ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1945

1. GENERAL

Princeton Mine

The only active property in the district, the Princeton Mine produced a tonnage of 269,041 tons of Cambridge grade ore and shipped 235,009 tons during 1945. These production and shipment tonnages exceeded all previous Princeton yearly figures.

An average of 146 men were employed with 44 men on surface work and 102 occupied underground as compared with a yearly average of 162 men employed during the previous year.

Maintenance and repair of the District water supply system and of the Gwinn Townsite sewer system was done by Princeton Mine surface employees.

The full time services of a doctor were obtained this year for the employees of the Company who live in the district and who work in the Ishpeming and Negaunee mines and Princeton. This acquisition was greatly appreciated by Gwinn District residents.

Schools

The enrollment of the Gwinn school for 1945 was as follows:

Elementary Grades,	257
Junior and High School,	211
Total,	468

An increase of 14 for 1945. A large school bus transports pupils daily from Wells Township to Gwinn, a distance of over twenty miles.

Townsite

No major improvements or changes were made during the past year in the townsite. Purchasers of company houses continued remodeling and painting of the structures to the limits of availability of materials. A branch supply house of the Consolidated Fuel & Lumber Company of Ishpeming was established in the old depot building in anticipation of increased demand for general building materials.

Red Cross Funds Drive

Excellent support was given the Red Cross drive by employees of the Princeton Mine who subscribed a total amount of $593.50 or an average of $3.69 per man which was the highest average contribution of any Company Mine or Department on the Marquette range.

House and Lot Sales

At the beginning of the year a total of 16 sides of Company houses were unsold in Gwinn, and 2 in Austin location, the Princeton houses being disposed of in 1944.

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1945

1. GENERAL (Cont.)

House and Lot Sales (Cont.)

Of the Gwinn houses eleven were sold during the year leaving a balance of five unsold as of December 31, 1945. The two remaining Austin structures were sold. A total of seven lots were also sold during the year in Gwinn Townsite.

The bank building in Gwinn was sold to the Gwinn State Savings Bank in October, the transaction was handled by the Ishpeming office.

Details of Gwinn Townsite transactions are given below:

Street	House No.	Lot	Block		Amount
Pine	188	10	28	John E. Erickson,	800.00
Ash	242	29	26	Mose St. Aubin,	500.00
"	240	28	26	" "	500.00
"	243	4	26	Hartley Ohlsen,	548.00
Maple	213	11	26	Ernest J. LaFave,	548.00
"	139	7	17	Patrick K. Lane,	568.00
Birch	103	9	15	Melio E. Arrieri,	540.00
Maple	235	6	26	Emma D. Dambrosio,	508.00
Elm	184	4	29	Phyllis Locke,	528.00
Ash	232	26	26	John H. Pelkola,	540.00
Maple	242	32	27	Elma L. Granholm,	450.00

All of the above sales were for cash, and amounts remitted to Land Department for execution of deed.

During 1945 the following lots in Gwinn Townsite were sold:

Lot No.	10	of Block No.	14	to Julius Koski,	$	100.00
" "	2	of " "	29	to John Stein,		62.50
" "	13	of " "	28	to Arthur Nylander,		100.00
" "	1	of " "	28	to Wilfred Tousignant,		125.00
" "	14	of " "	12	to John Bond,		125.00
" "	12	of " "	12	to A. LaFreniere,		125.00
" "	8	of " "	13	to Alfred Coran,		162.50

Following is a detail of Austin Houses sold:

No. 11 to Mrs. Gustina Storti, $200.00 Cash
No. 65 to Rudolph O. Ketola, 360.00 "

a. Statement Showing Total Ore Produced in District by C.C.I.Co., 1903 to 1945 Incl.

YEAR	AUSTIN	PRINCETON	STEPHENSON	GWINN	FRANCIS	GARDNER MACKINAW	TOTAL
Total to 1945,	1,589,018	2,113,131	3,835,157	988,665	504,667	1,289,118	10,319,756
1945 Product,		269,041					269,041
To Date,	1,589,018	2,382,172	3,835,157	988,665	504,667	1,289,118	10,588,797

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1945

1. GENERAL (Cont.

b. Statement Showing Ore Shipments by C.C.I.Co., from 1905 to 1944

YEAR	AUSTIN	PRINCETON	STEPHENSON	GWINN	FRANCIS	GARDNER MACKINAW	TOTAL
Total to 1945,	1,589,017	1,958,009	3,845,027	1,017,334*	502,131	1,326,439	10,237,958
1945,		235,009					235,009
To Date,	1,589,018	2,193,018	3,845,027	1,017,334*	502,131	1,326,439	10,472,967

* Included in the shipments from Gwinn Mine is 29,009 tons of Foundry Stockpile ore purchased from the Clement Quinn Company and shipped by the Cleveland Cliffs Iron Company in 1942.

c. Ore in Stock at Mines December 31, 1945

Princeton, 189,194 tons

10. TAXES

The following statement gives the taxes in detail for 1945 and 1944 for all company properties in the district. The mine taxes in the summary show totals only, as the detail for each mine is included in the mine report.

The summary also includes the taxes paid by Cliffs Power and Light Company in order to show the total taxes paid in Forsyth Township by the company, exclusive of those paid by the Land Department.

Forsyth Township Mineral Lands, Gwinn		1945 Valuation	1945 Taxes	1944 Valuation	1944 Taxes
SW¼ of SW¼ of Sec. 26-45-25,	40 A.	$ 100	$ 2.52	$ 100	$ 2.03
NE¼ of SE¼ of Sec. 28-45-25,	40A	100	2.52	100	2.03
N½ of NE¼ " " 34-45-25,	80 A.	200	5.04	200	4.05
SE¼ of NE¼ of Sec. 34-45-25,	40 A.	100	2.52	100	2.03
NE¼ of NW¼ of " 34-45-25,	38.05 A.	100	2.52	100	2.03
NE¼ of SE¼ of " 34-45-25,	36.3 A.	100	2.52	100	2.03
NW¼ of Section 35-45-25,	160 A.	400	10.08	400	8.10
Lots 1, 2 and 3 of Sec. 36-45-25	.53 A.	125	3.15	125	2.53
Lots 7, 8 and 9 of Sec. 36-45-25	98.92 A.	260	6.55	260	5.28
Lot 11 of Sec. 36-45-25,	13.3 A.	25	.63	25	.51
Und. ½ of S½ of NE¼ of Sec. 28-45-25	80 A.	150	3.78	150	3.04
Total,		$ 1,660	$ 41.83	$ 1,660	$ 33.66
Collection fee,			.42		.34
Total Taxes,			$ 42.25		$ 34.00

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1945

10. TAXES (Cont.)

		1945		1944	
		Valuation	Taxes	Valuation	Taxes
Gwinn Townsite - Surface Only		$	$	$	$
Lot 2, Sec. 21-45-25,	43.75 A.	100	2.52	100	2.03
NE¼ of SW¼ of Sec. 21-45-25, included in plat,	6 A.	100	2.52	100	2.03
NE¼ of NW¼ of Sec. 21-45-25,	17.54 A.	150	3.78	150	3.04
S½ of NW¼ of Sec. 21-45-25 not included in Plat of Gwinn,	25.01 A.	200	5.04	200	4.05
E½ of SE¼ of Sec. 21-45-25,	65.84 A.	150	3.78	150	3.04
W½ of SE¼ of Sec. 21-45-25,	38.80 A.	300	7.56	300	6.08
Gwinn Townsite Plat,		20,280	511.13	41,160	833.29
Supts. Res. W½ of SE¼ of Sec. 21	1.2 A.	1,800	45.35	1,500	30.38
NW¼ of NE¼ of Sec. 21-45-25 except for five acres,		100	2.52	100	2.03
S½ of NE¼ of Sec. 21-45-25,	50.88 A.	300	7.56	300	6.08
Total,		$ 23,480	$ 591.76	$ 44,060	$ 892.05
Collection fee,			5.92		8.92
Total Taxes,			$ 597.68		$ 900.97
Gwinn Townsite Group Divided by Accounts					
From Tax Statement,		$ 23,480	$ 597.68	$ 44,060	$ 900.97
Gwinn Club House, Lot 8, Blk. 17,		500	12.60	500	10.23
Hospital, Lot 9, Blk. 25,		1,000	25.19	1,000	20.45
Rented Buildings,		8,420	212.59	28,710	587.19
Gwinn Townsite, Unsold Lots,		13,560	347.30	13,850	283.10
Total Group as per statement,		$ 23,480	$ 597.68	$ 44,060	$ 900.97
Gardner Mackinaw					
N½ of NE¼ of Sec. 35-45-25	87.35 A.	$ 500	$ 12.60	$ 500	$ 10.13
Collection fee,			.12		.10
Total Taxes,			$ 12.72		$ 10.23
Machinery in Warehouse		$ 900	$ 22.67	$ 900	$ 18.40
Central Water Plant NW¼ of NE¼ of Sec. 28-45-25,				100	2.05
Personal - District Office,		500	12.73	500	10.23
District Crusher, N½ of NE¼ of Sec. 27-45-25,		1,000	25.44	1,000	20.45
Total,		$ 2,400	$ 60.84	$ 2,500	$ 51.13
Austin Location					
Part of Lot 5, SW¼ of NE¼ of Sec. 20-45-25,		50	$ 1.26	$ 3,500	$ 72.87
NW¼ of SE¼ of Sec. 20-45-25,		200	5.04	3,500	70.87
NE¼ of SW¼ of Sec. 20-45-25,		260	6.55	260	5.27
Total,		$ 510	$ 12.85	$ 7,260	$ 147.01
Collection fee,			.13		1.47
Total taxes,			$ 12.98		$ 148.48

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1945

10. TAXES (Cont.

	1945 Valuation	1945 Taxes	1944 Valuation	1944 Taxes
Summary				
Machinery in Warehouse,	$ 900	$ 22.90	$ 900	$ 18.41
Stephenson Mine,				
Princeton Mine,	422,450	10,749.28	411,260	8,411.02
Francis Mine,				
Gardner Mackinaw Mine,	2,500	63.61	2,500	51.13
Austin Location,	510	12.98	7,260	148.48
Mineral Lands,	1,660	42.25	1,660	34.00
Gwinn Townsite,	23,480	497.68	44,060	900.97
Gardner Mackinaw Location,	500	12.72	500	10.23
Central Water Plant,			100	2.05
Personal - District Office	500	12.73	500	10.23
District Crusher,	1,000	25.44	1,000	20.45
Total C.Cli. Co.,	453,500	11,539.59	469,740	9,606.97
Cliffs Power & Light Co.	148,150	3,769.71	148,150	3,030.04
Total taxes (Including 1%)	601,650	15,309.30	617,890	12,637.01
Princeton - Personal Property	340,000	8,651.35	320,000	6,544.58
Taxes Levied - Forsyth Township				
Forsyth Township Valuation,	1,123,860		1,111,835	
Rate per $100 of Valuation,	2.51932		2.02493	
Amount of Tax Roll				
School Sinking Fund Tax,	5,619.30			
County Tax,	6,181.23		6,226.28	
County Road,	1,573.40		2,223.67	
Township Tax,	2,247.72		2,223.67	
Township Debt Service,	2,700.00		2,700.00	
School,	6,855.55		6,003.91	
School Debt Service,	3,136.41		3,136.41	
Rejected Tax,	78.32		12.25	
Total,	28,391.93		22,526.29	
Amount Paid by C.C.I.Co.,	11,539.59		9,606.97	
Amount Paid by C.P. & L.Co.,	376.97		3,030.09	
Total,	15,309.30		12,637.06	
Percent Paid by C.C.I.Co. & C.P.&L.,	53.9%		56.1%	

16. WATER SUPPLY - GWINN DISTRICT

Under E&A CC-139 a new 500 gpm Layne-Northwest pump was installed and put into operation in May of this year. The old unit , a 500 gpm Cameron, was useless because of the lowering of the water level below the suction capacity of the pump.

A statement of the completed E&A follows:

	Amount Authorized	(Labor	Supp. & Expenses	Total)	Unexpended Balance
Pump Complete,	736.00		694.15	694.15	41.85
Installation,	800.00	326.19	108.86	435.05	364.95
Social Security Taxes,			7.39	7.39	7.39
	1536.00	326.19	810.40	1136.59	399.41

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1945

16. WATER SUPPLY - GWINN DISTRICT (Cont.)

Following is a comparative cost statement for operating the Pump Station for the years 1945 and 1944:

	1945	1944	Increase	Decrease
General Expense,	$ 293.66	$ 66.40	$ 227.26	$
Maintenance,	444.30	1398.36		954.06
Operating,	477.28	566.23		88.95
Electric Power Kidder Station,	3212.69	4960.27		1747.58
" " Booster "	964.43	815.48	148.95	
E&A Depreciation,	1331.16	1047.01	284.15	
Total Cost,	6723.52	8853.75		2130.23
" Revenue Credit	5939.11	4798.21		
Deficit,	784.41	4055.54		1140.90

A reduction of $1747.58 in power cost was effected this year because of the increased efficency obtained through the use of the new unit as compared to the power consumption necessary to operate the 1000 gpm Layne Western spare unit throttled down to 500 gpm to prevent bursting of the old wood mains. The reduction in power cost alone compares favorably with the cost of installation of the new unit.

Hydrants

Fire hydrant rental revenue from Forsyth Township continued as last year, namely, 40 hydrants @ $35.00 per hydrant equalling $1,400.00. Cost of upkeep of hydrants, including painting and repairs and hydrant boxes, amounted to $50.20, as compared to cost of $227.41 in 1944.

16a. SEWER SYSTEM

In addition to the water supply system the Company has maintained the Gwinn townsite sewer system. During the past seven years the yearly expenditure for this work was as follows:

1939	$ 722.37
1940	710.69
1941	598.10
1942	336.40
1943	581.06
1944	610.10
1945	842.25

As mentioned in the annual report for last year, maintenance work is becoming increasingly more costly because of the fact that the roots of the now large bordering trees are entering the sewer pipes causing widespread constriction.

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1945

17. CONDITION OF PREMISES

The rents accrued, collected, and repair expense for the company houses in Gwinn and Austin locations follows:

	1945	1944	1943	1942	1941
Gwinn Townsite,					
Rents Accrued,	$1,787.18	$3,613.97	$10,489.92	$11,576.54	$11,417.03
Repair Expense,	929.74	1,043.92	2,308.51	8,032.71	5,320.12
Accrued rents over repair cost,	857.44	2,570.05	8,181.41	3,543.83	6,096.91
Actual rent collected*,	1,698.51	4,103.38	10,942.36	11,520.13	11,198.62

* Cash collected for regular running accounts, Year 1945 1,599.51
Cash collected for old charged off accounts, " " 99.00
Total, $ 1,698.51

During the year 11 houses (sides) were sold as per detail on other sheet, leaving five houses (sides) of the regular double houses, unsold as of Dec. 31, 1945.

	1945	1944	1943	1942	1941
Austin Location					
Rents Accrued,	$ 44.50	$1,774.04	$2,275.83	$2,231.00	$2,177.08
Repair Expense,	80.69	424.59	514.11	417.52	856.35
Accrued rents over repair cost,	-36.19	1,349.45	1,761.72	1,813.48	1,320.73
Actual rent collected*	127.57	1,865.25	2,316.42	2,449.52	2,152.92

* Cash collected for regular running accounts, Year 1945, 80.12
Cash collected for old charged off accounts, " " , 47.45
Total, $ 127.57

The two houses at Austin Location remaining unsold as of December 31, 1944 were sold during 1945.

19. EXPLORATION

A brief program of diamond drill exploration under E&A CC 156 was carried out during the fall of this year in the northeast quarter of Section 19, 45-25 to test an area between the Princeton No. 2 and Austin ore bodies in which no previous information had been obtained. The area was considered to possess excellent ore bearing possibilities and should ore have been encountered the present Princeton facilities would have served as the only available means of extraction.

Two comparatively shallow holes were put down but neither showed any enrichment beyond insignificant streaks contained in the jasper formation. Hole No. 51 was drilled vertically to a depth of 530 feet. A penetration of 42 feet into the arkose footwall was made to this finished depth. Hole No. 52 was drilled approximately 500 feet west of No. 51, at the center of the northeast quarter but results were similarly negative.

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1945

19. GWINN ASSOCIATION

The clubhouse is maintained through the financial assistance of the Cleveland-Cliffs Iron Company, the Cliffs Power and Light Company, the Township Board of Education and membership fees received from residents of the community.

The average monthly membership was 246 a decrease of 18 over last year: 190 members were employed at the different mines; the remainder were employed elsewhere or held complimentary memberships as retired employees or members of the armed services.

