" " " All Explosives			.1207	.1092
Development in Rock				
50% L. F. Extra	2,600		281.49	445.75
60% L. F. Extra Gelatin	68,050		8502.00	6876.75
Total Powder	70,650		8783.49	7322.50
Fuse	78,700	5.65 M	443.64	463.87
#6 Caps	12,100	11.92 M	143.48	141.22
Electric Caps	4,800	11.59 C	595.10	234.79
Fuse Lighters	5,150	7.73 M	35.31	35.67
Wire	13,290		137.02	56.20
Tamping Bags	6,500		22.13	14.05
Fuse Cans	2		3.29	
Miscellaneous			58.85	8.80
Total Fuse, etc.			1438.82	954.60
Total All Explosives for Rock Development			10222.31	8277.10
Feet Rock Development			4,292	4,002
Cost per ft. Rock Development			2.38	2.07
GRAND TOTAL ALL EXPLOSIVES			75831.72	58185.84
Avg. Cost per lb. for Powder			.1214	.1147

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Following are comparative figures for the past seven years showing pounds of powder used per ton of ore produced and also the cost per ton for powder.

Year	Lbs. Powder Per Ton of Ore	Cost per Ton for Powder
1937	.9050	.1095
1936	.8575	.0980
1935	.8387	.0982
1934	.7838	.0879
1933	.7561	.0927
1932	.7312	.0914
1931	.8512	.1080

The comparative statement indicates some increased use of explosives per ton of ore which naturally increases the cost per ton discounting the increase in the unit cost for powder. The answer is three-fold - an increased amount of development work, more bulldozing instead of blockholing, and the mining out of leaner ore areas. When we began to crowd the miners for production we had to permit them to do quite a lot of bulldozing. Where ventilation is good, although it takes more powder, the chunks can be broken more readily and quickly by placing powder on top of the chunks than adopting the longer but cheaper method of drilling block holes.

The table shown below gives some comparative data for explosives used in the rock work done the past seven years.

Year	Footage	Lbs. of Powder Used	Lbs. per Foot of Drift or Raise
1937	4,292	70,650	16.5
1936	4,002	62,500	15.5
1935	3,043	49,150	16.1
1934	2,061	32,800	15.9
1933	615	9,200	15.0
1932	1,357	20,100	14.8
1931	3,577	63,150	17.6

A perusal of the 1936 and 1937 statements shows that the use of tamping bags has increased about 20% over the previous year

8. COST OF OPERATING:

a. Comparative Mining Costs

	1937	1936	Increase	Decrease
PRODUCT	543,567	456,760	86,807	
Underground Costs	1.526	1.326	.200	
Surface Costs	.220	.221		.001
General Mine Expense	.262	.227	.035	
Cost of Production	2.008	1.774	.234	
Depreciation	.003	.002	.001	
Taxes	.235	.242		.007
Loading & Shipping	.039	.035	.004	
TOTAL COST AT MINE	2.285	2.053	.232	
No. of Days Operating	297	269	28	
No. of Shifts & Hours	2 8-hr	3 8-hr		
Average Daily Product (tons)	1,830	1,698	132	

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The average daily production has been gradually speeded up as is evident from the following figures:

Year	Average Daily Product
1937	1,830
1936	1,698
1935	1,610
1934	1,595
1933	1,331
1932	1,368
1931	1,448
1930	1,383
1929	1,400

In the 1936 report this statement was made to-wit "Production in 1937 is going to be largely dependent on the speed with which new ore can be developed and made ready for stoping". We have got to continue to do that in 1938 and the years to come if the Cliffs Shaft Mine is going to be called upon to produce 550,000 to 575,000 tons per year. I make the latter a top figure assuming we hoist overtime every night in the week. To accomplish that, however, will involve the purchase of new equipment such as a new motor-generator set, a new shaft cable for the underground haulage system, and probably the duplication of the present shaft cables feeding the underground scraper hoists.

Detailed explanations of the various accounts on the cost sheets for 1936 and 1937 follow:

Exploring in Mine

Year	Labor	Supplies	Total
1936	$ 3,330.45	7,415.08	10,745.53
1937	4,575.62	8,758.89	13,334.51

The detail of the above figures follow:

	1937	1936
Labor for diamond drill	$ 4,379.50	3,211.02
Proportion of D. D. Supt's Time	196.12	119.43
Carbon Loss	2,342.76	1,761.36
Pipe & Fittings	177.60	7.73
Drill Equipment & Repairs		414.66
" " Rental	568.75	605.78
Miscellaneous Supplies	69.59	57.83
Compressor Expense	575.00	625.00
Total Drilling Cost	8,309.32	6,802.81
Miscellaneous & Direct Charges	1,027.99	1,171.05
Analysis Expense	396.37	491.03
Geological Dept. Expense	3,600.83	2,280.64
Grand Total	13,334.51	10.745.53
Cost per foot	3.445	2.517
Feet drilled for the year	2,825	3,362

Both labor and supply cost per foot increased in 1937. There are three reasons for the increased cost. Both labor and supply costs are up because of the 21.6% increase in the base rate for labor which in turn increases the supply costs also. Carbon loss was doubled in 1937,

the loss for 1936 being 12.65 carets compared with 22.24 in 1937. This is due to a difference in ground drilled in the past two years. Jasper and lean ore slow up drilling. Siderite is intermediate between Jasper and slate or dike, the latter materials being the easiest to drill. In 1936 1,841 feet out of a total of 3,362 ft., or 55%, was dike or slate material. In 1937 only 780 feet represents the dike and slate out of a total footage of 2,825. You can drill twice as much slate and dike in a shift, 21 or 22 feet a day being the average. When Siderite or Jasper is cut, footage drops back to 10 to 12 feet per day.

Development in Rock

A tabulation is submitted giving figures for the past four years:

		Labor Cost		Supply Cost		Total Cost	
Year	Footage	Total	Per Foot	Total	Per Foot	Total	Per Foot
1937	4,292	$46,240.53	10.78	$15,808.94	3.70	$62,049.47	14.48
1936	4,122	29,973.19	7.27	13,826.79	3.35	43,799.98	10.62
1935	3,043	19,725.90	6.48	11,486.68	3.77	31,212.58	10.25
1934	1,932	14,556.29	7.53	7,341.89	3.80	21,898.18	11.33

The unit cost shows a heavy increase for 1937. The supply cost is no greater per foot than it was in 1934 and 1935 but the labor cost has increased about 48%. Wages went up 21.6% in 1937 but the penalty due to paying time and a half for Saturdays actually increases wages 31%. Another factor influencing costs is the height of the rock raising done in any one year because long raises retard progress. In 1936 1,060 feet, or 25.7%, of the total of 4,122 feet were rock raises. A high raise costs us more per unit foot than a rock drift. Furthermore, a full size 10' x 10' rock drift would cost more than a 8' x 8' drift driven for storage battery locomotive haulage.

Comparative figures for rock raises, large and small rock drifts, follow:

	1937	1936
Rock Raises	1657'	1060'
10' x 10' Rock Drifts	1906'	2105'
8' x 8' Rock Drifts	729'	957'
Total	4292'	4122'

Another factor that greatly influences costs is the kind of material drifted through. The big projects in 1937 which were #4 drift, #23 drift, and #47 drift, were in Jasper or Siderite most of the year. For instance, we drifted 710 ft. in #47's drift in 588 working shifts in 1937 compared with 1,043 feet in 1936 in 527 shifts. For the first 9½ months of 1936 the drift was in dike. It then entered a Jasper zone and was in that material all of 1937. The 1937 unit cost for that drift alone was $18.31 per foot.

Development in Ore & Stoping

These two accounts are so closely interwoven that it is very difficult to segregate them. As mentioned previously in this report, a miner (such as #54) will have two or three working faces tributary to his raise. In one place he will mine out developed floors or backs and in the others will actually develop new ore. Even in the drifts it is difficult to draw a sharp line between Stoping and Developing in Ore.

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For instance, #5 drove 350 feet of 10' x 10' ore drifts and then sliced and stoped out the back of the same drift during the year. In some months or even half months both operations were carried on. Both #10 and #70 in the Bancroft area breast stoped and mined floors in the same half month. Contract #8 did both also. Some gangs, like #73, mined nothing but floors all year and others, like #48, drove only breast stopes out into unknown territory. The list is endless showing the futility of trying to keep the two accounts separate. A "Breaking Ore" account as we had years back would come nearer the truth than the present bookkeeping set-up.

Following is a detail of the labor and supplies combined for both Development in Ore and Stoping.

Year	Labor Cost	Supply Cost	Total Cost
1937	$ 234,506.85	98,963.60	333,470.45
1936	151,285.89	75,334.38	226,620.27

A detail of the Labor and Supply Costs Follows:

	1937		1936	
Labor	Total	Cost Per Ton	Total	Cost Per Ton
Miners' Labor	$ 166,546.27	.307	112,376.39	.246
Other Labor	67,960.58	.125	38,909.50	.087
Total Labor	234,506.85	.432	151,285.89	.333
Supplies				
General	1,606.89	.003	2,583.92	.005
Iron & Steel	16,252.80	.030	10,354.35	.022
Oil	949.12	.001	777.90	.002
Machinery	6,866.75	.012	5,846.42	.012
Explosives	65,609.41	.121	49,045.23	.107
Lumber	371.25	.001	260.04	.001
Sundries	2,113.37	.004	551.43	.001
Expense Accounts	5,194.01	.009	5,915.09	.013
Total Supplies	98,963.60	.181	75,334.38	.163
TOTAL LABOR & SUPPLIES	333,470.45	.613	226,620.27	.496
Tons Produced	543,567		456,760	

The unit cost increase for labor is .099 per ton or 29.7% increase. This is a normal increase because the increase in the miners' wage rate was 21.3% but because of the penalty paid for the Saturday operation the increase in rate is really 31.4%. We did not pay time and a half at the end of each one of the 52 weeks because the new rate did not go into effect until March 16th and there are a few weeks in the year when holidays prevent us from working six days. The records show that we paid the penalty rate for 34 days.

The supply account shows that the increased cost was confined to two items - Iron & Steel, and Explosives. In both cases prices increased. The largest item under Iron & Steel was drill steel and detachable bits, but mostly bits. In 1936 the price per bit was 27¢. In 1937 the average price was about 31½¢. Explosives cost about 6% more in 1937 which would

account for half the increase. The balance is due to a larger consumption of powder per ton of ore due to mining in so many narrow veins and also leaner ore areas. We also made an attempt to produce as much lump as possible by changing in October from a 50% L. F. Extra to 60 L. F. Extra Gelatin. The main idea, however, was to reduce the amount of block holing and bulldozing because that operation fills the mine workings with smoke and possibly also increases the percentage of fines. We know we do less blasting of chunks since changing the grade of powder used because there are fewer block holing fuses being sent underground. In September, for instance, with a mine tally of 43,597 tons we issued 4,745 four and five foot fuses. In December the mine tally showed 45,886 tons with only 4,240 four and five foot fuses used. Whether or not we are now at the end of the year producing more lump than during the active shipping season cannot be accurately ascertained until 1938 because all the product including both lumps and fines must be shipped from the pockets to get the weight of both grades.