Activities at the building covered bowling leagues for men and women; card playing facilities for adults; a library, receiving 7 weekly and 21 monthly magazines and daily and weekly newspapers; a library with popular fiction; a recreation room with pool, billiard and table tennis tables; the gymnasium equipped for class work or recreation, such as, basketball, volleyball, handball, badminton, boxing, wrestling and also used for dancing. Separate showers and locker rooms are provided for men and women. Meeting rooms are provided for scout organizations, the American Legion and the different churches and other groups.

Total number of meetings of a business, social, educational or recreational nature was 356; of this number 6 were annual events, Church organizations used the building on 131 occasions, scout troops held 66 meetings, 45 dances were held; federal agencies, women's organizations, rehearsals for plays and musical events, sportsmen's meetings and legion and committee meetings totalled 114. Equipment in the club kitchen was used on 90 occasions and equipment loaned for outside events 38 times.

The gymnasium was used 415 periods for supervised class work or for recreational activities by high school students or adults. There were 123 scheduled basketball games, including league games for boys and girls.

Outdoor activities covered softball, hardball, touch football, and horseshoe pitching. Equipment was furnished by the club for the above. The estimated attendance including participants for all outdoor activities and cottage at Bass Lake was 8,500.

During the year fuel, supplies and equipment were purchased to keep all departments functioning properly and the usual attention was given to the building to keep it in good repair. Arrangements are now underway whereby the local post of the American Legion will take over rooms formerly used as Red Cross quarters for general meetings and social activities.

Employees of the club expect an increase in attendance and activities during the coming year, due to the fact that many former members are being discharged from the armed forces and are returning to the district.

Building

The Clubhouse continues to operate under the same financial arrangements as in previous years. The Cleveland-Cliffs Iron Company renders financial assistance and supervision, the Cliffs Power and Light Company grants free service and the local Board of Education under a contract agreement pays rental for the use of the building and equipment for their physical training program and for social activities including dancing.

ANNUAL REPORT
GWINN DISTRICT GENERAL
YEAR 1945

19. GWINN ASSOCIATION (Cont.)

The usual amount of attention was given the building, such as, varnishing floors in the lobby, recreation room and community meeting room to keep them in good condition. The gymnasium was given a special coat of gym seal. Bowling alleys were re-finished and new pins purchased. Janitor supplies and fuel were purchased.

Arrangements are being completed to permit members of the American Legion to use rooms as quarters for their meetings and also to provide space for a small kitchen.

The financial condition of the Club is at the lowest point in many years but those in charge hope to correct this situation to some extent due to the fact that the Club will secure from the local Board of Education some fuel to off-set work being done for them in supervising their physical training program. The membership should also increase the coming year as many men that were in service are returning home.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

1. GENERAL

Production and costs at the Princeton mine show a considerable improvement for 1945 over past records. The year's production of 269,041 tons was the highest in the history of the property as was also the average daily product of 900 tons per day. Likewise, the tons per man per day figure of 6.20 tons surpassed previous figures. Consequently, the cost of production at the mine was reduced by $.332 per ton this year as compared to 1944.

The average number of men employed this past year again dropped for the second consecutive year to a figure for 1945 of 146 which was 15 less men than in 1944. A reduction of $0.19 per ton labor cost, however, was made this year over last.

Labor supply was the important factor in 1945 production and the influence of a shortage during the latter part of the year will be projected into the coming operating season. This phase of operations has been discussed in monthly reports on the property and repetitive statements are needless. A summation, however, would emphasize the fact that mining is now becoming concentrated in the No. 3 plastic orebody wherein a larger number of men is required for development and mining and that the status of development is not as advanced as a balanced operation would demand.

A number of general improvements were made in 1945 which have produced a beneficial effect on allround efficiency. These improvements were, of course, of the type wherein a quick return of the cost involved could be expected and the benefits of lower cost operating be immediately felt. Other possible major improvements are evident, but the return on the investment would, in all probability, coincide with the life of the mine and nothing would be gained.

The accomplishment of single greatest importance was the completion of the 7th Level drift and No. 3 Shaft to that elevation. Without this development work it would be no overstatement, as subsequent maintenance requirements have shown, to say that the property would not have produced any ore in the last few months of 1945. A section of this drift immediately under the orebody, a length of approximately 350 feet, was driven through a very soft, slickensided type of arkose. An excellent description of the rock is given by the observation that auger steel was employed in drilling this stretch of drift and mud was formed in the bottom of the scraper trough in mucking operations. This arkose, at the flattening zone of the dip, filled with slips and cracks produced a dead weight on the timber support. In the months of November and December it was necessary to put a crew of 16 men, working midnight shift, to supplement the regular timber repair gang in maintaining this section.

The south end of this main level drift, the remaining 450 feet to the No. 3 Shart and the plat is in fairly hard arkose and has given no trouble in maintenance. Necessity of working the extra crew in the troublesome section, however, meant the equivalent of four double shift mining or development gangs lost for that retimbering period of several months.

The scraping transfer drift method of loading cars underground has proven superior with the soft tenacious Princeton ore to the heretofore conventional raise and loading chute system. Use of the latter system incurred much loss of time and labor in dislodging ore stuck in the raise and also introduced a safety hazard when drainage water became impounded behind the wedged ore. The sudden slump of the mass

often became uncontrollable endangering the chutemen loading cars and causing much delay especially in main drifts because of hand mucking in the clean-up.

In the top timber transfer method the ore is dropped down the mining raise freely to the floor of a drift driven more or less at right angles from a haulage cross-cut at a height of 2 to 8 feet over the back of the cross-cut. The ore is then scraped directly into the cars. The apparent slowness of loading cars one scraperful at a time is actually faster than blowing clear a chute full of sticky ore.

The ore raises in the "heavy" section of the 7th Level drift were to have been replaced when crushed beyond usefullness by top timber transfer drifts but, of course, the necessity of close retimbering prevented their construction. Instead, it was possible to drive the drifts parallel to the main drift from cross-cuts to the north and south of the crushing section. This sidestepped the difficulty to a major extent but produced the undesirable feature of having several crews of miners working above the same transfer which entailed overlapping in delivery of timber, supplies and delays from blasting smoke. Counteracting desirable results, however, have been the use of one scraper hoist to load the ore produced by the several contracts rather than having to use a separate unit for each individual drift and contract and less interference on the haulage line by the use of one chute for loading.

A second loading trench at the No. 2 hoisting shaft was excavated and put into use during the year. Much needed flexibility of tramming methods was obtained by this trench which actually serves as a storage or surge bin. The property possessed ten 52 cubic feet capacity underground ore cars excluding the obsolete second-hand type which was available for purchase at the time of re-opening. It was obviously rather difficult to handle 900 tons of ore per day as set up by production estimates by 10 three-ton cars. Seven additional old 65 foot capacity cars were purchased from other Company mines, repaired and put into service to augment the original string of ten. The use of the trenches for storage, either for ore or rock, releases the cars for further loading enabling the miners to proceed without delays caused by ore pile interference to timbering and drilling. Skip loading under this method proceeds at a regular rate when ore production is high.

A labor wasting operation which was eliminated this year was the bucket method of cleaning skip pit. With the bucket procedure four men required a minimum time of one half a shift to remove the accumulation in the shaft bottom. An inclined raise was brought up from the bottom of the shaft to the inside edge of the storage trench and a short slide cut from the mouth of the raise to the side of the trench. A specially designed scraper brings the accumulation of spillage, regardless of the consistency, up the planked bottom of the raise to the slide at which point the self dumping scraper discharges its load into the trench. The mud is mixed with a small amount of dry ore and via a newly constructed measuring pocket is loaded into the skip. By this method one man can empty the skip pit in one and a half hours which is less than one tenth of the previously needed man hours.

The spillage problem had occasioned much concern and has been eased to a great extent. Because of the sticky characteristic of the ore, the corners of the skip had been fitted with fillet pieces to approximate a circular cross-section which would offer less area for sticking. Heavy chains were also fixed to the skip bottom in an attempt to force the dumping of the ore load. The bulk of the ore that stuck in the skip was concentrated at the bottom sticking the heaviest chain

that could be applied and the net result of the fillet pieces was a reduction in the capacity of the skip, to the point where a 65 cubic foot car produced a heaping load. Manual blowing of compressed air provided the only sure way of completely ridding the skip of its load, and the removal of the fillets provided a margin of a foot from the top of a maximum-fill car load to the lip of the skip when the load was hoisted.

The physical arrangement of the 7th Level loading station at the No. 2 Shaft is unique inasmuch as it is necessary to load the skip over the high side or lip. Obviously, the hoisting rope stretch at load impact offers opportunity for spillage from the tail end of the car load. This condition was most severe when chunky stope ore was being loaded. A splash or "rebound" plate was placed against the shaft timbers behind and at close clearance to the skip which causes most of the overflow stream to glance back into the skip.

Adequate facilities for underground repair of cars and motors were obtained during the year by the cutting of a repair station in the arkose from the 7th Level drift midway between the No. 3 Shaft and the orebody. This feature has aided indirectly to efficiency for the reason that the No. 3 Headframe was not constructed high enough to permit heavy or bulky objects such as cars or haulage motors to be slung below the cage. The cage is of small design and does not have the dimensions to carry large supplies. When it was necessary to bring bulky equipment underground it was necessary to lower it through the No. 2 hoisting shaft below the skip. To eliminate interference to hoisting and offer opportunity to remove dump bars and other apparatus at the underground station, the supply job had to be scheduled for overtime or week-end work when possible. Workmanlike repairs can now be made for the most part in the new station to any piece of underground equipment.

2. PRODUCTION, SHIPMENTS & INVENTORIES

a. Production by Grades

	PRINCETON		SEC. 19 LEASE		TOTAL	
	1945	1944	1945	1944	1945	1944
Cambridge,	245,355	195,005	23,686	21,507	269,041	216,512
Total,	245,355	195,005	23,686	21,507	269,041	216,512

b. Shipments

	1945	1944	Decrease	Increase	Total Increase
Cambridge,	235,009	192,658		42,351	42,351

c. Stockpile Inventories

	1945	1944	
Cambridge Sec. 19,	24,826	19,117	Tons
" " 20,	164,368	136,045	"
Total,	189,194	155,162	Tons

e. Production by months

	Sec. 19 Cambridge	Sec. 20 Cambridge	Total
January,	1,586	20,138	21,724
February,	389	26,263	26,652

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

2. PRODUCTION, SHIPMENTS & INVENTORIES (Cont.)

e. Production by months (Cont.)

	Sec. 19 Cambridge	Sec. 20 Cambridge	Total
March,	-	25,147	25,147
April,	-	21,588	21,588
May,	-	22,886	22,886
June,	-	23,024	23,024
July,	997	20,122	21,119
August,	1,477	15,259	16,736
September,	2,984	24,147	27,131
October,	4,605	19,909	24,514
November,	4,605	14,566	19,171
December,	7,043	12,306	19,349
Total,	23,686	245,355	269,041

f. Ore Statement

	Sec. 19 Cambridge	Sec. 20 Cambridge	Total
On hand Jan. 1, 1945,	19,117	136,045	155,162
Output for year,	23,686	245,355	269,041
Transfers,	17,977	17,977	-
Overrun,	-	-	-
Total,	24,826	399,377	424,203
Shipments,	-	235,009	235,009
Balance on hand Dec. 31, 1945,	24,826	164,368	189,194

3. ANALYSIS

a. Stockpile Analysis

Grade	Tons		Iron	Phos.	Sil.	Mang.	Al.	Lime	Mag.	Sul.	Loss	Moist.
Cambridge,	164,368	Dry	60.14	.795	4.17	.999	.90	3.83	.57	.019	1.16	
"	24,826	Natl.	51.315	.678	3.56	.853	.77	3.27	.49	.016	.990	14.66

The total tonnage in stock consists of 164,368 tons of Cambridge, and 24,826 tons of Cambridge Section 19 ore.

b. Average Analysis - 1945 Shipments

Grade	Tons	Iron	Phos.	Sil.	Mang.	Al.	Lime	Mag.	Sul.	Loss
Cambridge	235,009	60.90	.776	4.08	.87	.90	2.83	.58	.019	1.16

4. ESTIMATE OF ORE RESERVES

a. Developed Ore

Assumption: 12 cu. ft. equals 1 ton
Less 10% for mining and rock

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

4. ESTIMATE OF ORE RESERVES (Cont.)

a. Developed Ore (Cont.)

Princeport Sec.20	Cambridge Section 20 No. 2 Shaft - No. 3 Shaft	Cambridge Sec. 20 Total	Cambridge Sec. 19	Total
25,058	164,514	498,900	663,414	40,913	729,385

This total tonnage includes 145,380 net estimated tonnage below 7th Level elevation at Nos. 2 and 3 Shafts.

c. Estimated Analysis

Grade	Trade Name	Tons	Iron	Phos.	Sil.	Mang.	Alum	Lime	Mag.	Sul.	Loss	Moist.
Non-Bessemer	Princeport	25,058	50.60	.256	6.57	1.032	.429	1.365	.882	.020	1.90	15.90
Non-Bessemer	Cambridge	704,327	51.36	.694	3.29	.85	.97	3.41	.47	.017	1.70	14.97

d. Estimated Tonnage as Required by State Tax Commission

	Princeport Sec. 20	Cambridge Sec. 20 #2 Shaft - #3 Shaft	Cambridge Sec. 20 Total	Cambridge Sec. 19	Total Tons
Above 5th Level (1921 est.) No. 2 Shaft,	27,842	147,944	147,944		175,786
Above 6th Level,		42,522	42,522	5,837	48,359
Between 6th & 7th Levels,		28,102 370,699	398,801	47,448	446,249
Below 7th Level,		7,971 153,562	161,533		161,533
Gross Total Nov. 30, 1945,	27,842	184,017 566,783	750,800	53,285	831,927
Less December Production,		1,101 11,205	12,306	7,043	19,349
Gross Total Dec. 31, 1945,	27,842	182,916 555,578	738,494	46,242	812,578
Less 10% for Mining and Rock,	2,784	18,402 56,678	75,080	5,329	83,193
Net Total Dec. 31, 1945,	25,058	164,514 498,900	663,414	40,913	729,385

5. LABOR & WAGES

b. Comparative Statement of Wages and Product

	1945	1944	Increase	Decrease
Product,	269,041	216,512	52,529	
Number of Shifts & Hours,	6 2-8 hr.	5 2-8 hr. 1 1-8 hr.		
AVG. NUMBER OF MEN WORKING				
Surface,	44	43	1	
Underground,	102½	118½		16
Total,	146½	161½		15

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

5. LABOR & WAGES (Cont.)

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

	1945	1944	Increase	Decrease
AVG. WAGES PER DAY				
Surface,	7.64	6.90	.74	
Underground,	9.23	8.18	1.05	
Total,	8.74	7.83	.93	
AVG. WAGES PER MONTH OF 24 DAYS				
Surface,	183.36	165.60	17.76	
Underground,	221.52	196.32	25.20	
Total,	209.76	187.44	22.32	
PRODUCT PER MAN PER DAY				
Surface,	20.02	18.25	1.77	
Underground,	8.98	6.68	2.30	
Total,	6.20	4.89	1.31	
LABOR COST PER TON				
Surface,	.382	.378	.004	
Underground,	1.028	1.225		.197
Total,	1.410	1.603		.193
AVG. PRODUCT MINING				
Stoping,	256,882	158,633	98,249	
Ore Development,	12,159	57,879		45,720
Total,	269,041	216,512	52,529	
AVG. WAGES CONTRACT LABOR	9.99	8.97	1.02	
TOTAL NUMBER OF DAYS				
Surface,	13,437½	11,866¾	1,570¾	
Underground,	29,955½	32,408¼		2,453½
Total,	43,392¾	44,275½		882¾
AMOUNT FOR LABOR				
Surface,	102,726.33	81,916.01	20,810.32	
Underground,	276,730.56	265,176.35	11,554.21	
Total,	379,456.89	347,092.36	32,364.53	

PROPORTION OF SURFACE TO UNDERGROUND MEN

1945, 1 to 2.33 - 2-8 hr. shifts
1944, 1 to 2.75 - 2-8 hr. shifts

AVG. WAGES PER MO. BASED ON MEN CARRIED ON MINE PAYROLL				
Surface,	183.36	165.60	17.76	
Underground,	221.52	196.32	25.20	
Total,	209.76	187.44	22.32	

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

5. LABOR & WAGES (Cont.)

LABOR

The working force available at the property was 10% less in 1945 as compared with the previous year. This situation, of course, resulted in an ultimate reduction of mining and development crews, and as mentioned previously, the long range effect has been to place the development status behind schedule.