Timbering

Year	Total Cost	Cost per Ton
1937	$ 12,947.52	.024
1936	14,041.32	.031
Decr. for 1937	1,093.80	.007

The cost for any particular year for this item of the cost sheet will vary according to the number of new chutes that must be built and the costs also fluctuate by the amount of retimbering necessary to keep the old chutes servicable. Following the depression period, during which so many repairs were postponed, the timbering cost ran very high. Both 1935 and 1936 show high figures. The past year merely reflects normal and routine repairs.

Tramming & Electric Tram Equipment

	Labor		Supplies			
Year	Total	Per Ton	Total	Per Ton	Total	Per Ton
1937	$197,949.32	.364	12,907.40	.024	210856.72	.388
1936	129,185.38	.283	9,708.66	.021	138894.04	.304
Increase	68,763.94	.081	3,198.74	.023	71962.68	.084

The total cost per ton increased 27.6%, of which labor contributed 28.7%. In other words, the increase is almost directly proportional to the increase in wages.

Following are the comparative costs for maintenance of the electric haulage system:

	1937			1936
	Labor	Supplies	Total	Total
Generators & Motors	$ 265.37	64.06	329.43	$ 127.60
Locomotives	1119.27	238.85	3501.12	4536.87
Wiring	580.35	1321.39	1901.74	2606.46
Main Line Tracks	8031.91	3019.44	11051.35*	11902.17
" " Cars	6757.43	4429.31	11186.74	9260.76
Spotting Engines		849.10	849.10	91.69
Total	16754.33	12065.15	28819.48	28525.55

* To make the figures agree with the cost sheet, the sum of $1048.46 should be deducted for #47's drift which is chargeable to the Section 9 Exploration account.

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It will be noted that the total expenditures show but little change in two years. In 1936 we bought and charged out 10 new 5-ton cars but in 1937 we spent even a larger amount for main line cars. We kept four blacksmiths and helpers busy most of the year repairing the main line cars on the 8th, 10th, and 15th levels. We also equipped all the old 5-ton cars with the new type "Willison" couplers. The item "spotting engines" covers the purchase of two new "Utility" hoists used for switching cars on the 8th and 10th levels "A" Shaft.

Pumping

		Cost per Ton
Operating Cost as per Cost Sheet for 1937 -	$ 28,414.74	.052
Maintenance " " " " " " " -	1,779.93	.003
Total -	30,194.67	.055
Operating Cost as per Cost Sheet for 1936 -	27,774.37	.061
Maintenance " " " " " " " -	741.76	.002
Total -	28,516.13	.063

A detail of the 1936 and 1937 costs shows these figures:

	1937	1936
Maintenance	$ 1,779.93	741.76
Pumpmen Labor	7,338.56	6,170.22
Other Labor	643.97	359.47
Total Labor	7,982.53	6,529.69
Compressor Expense	600.00	830.00
Oil, Waste, and Packing	373.54	265.54
Tools	70.17	38.58
Electric Light	349.17	390.14
" Power	19,039.33	19,720.42
Total Operating Expense	28,414.74	27,774.37
" Maintenance & Operating	30,194.67	28,516.13
Gallons of Water Pumped	370,846,799	390,115,773
Gallons of Water Pumped Per Minute	706	740

The above comparisons reflect the increase in wages in 1937 because the labor items increased. Maintenance costs went up due to installing a new extra heavy 8" check valve and we also purchased a new Ingersoll-Rand sump pump to be used for emergencies.

In October the wine bore and sump on the 10th level "A" Shaft became plugged, flooding the level and the bottom of the shaft. Most of the incoming water entering the mine gets to "A" Shaft on the 10th Level and is led from the 10th to the 15th levels through a pipe line in the shaft and in case the main pipe develops trouble a second or spare pipe is used. Both these lines failed and it was then decided to revamp the entire installation. These repairs were completed in October.

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A comparison for 1936 and 1937 gives comparative data for each month, viz:-

	Gallons Per Minute	
	1937	1936
January	732	699
February	736	727
March	658	664
April	656	672
May	717	696
June	754	697
July	711	750
August	712	757
September	713	815
October	698	813
November	692	815
December	686	772
Average for Year	706	740

The above figures clearly reflect the heavy rainfall in the latter part of 1936.

Compressors, Air Pipes, & Power Drills

	1937	Per	1936	Per	Incr.	Per
	Total	Ton	Total	Ton	Total	Ton
Compr. & Air Pipes	$ 44,761.88	.082	37,164.15	.081	7,597.73	.001
Compr. & Power Drills	14,247.74	.026	10,983.09	.024	3,264.65	.002
Total	59,009.62	.108	48,147.24	.105	10,862.38	.003

To Explain the increase it is necessary to break down the figures.

	1937	1936
Labor for Compressors & Air Pipes	$ 5,831.87	6,213.10
" " " & Power Drills	3,035.84	707.14
Total Labor	8,867.71	6,920.24
Supplies for Comprs. & Air Pipes	38,930.01	32,003.82
" " " & Power Drills	11,211.90	9,223.18
Total Supplies	50,141.91	41,227.00
GRAND TOTAL	59,009.62	48,147.24

The foregoing figures plainly indicate that the increased cost is due to much larger labor costs for maintenance of compressors and power drills and heavier supply charges mainly under the account Compressors & Air Pipes. The first can be explained by the installation of the spare 2450 cu. ft. per minute compressor moved in from the Morris Mine. We spent $2,799.28 for labor and $1,079.87 for supplies to complete the tearing down, moving, and re-installation of this unit.

The supplies charged to Compressors & Air Pipes increased nearly $7,000 and this is due to more new piping installed and increase in prices.

The following table is of interest, viz:-

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Air and water pipes installed in 1936 and 1937:

	1937	1936
1/2" Pipe	898'	300'
3/4" "	8,253'	2,952'
1" "	7,470'	9,546'
1¼" "	1,003'	2,302'
1½" "	2,801'	1,192'
2" "	5,897'	8,180'
3" "	4,221'	1,617'
4" "	1,014'	
Total	31,557'	26,089'

It will be noted that there is an increase in footage in the larger sizes which naturally cost much more than the small pipe.

We also gave the miners 1265 ft. of 1/2" Water hose and 1490 ft. of 1" air hose during the past year.

The biggest project undertaken was the revamping of the compressed air pipe system in the East end of the 6th, 7th, 8th, and 9th levels, "A" Shaft. We found late in the Fall that the contracts working on these levels were hampered with poor air pressure and to remedy that condition a new 4" line was run direct from the shaft out East on the 8th Level and 3" lines tapped off the end for the 6th, 7th, and 9th levels.

New Drills Purchased in 1937

14 - N-75 Ingersoll-Rand Standard Drifters
7 - D-12 Cleveland Standard Drifters
5 - J-45 Ingersoll-Rand Block Holers

Back Filling

Cost for 1937	-	$ 5,932.24	Cost per ton	.011
" " 1936	-	5,775.28	" " "	.013
Increase	-	156.96		
Decrease	-			.002

The back filling item shows little change, the small increase in total cost being due to increased wage rate. Most of the cost is incurred on the night shift when rock from all the rock drifts and rock storage raises is hoisted to the 2nd level "A" Shaft and dumped into the big storage raise. On the following day shift the 5th level motor crew distribute and dump the rock into old stopes. There are certain levels, however, where it is possible to tram the rock from the headings and raises and dispose of it on the same level.

Underground Superintendence

	Total Cost	Cost Per Ton
1937	$ 25,883.12	.048
1936	19,126.80	.042
Increase	6,756.32	.006

We made no change in the number of bosses employed underground, the increased cost being entirely due to change in the monthly wages paid to the Captain, Mine Foremen, and Shift Bosses.

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Scrapers & Mechanical Loaders

	Labor Cost	Per	Supply Cost	Per	Total Cost	Per
Year	Total	Ton	Total	Ton	Total	Ton
1937	19,077.92	.036	38,036.46	.069	57,114.38	.105
1936	13,163.72	.029	27,948.81	.061	41,112.53	.090
Incr.for 1937	5,914.20	.007	10,087.65	.068	16,001.85	.015

It will be observed that the larger amount of the increased expenditure is supplies and so we have itemized that:

	1937		1936	
	Amount	Cost	Amount	Cost
3/8" Wire Rope	2,240'	$ 191.53	2,450'	$ 208.97
1/2" "	5,900'	612.82	2,150'	234.91
5/8" "	62,575'	11516.06	66,961'	9120.90
Electric Cables	10,175'	3678.87	4,000'	1480.13
" Motors	11 (New)	3010.48	11 (New)	2923.23
New Scraper Units	8 (New)	4165.52	6 (New)	3724.85
General Repairs		)		5406.15
Gen'l Electrical Repairs & Renewals		14861.18)		3214.51
Miscellaneous				1635.16
Total		$38036.46		$27948.81

We continued to add to the scraping equipment in order to give the Sales Department the desired product but the fact that we added eight complete new scraping units does not mean that we started up eight new mining contracts. We have found it advisable to sometimes put two scrapers in one working place to eliminate cross hauling. Contract #8 for instance has three scrapers. Contract #17 has two. No. 19 has two, etc. etc. The idea in those places is to try and place the scraping units so that the operator can see the entire operation instead of pulling around a blind corner.

We changed the type of 5/8" rope from the ordinary standard 6 x 19 construction to "Trulay" type. Trulay costs us more money per foot but it is guaranteed to give us longer life and to prevent accidents from splinters of wire rope getting into the hands. The cost of rope of ordinary construction in 1936 was .0195 per ton of ore produced. In 1937 Trulay gave us a unit cost of .0212. The consumption of rope per scraper hoist per shift in 1936 was 3.83 ft. compared with 2.88 in 1937. This would indicate a reduction of almost exactly 25%. The price of "Standard" type is 19.9% lower than "Trulay" so that it would appear that the change was justified. Another fact should be brought out and that is that the 1937 figures do not tell the complete story because not all of the scraping units were equipped with Trulay until April or May. We use up about 5,000 ft. of rope per month. There is an average of 550 ft. of rope used per scraper unit so that it would take us about 6½ months to shift all of the scrapers in the mine from one kine of rope to another based on our regular monthly consumption.

In view of the foregoing statement we have reconstructed our figures to show the scraper rope consumption for the last six months of 1936 and 1937 to get an accurate comparison.

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Year	Product	5/8" Rope Consumption	Cost	Cost Per Ton Produced	Consumption Per Scraper Per Shift
1937	279,994 Tons	36,070'	$6,811.53	.024	3.34'
1936	243,276 "	40,669'	5,573.88	.023	4.44'

The figures for the last half of each year do not agree with the yearly figures but that is exactly why they are put into this report. We feel that the latter data is more accurate.

Hoisting

Comparative data for 1937 and 1936 is as follows:

	1937	1936
Maintenance	$ 6,808.97	5,321.99
Operating Expense:		
Engineers' Labor	10,307.87	6,098.49
Other Labor	1,479.00	1,132.44
Total Labor	11,786.87	7,230.93
Supplies		
Oil, Waste, & Packing	105.43	114.52
Tools	42.78	47.64
Electric Lights	131.16	95.32
" Power	16,107.31	13,733.90
Compressor Expense	260.00	390.00
Heating Expense	970.83	831.03
Total Supplies	17,617.51	15,212.41
Total Operating Expense	29,404.38	22,443.34
" Maintenance & Optg. Exp.	36,213.35	27,765.33
Tons of Ore & Rock Hoisted	584,649	489,310
Average Depth Hoisted	677'	671'
Cost per Ton	.054	.049

There were two new hoisting ropes put into service in 1937, none in 1936, and three in 1935.

Stocking Ore

Total for 1937	$15,358.16	Cost Per Ton	.028
" " 1936	12,225.77	" " "	.027
Increase for 1937	3,132.39		.001

There were no unusual items this past year, the increased cost being due to higher wages.

Screening - Crushing at Mine

	1937		1936	
	Amount	Per Ton	Amount	Per Ton
Labor	$ 19,558.82		12,864.12	
Supplies	10,909.99		12,378.67	
Total	30,468.81	.056	25,242.79	.055
Incr. for 1937	5,226.02	.001		

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Labor costs increased 50% due partially to increased wage rate and partly to change in charging labor for rock pickers employed on stockpile areas and on picking belt in the shaft house. There are no more men employed in the crusher building than formerly with one exception and that is that we have two of the men, employed in the laboratory during the shipping season, act as samplers during the stocking season. This job was created in November 1936 to get a more accurate analysis on the daily product.

Dry House

Year	Total Cost	Per Ton
1937	$ 7,806.77	.014
1936	5,888.71	.013
Increase	1,918.06	.001

Increase due to labor charges because those costs increased $1,682.58 from $3,383.41 to $5,065.99. The fact that the mine worked six days a week during most of 1937 added three extra shifts each week. On the days the miners and other underground labor are employed, regular drymen report for duty. When only a skeleton crew works underground the floorman in the engine house looks after the dry. When the new dry for surface employees began being used, one of the surface men was delegated to work enough time within the new building to keep it cleaned up.

General Office Expense

Year	Total Cost	Per Ton
1937	$10,596.66	.019
1936	7,862.69	.017
Increase	2,733.97	.002

With the exception of two items totalling approximately $500.00 for resurfacing the road from the laboratory to the mine office and that portion of the road around Lake Bancroft going from the main office to the dryhouse, 90% of the surface expense is labor.

Shaft

Year	Total Cost	Per Ton
1937	$ 2,159.01	.004
1936	2,389.91	.005
Decrease	230.90	.001

Less shaft repairs which means fewer new runners installed in 1937.

Top Tram Equipment

Year	Total Cost	Per Ton
1937	$ 7,467.90	.014
1936	4,471.64	.010
Increase	2,996.26	.004

We added two new top tram stocking cars for the crushed ore piles, the one for the Bancroft pile equipped with a new type of brass bearing axles, the other for the Cliffs Shaft crushed pile was built with roller bearing wheels and axles.

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We had also in years past always had trouble with the running gear on the big "Granby" type cars used to transfer the run of mine ore from the shaft houses to the crusher building. One of the axles on these cars would break without warning, tying up all production for an hour or two. We finally decided to redesign the axles and bearings, increasing the wearing surface about 250%. All three cars were rebuilt and to date have given us no trouble.

Docks, Trestles & Pockets

Year	Total Cost	Per Ton
1937	$ 3,802.86	.007
1936	4,631.48	.010
Decrease	828.62	.003

Cost for 1936 higher than the average due to extensive rebuilding repairs of the main chutes and pockets in the crusher building and those outside alongside of the loading tracks. Also in 1936 a large area of the lump ore stocking grounds was regraded and planked with new 3" hemlock.

Mine Buildings

The various items under this heading have already been mentioned and detailed costs given under the caption "Surface".

General Mine Expenses

Mining Engineering

Year	Total Cost	Per Ton
1937	$ 4,931.33	.009
1936	1,361.45	.003
Increase	3,629.13	.006

Large increase due to closer engineering supervision and because it was necessary to make up a lot of new tracings and mounted maps in the office. This work had been postponed for the past four or five years.

Mechanical & Electrical Engineering

Year	Total Cost	Per Ton
1937	$ 1,743.20	.003
1936	1,430.26	.003
Increase	312.94	

Normal increase due to change in wage rate.

Analysis & Grading

Year	Total Cost	Per Ton
1937	$14,553.01	.027
1936	9,649.47	.021
Increase	4,903.54	.006

This is a Central Office charge, each mine being charged a portion of the Shipping Department and Central Laboratory expense.

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Safety Department

Year	Total Cost	Per Ton
1937	$ 2,229.75	.004
1936	1,370.93	.003
Increase	858.82	.001

This is another Central Office charge covering our proportion of the expense of maintaining the Safety Department.

Telephones & Safety Devices

Year	Total Cost	Per Ton
1937	$ 5,105.51	.009
1936	4,517.84	.010
Increase	587.67	
Decrease		.001

A normal increase considering the increased rate of wages for 1937. Most of the cost, however, is for supplies keeping the lighting system in proper shape. We charge all flood lights, cable and transformers on the lighting system, both surface and underground, to this account.

Local & General Welfare

Year	Total Cost	Per Ton
1937	$ 6,255.00	.012
1936	5,517.65	.012
Increase	737.35	

All of these expenses are charges from the Sociological Department.

Special Expense, Pensions & Allowances

Year	Total Cost	Per Ton
1937	$ 9,437.13	.017
1936	10,090.50	.022
Decrease	653.37	.005

This is another account over which the local mine has no supervision, all charges emanating from the Central Office and Cleveland.

Ishpeming Office

Year	Total Cost	Per Ton
1937	$21,531.00	.040
1936	18,062.98	.039
Increase	3,468.02	.001

Another Central Office charge based on figures that come from the Cleveland Office apportioned presumably on a payroll basis.

Mine Office

Year	Total Cost	Per Ton
1937	$21,163.16	.039
1936	18,948.67	.042
Increase	2,214.50	
Decrease		.003

The major portion of this expense is labor that is charged to the mine by the Central and Cleveland offices.

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Insurance

Year	Total Cost	Per Ton
1937	$ 4,990.58	.009
1936	1,361.45	.003
Increase	3,629.13	.006

This account in 1937 covers four separate items - Fire Insurance, Group Insurance, Catastrophe Insurance, and Riot Insurance. The Group Insurance premiums that the company pays increased the cost for 1937 more than any other item.

Personal Injury

Year	Total Cost	Per Ton
1937	$21,023.30	.039
1936	15,359.31	.034
Increase	5,663.99	.005

Increased because payrolls went up. The monthly expense is still figured at 2% of the total, to which is added the Ishpeming Hospital loss and expense of running the compensation department.

Social Security Taxes

Year	Total Cost	Per Ton
1937	$20,633.37	.038
1936	4,758.60	.010
Increase	15,874.77	.028

This account covers old age and unemployment benefits.

Employees Vacation Pay

Year	Total Cost	Per Ton
1937	$ 8,496.08	.016
1936	7,072.82	.016
Increase	1,423.26	

Increase due to larger payroll in 1937 and increased wage rate.

18. EXPLORATIONS

Major exploration projects are really confined to diamond drilling and the Section 9 exploratory drift going West on the 10th level "B" Shaft.

Following is a resume of the drilling done during the year:

Diamond Drill Hole #442 - Depth 429 ft. - 7' of Ore
443 - " 100 " - 26' "
444 - " 137 " - 32' "
445 - " 98 " - 27' "
446 - " 89 " - 0' "
447 - " 76 " - 0' "
448 - " 168 " - 0' "
449 - " 184 " - 0' "
450 - " 331 " - 6' "
451 - " 148 " - 37' "
452 - " 312 " - 0' "
453 - " 379 " - 12' "
454 - " 119 " - 54' "
455 - " 179 " - 0' "

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With the exception of the new lens of ore discovered along the North side of the 14th level "B" Shaft, the diamond drill uncovered nothing of note during the year. Some years we find more ore by exploratory drifts and raises than we do by drilling. That is exactly what happened in 1937. Other years the reverse is true and we uncover more new territory by drilling.

The Section 9 drift going West has been described in detail under the heading "Developing".

10. TAXES

Following is comparative data on taxes for 1937 and 1936:

	1937		1936	
	Valuation	Taxes	Valuation	Taxes
Realty	$ 2,510,000	85452.45	$ 2,025,000	68615.91
Minerals under NW¼ Sec.9-47-27	100,000	3404.48	80,000	2710.75
Personal	600,000	20426.90	780,000	26429.85
Lot 2, Sec. 3-47-27 (Bancroft)	450,000	15320.16	300,000	10165.32
SE¼ of NE¼ Sec.9-47-27 (Barnum)	52,000	1770.33	47,000	1592.57
Lot 174, Nelson Addition	100	3.41	100	3.39
South 35.91 ft. of Lot 179	50	1.70	50	1.69
Total	3,712,150	126379.43	3,232,150	109519.48
Collection Fees		1263.79		1095.20
GRAND TOTAL		127643.22		110614.68
Taxes per ton produced		.2348		.2422
" " " shipped		.2474		.2054

Valuation and taxes for the past few years are summarized:

Year	Taxes	Valuation
1937	$ 127,643.22	3,712,150
1936	110,614.68	3,232,150
1935	101,853.17	3,202,110
1934	99,486.51	3,119,110
1933	99,072.28	3,160,110
1932	123,114.90	3,640,130
1931	159,547.60	4,000,150
1930	146,588.82	3,725,150

The increase in valuation assessed against the Cliffs Shaft Mine raised the amount of taxes more than the increase in rate. The rate for 1937 was $34.0444 per $1,000 compared with $33.8861 for the previous year.