6. SURFACE

a. Buildings, Repairs

Several improvements designed to improve efficiency and enhance the safety program were made at the No. 2 Shaft this past year. Steps to the skip blowing platform from the landing were installed to replace the dangerous ladder access previously used. The steps were later continued to the top sheave station which eliminates the necessity of a man crawling up the outside iron ladder which, in cold and sleety weather, is a distinct hazard.

At the pocket, a loading platform and steps were built, and additional lighting installed to make it possible for the pocket men to work in safety with increased efficiency.

In addition to these improvements, a tool and supply room was built on the landing to house portable equipment and supplies in a neat fashion, eliminating temporary loss of the equipment under heavy snow fall and providing quick access to frequently used supplies such as wooden spools, brackets and sheaves.

At the No. 3 Shaft locality, a fire lane was ploughed around the long banks of poles and lagging placed in a field of heavy grass which sets up a fire hazard in the dry months from the fact that it borders a state highway.

Much cooperation has been given the Princeton by the personnel of other Company properties on the range. Two specific surface improvements, a device to more efficiently oil hoisting ropes was demonstrated here by Athens mine supervisors and assistance given to produce a similar device in the Princeton shops. From the Cliffs Shaft mine several surface employees supervised the construction here of an A-frame to speed up construction of wooden stocking trestles.

b. Stockpiles

Removal of a rock outcrop in the southeast area of the No. 2 grounds by drilling, blasting and bull dozer work provided stocking space for approximately 100,000 additional tons of ore.

Bull dozer work on the stockpiles was continued throughout the year levelling the crests producing practically a uniform height of bank for shovel loading. Consequently, the shovel loading efficiency rose and 112,000 tons were shipped at a reduction of $ .02 per ton as compared to the previous year when this system was not employed.

The stocking and shipping was so planned this past year that a stockpile on both north and south sides of the shaft were shipped and two replacement trestles erected. This permits stocking with no interference with shovel loading and also provides separate trestles, with of course separate top tram cars, for use during the winter. Failure of a trestle or car, with this flexibility, does not suspend hoisting.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

6. SURFACE (Cont.)

b. Stockpiles (Cont.)

An all steel top tram car was built in the Princeton shops early in the year to replace a car, originally from the Gardner-Mackinaw, which was completely worn out. The new car is slightly larger in capacity because of eliminating the thick wooden framework of the old type, and has given satisfactory service.

c. Trestles

The second and third trestles erected this year were built with an A-frame instead of the gin pole as heretofore used in this district. Instructions in the efficient and safe use of the frame were given Princeton men by Cliff-Shaft surface employees. Trestle erection has been considerably speeded up by this method.

Coal for steam-shovel use had been unloaded from cars by hand in the past at this property and had the effect of tying-up a crew of four or five several days. This inefficient set-up was eliminated by the construction at odd intervals during the year of a low coal dock at the end of the pocket track. The material used was scrap timbers recovered from old trestles. Unloading coal is now a matter of a few hours and the dock track now gives the added advantage of permitting five extra ore cars on the pocket track. Previously, pocket loading was suspended during a shift simply because no cars were available. The extra cars now serve to carry over during loading periods.

d. General

A new caving break through to the surface occurred during July at a point 550 feet south of the No. 2 Shaft off the end of the rock pile. The subsidence was on the nature of a circular section about 20 feet in diameter which dropped 25 feet forming a dirt pile, the sides of which, in three directions, sloped downwards into an open stope. Light smoke from the cave was determined to be the result of combustion of pyrites occurring in the jasper near the surface. No indication has been observed of any connection from the cave to the present open mine workings.

Because of this caving, however, it was necessary to bring in a new water supply line from the main a distance of approximately 800 feet to the No. 2 engine house.

Excavation of a surface drainage ditch was carried on intermittently during the year when either men or equipment was available. An attempt to curb the drainage of surface water to the general caving area overlying the No. 3 orebody by grouting was unsuccessful. The grouting was done in two churn drill holes that had been put down in 1944 to provide information on the drainage problem, but apparently the cement grout under pressure was finding release in one or more loose seams in the sandstone.

7. UNDERGROUND

Mining at the property consists of operations in two ore bodies distinct as to placement and also by the physical characteristics of the ore. Reference will be made in this report to the Nos. 2 and 3 separately and in that order.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

No. 2 Shaft

The No. 2 orebody lying between the 6th and 7th Levels as of the start of the year 1945 contained about 15,000 tons of mixed rubbly and plastic ore, mostly plastic type, at the north end immediately below 6th level elevation. The center and south portion had been stoped out, leaving pillars along the hanging wall side.

Mining of the north portion was economically unjustified because of several reasons, the chief predisposing factor being the drainage water. Operations in this area was therefore abandoned.

The hanging wall ore at the south and central areas were developed for stoping and mining carried on in balance with the progress of mining in the No. 3 area. When slicing or caving production dropped temporarily because of raise cutting or repairing, emphasis could be placed on stoping to maintain optimum activity in haulage and hoisting.

Periodic observation was maintained, however, on the north end and when it became apparent that the removal of the ore down the dip of the orebody to the south had caused a re-routing of much of the drainage water, another attempt at mining the north area was indicated. The timing of events was fortunate inasmuch as a general labor shortage coupled with the necessity of placing a large number of repair crews in the 7th Level No. 3 main drift had caused a serious lag in the development of working places in the No. 3 area. Raises and cross-cuts in the previously abandoned area were in generally good shape and mining was resumed with little delay.

Except for drift pillars along the 7100 cross-cut the south end of the No. 2 orebody is mined out. Crushing of the 7100 cross-cut occurred during the middle of the year presumably because of heavy caving from the worked out stopes higher up the dip, but it is planned to recover much of the drift pillar ore.

No. 2 Shaft

885' Sub-level

Section 20

Stoping Contract No. 4 mined a pillar of ore on this elevation from old workings on the east a distance of approximately 80 feet west toward the main cross-cut. Development Contract No. 5 brought up a single raise from the 6th Level drive to connect with a previously driven small drift to provide safe access to the stope.

867' Sub-level

Stoping Contract No. 4 recovered a supporting pillar of ore immediately above and on the footwall side of the 6th Level haulage drift. This mining on the south side of the straight drift from No. 2 Shaft was done in the latter part of the year. The contract had previously recovered similar supporting pillars on the north or No. 1 Shaft side of the straight drift approach. In both cases mining was accomplished by working from transfer drifts driven at top timber height from 6th Level haulage drifts.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

No. 2 Shaft (Cont.)

6th Level

Section 20

Stoping Contract No. 4, from the stub end of the straight drift southwest from No. 2 Shaft, mined two pillars north and south of the drift. Considerable lean ore and jasper was encountered against the arkose footwall which limited the extent of stoping work at this elevation.

Stoping Contract No. 10, working from Raise #721 on the 825' Sub-level, caved the supporting pillar surrounding this former timber transfer raise.

835' Sub-level

Section 19

Raise #7401, Contract No. 12, completed two slices southeast of the raise against the arkose footwall. Mining in this area, containing plastic ore, was seriously hampered by wide-spread in filtration of drainage water.

Stoping Contract No. 10, mining from Raise #7302, recovered a grade of ore intermediate in character between the plastic and rubbly types against the west ore contact. A lean transition jasper material below the true hanging wall caused high silica dilution in this stope. It was possible, however, to operate this stope because of the fact that a much larger tonnage of currently mined ore contained an extremely low silica analysis.

Stoping Contract No. 4, working from a transfer drift driven south from Raise #7301 on the 825' Sub-level, broke into a previously mined stope and recovered ore of excellent analysis in retreating to the raise.

Section 20

Raise #721, Stoping Contract No. 10, drove a timber drift east and upwards on the arkose footwall to make connection with the 6th Level former haulage drift. The contract mined this supporting pillar by stoping methods to within 20 feet of the raise and caved the major portion of the remaining ore to the 7th Level.

Stoping Contract No. 1, working from top timber elevation from the northwest extension of the 7100 cross-cut, mined a narrow pillar of ore which had been left from stoping operations in the previous year.

Raise #702A, Contract No. 9, attempted recovery of two small pillars of rubbly ore lying on the footwall northeast of the raise but the lean nature of the ore made this operation uneconomical.

825' Sub-level

Section 19

Raise #7302, Stoping Contract No. 10, drove two transfer drifts west from the raise and employed stoping methods to mine a rubbly type ore along the west

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

No. 2 Shaft (Cont.)

825' Sub-level (Cont.)

boundary of the orebody. A third transfer drift was driven north from the raise at the end of the year in an attempt to recover a pillar of plastic ore on the 6th Level elevation by caving procedure.

Raise #7301, Stoping Contract No. 4, drove a small sized drift south from the raise 40 feet in arkose and extended the drift an additional 135 feet full sized in ore to the jasper hanging wall. Despite the great length of scrape, excellent recovery was obtained from this operation.

Section 20

Stoping Contract No. 1, working as previously described from the 7100 cross-cut, made excellent recovery of ore pillars left on this elevation from previous stoping work.

At the junction of the Nos. 2 and 3 orebodies, stoping Contract No. 11 mined the ore face in successive stages towards the south.

800' Sub-level

Section 20

Stoping Contract No. 1, mining from three successive top timber transfers over the 7100 cross-cut lying immediately underneath the jasper hanging wall, stoped a large area north and east to the arkose.

Raise #722, Stoping Contract No. 10, drove a small drift south through the footwall and mined a small stope along the arkose.

Raise #7103, Slicing Contract No. 9, caved a pillar of ore north of the raise.

Raise #702A, Stoping Contract No. 11, retreated the stope face to the south from small sized transfer drifts driven to the hanging wall.

785' Sub-level

Raise #720A was brought up to this elevation in arkose by Contract No. 1 and a small drift driven due west towards the 7100 cross-cut extension to recover mining equipment when severe and rapid crushing of the cross-cut made removal impossible at the time of crushing. The equipment was successfully recovered and also a considerable quantity of ore mined by the contract from the small drift.

Raise #7103, Stoping Contract No. 9, mined a small stope approximately 50 feet in cross-sectional area on the footwall side of the orebody. A stoping limit was set approximately 20 feet from the rib of the 7th Level drift to leave a protective pillar. This ore, of course, will be mined when the cross-cut can serve no further haulage purposes.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

No. 2 Shaft (Cont.)

7th Level

Section 19

The 7300 cross-cut was extended 70 feet southwest to obtain position for Raise #7302 and also to provide loading track.

Section 20

Raise #702A was put by Contract No. 1 from the south rib of the main level drift to recover equipment, as mentioned previously.

From the south rib of the 7100 cross-cut near the jasper contact, a timbered transfer drift was driven at a sharp degree downwards following the arkose footwall. The purpose of this work was to determine the extent of the ore below 7th Level elevation in the southeast tip of the No. 2 orebody. The drift was halted at a distance of 70 feet by the convergence of the foot and hanging wall. The small amount of ore remaining was then recovered by stoping from the exploratory drift.

Raises 702A and 704 were put up through the arkose footwall from the west rib of the main level drift to gain access to the ore at the junction of the Nos. 2 and 3 orebodies.

No. 3 Shaft

Mining in the comparatively large central area of the No. 3 orebody followed a pattern of top slicing or sub-level caving methods. The 6th Level had been left irregular in height because in places it was possible to mine the 6th sub-level by construction of scraper slides, but this procedure was inexpedient in other areas because of lack of tail track, and interference to main line haulage and in these latter cases, the pillars were mined from the raises at one sub-level above the 6th Level elevation. When progress of the 7th Level main footwall drift was sufficient, raises to the central area were immediately put up and cut out at one sub-level interval below 6th Level.

It is planned to extend the 7900 cross-cut to the south and west to get in position to mine the several sub-levels of ore left above the 6th Level in the extreme southwest wing. Mud and drainage water had forced abandonment of mining late in 1943. The 7900 cross-cut extension will provide position for top timber scraping drifts from which raises will be put up to this area; and the drift will also serve to explore, develop and mine the southwest ore area at 7th Level elevation and above.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

No. 3 Shaft

885' Sub-level

Section 20

Two small pillars at the fringes of previous slicing operations were recovered from 6th Level elevation.

875' Sub-level

Raise #701B, Contract No. 18, mined a 120 foot section of the orebody which, in this area, is of an elongated, extremely narrow shape. Mining in the central portion of the No. 3 orebody was done from raises brought up from the 7th Level elevation and which were cut out on the 835' Sub-level. The work consisted of recovering scattered pillars left from previous mining attempts from 6th Level elevation prior to the completion of the main 7th Level footwall drift.

6th Level

Raise #701A, Contract No. 18, working in the narrow north portion of the orebody, mined a narrow lense of ore approximately 80 feet long.

The central portion of the orebody was treated in a similar manner as described for the 875' Sub-level; with scattered ore pillars being recovered by caving methods from the 835' Sub-level.

Two small development projects were accomplished on the hanging wall side of the 6th Level and consisted of small sized drifts connecting to the 6th Level hanging wall drift for ventilation purposes.

835' Sub-level

Contracts No. 7 and 12 in the north off-set portion of the orebody, brought stoping work against old 6th Level workings from the 800 elevation.

Raise #701, Contract No. 18, completed mining of the north tip of the No. 3 orebody on this elevation by a combination of stoping and sub-level caving methods.

The central part of the No. 3 orebody was mined by top slicing and sub-level caving methods from Raises #709, 711, 715, and 717.

825' Sub-level

Exploration work at the supposed junctions of the Nos. 2 and 3 orebodies developed an ore area approximately 300 feet in length with an average width of 50 feet. This entire length of orebody was mined during the year by stoping methods employed by Contracts No. 7, 11 and 12.

Raise #701, Contract No. 18, mined the remaining ore at the north tip of the orebody by top slicing and sub-level caving. A jasper horse of great extent has been encountered at the north end of the orebody which apparently segregates the plastic type ore from the rubbly ore, characteristic of the No. 2 body.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

No. 3 Shaft (Cont.)

825' Sub-level

Raise #7801, Contract No. 7, mined a small section of ore against the jasper horse west of the raise.

Raise #708, Contract No. 18, employing the sub-level caving method, mined the available ore on this sub-level north and east of the raise to the arkose footwall.

Raise #709, Contract No. 17, mined an area east of the raise to the arkose footwall during the latter part of the year. Considerable water drainage has been encountered in this area and failure of the raise by crushing resulted. Further mining from the raise was then suspended until access to this area could be obtained from scraping drifts to be driven at top timber height from the 7th Level cross-cuts.

At the south end of the orebody a small amount of mining was done from Raises #7901 and #715. In this area a thick cross-dike and two consecutive jasper intrusions were encountered which cut down considerably the ore area previously assumed for this area. Extraction was unavoidably complicated which resulted in a reduced mining efficiency in this locality.

800' Sub-level

Stoping Contracts No. 7 and 12 working from raises in the 7700 cross-cut north of the 7710 scraping drift, completed mining of the rubbly ore north of the large jasper intrusion.

Raise #7811, Contract No. 9, drove two connecting drifts at plus 817 elevation to raises 709 on the north and 7901A on the south.

Raise #7902, Contract 16, cut out the raise in the jasper hanging wall at plus 808 elevation and drove a small sized drift 40 feet west in an endeavor to collect drainage water coming from the hanging wall and divert it along the 7th Level footwall drift.

785' Sub-level

Top timber scraping drift 7710, which had been started in 1944 but discontinued at that time because of excess amounts of drainage water, was completed this year to a distance of 90 feet northwest from the 7700 cross-cut. Convergence of the arkose and jasper halted drifting at this distance. The scraping drift was then extended from the south rib of the cross-cut and in this direction was stopped at a distance of 70 feet by the large jasper horse cutting northeast-southwest through the No. 3 orebody. A second scraper drift over the 7700 cross-cut was completed by Contract No. 17.

At top timber height above the 7800 cross-cut, a scraping drift was driven by Contract No. 9. North of the cross-cut the drift was stopped by the jasper intrusion and the south extension was completed at a point directly above the main footwall drift.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

No. 3 Shaft (Cont.)

785' Sub-level (Cont.)

Raise #7901, Contract No. 3, drove a scraper drift northwest from the raise immediately above 7th Level elevation for a total length of 120 feet and put up Raise #7901A from the north rib of the transfer drift.

7th Level

Extension of the 7700 cross-cut southwest through the orebody was made during the year by Contract No. 10. An advance of 110 feet was made at this time. Drifting was halted by the influx of drainage water from the hanging wall. The drainage water was collected and piped across the orebody and discharged into the drainage ditches in the rock section of the cross-cut. Diamond drill hole No. 13 was then completed from the north rib of the cross-cut near the breast and apparently served to drain the hanging wall in this area. Continuance of drifting was then attempted and an additional 70 feet of cross-cut was accomplished turning to the south. However, the drainage water problem again became acute causing failure of the timber support in this stretch and a turnout was made into the hanging wall. It was planned to continue the cross-cut then in jasper to the south. The project, however, was suspended temporarily because of the lack of manpower.