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The tax levy for the City of Ishpeming for the past two years follows:

	1937	1936
County Tax	$ 69,087.48	$ 64,865.22
" Road Tax	17,429.79	6,023.20
" Debt Service Tax	2,959.93	3,205.48
Highway Fund Tax	79,700.00	69,450.00
Library " "	9,700.00	7,300.00
Fire " "	10,400.00	12,400.00
School "	71,844.74	67,181.84
" Debt Service Tax	24,875.00	25,312.50
Sewer Fund Tax	4,100.00	2,100.00
Cemetery Fund Tax	5,100.00	4,500.00
City Tax General Fund	44,400.00	37,850.00
City Debt Service Tax	16,235.00	8,500.00
Water Fund Tax	6,000.00	5,300.00
Total	361,825.94	313,988.24

There is an increase of $47,837 in the taxes levied by the City of which the County contributes only about 30%.

The City budget itself is responsible for 70% of the increase.

11. ACCIDENTS AND PERSONAL INJURIES

The following figures give a five-year picture of the safety record of the Cliffs Shaft Mine:

	1937	1936	1935	1934	1933
Number of No-Time Lost Accidents	101	62	49	51	8
Compensable or Fatal Accidents	10	3	7	9	2
Number of Man Shifts Worked	109,412	93,937	59,597	45,910	18,694

On the face of it our 1937 record looks poor compared with the year before, being about on a par with 1935, when you consider the total man shifts worked which is the only correct way to measure exposure to accidents. Fortunately, we suffered no fatality during 1937 but we did have two bad compensable accidents. The surface boss was home for nearly half the year with a broken knee cap resulting from a fall off the dryhouse roof. A crusher man preparing samples for the laboratory lost several fingers in a roll type crusher because he disobeyed the rules and jammed his hand through the guard to remove chunks.

12. NEW CONSTRUCTION OR EQUIPMENT

E. & A. No. 708

This covers equipment needed to increase production covering 12 new drifting machines, also replacement of cells in storage battery locomotives and 4 double drum scraper hoists. We purchased the 12 machines and also 4 scraper hoists but so far have found it unnecessary to replace the cells for the storage batteries. This E. & A. should therefore be kept open during 1938.

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E. & A. No. 743

Expenditures of $1,048.97 out of $3,500.00 authorized were incurred installing a vibrating screen at the Maas Mine crusher in the hopes of being able to screen out some of the larger lump in the crushed grade. The revolving screen at the Cliffs Shaft Mine has a $2\frac{1}{2}$" hole and it was thought advisable to try and salvage all the lumps from 2" up and add them to the lump grade. The experiment, however, did not prove successful because the quantity of lump saved was too small.

E. & A. No. 746

Covers 6 more drifting drills, all of which were bought by the end of the year.

E. & A. No. 768

Authorized the purchase of an Ingersoll-Rand semi-automatic Jackbit grinder. This machine was at the mine on trial for six months before we actually bought it. It grinds and dresses 275 bits per day which is double the work done by the other machines. It also centers the bits better and does a better job of gauging them.

14. MAINTENANCE AND REPAIRS:

Dwellings

A detail of the expense control for rented buildings in the Ishpeming District follows:

	Rented Buildings			Loc. Expense	Grand
	Labor	Supplies	Total	Cleaning, etc.	Total
Hard Ore Location	1926.07	2268.48	4194.55	876.71	5071.26
Nebraska "	-	11.20	11.20	-	11.20
Barnum "	1264.15	1114.66	2378.81	68.48	2447.29
Angeline "	-	173.53	173.53	678.12	851.65
Salisbury "	-	3.06	3.06	137.92	140.98
Second Addition	694.92	796.00	1490.92	721.59	2212.51
Outhwaite Purchase	605.35	555.15	1160.50	-	1160.50
Hyde Purchase No. 1	22.41	.75	23.16	-	23.16
" " " 2	398.61	664.35	1062.96	-	1062.96
Smith Purchase	1137.35	1426.32	2563.67	-	2563.67
Nelson Purchase	17.50	26.01	43.51	-	43.51
Total	6066.36	7039.51	13105.87	2482.82	15588.69

We have continued to sell the older dwellings to the tenants occupying them. In one or two cases houses were sold to company employees that were occupying other dwellings. Thirteen were sold in 1936 and twelve in 1937.

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15. POWER

Electric power used at the Cliffs Shaft Mine for 1937 totalled 6,300,800 k. w. h. compared with 5,415,857 in 1936 and 3,710,853 k. w. h. in 1935. Cost per k.w.h. was .014553. In 1936 the rate was .01397 and in 1935 .0161.

Following is a detail of the 1937 consumption:

	K. W. H.	Cost
Tramming	365,670	$ 5,321.62
Pumping	1,334,205	19,416.70
Hoisting	1,115,515	16,234.09
Crushing	191,025	2,779.98
Stocking	8,465	123.20
Dry House	18,210	265.05
Surface	15,825	230.34
Telephones & Safety Devices	64,825	943.43
Mine Office	6,455	93.92
Machine Shop	2,895	42.13
Carpenter Shop	2,155	31.36
Drill & Bit Shop	31,315	455.72
Heating Plant	9,400	136.84
Compressors	2,499,150	36,370.14
Electric Haulage	438,585	6,382.70
Miscellaneous	690	10.20
Total	6,104,385	$88,837.43

Comparative data for 1936 and 1937 shows how the increase or decrease varies under the different sub-divisions:

		1937	1936	% Increase	
Production (tons)		543,567	456,760	18.9	
Tramming	K.W.H.	365,670	311,794	17.3	
Pumping	"	1,334,205	1,439,292	7.3	Decrease
Hoisting	"	1,115,515	990,324	12.6	
Crushing	"	191,025	114,974	66.1	
Stocking	"	8,465	13,608	37.6	Decrease
Dry House	"	18,210	9,046	100.1	
Surface	"	15,825	17,447	9.3	Decrease
Telephones & Safety Dev.	"	64,825	54,177	19.6	
Mine Office	"	6,455	6,439	0.2	
Machine & Carpenter Shop	"	5,050	3,427	47.4	
Drill & Bit Shop	"	31,315	11,743	166.1	
Heating Plant	"	9,400	12,406	24.2	Decrease
Compressors	"	2,499,150	2,072,739	20.6	
Electric Haulage	"	438,585	357,942	22.5	
Miscellaneous	"	690	508	35.8	

The decreased consumption for pumping is easily explained by less water being pumped. The decrease under heading "Stocking" is due probably to too much current being charged to crushing ore and not enough to stocking ore. Both circuits are on the same switchboard

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18. NATIONALITY OF EMPLOYEES:

	American Born	Foreign Born	Total
English	72	32	104
Finnish	62	86	148
Swedish	36	23	59
Italian	11	11	22
French	26	4	30
Norwegian	12	6	18
Irish	8	2	10
German	3	-	3
Scotch	1	-	1
Total	231	164	395

Comparison for 1937 and 1936 follows:

	1937		1936	
	Number	% of Total	Number	% of Total
English	104	26.3	98	26.2
Finnish	148	37.5	135	36.0
Swedish	59	14.9	64	17.1
Italian	22	5.6	16	4.3
French	30	7.6	32	8.5
Norwegian	18	4.5	14	3.7
Irish	10	2.5	10	2.7
German	3	0.7	4	1.1
Scotch	1	0.4	1	0.4
Total	395	100.0	374	100.0

It will be noted that about one-third of the entire force are Finns, followed by one-fourth representing the English, and the Swedes making up about one-seventh of the total. There is no great variation in percentages for the two year period.

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1. GENERAL

Production and shipments from the Lloyd Mine in 1937 surpassed all previous combined records since the opening of the Morris and Lloyd properties. The working schedule for the greater part of the year was virtually at capacity production of the Lloyd Shaft. The total production was 545,274 tons, the largest monthly production was 51,449 tons in September, and the highest average daily hoist was 2,299 tons in October.

The lease and management agreement with the Republic Steel Corporation continued in effect. Under these provisions, production was split into 204,838 tons for the account of Republic and 340,436 tons for the account of Cliffs, while shipments were 246,465 tons and 397,930 tons respectively.

The working force reached a maximum of 274 in October and the yearly average approximated 263 men. Extensive additions and improvements were made to the surface plant, and this work also included landscaping of the grounds near the main building.

Mining operations continued in the East Lloyd deposit in three separate areas. The first was at the east end above the 4th Level, the second was in the center of the ore body below the 4th Level, and the third was the sub level stoping area at the west end of the deposit above the 5th Level. The larger share of production resulted from the top slicing area in the center, and here also the proportion of Lloyddale grade was highest. The analysis of ore was practically unchanged from that of last year except for an increase in the iron content of the Silica grade.

2. PRODUCTION SHIPMENTS & INVENTORIES

a. Production by Grades

Grade	Tons
Lloyddale	400,394
Lloyd Silica	144,880
Total	545,274

This product compared with a total of 364,326 tons in 1936. The proportion of silica grade was reduced slightly from 28% in 1936 to 26.5% in 1937. No Lloyd grade ore was produced in 1937, the lower phosphorus material from the west end being included in the Lloyddale grade.

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2. PRODUCTION
SHIPMENTS &
INVENTORIES (Cont.)

b. Shipments

Grade	Pocket Tons	Stockpile Tons	Total Tons	Total Last Year
Lloyddale	235,968	210,416	446,384	274,833
Lloyd Silica	91,136	55,686	146,822	77,052
" " #1	-	4,910	4,910	1,221
Morris	-	46,279	46,279	-
Total	327,104	317,291	644,395	353,106
Total Last Year	206,892	146,214	353,106	
Increase	120,212	171,077	291,289	

The following table shows the shipments for the past five years:

Year 1933	171,917
1934	99,023
1935	180,208
1936	353,106
1937	644,395

The continuous increase since 1934 may be noted. Also, that shipments exceeded production by nearly 100,000 tons in 1937.

c. Stockpile Inventories

Grade	Tons
Lloyddale	58,993
Lloyd Silica	50,053
Total	109,046

In spite of the increased production, this is the lowest stockpile balance at the year end for some years past.

d. Division of Product by Levels

The ore produced above various levels was as follows:

	Lloyddale Tons	Lloyd Silica Tons	Total Tons
Third Level	5,310	2,735	8,045
Fourth Level	103,255	32,489	135,744
Fifth Level	292,345	109,140	401,485
Total	400,910	144,364	545,274

Production from the Fourth Level decreased sharply while that from the Fifth rose from 69,044 tons in 1936 to 401,485 tons in 1937.