An extension of 90 feet was made during the latter part of the year in the 7900 cross-cut. This drift was advanced to the south in arkose to provide access to ore in the extreme south wing of the orebody lying on and extending several sub-levels above the 6th Level.

At a point approximately midway between the orebody on 7th Level and the No. 3 supply shaft, a cut-out was made in the south rib of the 7th Level drift to provide a repair station for underground haulage motors and cars.

Extension of the main arkose footwall drift an additional 160 feet to the south early in the year provided the means of connecting the No. 3 Shaft with 7th Level operations.

Raise construction from the main level in the No. 3 area for the year included the completion of Raise #717 to 6th Level elevation; Raise #7702 a single compartment raise in rock to the 800' Sub-level; Raise #7903 a single compartment raise in the hanging wall for water drainage purposes and also three ore chutes from the level to top timber scraping transfer drifts.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

d. Timbering

KIND	LINEAL FT.	AVG. PRICE PER FT.	AMOUNT 1945	AMOUNT 1944
6" x 8" Cribbing Timber,	14,044	.0500	$ 772.45	$ 2,703.03
8" x 10" Stull "	3,419	.0988	337.84	804.46
10"x 12" " "	22,491	.1273	2,863.79	4,294.79
12"x 14" " "	19,448	.1985	3,861.81	4,209.95
14"& Up " "	8,707	.2000	1,741.88	912.39
Total timber 1945,	68,109	.1406	$ 9,577.77	
" " 1944,				$12,924.62
		Per 100 Ft.		
7' Lagging,	424,533	1.3878	$ 5,891.86	$ 7,821.23
9½' Poles,	263,376	2.0872	5,497.30	7,885.30
Total 1945,	687,909		$11,389.16	
Total 1944,				$15,706.53
GRAND TOTAL 1945,			$20,966.93	
GRAND TOTAL 1944,				$28,631.15

Product - Tons	269,041	216,512
Feet of Timber per ton of ore - Stulls & Cribbing,	.2531	.5722
" " Stull Timber only per ton of ore,	.2009	.3271
" " Lagging per ton of ore,	1.5779	2.6622
" " Poles per ton of ore,	.9789	1.7723
" " Wire Fencing per ton of ore,	-	-
" " Lagging per foot of timber,	6.2331	4.6525
" " Poles " " " "	3.8669	3.0973
Cost per ton for timber,	.0356	.0597
" " " " Lagging,	.0219	.0361
" " " " Wire Fencing,	-	-
" " " " Poles,	.0204	.0364
" " " " All Timber,	.0779	.1322
Equivalent of stull timber to board measure,	235,661	307,761
Feet of board measure per ton of ore,	.8759	1.4214

Total cost for Timber, Lagging, Poles, etc:

Year	Amount	Cost per Ton
1945,	$20,966.93	.0779
1944,	28,631.15	.1322
1943,	26,408.73	.1162

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

e. Drifting & Raising

Development work was carried on during the year in very close dovetailing with production, because of the fact that with eight to ten contracts working the loss of one or two from ore output to rock work resulted in a high percentage loss of product. In the few periods when the contracts were fully manned, the several extra miners were put on development work. This method, of course, was far from satisfactory and the actual procedure resolved itself into a sequence of a contract developing its own ore producing working place, mining the ore and developing another.

The development footages for the year are given below:

	Drifting		Raising		
	Ore	Rock	Ore	Rock	Total
1945,	803	383	78½	226	1490½

f. Explosives, Drilling and Blasting

Explosive Statement - Year 1945 - Stoping, Slicing & Ore Development

Kind	Quantity Pounds	Average Price	Amount 1945	Amount 1944
1 1/8" 45% Gelax #2	90,615	$ 11.50	$ 10,420.80	$ 9,034.74
1 1/4" 60% Special Gelax	8,059	11.50	926.79	-
2 x 16 40% " "	-	-	-	42.00
Total Powder - 1945,	98,674	$ 11.50	$ 11,347.59	$
Total Powder - 1944,				9,076.74
Fuse - M Ft.	345,216	5.15	1,777.90	1,727.87
No. 6 Blasting Caps - M Ft.	50,024	12.50	610.30	600.29
Electric Blasting Caps - C	-	-	-	.56
Powder Bags - Large	11	3.45	37.95	58.65
" " - Small	2	1.40	2.80	7.00
Tamping Bags - M	-	-	-	11.00
Fuse Lighters - M	8,000	6.75	53.99	66.40
#14 Duplex Blasting Wire - M Ft.	-	-	-	-
#20 Connecting Wire - M Ft.	210	2.62	.55	1.01
Master Fuse Lighters - M Ft.	-	-	-	-
Miscellaneous	-	-	59.33	53.79
Total Fuse, Caps, etc. 1945,		$	$ 2542.82	$
" " " " 1944,				2,526.57
Total All explosives - 1945,			13,890.41	
" " " - 1944,				11,603.31
Product - Tons			269,041	216,512
Pounds Powder per Ton of Ore			.3667	.3647
Cost per Ton for Powder			.0421	.0419
Cost per ton for Fuse, Caps, etc.,			.0095	.0116
Cost per ton for Explosives			.0516	.0535

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

f. Explosives, Drilling and Blasting (Cont.)

Rock Development & Filling	Quantity Pounds	Average Price	Amount 1945	Amount 1944
		$	$	
1 1/8" 45% Gelax #2	-	-		$ 1,381.39
1 1/4" 60% Special Gelax	7,173	11.50	824.92	
1 1/4" 80% " "	-	-	-	-
Total Powder - 1945,	7,173	$ 11.50	$ 824.92	
" " - 1944,				$ 2,192.02
Fuse - M ft.	26,600	5.15	136.98	309.43
No. 6 Blasting Caps - M ft.	3,800	12.20	46.35	107.22
Electric Blasting Caps - C	75	10.40	7.80	7.22
Powder Bags - Large	2	3.45	6.90	10.35
" " - Small	-	-	-	4.20
Tamping Bags - M	-	-	-	5.50
Fuse Lighters - M	1,500	6.75	10.14	23.63
Master Fuse Lighters - M	-	-	-	.91
Miscellaneous	-	-	6.59	41.10
Total Fuse, Caps, Etc. - 1945,			$ 214.76	
" " " " - 1944,				$ 509.56
Total all Explosives - 1945,			1,039.68	
" " " - 1944,				2,701.58
Total Explosives Used at Mine - 1945,			$14,930.09	$
" " " " - 1944,				14,304.89

i. Ventilation

Discussion of the ventilation for the mine in last year's report hinged mainly on the statement that as a positive source of fresh air the No. 1 Shaft was a poor risk. This shaft and immediate locality is the key to proper ventilation of the Princeton and from underground inspection in 1945 it was believed that the shaft had failed to function as a fresh air supply. To remove the reinforced concrete capping and entangled mass of timbers that had been dumped into the mouth of the shaft prior to the re-opening in what was an attempt to keep it from caving, entailed a great deal of labor and extreme care to maintain safe procedure.

Ultimately, observation of the shaft was possible from surface and the answer was seen in the fact that the shaft was blocked by fallen timber at a distance of 190 feet below the collar, or at a height of 70 feet above the 5th Level which was the highest opening into the mine. The 70 odd feet of debris was so tightly packed that standing water was present on the upper surface.

Tests made by introducing stench fluid into the limited flow of fresh air entering the mine through the surface cave adjacent to the No. 1 Shaft, indicated that an interval of over four hours elapsed until the air reached the 7th Level workings. Further, the stench laden air entered the 7th Level air stream through raises on the No. 3 side of the main level drift from No. 2 Shaft and did not enter the air current induced by the fan.

It will be necessary to provide a positive means of admitting fresh air to the mine as early as possible.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

k. Pumping

Excavation of the surface ditch to intercept surface drainage water overlying the No. 3 orebody was resumed early in the summer using a tractor and bulldozer borrowed from the Cliffs Shaft property. A great deal of the rough work was accomplished in a month and a half until the Cliffs Shaft called for the return of the unit. With the acquisition of a new tractor and bulldozer for the Princeton in the middle of the year it was possible to continue excavation, but the work was interrupted because of the fact that the use of the bulldozer was necessary in the handling of ore in stocking and loading.

At the close of the shipping season, labor was available and drilling and blasting in a 30 foot length of the ditch bottom through several water bearing seams was accomplished. It is hoped that actual pumping can be done in the spring.

A comparison of the gallons pumped and total cost by months for the years 1945 and 1944 is given below:

Mo. 1945	Average Gal/Min	Total Cost	Average Gal/Min Mo. '44	Mo. '44 Total Cost
January,	165	$1276.76	209	$ 821.50
February,	171	906.16	195	908.87
March,	184	912.82	176	924.87
April	178	1483.29	202	1534.10
May,	283	2231.57	208	891.99
June,	286	1308.94	224	1027.29
July,	280	1515.96	199	927.90
August,	243	1479.05	211	921.90
September,	238	1287.71	198	1155.04
October,	227	1331.81	187	2068.72
November,	228	1178.91	200	1269.42
December,	242	1931.56	187	1534.10
Avg. for year,	227	$1403.79	198	$1114.63

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

8. COST OF OPERATING

a. Mining Costs

	1945	1944	Increase	Decrease
Product	269,041	216,512	52,529	
Underground Costs	1.480	1.811		.331
Surface Costs	.309	.300	.009	
General Mine Accounts	.327	.337		.010
Cost of Production	2.116	2.448		.332
Depreciation - Plant Account	.058	.050	.008	
Depreciation - Development	.001	.001		
Taxes	.040	.039	.001	
Cost on Stockpile	.099	.090	.009	
Loading and Shipping	.075	.097		.022
TOTAL COST ON CARS	2.290	2.635		.345
Number of Days Operating	299	.283	16	
Number of Shifts and Hours	2-8 hr.	2-8 hr.		
Average Daily Product	900	765	76	

Cost of Production

Labor	1.438	1.682		.244
Supplies	.678	.766		.088
Total	2.116	2.448		.332

b. Detailed Cost

Days Per Week	6	5 & 5½	
Shifts and Hours	2-8 hr.	2-8 hr.	
Production, Tons	269,041	216,512	52,529
Average Daily Production, Tons	900	765	76
Number of Days Worked	299	283	16

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

8. COST OF OPERATING (Cont.)

b. Detailed Cost (Cont.)

UNDERGROUND COSTS	1945		1944		Increase		Decrease	
	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
Exploring in Mine	7896.89	.029	5329.80	.025	2567.09	.004		
Sinking in Shaft	4900.86	.018	2686.09	.012	2214.77	.006		
Development in Rock	14783.22	.055	31942.19	.148			17158.97	.093
Development in Ore	8912.90	.033	56148.72	.259			47235.82	.226
Stoping	134413.86	.500	80303.68	.371	54110.18	.129		.
Timbering	85436.74	.318	86069.89	.397			633.15	.079
Tramming	61193.29	.227	59173.96	.273	2019.33			.046
Ventilation	1050.49	.004	1665.08	.008			614.59	.004
Pumping	12137.57	.045	10114.86	.047	2022.71			.002
Conpressors and Air Pipes	8131.57	.030	6044.95	.028	2086.62	.002		
Back Filling								
Undergroudn Superintendence	9851.18	.037	12455.77	.058			2604.59	.021
Maint: Compressors & Power Drills	863.15	.003	448.34	.002	414.81	.001		
" Scrapers & Mech. Loaders	25184.72	.094	18485.63	.085	6699.09	.009		
" Electric Tram Equip.	18816.10	.070	17919.25	.083	896.85			.013
" Pumping Machinery	4706.97	.017	3258.42	.015	1448.55	.002		
Total Underground Costs,	398279.51	1.480	392046.63	1.811	6232.88			.331
SURFACE COSTS								
Hoisting	20420.54	.076	17412.70	.081	3007.84			.005
Stocking Ore	25464.98	.095	18699.90	.086	6765.08	.009		
Dry House	7119.94	.026	6552.21	.030	567.73			.004
General Surface Expense	11218.06	.042	11624.82	.054			406.76	.012
Maint: Hoisting Equipment	5191.78	.019	4198.31	.019	993.47			
" Shaft	5078.98	.018	1781.60	.008	3297.38	.010		
" Top Tram Equipment	4194.24	.016	2341.84	.011	1852.40	.005		
" Docks, Trestles, Pockets	278.67	.001	268.37	.001	10.30			
Mine Buildings	4291.30	.016	2172.36	.010	2118.94	.006		
Total Surface Costs,	83258.49	.309	65052.11	.300	18206.38	.009		
GENERAL MINE EXPENSE								
Employee's Vacation Pay,	11961.53	.045	6364.35	.029	5597.18	.016		
Group Annuity Premium	403.72	.001	752.86	.003			349.14	.002
Insurance	1978.11	.007	1815.20	.008	162.91			.001
Mining Engineering	3300.50	.012	3803.86	.018			503.36	.006
Mech. & Elec. Engineering	852.33	.003	712.46	.003	139.87			
Analysis and Grading	9502.93	.035	8967.07	.041	535.86			.006
Personal Injury	14435.07	.054	9220.56	.043	5214.51	.011		
Safety Department	1058.16	.004	1005.73	.005	52.43			.001
Telephones & Safety Devices	2509.13	.009	2640.21	.012			131.08	.003
Local & General Welfare	1604.36	.006	1479.25	.007	125.11			.001
Special Exp.,Pensions, Allow.	4006.04	.015	3654.69	.017	351.35			.002
Ishpeming Office	10715.75	.040	9475.12	.044	1240.63			.004
Social Security Taxes	8698.74	.032	8221.32	.038	477.42			.006
Mine Office	16864.73	.064	14888.42	.069	1976.31			.005
Total General Mine Exp.	87891.10	.327	73001.10	.337	14890.00			.010
COST OF PRODUCTION	569429.10	2.116	530099.84	2.448	39329.26			.332
Taxes	10749.28	.040	8411.02	.039	2338.26	.001		
Total Cost	580178.38	2.156	538510.86	2.487	41667.52			.331

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

8. COST OF OPERATING (Cont.)

b. Detailed Cost (Cont.)

	1945		1944		Increase		Decrease	
	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
General Supplies	24405.62	.091	16888.50	.078	7517.12	.013		
Iron and Steel	4045.95	.015	5162.14	.024			1116.19	.009
Oil and Grease	2069.40	.008	1892.62	.009	176.78			.001
Machinery Supplies	6559.34	.024	4659.57	.022	1899.77	.002		
Explosives	15475.38	.058	14523.68	.067	951.70			.009
Lumber and Timber	27475.98	.102	32727.17	.151			5251.19	.049
Fuel	3510.71	.013	3131.97	.014	378.74			.001
Electric Power	32520.22	.121	32050.44	.148	469.78			.027
Sundries	18869.30	.070	16751.98	.077	2117.32			.007
Other Mines and Accounts	486.18	.002	488.33	.002	2.15			
Supply Inv. Adj.	8.96		106.52	.001			97.56	.001
Total Cost per Cost Sheet.	134454.68	.500	127406.26	.589	7048.42			.089
Comparative Supply Balance								
General Supplies	6048.89		6610.48				561.59	
Iron & Steel	2065.39		1644.07		421.32			
Oil & Grease	703.19		620.62		82.57			
Machinery Supplies	1129.96		1259.78				129.82	
Explosives	226.72		383.78				157.06	
Lumber & Timber	12575.13		24299.99				11724.86	
Fuel	1281.12		1381.82				100.70	
	24030.40		36200.54				12170.14	

The fact that the year 1945 showed an increase of 52,529 tons over the 1944 production, which is a 24.2% gain, produced a net decrease in underground operating costs of $ .33 per ton for the year 1945.

Surface costs were not reduced in all accounts, several in fact showing increases. Only one item however, showed an increase as high as one cent per ton, that being the Shaft account. This increase was caused by the expenditures incurred in the excavation and construction of a new measuring pocket and storage trench on the 7th Level underground loading plat. The expense, however, is chargeable to "Shaft". Much of the surface improvement, including the erection of four stocking trestles, a new top tram car, coal dock, etc., were designed to effect a condition capable of handling any peak in underground production, in contrast with prior years when delays were occasioned to hoisting simply because stocking facilities were inadequate. The cost of improvements were, of course, chargeable to surface accounts.

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

9. EXPLORATION AND FUTURE EXPLANATION

Diamond drill hole No. 13 was started from the north rib of the 7700 cross-cut near the northwest jasper contact of the No. 3 orebody. The hole was drilled on a course of South 66°-06° West at an inclination of 46°-45'. A total distance of 750 feet was traversed through the jasper with only insignificant seams of enrichment encountered. The hole was planned to test an area unexplored by surface drilling, and to determine if the shallow seam-like orebody possesed an upturn in the west extremity.

A higher valuation was placed on the property for the year 1945. The increase in taxes totalled $2,338.26 which resulted in an increase of $.001 in the cost per ton.

10. TAXES

	1945		1944	
	Valuation	Taxes	Valuation	Taxes
NE¼ of NE¼ of Sec. 19, 45-25 C&NW Lease #29,)			10,000	202.49
158.27 acres in Sec. 18, 45-25,)	80,000	2015.46	15,000	303.74
160 acres NW¼ of Sec. 20, 45-25,)			65,000	1316.20
Personal Property,	340,000	8565.69	320,000	6479.78
Total,	420,000	10581.15	410,000	8302.21
Collections fees,		105.81		83.02
TOTAL TAXES,		10686.96		8385.23
Lot 3-NE¼ of SE¼ 18, 45-25--38.27A,	350	8.82		
W½ of SE¼ " 80. ",	840	21.15		
NW¼ of NE¼ 19, 45-25--40. ",	420	10.58	420	8.51
SW¼ of NE¼ " 40. ",	420	10.58	420	8.51
SE¼ of NE¼ " 40. ",	420	10.58	420	8.51
Total,	2,450	61.71	1,260	25.53
Collection Fees,		.61		.26
TOTAL TAXES,		62.32		25.79
TOTAL PRINCETON MINE,	422,450	10749.28	411,260	8411.02

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

11. ACCIDENTS AND PERSONAL INJURY

More ore was produced by fewer men in 1945 than in the past and the results of the accident prevention program as shown in the following table were very encouraging. Of the seven compensable accidents, two were caused by mud being splashed in the eye, two were due to haulage mishaps, one caused by a substitute cage tender riding in the cage with tools; and two accidents in mining places caused by chunks falling with scraper ropes directly involved in the mishaps.

Statistical comparison of accidents for the past three years is given below:

	Days of Labor	Hours of Labor	Tons of Ore Mined	Number of Compensable Accidents	Fatalities	Days Lost	Frequency Rate	Severity Rate
1945,	44614¼	356,916	269,041	7	-	318	19.61	0.89
1944,	45713½	365,708	216,512	11	-	652	30.08	1.78
1943,	51503½	412,028	227,185	25	-	1558	60.61	3.78

15. POWER

The detail of Power used in 1945 and 1944 follows:

	Kilowatt Hours Used			
	1945	1944	Increase	Decrease
Hoist No. 2 Shaft,	273,400	207,890	65,510	
" " 3 " ,	61,320	45,680	15,640	
Compressors,	805,200	966,100		160,900
Haulage Set No. 1,	304,900	271,000	33,900	
" " " 2,	258,170	193,190	64,980	
Pump No. 2 Shaft,	262,000	181,000	81,000	
Shops - Power,	8,229	12,000		3,771
Shops - Light,	7,042	6,725	317	
Lights and Signal System,	23,369	20,707	2,662	
Top Tram,	14,300	68,300		54,000
Surface Diamond Drill (E&A CC156)	235	-	235	
Total,	2,018,165	1,972,592	45,573	
In Cash,	$ 32,523.75	$ 32,053.44	$ 470.31	
Cost per KWH,	.0161	.0162		.0001

PRINCETON MINE
ANNUAL REPORT
YEAR 1945

18. NATIONALITY REPORT

As to Parentage	1945	%	1944	%
Finnish,	53	35.8	54	35.1
Italian,	33	21.7	35	22.7
American,	22	14.4	24	15.6
Swedish,	12	7.9	12	7.8
French,	10	6.6	9	5.9
Norwegian,	10	6.6	8	5.2
English,	7	4.6	6	3.9
German,	2	1.2	2	1.3
Austrian,	1	.6	1	.6
Polish,	1	.6	1	.6
Irish,	-	-	2	1.3
Total,	151	100.0	154	100.0

	Total		American Born		Foreign Born	
As to Birth	1945	1944	1945	1944	1945	1944
Finnish,	53	54	35	33	18	21
Italian,	33	35	20	20	13	15
American,	22	24	22	24	-	-
Swedish,	12	12	8	8	4	4
French,	10	9	8	7	2	2
Norwegian,	10	8	7	5	3	3
English,	7	6	6	5	1	1
German,	2	2	2	2	-	-
Austrian,	1	1	-	-	1	1
Polish,	1	1	1	1	-	-
Irish,	-	2	-	2	-	-
Total,	151	154	109	107	42	47
Percentages,			72.2	69.5	27.8	30.5

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

1. General

The production from the Virgil Lease was 29,371 tons and operations were abandoned in this property in September due to depletion of reserves. A substantial tonnage of reserves have been left in the Virgil Lease but this pillar of ore is unavailable due to the fire caused by oxidation of the surrounding slate formation. Several attempts to mine the pillar have been unsuccessful because of the abnormally high temperatures encountered. In depleting the mineable reserves, operations were hindered by numerous delays arising from ventilation difficulties and caving from old adjacent stopes and both of these factors account for the high cost of mining in 1945. Before operations were abandoned some additional diamond drilling was done to explore the area north of the Virgil deposit, but no ore was encountered and the program was discontinued after completing two holes.

Development in the Spies East Deposit has been the major program throughout the year and after mining was completed in the Virgil Lease, the entire labor force was concentrated on this work. A production of 7,636 tons was obtained from the development and preliminary mining. A serious water problem has been encountered in the new development and this has not only delayed the program but has created a pumping problem. At the close of the year, about 550 G.P.M. were draining from the orebody and the volume was gradually increasing as the development expanded. It became evident that a water drainage project must be instituted to enable mining to be conducted with a favorable cost. Late in the year, work was started on an underground drainage project and briefly, this will consist of raising to an elevation of 300' above the 4th Level and advance a drift along the east side of the orebody following the strike. A number of holes will be drilled from the drift across the formation above the orebody to intercept the water before it reaches the stopes at a lower elevation. The water will then be pumped directly to surface from the drift elevation through a pipe line installed in a churn drill hole.

A surface drilling program has been continued to further explore the Spies East Deposit and also an area in the NW¼ of Section 24. Drilling in the latter area failed to disclose ore and consequently was discontinued. The drilling for extensions of the Spies East Deposit was not very encouraging but a continuation of this program is warranted on the basis of favorable structure and formation. The Johnson Lease was further explored by drilling from the 4th Level but no additional ore was discovered. On the basis of the drilling done on this property to date, the known reserves consist of the upper extension of the East Deposit and from an economic standpoint, this ore is unavailable due to its close proximity to ledge and the water bearing material overlying the ledge. In view of this, early consideration can be given to cancellation of the Johnson Lease. However, this action must await completion of a satisfactory drainage project.

Shipments from the mine were considerably less due to the smaller product. All the Hi-sulphur grade in stock was cleaned out before the close of the season and there was less than 4,000 tons of Virgil grade on hand at the end of the year. A token shipment of Spies ore was made from the pocket before the close of the shipping season.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

1. General (Cont.)

There was a shortage of labor about the middle of the year due to men quitting, but after "V-J" Day, the labor force was built to normal strength by hiring new men. Operation of the mine was continued on a schedule of five days per week until January 27th and then the schedule was increased to six days per week. The latter schedule was maintained to the end of the year, with mining conducted on 2-8 hour shifts per day and hoisting on 1-8 hour shift per day.

In addition to the six regular holidays observed, a two-day national holiday was observed on August 15th and 16th in observance of "V-J" Day and there were no operations on December 24th. Vacations were allowed all eligible employees in August and these were arranged so the mine could operate on a one-shift basis during this two-week period.

In accordance with the new contract with the Union, a retroactive wage adjustment for shift differential and vacations was paid in December. In both cases, the adjustments were made retroactive to January 4th, 1944. The vacation adjustments were made on the basis of new eligibility requirements, namely one week vacation pay for employees with one year of service and two weeks for employees with five years or more. Effective August 21st, time and one-half was paid for work done on the 7th consecutive day in contrast to payment of double time for this work prior to this date.

Mining in the Virgil Lease consisted of recovering two supporting pillars between old stopes above the 8th Level and the bulk of the product from each of the areas was Virgil grade. One of the pillars was completely recovered early in the year and the product during the remaining months until September, was dependent on the mining in the remaining pillar. The product from the Spies East Deposit was mostly from the ore development but late in the year development had been completed so one stope could be started and a small tonnage was obtained from this operation in December.

2. PRODUCTION, SHIPMENTS AND INVENTORIES

a. Production by Grades

	1945	1944
Virgil	23,995	16,307
Virgil Hi-Sulphur	5,376	51,330
Total Virgil Lease	29,371	67,637
Spies	6,886	797
Spies Hi-Sulphur	750	-
Grand Total	37,007	68,434

Production from the Virgil Lease decreased 38,266 tons due to depletion of mineable reserves. The product from the Spies East Deposit was obtained almost entirely from the ore development and a small amount was produced by the first stope operation.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

b. Shipments

Grade	Pocket	Stockpile	Total	Total Last Year
Virgil	18,282	34,492	52,774	21,274
Virgil Hi-Sulphur	-	29,932	29,932	80,544
Total Virgil	18,282	64,424	82,706	101,818
Spies	367	-	367	-
Total	19,649	64,424	83,073	101,818
Total Last Year	6,508	95,310	101,818	
Difference	13,141	30,886	18,745	

There was a material decrease in total shipments from the mine due to the smaller product. The shipments of Hi-Sulphur grade were considerably less due to the small production and small inventory of this grade in stock. Before the close of the shipping season all the Hi-Sulphur ore was loaded out and a prior year's stockpile over-run of 2,802 tons was realized. The Virgil grade shipments were larger than in 1944 because of the large inventory of prior year's stockpile over-run on hand. A total of 27,729 tons of Virgil grade over-run was loaded from the stockpile and a small balance of over-run remained on hand at the close of the year.

c. Stockpile Inventories

Grade	Tons
Virgil	-
Spies	6,749
Spies Hi-Sulphur	1,317
Total	8,066

The stockpile inventory at the end of the year is one of the smallest in the history of the mine. The book figures of Virgil grade in stockpile have been wiped out but there is slightly less than 4,000 tons of additional over-run of this grade remaining on hand.

d. Division of Product by Levels

The product from the Virgil Lease, similarly as in the previous year, was mined between the 6th and 8th Levels and trammed on the latter level. In the Spies East Deposit all the development and initial mining was conducted above the 4th Level.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

e. Production by Months

Month	Virgil Ore	Virgil Hi-Sulphur Ore	Spies Ore	Spies Hi-Sul. Ore	Total Ore	Tons Per Man Per Day	Tons Rock
Jan.	2,218	597	148	363	3,326	3.02	1,280
Feb.	1,911	442	826	173	3,352	2.37	136
Mar.	1,368	3,691	346	168	5,573	4.38	1,048
April	3,512	459	465	46	4,482	4.41	1,188
May	3,481	126	472	-	4,079	4.56	1,668
June	3,943	61	380	-	4,384	5.38	1,204
July	2,227	-	614	-	2,841	3.09	1,012
Aug.	2,010	-	509	-	2,519	3.03	908
Sept.	3,325	-	374	-	3,699	4.91	1,400
Oct.	0	-	753	-	753	-	804
Nov.	-	-	978	-	978	-	1,052
Dec.	-	-	1,021	-	1,021	-	840
Total	23,995	5,376	6,886	750	37,007	3.85	12,540

f. Ore Statement

	Virgil	Virgil Hi-Sulphur	Spies	Spies Hi-Sulphur	Total	Total Last Year
On Hand Jan. 1, 1945	1,050	21,754	797	-	23,601	56,985
Output for Year	23,995	5,376	6,886	750	37,007	68,434
Transfers	1,788	1,788	567	567	-	-
Over-runs	27,729	2,802	-	-	30,531	-
Total	54,562	28,144	7,116	1,317	91,139	125,419
Shipments	54,562	28,144	367	-	83,073	101,818
Balance on Hand	-	-	6,749	1,317	8,066	23,601

Decrease in Output	31,427
Decrease in Shipments	18,745
Decrease in Ore on Hand	15,535

The operating schedule for the past five years follows:

1941 - 2-8 Hr. Shifts 5 days per week Jan. 1 to Dec. 31.

1942 - 2-8 Hr. Shifts 5 days per week Jan. 1 to Oct. 16.
2-8 Hr. Shifts 5½ days per week Oct. 17 to Dec. 31.

1943 - 2-8 Hr. Shifts 5½ days per week Jan. 1 to Dec. 31.

1944 - 2-8 Hr. Shifts 5½ days per week Jan. 1 to July 1.
2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 5 days per week July 1 to Dec. 31.

1945 - 2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 5 days per week Jan. 1 to Jan. 27.
2-8 Hr. Shifts mining and 1-8 Hr. Shift hoisting 6 days per week Jan. 27 to Dec. 31.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

2. PRODUCTION, SHIPMENTS AND INVENTORIES (Cont.)

g. Delays

There were three delays of significance that occurred during the year, two of which were of a major character. One of the major delays was caused by ventilation difficulties when operations in the Virgil property were still underway and this resulted in seriously delaying the completion of operations in this property. The other delay was caused by pumping difficulties arising from the break-down of one of the main pumps. In this case all work had to be abandoned in the Spies East Deposit when it became necessary to close the dam on the 4th Level to provide storage for the accumulated water until the repairs were completed. The delays are listed in detail as follows:

On March 31st a delay to operations occurred due to a break-down of a bearing on the compressor. Two operating shifts were lost while the repairs were made and the loss in product on this account was 200 tons.

On July 23rd operations in the Virgil property were suspended and the crew was transferred to work building brattices to control and direct the course of the ventilating air. The ventilation in this part of the mine was disrupted when caving above old stopes in inaccessible parts of the mine short-circuited the air through a fire area and resulted in high temperature air being exhausted through the Virgil shaft. To reestablish the old ventilating circuit and prevent air from reaching the fire area, it was necessary to construct a number of brattices on the 8th Level and subs above. This work was completed so operations could be resumed in the Virgil Lease on August 9th. The delay resulted in postponing for three weeks the date that operations in this property could be completed.

On October 27th the pump on the 3rd Level broke down and before the newly installed pump on the 6th Level could be put into satisfactory operation it became necessary to close the dam on the 4th Level to provide storage capacity for the accumulating water. Operations in the East Deposit were suspended on this account until November 5th, after the pump was put into steady operation and the water drained from behind the dam. One week of operations in the new deposit was lost on this account.

3. ANALYSIS

Average Mine Analysis on Output

The average analysis on the output from the Virgil Lease shows a slight increase in the iron content and a smaller sulphur content. The average analysis on the output from the Spies East Deposit improved considerably as compared to last year in both iron and sulphur content, both of which vary over a wide range because of the spotty nature of these elements in the ore.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

3. ANALYSIS (Cont.)

a. Average Mine Analysis on Output (Cont.)

Grade	Tons	Iron	Phos.	Silica	Sulphur
Virgil	23,995	59.03	.371	3.68	.069
Virgil Hi-Sul.	5,376	57.87	.362	3.38	.173
Spies	6,886	57.72	.259	6.21	.077
Spies Hi-Sul.	750	57.24	.287	5.95	.125

b. Analysis of Ore in Stock

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist.
Spies Dried	57.48	.261	6.52	.19	1.84	.58	.26	.093	7.46	
Spies Nat'l	51.24	.233	5.81	.17	1.64	.52	.23	.083	6.65	10.86
Hi-Sul. Dried	57.23	.287	5.95	.19	1.84	.60	.21	.125	7.80	
Hi-Sul. Nat'l	51.52	.258	5.36	.17	1.66	.54	.19	.113	7.02	9.98

c. Analysis of Shipments

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss
Virgil	58.30	.366	4.64	.16	1.90	.47	.28	.072	7.98
Hi-Sulphur	56.75	.343	7.31	.15	1.90	.64	.25	.168	7.58
Spies	58.40	.284	5.26					.059	10.86

d. High-Sulphur Ore

In contrast to the previous year production of Hi-Sulphur ore constituted the smaller propertion of the total product. Mining in the Hi-Sulphur part of the orebody was completed in the previous year and the small amount produced in 1945 was obtained from the development and mining whenever the sulphur content increased beyond the limits established for the Virgil grade.