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2. PRODUCTION
SHIPMENTS &
INVENTORIES

e. Production by Months

Month	Days	Lloyddale Tons	Lloyd Silica Tons	Total Ore Tons	Rock Tons	Tons per Man per Day
January	22	32,267	10,012	42,279	324	7.25
February	20	29,315	12,015	41,330	441	7.49
March	20	39,456	8,917	48,373	561	7.90
April	22	31,161	14,300	45,461	531	7.53
May	21-1/3	28,236	16,757	44,993	804	8.08
June	24	32,916	14,370	47,286	576	7.18
July	23-2/3	34,461	14,064	48,525	138	7.71
August	23-1/3	33,911	14,501	48,412	1,443	7.65
September	23-1/3	38,158	13,291	51,449	2,853	7.94
October	21-1/3	39,534	9,506	49,040	1,485	8.00
November	22	34,794	6,490	41,284	1,926	7.05
December	23	26,185	10,657	36,842	3,225	6.78
	266	400,394	144,880	545,274	14,307	7.55

f. Ore Statement

	Lloyddale Tons	Lloyd Silica Tons	Lloyd Silica #1 Tons	Morris Tons	Total Tons	Total Last Year
On hand Jan.1,1937	104,983	51,995	4,910	33,598	195,486	184,266
Output for Year	400,910	144,364			545,274	364,326
Transfers	516	516				
Overruns				12,681	12,681	
Total	505,377	196,875	4,910	46,279	753,441	548,592
Shipments	446,384	146,822	4,910	46,279	644,395	353,106
Balance on hand	58,993	50,053	-	-	109,046	195,486
Increase in output					177,948	
Decrease in ore on hand					86,440	

The operating schedule for the past five years follows:

1933 - 3-8 hr.shifts 6 days per week Jan.1st to Apr.8th.
Mine idle Apr.8 to Nov. 8.
3-8 hr. shifts 6 days per week Nov. 8 to Dec.31.

1934 - 3-8 hr.shifts six days per week Jan. 1 to Apr. 3.
1-8 hr. shif 3 days per week Apr. 3 to Sept.1.
1-8 hr. shift 2 days per week Sept.1 to Dec.31st.

1935 - 1-8 hr. shift 2 days per week Jan.1 to Feb. 11.
1-8 hr. shift 3 days per week Feb. 11 to Dec.31.

1936 - 1-8 hr. shift 3 days per week Jan.1 to Feb. 1.
1-8 hr. shift 4 days per week Feb.1 to May 1.
2-8 hr. shifts 5½ days per week May 1 to Dec.7.
3-8 hr. shifts 5 days per week Dec.7 to Dec.31st.

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2. PRODUCTION
SHIPMENTS &
INVENTORIES (Cont.)

f. Ore Statement (Cont.)

1937 - 3-8 hr. shifts 5 days per week Jan;1 to Apr.17.
3-8 hr. shifts 5-1/3 days per week Apr.17 to Oct.2.
3-8 hr. shifts 5 days per week Oct.2 to Dec. 6.
2-8 hr. shifts 6 days per week Dec. 6 to Dec. 31.

g. Delays

There were no serious delays or interruptions to production during the year from either mechanical or electrical causes. The changing of the skip hoist drum however ttransferred some of the month of May working time to June.

3. ANALYSIS

a. Average Mine Analysis on Output

Grade	Tons	Iron	Phos.	Silica
Lloyddale	400,394	58.50	.154	7.42
Lloyd Silica	144,880	52.78	.125	15.60

The only appreciable change from the 1936 output was in the silica grade where the respective figures for that year were 51.20, .134 and 17.15. The inclusion of the Lloyd grade ore from the west end stopes above the 5th Level again served to keep the phosphorus in the Lloyd-dale grade near .150.

There were no straight cargos forwarded from the mine in 1937 so the output analysis is again the only one given.

b. Analysis of Ore in Stock Dec. 31, 1937

Grade	Tons	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist
Lloyddale Dried	58,993	58.43	.163	7.54	.23	2.51	.80	.27	.011	4.71	
Nat'l		51.63	.144	6.66	.20	2.22	.71	.24	.010	4.16	11.64
Lloyd Sil.Dried	50,053	51.60	.124	17.70	.22	2.63	.75	.38	.011	4.00	
Nat'l		46.61	.112	15.99	.20	2.38	.68	.34	.010	3.61	9.67

c. Complete Analysis of Ores Shipped in 1937

Lloyddale	58.55	.163	7.22	.24	2.30	.71	.36	.011	4.80
Lloyd Silica	51.75	.130	17.39	.22	2.69	.77	.37	.009	4.20
Morris Stockpile	58.45	.080	7.94	.33	2.16	.93	.45	.013	4.23

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3. ANALYSIS (Cont.)

d. Estimated Analysis of Ore Reserves

The estimated analysis of the Lloyd and Lloydale grade reserves is the same as the previous year, and is shown in the following table:

Grade		Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Llloyd	Dried	58.98	.127	6.68	.25	2.29	1.18	.38	.012	4.81	
	Nat'l	52.45	.111	5.93	.22	2.04	1.05	.34	.011	4.08	11.25
Lloyddale	Dried	58.25	.187	7.08	.25	2.65	1.26	.44	.011	5.02	
	Nat'l	51.56	.166	6.28	.22	2.35	1.12	.39	.010	4.46	11.25

4. ESTIMATE OF ORE RESERVES

Assumption: 12 cu. ft. equals 1 ton
10% deduction for rock
10% deduction for loss in mining

Developed Ore Dec. 31, 1937:

LLOYD EAST DEPOSIT

	Lloyd Ore Tons	Lloyddale Ore Tons	Total Ore Tons
Fourth Level and above	0	149,769	149,769
Fourth Level to Fifth Level	0	577,690	577,690
Fifth Level to Seventh Level	320,822	962,468	1,283,290
Total Ore above 7th Level	320,822	1,689,927	2,010,749
Ore Below 7th Level	70,538	211,612	282,150
Total Reserve Lloyd Mine East	391,360	1,901,539	2,292,899

LLOYD DEPOSIT

Ore Above 3rd Level	0	8,351	8,351
Ore Below 3rd Level	0	7,552	7,552
Total Reserve LloydnDeposit	0	15,903	15,903
TOTAL RESERVE LLOYD MINE	391,360	1,917,442	2,308,802

The following table shows the development of standard ore reserves during the past three years:

	1935	1936	1937
Ore in Mine Jan. 1st	2,756,818	2,771,174	2,676,686
Production	161,406	260,577	400,394
Balance	2,595,412	2,510,597	2,276,292
Ore in Mine Dec. 31st	2,771,174	2,676,686	2,308,802
New Ore Developed	175,762	166,089	32,510

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5. LABOR AND WAGES

a. General

The labor conditions at the mine throughout the year were satisfactory. Membership in the newly organized Marquette Range Industrial Union was nearly 100% and dealings with the mine committee of this organization were pleasantly welcomed.

There was an over supply of common labor due to continued general unemployment. During the summer months, a number of extra men were hired with the understanding that the work was to be temporary, and the best of these were retained on part time work in the fall as a nucleus for next season's shovel crews. The younger men added to the mining force in 1936 have fulfilled expectations,and in most instances are now numbered among the more efficient mining contracts.

The wage rate that was in effect since Nov. 16, 1936 continued until March 16, 1937. At that time, there was a minimum increase of 10¢ per hour or an average increase of approximately 15%. Working time was also limited to 8 hours per day and 40 hours per week with payment of time and a half for anything over these amounts. This combination raised wages (particularly during the summer months when one overtime mining shift was worked on Saturdays) to a level well above that enjoyed in previous years.

b. Comparative Statement of Wages & Product

	1937	Y1936	Incr.	Decr.
PRODUCT	545,274	364,326	180,948	
No. Shifts & Hours				
Jan. 1 to May 1		1-8 hr.		
May 1 to Dec. 7		2-8 hr.		
Dec.7 to Dec.31		3-8 hr.		
Jan. 1 to Dec.4	3-8 hr.			
Dec.4 to Dec.31	2-8 hr.			
AVG. NO. MEN WORKING				
Surface	52	42	10	
Underground	211	140	71	
Total	263	182	81	
AVG. WAGES PER DAY				
Surface	5.44	4.30	1.11	
Underground	6.30	5.25	1.05	
Total	6.20	5.03	1.17	

Average wages per day Surface and Underground respectively were 1932-3.75 and 4.46; 1933-3.84 and 4.29; 1934-4.18 and 5.00; 1935-4.19 and 4.98; 1936-4.30 and 5.25.

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5. LABOR AND WAGES (Cont.)

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

	1937	1936	Incr.	Decr.
WAGES PER MONTH OF 25 DAYS				
Surface	136.00	107.50	28.50	
Underground	159.75	131.25	28.50	
Total	155.00	125.75	29.25	
WAGES PER MONTH OF22 DAYS				
Surface	119.68	94.60	25.08	
Underground	140.58	115.50	25.08	
Total	136.40	110.66	25.74	
WAGES PER MONTH OF 18 DAYS				
Surface	97.92	77.40	20.52	
Underground	115.02	94.50	20.52	
Total	111.60	9.54	21.06	
PRODUCT PER MAN PER DAY				
Surface	36.75	32.51	4.24	
Underground	9.51	9.77		.26
Total	7.55	7.51	.04	
LABOR COST PER TON				
Surface	.148	.132	.016	
Underground	.673	.538	.135	
Total	.821	.670	.151	

The 1937 labor cost per ton is probably the highest percentage of the total cost so far recorded at the Lloyd Mine.

AVG. PRODUCT STOPING	25.74	24.68	1.06
AVG. WAGES CONTRACT MINERS	7.13	5.92	1.21

The large increase in wages was accompanied by a corresponding small increase in productive efficiency.

TOTAL NUMBER OF DAYS			
Surface	14,837¼	11,206	3,631¼
Underground	57,351¼	37,276¾	20,074½
Total	72,188½	48,482¾	23,705¾
AMOUNT FOR LABOR			
Surface	80,643.16	48,210.70	32,432.46
Underground	366,735.07	195,848.15	170,886.92
Total	447,378.23	244,058.85	203,319.38

While the production gain over 1936 amounted to a little less than 50% the increase in the amount paid for labor was over 83%.

PROPORTION SURFACE TO UNDERGROUND MEN

1933	1 to 2.70
1934	1 to 2.88
1935	1 to 3.29
1936	1 to 3.33
1937	1 to 4.06

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6. SURFACE

a. Buildings

Surface plant improvement included additions or alterations to virtually every structure. The electrical distribution system was improved to meet modern specifications and a 10' x 18' building erected as a central switch and transformer station. This building is located 50' west of the headframe and houses the necessary equipment connecting all other units. The top tram system was completely renovated by the completion of the two new motor transfer houses on the surface west of the shaft, and the new control room on the south side of the headframe landing floor. These three small buildings were of steel and concrete and replace the two old units which formed a fire hazard below the landing floor.

A second fire hazard was eliminated by the replacement of the old heating plant on the north side of the headframe. A steel and concrete building housing a new stoker fired boiler now provides heat through insulated pipes to radiators in the headframe. A large unit heater was added to the system in November and this has so far been effective in keeping the shaft free of ice. The ferro deck enclosure of the headframe was painted with aluminum paint, and a complete new lighting system was installed.

The two old frame barns at the foot of the hill south of the shaft house were torn down early in the summer. One was replaced with a 30' x 24' corrugated iron and concrete storage building located 50' south of the shaft. This building was necessary to handle the transfer and storage of equipment to and from the shops. A short connecting track to the cage road provides easy handling on the mine timber trucks.

Improved ventilation of the engine house was secured by the construction of an adjustable ventilator in the roof, plus the addition of a force blower in the west wall. The basement of the engine house was rearranged by adding a fireproof oil room, and a change room for the surface hands, which was equipped with a hot water tank, pedestal sink, heater, lockers and the whole was freshly painted. Improvements to the main building included the permanent machinery installations, and the addition of another wash room at the north end of the building to relieve overcrowding and provide for the top landing crews. The machine and carpenter shop interiors were painted, and the garage space in the building to the east was given

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6. SURFACE (Cont.)

a. Buildings (Cont.)

a coat of plaster and then painted. All surface buildings with the exception of the engine house are now of steel construction coated with aluminum paint. In combination with the improved roads and the landscaping of the slope in front of the main building, the mine surface presents a greatly improved appearance.

b. Stocking Grounds

The stocking trestles east of the shaft were filled on the 25th of February and scraping of ore between the piles was necessary until the shipping season started. The west trestle extending over on to the leased portion of the Morris Mine surface, was also nearly filled at the beginning of the shipping season. Shipments were then started from the southeast trestle and later from the northeast and west trestles. The last two were dismantled, cleaning up the #1 Silica stockpile as well as the old Morris stockpile north of the shaft. Two shovels were used intermittently throughout the season and stocking room was provided for under the southeast trestle at all times in case of a shortage of cars.

The rebuilding of the northeast and west trestles was completed in November. The number of bents erected was 27 on the northeast, 20 on the west, and 2 additional on the southeast trestle. With the reduced working schedule in effect since December 6th, there is a possibility that scraping of ore between the piles east of the shaft for a short time in the spring will reserve the new west trestle for use in the fall of 1938.

c. Tracks and Roads

A new siding was extended into the central part of the timber yard by the Lake Superior & Ishpeming Railroad section crew. This track is extremely useful for the rapid unloading of poles and lagging since piles can now be arranged on both sides for reloading into the mine timber trucks.

All roads on the mine surface were graveled, two new parking areas were filled and surfaced, and the fill in front of the main building extended to double road width. The work was done in June by one of the stockpile shovels switched into the gravel bank north of the old Morris pile. Three rented trucks hauled for a three day period and the improvement was well worth the cost. The parking of cars last winter was quite a problem after each storm and the two new areas have eliminated this congestion entirely. The leveled and fenced in areas and orderly parking of cars also add to the appearance of the surface plant.

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7. UNDERGROUND

a. Shaft Sinking

There was no shaft sinking or stripping in 1937.

b. Development

The larger share of development in 1937 was within the limits of the ore body above the 5th Level. It consisted mainly of small drifts and raises driven in advance of sub level stoping operations. These operations were carried on in two general territories: No. 7 stope at the east end of the ore body between the 690' elevation, and the 4th Level, and Nos. 3, 5, and 14 stopes at the west end of the deposit between the 640' and 820' sub levels. Development work was also carried on preparatory to sub level stoping on the 890' and 830' elevations above the 4th Level. However, neither of these stopes show promise of being as large as those above the 5th Level. The standard development procedure is the driving of a timbered sub level transfer drift followed by small untimbered mill raises and drifts. The total footage of this small sized development reached the comparatively high figure of 10,405' in 1937, and all but 244' of this amount was in ore. A full sized timbered development drift was driven on the 675' sub as an intermediate sub level connecting all raises between the 5th and 4th Levels at this elevation.

Development in rock included the completion of the ventilation intake raise connection to the bottom of the surface cave southeast of the Lloyd shaft. The total height of the raise above the 1st level is 175', and it appreciably increased the volumn of air entering the mine. A short rock drift was driven in the north footwall connecting the Section 6 drift to the 4th Level drift under the east end raises. This drift was to replace a portion of the 4th Level drift undermined by No. 7 stoping operations.

Work on the new 6th Level (formerly the 5½ Level) was started in March with the construction of the pocket. Although this work was delayed considerably by waiting for materials, the excavation of the plat was started in July. At the end of the year, the pocket had been constructed, the plat cut to full size and timbered, the laying of track completed, and the footwall drift advanced 550' of an estimated distance of 1500' from the shaft to the ore body.

An average total of 19 contracts worked underground in 1937. Approximately six of these were maintained on development, the proportion in some months being slightly larger. The development footage driven by these contracts amounted to a total of 12,867'.

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7. UNDERGROUND (Cont.)

c. Stoping

During most of the year, three contracts carried on mining operations in the upper east end of the ore body by the top slicing method. However, two small sub level stopes were developed in the southern part of this territory in November and December. In the central part of the ore body, mining operations were carried from the 775' to the 715' sub levels by the top slicing method during 1937. However, the sub level stoping system supplanted slicing operations in the narrower part of the trough at the east end of this territory. This ore was stoped from a transfer on the 690' sub by #7 contract. At the west end of the ore body under the jasper hanging wall, the sub level stoping method was used exclusively. This territory was mined by three stopes: No. 3, in the southwestern part of the ore body; No. 5, in the west-central portion, and No. 14 in the northwestern part of the deposit.

The following is a detailed review of the year's mining operations:

3rd Level

In March, slicing operations were resumed in the Lloyd ore body at this elevation by means of a scraper slide. The slide was set up in the third crosscut and a block of ore mined which was bounded on the south by the footwall, on the east and west by dikes and on the north by a pillar of ore protecting the main drift. The slide was then moved to a point 20' beyond the 4th crosscut and two slices taken, one to the south and one to the east. A small ore shoot was stoped out above the end of the east slice before operations ceased. This stope finally reached a height of 50' above the floor of the 3rd Level. Because the trolley locomotive on this level was needed for the new 6th Level development, operations were suspended for an indefinite period. The remaining pillars on this level may be extracted in the future by a similar mining method.

Subs Above the 4th Level

940' Sub-Level

Contracts Nos. 1 and 8 completed mining the pillars on this sub, which is the first one below the 3rd Level, during the month of January. Although the ore area at this elevation was somewhat larger than on the sub above, the ore was partially lean material.

During December, No. 18 contract reached this elevation with a small untimbered raise in advance of the stoping operations of No. 8 contract. This new development is 60' south of any previous mining in this territory.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

925' Sub-Level
Contracts 1 and 8 cut out their respective raises at this elevation late in the month of January. After establishing the connecting drift, slicing was begun. No. 1 contract mined the ore as far as an old stope on the east, and to their mining limit on the west. The slicing operations of No. 8 were terminated on the west by No. 2 contract's old workings. Both contracts were limited on the north by the footwall and on the south by a dike.

No. 18 contract also established a sub at this elevation during December in preparation for No. 8 stope.

910' Sub-Level
Operations were started on this sub late in April by contracts 1 and 8. No. 1 contract extended their ore area to the southeast in lean ore. Otherwise the limits were about the same.

The mill sub for No. 8 stope was cut out at this elevation in December.

900' Sub-Level
Mining progressed at this elevation during the months of August, September and October. During this time, contracts 1 and 8 mined to No. 2 contract's old workings on the west, to the old stope on the east, the footwall on the north and the dike on the south. Here again the workings of No. 1 extended further to the southeast than on the sub above.

890' Sub-Level
No. 2 contract began mining on this sub early in January, and carried their slices to old stopes on the south and west, to the mining limit on the east, and to the footwall on the north. A lean ore area limited slices to the southwest of No. 483 raise. In the last months of 1937, contracts 1 and 8 cut out their raises on this sub-level. No. 1 started slicing to the southwest, while No. 8 contract drove a small drift 90' to the south before the footwall was encountered. A 25' width of previously unexplored ore was discovered in this drift which was bounded on the north by a 10' dike and on the south by the footwall.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

During the month of December, No. 8 contract enlarged the small exploration drift and put up two small mills on the east sideof this drift. A second or cross transfer was started 50' from their raise and continued to the east until No. 1 workings were encountered. Mill raises were also extended from the south side of this drift in preparation for sub level stoping. No. 1 contract had completed three slices southwest of their raise and had followed 40' along the north rib of the old transfer drift with a 4th slice at the end of December.

870' Sub-Level
No. 485 raise was cut out at this elevation in March and slicing operations were carried on by No. 2 contract. A small one compartment raise was driven to the 890' sub level to provide a traveling road and ventilation for contracts 1 and 8.

No. 2 contract reached this elevation again in December with their stoping operations originating from the 830' sub. From this small stope, ore was mined south of an old stope.

860' Sub-Level
After cutting out their raise, No. 2 contract drove a small drift 70' to the east. From the end of this drift, a single compartment raise was put up to the sub above for ventilation and traveling. The small drift was later stripped to a full size and slicing carried on as usual. The same lean ore area on the southwest limited the slices in this direction.

No. 2 contract established their mill sub at this elevation in December and mined the small amount of ore available. The old stope cave was encountered on the west side of this new stope.

840' Sub-Level
No. 485 raise was cut out on this sub in September by No. 2 contract. A small drift was driven to No. 487 raise to the east and a second connection made to the timber raise west of No. 487 raise. The small drift was stripped and slicing carried on as usual. An old transfer drift interrupted slicing to the south, and the old stope limited operations to the west.

830' Sub-Level
No. 2 contract cut out their raise at this elevation late in November. In December the contract drove a transfer drift to the southeast and after putting up mills, began sub level stoping operations. The stope proved to be small and was finished by the end of the month. A 40' slice was then taken along the west

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

rib of the transfer drift. This elevation marks the lowest one at which mining operations were carried on by the three east end contracts.

820' and 800' Sub-Levels
No. 18 Contract in May reached these sub levels with two small untimbered raises in advance of No. 3 - 5th Level stope. The 9th and 10th subs were established and a considerable percentage of Lloyddale Ore was then mined here. This stope, about 40' in width, was in a small upward extension along the south footwall dike and the ore analyzed well below .100 in phosphorus.

790' Sub-Level
A working sub was established at this elevation early in the year by No. 18 contract in advance of No. 3 stoping operations. The ore was later stoped to within 15' of the traveling raise. In July a test raise reached this elevation farther east but the information obtained was disappointing in that it established the top of the main stope in this area at the 4th Level elevation. Another test raise reached this elevation near the north footwall in November. This raise was ahead of No. 14 stope but only hard lean ore, and jasper were found thereby establishing the top of this stope, also at some lower point.