A small amount of Hi-Sulphur ore was produced by the development in the Spies East Deposit. The development in the new orebody suggests an average sulphur content ranging from .075% to.080% and it is very likely that one grade of ore can be produced within these sulphur limits after regular mining operations are started.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

4. ESTIMATE OF ORE RESERVES

a. Developed Ore

The following is an estimate of ore reserves made as of December 31, 1945 using a factor of 12 cubic feet per ton:

	Virgil	Virgil Lease Hi-Sulphur	Total
Between 6th & 8th Levels Gross Tons	17,571	28,598	46,169
Less 10% loss for mining & rock	1,757	2,860	4,617
Net tons as of Dec. 31, 1945	15,814	25,738	41,552

The estimated reserves in the Virgil Lease consist of a number of supporting pillars between old stopes and from an economic standpoint, this ore is unavailable because the pillars are too small in size to be mined profitably. It was proven in 1945 that small size pillars between old stopes can not be recovered with favorable cost under present wage rates. The high development cost in proportion to the tons recovered and the limited productive capacity of small stopes are inherent factors incident to mining small areas. Another handicap to mining small pillars is caused by caving from adjacent rock filled stopes, resulting in dilution and small percentage of recovery.

	Spies	Spies East Deposit Johnson Lease	Total
Above 6th Level Gross Tons	1,447,552	208,750	1,656,302
Less December Production	1,021	-	1,021
Gross tons as of Dec. 31, 1945	1,446,531	208,750	1,655,281
Less 30% loss for pillars and nonavailable ore in Johnson Lease	434,266	208,750	643,016
Net tons as of Dec. 31, 1945	1,012,265	-	1,012,265

The estimate of reserves in the Spies East Deposit is based on the estimate made in the previous year and deducting the tonnage produced from the deposit in 1945. The outline of the orebody as determined by the development has disclosed no additional information that warrants a change in the estimate based on the diamond drill holes from surface. However, the water problem encountered in the development of this deposit has resulted in reducing the tonnage that will be mineable above the 4th Level. The proven ore in the Johnson Lease consists of the upper extension of the East Deposit and this apparently extends to ledge. The over-lying surface material above ledge is water bearing and test holes and diamond drill holes have proven a substantial thickness of course gravel containing a flat extensive water table. To mine the ore in the Johnson Lease would entail an elaborate surface drainage program but the tonnage of proven reserves is not sufficient to warrant this added cost. Further, the upper extension of the ore is narrow in width and lies at a relatively flat angle and would necessitate a higher than normal development cost. In view of the above factors, the ore in the Johnson Lease is considered economically unavailable and the estimated tonnage is taken as a deduction from the reserves in the Spies East Deposit.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

4. ESTIMATE OF ORE RESERVES (Cont.)

a. Developed Ore (Cont.)

Another substantial deduction that is warranted is the tonnage of ore that will be left in supporting pillars to assure that mining in the East Deposit will not induce a cave extending to ledge and the water bearing material. Therefore it will be necessary to leave a series of pillars between the stopes and these will constitute about 30% of the estimated reserves. The tonnage not mineable because of the above factors results in substantially reducing the total reserves in the East Deposit as compared with the estimate of last year. There is a good possibility however that development to the south along the strike will disclose a substantial tonnage that presently is not included in the estimate.

Diamond drilling from both surface and underground has failed to disclose new extensions of the East Deposit. At the close of the year drilling was underway in one hole on the 4th Level and based on present knowledge of the structure, this hole will crosscut the iron formation at the 6th Level elevation.

b. Estimated Analysis of Ore Reserves

Grade	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Loss	Moist
Virgil Dried	57.49	.360	7.51	.21	1.90	.58	.26	.081	7.54	
Virgil Nat'l	52.32	.328	6.83	.19	1.73	.53	.24	.074	6.86	9.00
Virgil Hi-Sul Dried	56.49	.360	8.00	.21	1.90	.60	.21	.300	7.25	
Virgil Hi-Sul Nat'l	51.41	.328	7.28	.19	1.73	.55	.19	.273	6.60	9.00
Spies Dried	57.70	.295	6.00	.20	2.17	.25	.38	.080	6.70	
Spies Nat'l	51.64	.264	5.37	.18	1.94	.22	.34	.072	6.00	10.50

5. LABOR AND WAGES

a. General

The general attitude of the employees has not been entirely satisfactory and this was brought about largely by the Union demand in the latter part of the year for an increase in wages. On November 28, the Union called a strike vote throughout the industry to support their demand for a $2.00 per day increase in wages. Approximately 90% of the employees at the mine cast their vote for a majority of 5 to 1 in favor of the strike action. The date of the strike was set for January 14, 1946 but was later postponed to February 7, 1946.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

5. LABOR AND WAGES (Cont.)

a. General (Cont.)

The labor turn-over was not quite as severe as in 1944. During a part of the year there was an acute shortage of labor but as the supply of labor increased the force was built to normal strength by hiring. There were 82 employees on the payroll at the end of the year compared with 74 at the end of 1944. A total of 14 employees quit, one was retired and one died. There were 22 men hired, resulting in a net increase of eight men on the payroll.

After operations in the Virgil Lease were completed, additional men were transferred to development work in the Spies East Deposit and the entire labor force was then concentrated on this work. The wet conditions in the new ore-body account for a part of the labor turn-over to maintain the crew at full strength. Protective clothing is provided each man working in wet areas but good working conditions in the East Deposit and the best efficiency cannot be realized until a satisfactory water drainage project has been completed.

b. Statement of Wages and Product

	1945	1944
PRODUCT	29,371	67,637
NUMBER OF SHIFTS AND HOURS	2-8	2-8
Average No. of Men Working		
Surface	13	20
Underground	18	32
Total	31	52
Averages Wages Per Day		
Surface	8.23	6.97
Underground	9.46	7.90
Total	8.95	7.55
Average Wages Per Month of 22 Days		
Surface	181.06	153.34
Underground	208.12	173.80
Total	196.90	166.10
Product per Man per Day		
Surface	9.39	12.11
Underground	6.53	7.44
Total	3.85	4.61
Labor Cost Per Ton		
Surface	.8766	.5759
Underground	1.4461	1.0615
Total	2.3227	1.6374
Average Product Breaking and Tramming	20.60	37.46
Average Wage Contract Miners	9.02	8.508

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

5. LABOR AND WAGES (Cont.)

b. Statement of Wages and Product (Cont.)

	1945	1944
Total Number of Days		
Surface	3128	5585½
Underground	4498⅛	9084¾
Total	7626⅛	14670¼
Amount for Labor		
Surface	25,747.13	38,950.91
Underground	42,472.61	71,794.60
Total	68,219.74	110,745.51

Proportion Surface to Underground Men

1945	1 to 1.38
1944	1 to 1.60
1943	1 to 1.78
1942	1 to 2.16
1941	1 to 2.12

6. SURFACE

a. Buildings

There was no new building construction and the repairs that were made were of a minor nature. All of the buildings except the engine house are obsolete and early consideration must be given to remodeling and replacement of several buildings when sufficient reserves have been proven to warrant it. In the coming year a new asphalt roofing will have to be placed on the engine house and it will be necessary to renew some of the rotted lumber sheeting on the roof before the roofing is laid.

Shortly before operations in the Virgil Lease were completed the fan was removed from the collar of the Virgil shaft and the small building that housed the fan was moved to the new ventilation shaft site. The building was reerected here and will temporarily serve as a dry house and storage building while shaft sinking is underway.

b. Stockpiles

The stockpile of Hi-Sulphur grade to the northwest of the shaft was all loaded out by shovel operations and the solar in this area was thoroughly cleaned by the bull-dozer before the last shipment was made. A small amount of Virgil grade remains in stock and the solar surrounding this pile has also been cleaned with the bull-dozer. No stocking trestle was erected in the area where the latter grades of ore have been stocked but after all the Virgil grade has been loaded out some trestle will be erected for stocking Spies grade.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

6. SURFACE (Cont)

b. Stockpiles (Cont.)

Work was completed grading the stocking area directly north of the shaft. A portion of this area was graded in the previous year so that a small amount of trestle could be erected for stocking Spies ore during the winter of 1944-45. The balance of the grading, and most of it, consisted of moving a large amount of rock from a nearby pile to obtain the desired width and a large amount of sand and gravel was moved from the solar to reach the desired grade. Upon completing the grading, 12 additional bents of trestle were erected, extending the original trestle farther north.

In the near future it will be necessary to rebuild the approaches to the trestles north of the shaft. The permanent part of the trestle is badly rotted and will need to be rebuilt before trestle is again erected in the area to the northwest of the shaft.

7. UNDERGROUND

a. Shaft Sinking

There was no shaft sinking done but preparations to start sinking the ventilation shaft near the Spies East Deposit were completed late in December. In the previous year, 95' of shaft with an inside diameter of 7' was sunk to the ledge and a 15" diameter churn drill hole was drilled from the bottom of the shaft to connect with a raise put up from the 4th Level. Drilling of the hole was started late in 1944 and completed in May, 1945. This work was done on a contract basis by the Layne Northwest Company. The balance of the shaft sinking will be done by stripping the bore hole. The broken material will be dropped through the 15" diameter hole to the 4th Level where it will be trammed and hoisted to surface. It will be necessary to sink for a distance of 430' from the bottom of the present shaft to complete a connection to the top of the raise put up from the 4th Level.

The preliminary work for the shaft job consisted of installing air and water lines extending from the Spies shaft to the new shaft site. Also, 3,500' of transmission line was erected to provide power and lighting. The building that formerly housed the fan at the collar of the Virgil shaft was moved and rebuilt to serve as a dry house and storage shed while the work is underway. A churn drill rig has been loaned from the Company's Tilden Mine and will be used in conjunction with the shaft sinking operation. Concrete was poured around the steel casing for the entire depth of the shaft and a concrete collar was poured around the shaft at surface elevation.

b. Development

Development in the Spies East Deposit was the major program during the year and due to the extent of this work it will be described under the various sub level headings.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

b. Development (Cont.)

4th Level

Late in the previous year the first crosscut was started branching to the northeast and this was continued in lean ore and jasper for a distance of 170' until slate was encountered. A short test drift was driven to the east and west to determine the width of the orebody and a width of only 10' of ore was proven along the east side adjacent to the slate. A test drift was also driven from the end of the crosscut and advanced to the southeast for a distance of 70'. This drift disclosed a width of 35' of ore near the Bates Boundary and also a sharp change in the strike which results in the the orebody crossing the east boundary into the Bates Mine property. No. 402 Raise was cut out about midway in the crosscut and advanced to a height of 25' in ore where it was cut out for a transfer drift. No. 410 Raise was put up in ore from the main drift to a similar height above the level and also cut out for a transfer drift. In the latter months of the year a short crosscut was driven to the southeast from the main jaulage drift west of the orebody for a distance of 170' in slate and a diamond drill station was cut out near the end of the drift. No. 420 Raise was cut out along the east side of the crosscut and advanced to a height of 20' above the level in slate. This raise is part of the rock development that will be done for ventilation above the 4th Level to connect the new ventilation shaft with the orebody.

A raise that will be connected to the small size shaft from surface for ventilation was put up from the northeast crosscut west of the orebody to a height of 95' in slate. This raise holed to the 15" diameter churn drill hole that was put down from surface and it will be used for handling the broken material when stripping of the bore hole is started.

Development on the 4th Level indicated the presence of a large amount of water within the orebody and the rock formation adjacent to the orebody. The water problem gradually became more serious as the development was carried to higher elevations and expanded laterally. It became evident that a means of controlling and draining the water from the mining areas would have to be provided before mining can be conducted with a favorable cost. An underground drainage project has been planned and in December work was started on this program under E & A CC-165. The project will consist of putting up a raise from the 4th Level in an ore pillar between two proposed stopes to a height of approximately 300' vertically above the 4th Level. At the latter elevation about 400' of drift will be driven to the north and south along the east side of the orebody and a number of large size diamond drill holes will be drilled across the formation to the east and west above an elevation to which mining will be conducted. The drill holes will serve to intercept a bulk of the water before it reaches mining areas at a lower elevation and by means of several automatically operated pumps installed in the drift the water will be pumped to surface through a discharge line in a churn drill hole. Work will be concentrated on this project so the balance of the development and future mining can be conducted under better working conditions.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

b. Development (Cont.)

1050' Sub Level

Upon completion of two raises to this elevation from the 4th Level drifting was conducted along the strike of the orebody for a distance of 520'. Transfer drifts were driven to the northeast from No. 402 Raise to the north limits of the ore and to the south from No. 410 Raise for a distance of 170' in ore. A test drift 50' in length was driven to the west from the latter transfer to determine the width of the orebody. A drift 220' in length was advanced to connect the raises and approximately half of this connecting drift was driven in jasper. The development and exploration outlined a narrow width to the orebody at the north end but more favorable width was proven in the most southerly development. Two mill raises were put up from the transfer at the north end of the deposit and each advanced to the jasper hanging which was encountered at a height of 75' in the most northerly mill and 160' in the other mill. A third mill raise was put up directly above the main raise and advanced to a height of 190' to the jasper hanging. The latter mill was started in the slate footwall and advanced in this material for a distance of 50' before it entered the ore.

Two mill raises were cut out along the east side of the transfer that connects No. 402 and No. 410 Raises. Both of the mill raises were advanced to a height of 190' above the transfer and the most southerly of the two mills was extended, later in the year, an additional 30' in ore to reach the highest elevation to which development was carried in the new deposit. Four mill raises were cut out in the transfer south of No. 410 Raise and the most southerly two mills advanced to a height of 75' in ore. In December, the most southerly mill was put up an additional 25' in ore.

Work in putting up the mill raises was done under difficult conditions due to the water that was encountered. It was often necessary to abandon work temporarily in advancing a mill until the adjacent mill reached a corresponding elevation and a connecting drift was driven between the mills. The worst water conditions have been experienced in putting up the two mills in the central part of the area that is being developed and this is due to the development in this area being conducted in advance of the other work.

1075' Sub Level

In the northerly part of the orebody a drift for sub level stope development was advanced for a distance of 250' along the strike to connect a series of five mill raises. About 70' of the drift was advanced in slate near the north end of the orebody and a small amount of jasper was encountered near the most southerly mill. The balance of the drift was in ore including 50' of test drift that was advanced to the west to explore the width of the orebody. In the development farthest south, 70' of small drift was advanced in ore to connect a series of three mill raises.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

b. Development (Cont.)

1100' Sub Level

A drift for sub level stope development was advanced for a distance of 350' in ore following along the strike of the deposit to connect a series of six mill raises. The drift extends from the north limits of the ore near the Bates boundary south to a mill put up directly above No. 410 Raise. In the most southerly development about 40' of small drift was advanced in ore to connect two mill raises.

1125' Sub Level

A total of 500' of small drift was advanced in ore following along the strike of the deposit and extending from the north limits of the ore south to the most southerly mill. A series of eight mill raises are connected by this drift. Test drifts were advanced to the east and west at various points to determine the width of the orebody and two short Gopher Drill holes were drilled near the north end to outline the orebody more completely.

1150' Sub Level

In the north half of the orebody that is being developed, a small drift for stope development was advanced for a distance of 220' in ore following along the strike to connect a series of four mill raises. From the most southerly mill about 50' of small drift was advanced to the west to explore the width of the deposit.

This is the highest elevation to which the development farthest south has reached and one mill was completed to this elevation by the end of the year. About 25' of small drift was advanced in ore to the east and west from the mill to explore the width of ore.

1180' Sub Level

About 300' of small drift was advanced in ore for stope development to connect four mill raises. The drift extended from the north limits of the ore south along the strike to a mill put up directly above the main raise from the 4th Level.

1210' Sub Level

In the northerly part of the deposit about 220' of small drift was advanced in ore to connect a series of four mill raises. From the most southerly mill about 60' of small drift was advanced to the east and west to explore the width of the ore and with the exception of 30' of the drift to the east, the balance of the test drift was in jasper. A width of 30' of ore was disclosed at this point compared with 40' to 50' at lower elevations.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

b. Development (Cont.)

1240' Sub Level

About 160' of small drift was advanced along the strike to connect three mill raises and about 40' of the drift extending beyond the most northerly mill was in jasper and lean ore. From the latter mill, 40' of test drift was advanced to the east and west to explore the width of the orebody and with the exception of 20' of the drift to the west, the balance was in jasper.

1270' Sub Level

This is the highest elevation to which development had reached by the end of the year. One mill raise had been completed to this elevation and about 65' of drift was advanced to the east and west to explore the width of the orebody. This exploration disclosed a width of 60' of ore which is about the maximum width that has been proven by the exploration to date.