775' Sub-Level
No. 6 slicing contract mined the last pillar southeast of No.482 raise at the beginning of the year and dropped to the sub below.

A transfer sub was driven 60' southeast from No. 484 raise early in the year by No. 16 contract in an attempt to outline the ore encountered on the 840' sub. A small test drift was also driven east from this transfer. Because only 12' of ore was found between dikes the idea of opening a sub level stope had to be abandoned.

765' Sub-Level
At the beginning of the year, Contracts 6, 7 and 16 were mining in the east central part of the ore body at this elevation. The ore narrowed considerably east of No. 472 raise, thereby limiting operations. During the month of March, Contracts 6 and 7 completed

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

mining pillars south of No. 482 and No. 472 raises, respectively, and moved to the 690' sub to open a sub level stope in that section. After No. 16 had finished removing pillars north of No. 462 raise, they were moved to the 775' sub preparatory to driving the transfer drift previously described.

Contracts 10 and 13 finished mining pillars adjacent to No.434 and 432 raises in January and dropped to the sub below. Three other contracts, 9, 17 and 19, were mining from 5th Level raises in the west end of the ore body at the first of the year. A small stope was developed and worked west of 543 raise by No. 9 contract. All three contracts were working under the jasper hanging wall and special precautions were used in timbering.

The 7th sub of No. 3 stope was cut out at this elevation and the ore width was found to have increased considerably. Later in the year, small raises also reached this elevation ahead of No. 14 stoping operations.

755' Sub-Level

This sub level was the center of top slicing operations during the month of April. Contracts 11 and 12 finished mining the extensive pillar surrounding 522 raise, while Contracts 9, 10, 13, 17 and 19 mined from the 530 and 540 series of raises. Incoming mine water interferred to some extent with slicing operations by No, 19 contract along the south footwall, but the sub was mined out by the end of August except for the area over No. 7 stope. By the end of the year nearly all of this remaining pillar on the 755' sub had been drawn into No. 7 stope. A small pillar was left at the east end by No. 7 contract to protect 485 raise above the 4th Level. Stoping in Nos. 3 and 14 at the west end completed operations at this elevation.

4th Level

Mining was started at this elevation by Contracts 11 and 12 from 521 and 522 raises in the first months of the year. The area mined by these two contracts was bounded east and west by mining limits, on the north by the footwall and on the south by the dike. All the pillars around 521 and 522 raises had been mined early in June, at which time both contracts dropped to the 725' sub. Contracts 13, 16 and 10 reached this elevation with their mining

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

operations in May and June, and after the 530 series of raises had been connected, slicing was begun. The pillars around this series had been completely mined by the end of August and these three contracts also dropped to the sub below. Contracts 9, 17 and 19 mined into the 540 series of raises near the west end of the ore body. Slicing operations here intersected the jasper hanging wall to the west and north, and Nos. 3 and 5 stopes to the south and west. The amount of water entering this area created an unstable condition in the timber mat above. This necessitated close timbering on the subs and was, in part, the cause of several breakdowns east of 544 raise. On November 24th, a general subsidence took place over this territory which later added considerably to the weight on the slices and extended the surface cave 50' farther west. The three contracts finished mining pillars on this elevation and had dropped to the 725' sub level by the end of November.

No. 3 contract began stoping operations on this sub in February in the southwest corner of the ore body. Contract No. 18 drove most of the development drifts and raises in advance of No. 3 stope. Development in advance of No. 14 stope reached this elevation in August and test drifts were driven in four directions without disclosing ore. Later in the year, No. 14 again reached this elevation with a raise southeast of the above mentioned workings and found a small lense of minable ore. A connecting drift was driven east from this new raise to the small untimbered drift between No. 543 raise and No. 430 crosscut. At the east end of the ore body, No. 7 stope reached this elevation in June. The ore was stoped up to the timber mat on the 765' elevation over a length of 70' east and west. After a short interval, the mat settled into the stope so a 15' pillar was left at the west end of the stope and operations were resumed. Another 70' length of ore was stoped, the pillar was blasted down and mined and the process has since been repeated a third time. Recovery has been complete, costs have been lowered and a considerable quantity of timber saved by this change of method. At the end of the year the stope had mined ore back of No. 511 raise to within 15' of old No. 11 and No. 12 slices.

In December a new mill raise reached this elevation northwest of 511 raise and a connecting drift was started towards 460 crosscut.

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7. UNDERGROUND (Cont.)

725' Sub-Level

Top slicing operations were centered at this elevation during the month of September. Contracts 11 and 12 were carrying on slicing which had been started in August, and Contracts 13,16 and 10 were mining from the 530 series of raises. Pillars surrounding the two 520 raises were mined out by the end of November and Contracts 11 and 12 then dropped to the 715' sub-level. Contracts 13, 16 and 10 also completed the removal of pillars around their respective raises and began mining on the 715' sub early in December. Mining operations in #7 stope had passed beyond the west side of #511 raise at the end of the year, although two small pillars on the east side will later be mined. The total length of the stope at this elevation is close to 300', and the average width about 55'.

No. 3 stope in August had been mined a distance of 95' and a 15' pillar left to prevent dilution of the ore by the soft caving south footwall dike. A small stope was mined at this elevation east of the pillar before operations were suspended temporarily. No. 5 stope was then reopened and the fact of the stope advanced as far as possible to the east over the old transfer. Three small raises also reached this sub in advance ofNo. 14, and a small amount of ore was removed through the west mill. A connection was established from 543 raise to this new development which in turn is connected with the 4th Level drift between 543 raise and 430 crosscut.

During the month of December, a 15' length of ore was mined at the west end of No. 7 stope at this elevation, and a new traveling raise northwest of 511 raise passed through this sublevel. Contract #9 drove a slice northeast of 543 raise, connecting 530 and 540 series of raises. A second connecting drift from #545 to 544 raise was driven by No. 19, and this contract then started mining along the south footwall dike. Contract #17 completed two slices east of their raise and were starting a third at the end of the year.

715' Sub-Level

The mill sub of No. 7 stope was established at this elevation and the ore at the bottom of the trough east of #511 raise was mined in 1937. Stoping operations progressed west beyond #511 raise and the new traveling raise had been driven from this sub to the 4th Level.

This elevation is the lowest one on which top slicing operations have yet been conducted. In December, five contracts were using this method in the central portion of the ore body. No. 11 contract

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7. UNDERGROUND (Cont.)

connected 521 and 522 raises and then drove a small drift connection in ore and a raise in rock to the 4th Level #450 crosscut. This raise and drift serves the triple purpose of ventilation, traveling and timber supply. Mining operations were then started by #11 on the west side of the raise and at the end of the year 3 slices had been mined along the north footwall. No. 12 contract cut out #522 raise and completed 3 slices to the south footwall. On the 531 series No. 13 contract first completed a drift and raise which intersected the bottom of the former raise connection to the 4th Level. Slicing operations were then started west of the raise, and later to the east to join with No. 11 workings. No. 16 contract also mined several slices on both the west and east sides of No. 532 raise. No. 10 contract, after completing the connection to No. 533, mined a large area adjacent to the south footwall dike.

At the west end of the ore body, stoping operations in Nos. 3, 5 and 14 progressed at this elevation by means of connecting sublevels above and below.

700' Sub-Level

Sub-Level stoping operations mined both the east and west ends of the ore body in 1937 and top slicing operations will reach this elevation in the contral portion early in 1938. At the east end a length of 180' was mined in #7 stope by means of the inclined transfer which started at this elevation. The lower transfer on the 690' sub level extended a distance of 120' east of 511 raise, and the inclined transfer an additional distance of 160'. The inclined drift was in contact with both the north and south footwalls throughout most of its length. The angle of inclination was about 16° and the top elevation was the 725' sub at the east end. The ore in the narrow trough under the old top slicing territory was successfully mined by this method, and all of the necessary development was in ore.

At the west end of the ore body the three stopes connected at this elevation and the north-south dimension of the area mined was nearly 250'. No. 5 stope, in the center, at the end of the year was 140' in length, No. 3 was 150' and #14 nearly 100'. No. 5 was completed at the east mining limit set to protect the top slicing territory above. Lean ore interferred somewhat with operations in No. 3 but it is expected to reach this same limit in 1938. No. 14 stope along the north footwall will be carried 150' farther east so that the eventual length of this stope is expected to measure nearly 250'. In December No. 5 contract was developing in advance of No. 3 stope and No. 6 contract in advance of No. 14.

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7. UNDERGROUND (Cont.)

A small traveling raise reached this elevation near the extended mining limit east of #14,

690' Sub-Level

The development of No. 7 stope started in March. #511 raise was cut out and the transfer drift driven to the east. The length of this drift was 130' to the junction of the north and south footwalls. The inclined drift described on the 700' sub level was started from a short raise put up 15' back of the breast. Later, as stoping operations were carried to the west, mill raises advanced from the north and south sides of this transfer. At the end of the year, mining operations had reached a point directly over #511 raise and a similar development was underway at the 625' elevation so that the stope can be continued still farther west.

At the west end of the ore body stoping operations in Nos. 3, 5 and 14 similar to those on the sub above were carried on in 1937. The maximum stoping length was 200' in No. 5 and the combined north-south width was 260'.

675' Sub-Level

The intermediate sub drift connecting all raises in the central portion of the ore body was driven at this elevation. The sub is about midway between the 4th and 5th levels and it furnishes ventilation-traveling road connections, and timber and mining equipment storage space for the eight top slicing contracts above. No. 6 contract first drove the drift connecting the 530 series of raises. Then east-west drifts were driven to the 640 and 520 series, and small extension drifts to each of the ladder roads on these series. All of this development was in ore, and particular care was taken not to damage the raise cribbing, so there was no interference with regular mining operations on subs above.

At the west end of the ore body, stoping operations in Nos. 3, 5 and 14 reached an outline similar to that of the 690' sub. Development ahead of Nos. 3 and 14 on this second sub above the transfer progressed in December.

650' Sub-Level

The mill subs for the three stopes at the west end of the ore body were lengthened at this elevation at various times during the year. During December, No. 3 contract had returned to the old stope in the southwest corner of the ore body and put up three mills from the north side of the transfer to this elevation. A small drift was driven west connecting these mills. No. 14 contract also started a drift to connect a series of mills along the north side of their new transfer.

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7. UNDERGROUND (Cont.)