The following table shows a classification of the development footage in the Spies East Deposit under E&A CC-138 and E&A CC-116A:

	Drifting		Raising		
	Ore	Rock	Ore	Rock	Total
Small Size	3,154'	26'	1,267'	62'	4,509'
Large Size	382'	133'	30'	50'	595'
Total	3,536'	159'	1,297'	112'	5,104'

6th Level

Due to the large increase in mine water additional pumping capacity was needed and a 600 G.P.M. pump was purchased from the Oliver Mining Company and installed on the 6th Level. A large capacity sump was excavated along the northest side of the plat and a pump house was constructed at the north end near the shaft. Installation of the pump and excavating the sump was completed in November and the plant was put into operation. The pumping capacity was increased by 33-1/3% by the addition of this pump and the steady increase in mine water since its installation has necessitated quite steady operation of this unit.

The following table shows a classification of the rock development for the pump house and sump on the 6th Level under E&A CC-145:

Equivalent Rock Drift - - - - - - - - - -	514'
Small Rock Raise - - - - - - - - - - - -	17'
Total	531'

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

b. Development (Cont.)

In the Virgil Lease some development was done for the two stope operations that depleted the mineable reserves. Both of the stopes were developed in supporting pillars near the central part of the orebody above the 8th Level. The major part of the development for one of the stopes was completed in the previous year but additional development was required as mining progressed so the stope could be extended to the ore limits. Development for the stope in the largest pillar consisted of three mill raises that were put up to a height of 75' above the transfer and intermediate sub level drifts were driven to connect the mills. Some rock drift was also advanced to connect the stope with a nearby airway for ventilation.

The following table shows a classification of the development footage in the Virgil Lease:

	Drifting		Raising		
	Ore	Rock	Ore	Rock	Total
Small Size	508'	50'	783'	60'	1401'
Large Size	56'	-	-	-	56'
Total	564'	50'	783'	60'	1457'

c. Stoping

Spies East Deposit

In the Spies East Deposit the first stope operation was started in December at the north end of the deposit. Mining commenced from the most northerly mill and this was enlarged to about 15' in diameter to a height of about 50' above the transfer drift. Only a small product was produced by stoping before the end of the year. Due to a change in the strike of the orebody at the north end, a part of the orebody extends directly underneath a county road on surface that follows along the section line. On this account a pillar will be left to support the roadway and a mining limit has been established parallel to the east boundary of Section 24 at a distance of 33' east of the boundary.

Virgil Lease

Mining in the Virgil Lease was confined to the two stope operations that depleted the mineable reserves. Mining was completed in one of the stopes early in the year and the product during the balance of the year until September was obtained from one stope. Two contracts were employed in the Virgil property and the work was divided between developing and stoping.

The following is a detailed description of stoping operations in the Virgil Property:

Subs Above the 8th Level
~~+~~50' Sub Level

In the central part of the deposit along the footwall side, an area 120' x 50' was mined by No. 3 Contract. This was the top sub level of the stope that was

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

c. Stoping(Cont.)

+50' Sub Level (Cont.)

developed in a relatively large supporting pillar and upon completing the mining in this stope, operations in the Virgil Lease were abandoned. Caving from old adjacent workings filled the stope with rock before all the pillar could be mined. Additional development would have been necessary to mine the small amount of remaining ore but the small tonnage did not warrant the cost of the development.

+25' Sub Level

An area 80' x 50' was mined by No. 3 Contract in the stope along the footwall side. Stoping was started at the west end of the pillar adjacent to the slate footwall and mining was retreated east to the traveling raise.

00' Sub Level

A small amount of mining was done by No. 3 Contract at this elevation and an area about 55' x 20' was mined. Most of the development on this sub level was in lean ore and slate and consequently there was only a small amount of mineable ore at this elevation.

-50' Sub Level

In the south half of the orebody along the Sherwood boundary, an area 130' x 50' was mined by No. 6 Contract. This sub level which is directly under old workings was the top elevation of the stope in the second pillar that was mined.

-75' Sub Level

The transfer drift northeast of No. 832 Raise was advanced an additional 45' in ore to the north following along the Sherwood boundary. Three additional mills were cut out and put up to a height of 25' as development for the stope described in the preceding paragraph.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

d. Timbering

The consumption of timber was less due to completion of mining in the Virgil Lease. In the development for one of the stopes an extension to one of the transfer drifts was driven and this was the only development that required timbering. Some repairs were made in the timbered drifts on the 8th Level and one of the mining raises that was subjected to heavy crushing. Some repairs were also made on the 4th Level in a portion of the drift that has been maintained for ventilation. Late in the year, substantial increases were made in the price of timber, poles and lagging but the total expense for timbering was less because a smaller amount was used.

The following is a comparative timber statement for the past two years:

Kind	Lineal Feet	Avg. Price Per Foot	Amount 1945	Amount 1944
6" to 8" Cribbing	2,030	.0580	117.89	116.22
8" to 10" Stull Timber	1,385	.0989	136.87	250.66
10" to 12" Stull Timber	1,007	.1285	129.41	194.38
Total Timber	4,422	.0868	384.17	561.26
7' Cedar Lagging	19,926	.0135	269.41	696.48
Poles	14,000	.0213	297.86	305.47
Total Lagging & Poles			567.27	1,001.95
Product			29,371	67,637
Feet of Timber Per Ton of Ore			.1505	.1025
Feet of Lagging Per Foot of Timber			4.5061	8.6577
Cost Per Ton for Timber			.0131	.0083
Cost Per Ton for Lagging			.0092	.0103
Cost Per Ton for Poles			.0101	.0045
Cost Per Ton for Timber, Poles & Lagging			.0324	.0231
Equivalent of Stull Timber to Board Measure			6,484	10,254
Feet of Board Measure Per Ton of Ore			.2208	.1516
Cost of Timber, Lagging & Poles			951.44	1,563.21

Most of the development, drifting and raising, in the Spies East Deposit required no timbering. A portion of the northeast crosscut that is in lean ore and jasper required timbering as did the transfer drift to the northeast from No. 402 Raise. The balance of the drift that was driven for transfer purposes is untimbered and with the exception of one mill raise that was advanced for some distance in footwall slate, all the stope development above the transfer elevation was done without timbering.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

d. Timbering (Cont.)

The following table shows the total cost for timbering under E&A CC-138:

6" to 8" Cribbing	2,030 Ft.	$117.89
8" to 10" Stull Timber	710 "	69.40
10" to 12" Stull Timber	979 "	128.37
12" to 14" Stull Timber	418 "	71.14
Total	4,137 "	$386.80
7' Cedar Lagging	19,926 Ft.	269.42
Poles	17,200 "	423.57
Total Lagging and Poles		692.99
Grand Total		$1,079.79

e. Explosives, Drilling and Blasting

The cost per ton for explosives increased due to the large amount of development required in proportion to the tons recovered. The total explosives cost decreased nearly in the same proportion as the decrease in production.

The cost of explosives used in the development of the Spies East Deposit was considerably less than in the previous year because the development was mostly in ore in contrast to rock development in 1944. Electric blasting has been continued in all the development and good results have been obtained. The wet conditions in the development headings has made it advisable to continue electric blasting as it reduces the occurrence of miss-holes more so than if blasting with conventional fuse and caps. Another factor favoring the use of electric blasting is the smaller amount of smoke and gases that are produced and this is important from a ventilation standpoint.

Statement of Explosives Used

Ore Development & Stoping	Quantity	Average Price		Amount 1945	Amount 1944
No. 1 Gelamite 60%	15,528	.1150	Lb.	1785.73	3610.20
Fuse (Feet)	33,682	5.15	M	173.41	426.35
No. 6 Blasting Caps	4,849	12.20	M	59.16	145.34
Hot Wire Lighters	1,963	6.70	M	13.15	27.68
Master Lighters	-	-		-	10.34
Powder Bags No. 1	7	1.40	Ea.	9.80	12.60
Tamping Bags	3,600	2.15	M	7.74	20.44
Total Fuse, Caps, Etc.				263.26	642.75
Total Expense Breaking Ore				2048.99	4252.95
Production, Tons				29,371	67,637
Lbs. Powder Per Ton of Ore				.5287	.4641
Cost Per Ton for Powder				.0608	.0534
Cost Per Ton for All Explosives				.0697	.0629

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

f. Explosives, Drilling and Blasting (Cont.)

Statement of Explosives Used (Cont.)

Rock Development

	Quantity	Average Price		Amount 1945	Amount 1944
No. 1 Gelamite 60%	675	.1150	lb.	77.40	307.51
Fuse (Feet)	2,848	5.1509	M.	14.67	56.65
No. 6 Blasting Caps	443	12.20	M.	5.40	17.42
Hot Wire Lighters	-	-		-	1.02
Powder Bags	-	-		-	2.80
Tamping Bags	-	-		-	2.22
Total Expense				97.47	387.62

E&A Development

No. 1 Gelamite 60%	42,959	.1150	lb.	4940.24	8026.77
Fuse (Feet)	30,269	5.1509	M.	155.69	105.83
No. 6 Blasting Caps	4,068	12.20	M.	49.63	33.30
Electric Caps	16,085	11.9198		1917.31	1821.91
Hot Wire Lighters	755	6.70	M.	5.06	3.38
Powder Bags	13	1.40	Ea.	18.20	4.20
Tamping Bags	1,697	2.15	M.	3.65	.54
Tamping Shells	550	6.00	M.	3.30	81.00
Duplex Wire					4.50
Connecting Wire	1,100	.55¢	lb.	605.00	288.75
Total Fuse, Caps, etc.				2757.84	2343.41
Total Explosives E&A Development				7698.08	10370.18
Total All Explosives Used in Mine				9844.54	15010.75

g. Ventilation

Before mining operations in the Virgil Lease could be completed, ventilation difficulties arose and resulted in a serious delay to operations. The course of the ventilating air through old workings was changed by caving above old stopes in inexcessible parts of the mine, allowing the ventilating air to enter a fire area. It is apparent that caving extended to the old 1st Level of the Virgil Mine and this short circuit reduced the resistance to the flow of air through the mine and the total mine volume was more than doubled on this account. All the air was passing through an old fire area and exhausting through the Virgil shaft where a temperature of 160° was measured. To re-establish the old ventilating circuit, and seal the fire area, a number of brattices were constructed on the 8th Level and sub levels above. Upon completing this work, the volume of air was reduced to the desired amount and work was resumed in the mining places but due to the cave extending to the old 1st Level the ventilating circuit could not be re-established in this part of the mine and the fire area completely sealed off. To prevent damage to the fan it was removed from the collar of the Virgil shaft and the natural ventilation provided a sufficient volume of air to continue operations and deplete the mineable ore.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

7. UNDERGROUND (Cont.)

g. Ventilation (Cont.)

After operations in the Virgil Lease were abandoned, concrete seals were constructed on each of the levels to completely seal off the Virgil workings. To ventilate the Spies development, a high pressure fan is employed to exhaust the air through the skip roads through a 14" diameter metal pipe which extends from the development headings in the orebody to the shaft. A plank casing seals the skip roads from the cage compartment so that the latter compartment serves as a down-cast for the air entering the mine. This system of ventilation has proved very satisfactory despite the fact that a volume of only 3,000 c.f.m. is being delivered. The new workings will be ventilated in this manner until completion of a small size ventilation shaft from surface.

8. COST OF OPERATING

a. Comparative Mining Costs

	1945	1944	Incr.	Decr.
Product	29,371	67,637		38,266
Underground Costs	2.112	1.815	.297	
Surface Costs	.648	.583	.065	
General Mine Expense	.814	.654	.160	
Cost of Production	3.574	3.052	.522	
Depreciation & Depletion	.912	.236	.676	
Taxes	.167	.157	.010	
Loading & Shipping	.245	.142	.103	
Total Cost at Mine	4.898	3.587	1.311	
Budget Estimated Cost at Mine	4.281	3.028	1.253	
Number of Operating Days	215	273		58
Number of Shifts and Hours	215 2-8 Hr.	150 1-8 Hr. 123 2-8 Hr.		
Average Daily Product	136	282		146

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison

		1945		1944	
	Underground Costs	Amount	Per Ton	Amount	Per Ton
1.	Exploring in Mine	3665.99	.125	8556.31	.127
3.	Development in Rock	495.81	.017	993.98	.015
4.	Development in Ore	5053.48	.172	13383.18	.198
5.	Stoping	17995.90	.612	31640.56	.468
6.	Timbering	6259.59	.213	11013.85	.163
7.	Tramming	7745.97	.264	14094.24	.207
8.	Ventilation	2776.17	.095	4200.97	.062
9.	Pumping	4495.71	.153	12528.23	.185
10.	Compressors and Air Lines	4799.67	.163	8830.94	.130
12.	Underground Supt.	4482.18	.152	8621.63	.128
14.	Compressors and Power Drills	362.61	.012	994.93	.015
15.	Scrapers	815.80	.028	1319.17	.019
16.	Electric Tram Equipment	903.12	.031	3824.73	.057
17.	Pumping Machinery	2188.23	.075	2756.43	.041
	Total Underground Costs	62040.23	2.112	122759.15	1.815
	Surface Costs				
18.	Hoisting	5135.57	.175	9302.07	.138
19.	Stocking Ore	1819.97	.062	4798.76	.071
20.	Screening-Crushing at Mine	1532.67	.052	2682.64	.040
21.	Dry House	3578.02	.122	5588.15	.083
22.	General Surface Expense	3066.04	.104	6167.00	.091
23.	Hoisting Equipment	509.36	.017	2757.83	.041
24.	Shaft	1584.06	.054	4071.59	.060
25.	Top Tram Equipment	677.56	.023	2428.05	.036
26.	Docks, Trestles & Pockets	107.24	.004	41.01	.000
27.	Mine Buildings	1027.39	.035	1599.50	.023
	Total Surface Costs	19037.88	.648	39430.60	.583
	General Mine Expense				
28.	Insurance	888.85	.030	762.47	.011
29.	Mining Engineering	927.29	.032	2262.42	.033
30.	Mechanical & Electrical Engr.	130.78	.004	230.48	.003
31.	Analysis and Grading	1657.25	.056	3355.86	.050
32.	Personal Injury	841.59	.028	12676.69	.188
33.	Safety Department	389.91	.013	660.56	.010
34.	Telephones and Safety Devices	531.03	.018	1012.95	.015
35.	Local and General Welfare	653.91	.022	792.67	.012
36.	Special Exp, Pensons & Allow.	1600.91	.055	2099.33	.031
37.	Ishpeming Office	1926.24	.066	3023.94	.045
38.	Social Security Tax	1582.52	.054	2729.33	.041
	Employees Vacation Pay	6339.26	.216	4784.84	.070
	Group Annuity Premiums	579.72	.019	825.82	.012
39.	Mine Office	7569.55	.257	9039.49	.133
		25915.63	.814	44256.85	.654
	COST OF PRODUCTION	104993.74	3.574	206446.60	3.052
40	Taxes	4900.00	.167	10647.61	.157
	Total Cost	109893.74	3.741	217094.21	3.209
	Budget Estimated Cost		3.970		2.623

SPIES VIRGIL MINE
ANNUAL REPORT
YEAR 1945

8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

		1945		1944	
		Amount	Per Ton	Amount	Per Ton
41.	General Supplies	2546.84	.087	4344.43	.064
42.	Iron and Steel	375.00	.013	800.58	.012
43.	Oil and Grease	705.39	.024	1242.79	.018
44.	Machinery Supplies	812.02	.028	4822.03	.071
45.	Explosives	2189.03	.075	4400.98	.065
46.	Lumber and Timber	1788.46	.061	1944.51	.029
47.	Fuel	3486.50	.119	4305.55	.064
48.	Electric Power	15186.67	.517	26364.11	.390
49.	Sundries	13699.91	.466	17034.47	.252
50.	Michigan State Tax	11.37	.000	9.92	.000
	Supply Inv. Adjustment	9722.79	.331	6266.38	.093
	Total per Cost Sheet	31078.40	1.059	59002.99	.872

The following are explanations of cost accounts that show significant variations compared with the previous year:

1. Exploring in Mine

Decrease in expenditure is due to smaller drilling program which was completed early in the year.

4. Development in Ore

Decrease is due to smaller stope development program.

5. Stoping

The decrease in total expense is due to a smaller underground operation and the large increase in cost per ton is due to mining confined to recovery of small pillars. Labor cost also increased by payment of shift differential.

6. Timbering
7. Tramming

The total expense for these accounts is less due to smaller underground operation and large increase in cost per ton is due to small product.

8. Ventilation

The increase in cost per ton is due to constructing brattices to control the ventilation.

9. Pumping

The decrease is due to a large portion of this expense charged to E&A CC-138.

12. Underground Superintendence

The increase in cost per ton is due to payment of $125.00 bonus to each foreman on monthly salary.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

16. Maint: Electric Tram Equipment

The decrease is due to major part of the cost of repairs and overhauling charged to E&A CC-138.