640' Sub-Level

At the beginning of the year, the transfer drift for #3 stope was extended until it intercepted the jasper hanging wall. Four additional mills were put up from the south side of the transfer and stoping operations started soon after. #14 contract cut out 542 raise and drove a transfer drift to the west a distance of 155'. The material in this drift was mostly lean ore and jasper but the mills put up on both sides of the drift encountered higher grade ore above. Later in the year, after mining limits had been established for the top slicing contracts, and as #14 stoping operations progressed towards 542 raise, a new transfer sub was extended by #6 contract to 531 raise. This drift intercepted the north footwall as it approached 531 raise but is expected to increase the maximum eventual length of #14 stope to nearly 300'. Mills were then started from the north side of this drift well ahead of #14 stoping operations, and a traveling connection cut in the ladder road of 531 raise.

625' Sub-Level

In November, #15 contract added a third cribbed compartment to the north side of 522 raise, cut out at the 625' elevation and began drifting towards 511 raise. This drift was continued in December and at the end of the year had progressed in ore 110'. When completed, it will serve as a transfer drift for the advance of #7 stope west of 511 raise.

5th Level

The drift development of this level was completed in November 1936. Raise development ended in January 1937 when 511 and 521 raises were completed at the 4th Level elevation. Later however, a single compartment raise in lean ore was put up from 550 crosscut to the west end of #14 transfer drift for ventilation purposes, and a sump 10x10x25' in size was excavated in the footwall south of the shaft for the relay pump.

d. Timbering

The increased expenditure for timber in 1937 was nearly in proportion to the increased production. The completion of the 5th Level raise program early in the year reduced the amount of cribbing timber to such an extent however, that the linear feet of cribbing and stulls dropped from 226,718' in 1936 to 182,518' in 1937. This loss was made up by the increased quantity of poles and lagging used in securing a good timber mat in the top slicing territory in the central portion of the ore body. The expense here increased from .0130 per ton in 1936 to .0151 in 1937.

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7. UNDERGROUND (Cont.)

d. Timbering (Cont.)

The total cost per ton, in spite of the higher freight rates and average price of timber in 1937, was reduced from .0596 in 1936 to .0528. The change to sub level stoping operations at the east end of the ore body above the 5th Level was largely responsible for this reduction in the over all cost. The table of comparative statistics follows:

Statement Showing Timber Used for Year 1937

	Lineal Feet	Avg.Price Per Foot	Amount 1937	Amount 1936
6" to 8" Cribbing Timber	31,255	.036	1,113.98	3,865.44
8" to 10" Stull Timber	63,274	.067	4,234.45	2,553.56
10" to 12" " "	62,923	.093	5,842.85	4,189.25
12" to 14" " "	25,066	.123	3,071.65	1,426.53
Total Timber 1937	182,518	.078	14,262.93	12,034.78
Total timber 1936	226,718	.053	12,034.78	
	Per 100 Ft.			
7 ft. Lagging	764,065	.828	6,329.22	4,941.81
Total Lagging	764,065	.828	6,329.22	4,941.81
Maple Covering Boards	27,000	1.40	378.00	243,96
3½" Poles	568,364	1.34	7,598.48	4,287.31
Wire Fencing	6,551	3.61	236.34	212.72
Total Poles, Fencing,etc.	601,915	1.36	8,212.82	4,743.09
Total Laggins, Poles and Fencing	1,365,980	1.06	14,542.04	9,684.90
Total Lagging Poles and Fencing, 1936	1,110,489	.87	9,684.90	

	1937	1936
Product - Tons	545,274	364,326
Feet of Timber per ton of ore	.335	.622
Feet of Lagging per ton of ore	1.401	1.969
Feet of Lagging per foot of timber	4.186	3.165
Cost per ton for timber	.026	.033
Cost per ton for Lagging	.0117	.0136
Cost per ton for Poles, Fencing, etc.	.0151	.0130
Cost per ton for all timber	.0528	.0596
Equivalent Stull timber to board measure	380,965	377,070
Feet of board measure per ton of ore	.699	1.035

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7. UNDERGROUND (Cont.)

d. Timbering (Cont.)

		Cost Per Ton	Amount
Cost of timber, lagging, poles, fencing,	1937	.0528	28,804.97
	1936	.0596	21,719.68
	1935	.0515	11,432.19
	1934	.0409	5,028.24
	1932	.0729	6,047.62
	1931	.0747	26,098.93
	1930	.0729	33,914.29
	1929	.0687	29,885.03
	1928	.0777	27,690.94

The effect that the larger proportion of ore from sub level stoping operations has had on timber consumption may be seen by comparison with the years before 1931 in the table above. In none of these years was the production as large as in 1937.

e. Drifting and Raising

The larger share of development in 1936 was raising from the 5th to the 4th Levels. In 1937 this condition was reversed, drifting toward the orebody on the 6th Level placing most of the work under that heading. The following table shows the comparison:

	Ore Drift	Rock Drift	Total Drift	Ore Raise	Rock Raise	Total Raise	Grand Total
1937	6,771	1,176	7,947	4,711	209	4,920	12,867
1936	3,216	824	4,040	4,629	274	4,903	8,943
Increase			3,907			17	3,924

If the small untimbered raise and drift development in advance of sub level stoping operations is eliminated from the above table, the full size development may be shown as follows:

	Ore Drift	Rock Drift	Total Drift	Ore Raise	Rock Raise	Total Raise	Grand Total
1937	1,168	1,141	2,309	153	0	153	2,462
1936	914	824	1,738	1,850	164	2,014	3,752

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7. UNDERGROUND (Cont)

f. Explosives, Drilling & Blasting

The total cost per ton for explosives in 1937 duplicated the .073 cost of 1936. Powder consumption was slightly higher at .495 lbs. per ton and the same was true of the price at .1199. The reduced amount of rock development, and the small size (excluding the 6th Level drift E&A #752) lowered this cost to about one third, so the total cost wasunaffected.

The explosives statements are shown under three headings as follows:

BREAKING ORE	Quantity Lbs.	Average Price	Amount 1937	Amount 1936
Gelamite Powder#1	26,350	12.25	3,227.89	230.63
Gelamite Powder #2	224,107	11.99	26,867.73	12,809.55
Hercomite #3	4,550	10.75	489.12	693.38
Gelatin 60%	14,656	12.26	1,796.52	6,246.33
Total Powder	269,663	12.01	32,381.26	19,979.89
Fuse - Feet	922,472	5.64 M	5,204.89	3,385.36
No. 6 blasting caps	139,182	11.68 M	1,625.98	937.87
Tamping Bags	4,000	2.00 M	8.00	10.88
Electric Exploders	690	10.78 C	74.38	398.61
Fuse Lighters	19,000	7.35 M	139.56	82.45
Total Fuse, Caps,etc.			7,052.81	4,815.17
Total Explosives,Breaking Ore			39,434.07	24,795.06
Product - Tons			545,274	364,326
Lbs. Powder per ton of ore			.495	.473
Cost per ton for powder			.059	.055
Cost per ton for Fuse, Caps, etc.			.013	.0132
Cost per ton all explosives			.072	.068
DEVELOPMENT IN ROCK (Excluding 6th Level Drift E&A #752)				
Gelamite #2	938	11.98	112.40	240.64
Gelatin 60%	106	12.84	13.62	1,236.64
Gelamite #1	50	12.24	6.12	
Total Powder	1,094		132.14	1,477.28
Fuse - Feet	4,485	5.63	25.26	223.33
#6 Blasting caps	625	11.40	7.13	69.15
Total Fuse, Caps. etc.			32.39	292.48
Total Explosives, Development Work			164.53	1,769.76

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7. UNDERGROUND (Cont.)

f. Explosives, Drilling & Blasting (Cont.)

	1937	1936
Rock Drifting - Feet	317	1,071
Cost per foot for powder	.417	1.379
Cost per foot for Fuse, Caps, etc.	.102	.273
Cost per Foot All Explosives	.519	1.652
Grand Total Explosives Used in Mine	39,598.60	26,564.82
Loading by Steam Shovel, etc.	269.38	20.00
Total cost as per cost sheet	39,867.98	26,584.82
Cost per tonnall explosives used	.073	.073
Average price per lb. for powder	.1199	.1162

Statement of Explosives used for E&A #752, 6th Level Drift

	Quantity Lbs.	Average Price	Amount 1937
Gelamite Powder #1	2,650	12.25	324.63
Gelatin Powder 60%	11,200	12.19	1,365.00
Total Powder	13,850	12.20	1,689.63
Fuse - Feet	29,755	5.64	167.91
No. 6 Blasting Caps	3,815	12.20	46.56
Electric Exploders	25	12.15	3.04
Total Fuse, caps, etc.			217.51
Total All Explosives			1,907.14
Rock Drifting - Feet			980
Cost per foot for powder			1.725
Cost per foot for caps, fuse, etc.			.221
Cost per foot all explosives			1.946

g. Ventilation

The completion of the new ventilation intake raise above the first level to the bottom of the old Lloyd surface cave, the addition of the skip road heating unit, and the door and fan arrangement at the bottom of the Section 6 shaft, were all factors which tended to increase the volume of air circulated through the mine by the natural ventilation system. This quantity varied from 8,000 cu.ft. per minute on the warmest days to 22,000 cu. ft. in the cooler weather. The steady three shift operation, with blasting going on at all hours, made it extremely important that the smoke be exhausted as quickly as possible. Fortunately, the direct raise connections

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7. UNDERGROUND (Cont.)

g. Ventilation (Cont.)

from the 5th to 4th Levels led the smoke away with very little interference between contracts.

A reversible D. C. 15 H.P. fan was installed at the bottom of the Section 6 shaft to increase the volume on warm days when the natural ventilation slacked off, and to reverse the circuit in the coldest weather in order to thaw any accumulation of ice in the downcast Lloyd shaft. Because of the skip road heater, this reversal had been necessary only a few times up to the end of the year. The dorr was closed at the Section 6 shaft and the fan reversed for 8 hour periods during night repair shifts, so there was no interference with regular mining operations at any time and the method was very effective in ridding the cage road of small accumulations of ice.

8. COST OF OPERATING

a. Comparative Mining Costs

	1937	1936	Incr.	Decr.
Product, Tons	545,274	364,326	180,948	
Underground Costs	.955	.869	.086	
Surface Costs	.140	.143		.003
General Mine Expense	.177	.166	.011	
Cost of Production	1.272	1.178	.084	
Depreciation	.033	.062		.029
Taxes	.059	.080		.021
Loading and Shipping	.048	.029	.019	
Total cost at Mine	1.412	1.349	.063	
Number of Operating Days	284	303		
Number of shifts & hours	18 - 1-8 hr.	115 - 1-8 hr.		
	19 - 2-8 hr.	172 - 2-8 hr.		
	247 - 3-8 hr.	16 - 3-8 hr.		
Average Daily Product	1,920	1,202	718	