17. Maint: Pumping Machinery

The large expense is due to the replacement of a broken pump casting with a new one.

18. Hoisting

Increase in cost per ton is due to small product and increase in labor cost due to payment of shift differential.

21. Dry House

The large expense is due to the increase in labor cost on account of payment of shift differential. There has been no decrease in this expense in the same proportion as in other accounts because full time operation of dry house facilities has been necessary.

22. General Surface Expense

The total expense was less due to small underground operation but the cost per ton increased due to small production and higher labor cost on account of payment of shift differential.

28 - 39 Inclusive

The total expenditures in these accounts with two exceptions were less because of the reduction in the size of the Virgil Lease operations and the higher cost per ton is due to the small product.

Employees vacation pay was considerably larger on account of payment of retroactive vacation adjustment.

40. Taxes

The decrease is due to smaller valuation and large proportion of taxes charged to Spies East Deposit development account.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

9. EXPLORATIONS AND FUTURE EXPLORATIONS

a. Underground

Some additional drilling was done in the Virgil Lease before operations were abandoned in this property. Two holes were drilled to the north and northwest from the main level haulage drift on the 8th Level to further explore the area north of the Virgil orebody. No ore was encountered in the drilling and the program was abandoned early in the year.

Diamond drilling was done in the Spies East Deposit for the purpose of outlining the orebody and three short holes were drilled on subs above the 4th Level near the north end of the deposit. A relatively large amount of exploration has been done by drifting across the formation at various elevations and due to the narrow width of ore, this method has proven more economical than diamond drilling. However, when exploration involving longer distances is necessary, diamond drilling will be employed.

A drilling program under contract with the E. J. Longyear Company was conducted from the 4th Level to explore the Johnson Lease property. Three holes were drilled from the end of the 4th Level drift to the east and southeast but no ore was discovered in the drilling. Favorable runs of iron formation were encountered in each of the holes and in one of the holes a small amount of lean ore was penetrated. The program was abandoned before one of the holes was completed to the desired depth. A large volume of water was encountered in this hole and due to the serious water problem in the Spies East Deposit, it became advisable to stop drilling and seal the hole.

Late in the year, preparations were made to conduct additional drilling to explore the extension of the east deposit below the 4th Level. A drilling station was cut out near the end of the short southeast crosscut and the first inclined hole will be drilled from this point. Based on present knowledge of the structure, the hole will penetrate the iron formation at the 6th Level elevation.

The following is a log of the underground drilling in the Virgil Lease:

D.D.H. No. 129

8th Level N34°E	Dip 0°
0' - 598'	Grey Slate

D.D.H. No. 130

8th Level Due North	Dip 0°
0' - 77'	Grey Slate
77' - 563'	Banded Grey Slate
563' - 625'	Dark Grey Slate

The following is a log of the underground drilling in the Spies East Deposit:

D.D.H. No. 14.

1050' Sub - N.70°W. -	Dip 0°
0' - 15'	Lean Ore
15' - 132'	Jasper & Slate
132' - 161'	Slate

D.D.H. No. 15.

4th Level S38°E. -	Dip 0°
0' - 593'	Slate
593' - 650'	Oxidized Chert & Slate
650' - 685'	Cherty Iron Form.
685' - 690'	Jasper
690' - 695'	Cherty Iron Form.
695' - 700'	Lean Ore
700' - 720'	Cherty Iron Form.
720' - 725'	Lean Ore
725' - 756'	Cherty Iron Form.
756' - 870'	Jasper

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

9. EXPLORATIONS AND FUTURE EXPLORATIONS (Cont.)

a. Underground (Cont.)

D.D.H. No. 16.
4th Level Due East - Dip 0°

0' - 1077'	Slate
1077' - 1246'	Jasper Iron Form.
1246' - 1300'	Gray Slate
1300' - 1306'	Jasper Iron Form.
1306' - 1394'	Slate

D.D. H. No. 17.
1125' Sub - N45°W. - Dip 0°

0' - 23'	Jasper
23' - 27'	Slate
27' - 57'	Jasper Iron Form.
57' - 62'	Lean Ore
62' - 87'	Slate

D.D.H. No. 18.
4th Level S68°E. - Dip 0°

0' - 543'	Slate
543' - 558'	Dike
558' - 700'	Gray Slate
700' - 710'	Black Slate
710' - 907'	Iron Carb. & Gray Slate
907' - 1259'	Dark Gray Slate
1259' - 1285'	Cherty Iron Carb.
1285' - 1292'	Jasper
1292' - 1305'	Gray Slate
1305' - 1383'	Jasper
1383' - 1393'	Gray Slate
1393' - 1513'	Jasper
1513' - 1575'	Gray Slate

D.D.H. No. 19.
1125' Sub Due West - Dip 0°

0' - 25'	Ore
25' - 30'	Second Class Ore
30' - 44'	Jasper
44' - 65'	Gray Slate

b. Surface

A surface drilling program under contract with E. J. Longyear Company has been continued in Section 24. The results of this program have been very disappointing as no ore was encountered in any of the holes. A hole that was started the previous year in the SW¼ of the section was completed and failed to disclose any extension to the Spies East Deposit. Another hole was started late in the year to explore the same area but considerable trouble was experienced in driving the casing to ledge and after three separate attempts had failed another location was selected.

Two test holes were drilled to ledge to determine the elevation of the water table above the Spies East Deposit. The holes are about 300' apart and they were drilled near the east boundary of the property directly above the orebody. In addition to these two holes, several old diamond drill holes in which the casing has been left permits measuring the ground water level and determining what effect if any, continued draining through underground workings may have on the water table.

Some drilling was also done in the NW¼ of Section 24 to explore the favorable structure developed in the adjoining property to the west. Three holes were drilled in this area but no ore was discovered and the program was abandoned.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

9. EXPLORATIONS AND FUTURE EXPLORATIONS (Cont.)

b. Surface (Cont.)

The following is a log of the surface drilling:

D.D.H. No. 71.
SE¼ Sec. 24 - Dip 60°S.

0'	- 248'	Surface Material
248'	- 541'	Cherty Grey Sl. & Iron Carb.
541'	- 643'	Slate & Iron Seams
643'	- 665'	Iron Formation
665'	- 899'	Dark Grey Slate
899'	- 1040'	Jasper & Iron Form.
1040'	- 1045'	Chert & Grey Slate
1045'	- 1089'	Dark Grey Slate
1089'	- 1123'	Chert
1123'	- 1216'	Slate

D.D.H. No. 72.
NW¼ Sec. 24 - Dip 90°

0'	- 47'	Surface Material
47'	- 340'	Cherty Grey Slate
340'	- 630'	Banded Grey Slate
630'	- 837'	Slate & Greywacke
837'	- 890'	Grey Slate
890'	- 1027'	Cherty Iron Carb.
1027'	- 1047'	Grey Slate
1047'	- 1060'	Lean Ore
1060'	- 1322'	Grey Slate
1322'	- 1567'	Slate & Greywacke
1567'	- 1611'	Cherty Iron Carb.
1611'	- 1827'	Slate

D.D.H. No. 75.
NW¼ Sec. 24 Due North Dip 70°

0'	- 42'	Surface Material
42'	- 55'	Black Slate
55'	- 75'	Cherty Iron Carb.
75'	- 316'	Grey Slate
316'	- 893'	Grey Slate & Iron Carb.

D.D.H. No. 76.
NW¼ Sec. 24 Due North Dip 65°

0'	- 48'	Surface Material
48'	- 51'	Broken Ledge
51'	- 124'	Dark Grey Slate
124'	- 335'	Cherty Iron Carb.
335'	- 485'	Grey Slate & Greywacke
485'	- 865'	Cherty Iron Carb.& Sl.

D.D.H. No. 77.
SE¼ Sec. 24 Due South Dip 60°

0'	- 216'	Surface Material (Abandoned)

The following is a log of the water level test holes:

D.D.H. No. 73.
Sec. 24 - Dip 90°

0'	- 110'	Surface Material
110'	- 113'	Broken Ledge

D.D.H. No. 74.
Sec. 24 - Dip 90°

0'	- 143'	Surface Material
143'	- 144'	Slate Ledge

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

10. TAXES

The following shows a comparison of taxes paid in 1945 and 1944 in Iron County:

Description	1945 Valuation	1945 Taxes	1944 Valuation	1944 Taxes
Iron County				
Iron River Township				
NE¼ of NW¼ of Sec. 24, 43-35 40A)				
SE¼ OF NW¼ of Sec. 24, 43-35 40A)				
Virgil Lease				
SW¼ of NW¼ of Sec. 24, 43-35 40A)	110,000	2,452.88	50,000	1,110.00
Stockpile, Supplies & Equipment	90,000	2,006.91	160,000	3,552.00
Total Spies Virgil	200,000	4,459.79	210,000	4,662.00
Spies Dwellings	3,000	66.90	7,500	166.50
Total Iron River Township	203,000	4,526.69	217,500	4,828.50
Rate		2.2299		2.220
Village of Mineral Hills				
Spies Lease				
NE¼ of NW¼ of Sec. 24, 43-35 40A)				
SE¼ of NW¼ of Sec. 24, 43-35 40A)				
Virgil Lease				
SW¼ of NW¼ of Sec. 24, 43-35 40A)	110,000	481.07	50,000	216.87
Stockpile, Supplies & Equipment	90,000	393.60	160,000	693.98
Total Spies Virgil	200,000	874.67	210,000	910.85
Spies Dwellings	3,000	13.12	7,500	32.53
Total Village of Mineral Hills	203,000	887.79	217,500	943.38
Rate		4.373305		4.337
City of Iron River				
Spies-Johnson (East Deposit)				
SE¼ of NE¼ of Sec. 24, 43-35 40A)	107,500	3,848.50	70,000	2,516.50
NE¼ of SE¼ of Sec. 24, 43-35 40A	107,500	3,848.50	70,000	2,516.50
Mineral Lands				
NE¼ of NE¼ of Sec. 24, 43-35 40A	2,000	71.60	2,000	71.90
NW¼ of NE¼ of Sec. 24, 43-35 40A	1,600	57.28	1,600	57.52
NW¼ of NW¼ of Sec. 24, 43-35 40A	2,000.	71.60	2,000	71.90
NW¼ of SE¼ of Sec. 24, 43-35 40A	1,600	57.28	1,600	57.28
NE¼ of SW¼ of Sec. 24, 43-35 25A	1,400	50.12	1,400	22.55
(Except Carlson's Maple Valley Add.)				
Lots in Carlson's Maple Valley Add.	1,025	36.90	375	6.45
Total	224,625	8,041.78	148,975	5,320.82
Collection Fees		80.40		53.21
Total City of Iron River		8,122.18		5,374.03
Paid in August 1945		4,537.43		2,973.44
Paid in January 1946		3,584.75		2,400.59
Total		8,122.18		5,374.03
Tax Rate		3.580		3.595
Bates Township				
Spies East Deposit				
Mineral rights only:				
SW¼ of Sec. 19, 43-34	35,000	1,155.00		
Collection Fees		11.55		
Total		1,166.55		

Note: Iron River Township & Village of Mineral Hills taxes are assessed on the same valuation.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

11. ACCIDENTS AND PERSONAL INJURY

The accident frequency and severity rate improved considerably as compared with the previous year. There was one lost time accident which resulted in 59 days lost time. There was very little difference in the total man days worked; the total in 1945 was 22,446 compared with 22,810 in the previous year. The good accident record put the mine into first place among the Company's underground mines and the mine was awarded the safety banner for the coming year.

The following table shows a comparison of the accident severity and frequency rates for the past two years.

	Frequency Rate	Severity Rate
1945	5.57	.329
1944	43.83	43.42

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

Accident No. 164 - April 9th, 1945. David Tarsi, Company Account Miner. While tamping fresh concrete that was being poured for a pump motor base, Tarsi suffered a strained back. Lost time - 59 days.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

There was no new building construction other than moving the small size building that housed the fan at the Virgil shaft to the new shaft site where it was reerected to serve as a dry house and storage shed. The most important new construction was the installation of a 2,300 volt transmission line that extends from the Spies shaft east to the ventilation shaft site near the Spies East Deposit. The line runs for its entire length of 3,500' on Company property and it was necessary to clear a large amount of brush and trees for the route. All the work except erecting the poles and hanging the lines was done with mine labor. The balance was let on contract to a transmission line crew that is employed with the Wisconsin, Michigan Power Company.

Air and water lines extending for the same distance and following the same route as the transmission line were laid to the ventilation shaft. A 2" water line was laid and approximately half of the air line was 4" diameter and the balance 2". Both of the lines were laid in a relatively shallow ditch that was excavated with the bull-dozer and back filled to prevent freezing.

Some stocking trestle was erected in the area where Spies ore is stocked north of the shaft. A total of 12 bents were erected extending the trestle farther north. No important new construction is contemplated for 1945.

13. EQUIPMENT AND PROPOSED EQUIPMENT

There was a large amount of additional new equipment purchased, most of which was charged to E&A's. The largest expenditure for new equipment was the new pump and accessories that was installed on the 6th Level to increase the mine pumping capacity. A large amount of new equipment such as scraper hoists, drill machines and electrical equipment and other accessories were purchased for use in connection with developing the Spies East Deposit for mining.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

13. EQUIPMENT AND PROPOSED EQUIPMENT (Cont.)

Additional pumping equipment is on order for delivery in the coming year for use in the drainage project in the Spies East Deposit. Three centrifugal pumps, each having a capacity of 250 G.P.M. will be purchased and electrical accessories such as transformers, switches and other controls will be purchased. A large size churn drill hole will be drilled from surface to connect to the development for the drainage project at a depth of about 300' from surface and a discharge line and power line will be installed in the hole. A short extension will be erected to the new transmission line from the ventilation shaft to the churn drill hole and power for the pumping equipment will be obtained from this source.

The following is a list of the important items of new equipment added to the inventory:

Item	Number of Items	Cost	
10 KVA. Transformer	2	$ 208.56	(2)
Unit Heater #35	4	252.48	(1)
Stoper - R-48	1	366.17	(1)
Gate Valve 10"	1	76.94	(1)
Toledo Hand Threader	1	98.77	(3)
Stoper - S-91	1	365.00	(1)
Aldrich Pump, 7" x 12"	1	5,206.35	(2)
Jack-Leg JL - 3	2	171.44	(1)
Vertical Hot Water Tank	1	141.35	
Water Heater	1	137.20	
Hot Water Circulator	1	30.66	
Jackhammer, JA-55	1	215.92	(1)
Mang. Track Frogs	2	148.16	(1)
Armoured Shaft Cable - 1738'	1	1,791.88	(1)(2)
Temperature Regulator	1	69.31	
Cable - 3 Conductor	1	69.72	(2)
Subway Box - 4 way	1	291.60	(2)
Scraper Hoist I.R. 25 h.p.	1	1,823.89	(1)
Utility Hoist - HU	1	475.00	(1)
Double Drum Utility Hoist	1	603.00	(1)
Sludge Pump, C.P.	1	181.93	(1)
Transmission Line	1	158.22	-116-A
Prescott Pump Pot	2	2,306.00	
Scraper Hoist Drum	1	50.00	
Compressor Discharge Valves	6	309.93	
Leather Pump Belt	1	428.55	
Bullgrader Blade Edge	1	22.05	
Track Jack	1	24.66	(1)
Valve S&R	1	75.00	(1)
Oil Circuit Breaker Type F.G.-11	1	90.90	(1)
Column Arm & Clamp	2	103.90	(1)

(1) New Equipment charged to E&A CC-138.
(2) New Equipment charged to E&A CC-145.
(3) New Equipment charged to E&A CC-133.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

14. MAINTENANCE AND REPAIRS

a. Mine

The maintenance expense charged to operating decreased in proportion to the decrease in the size of the underground operation but a large proportion of the maintenance work was charged to the E&A's under which development of the new deposit is being done. One of the largest expenses for maintenance has been the pumping equipment which has been operating near full capacity due to the large increase in mine water. The pot castings on each of the 8th Level pumps broke and were replaced with new castings. After the second-hand pump that was purchased from the Oliver Mining Company was installed and placed in operation, a large amount of maintenance and some replacement of parts was necessary to maintain the pump in operating condition. Another large maintenance expense has been the discharge line in the shaft. Frequent leaks have broken out at various points along the length of the column, necessitating a large amount of work to maintain it in condition. The leaks have occurred mostly in the cast iron flanges and as leaks break out at these points the flanges are being removed and a welded connection made.

One underground locomotive that has seen many years of service in the Virgil operation was overhauled and put into good condition before it was put to use for tramming from the Spies East Deposit. The small size tram cars that were used in the Virgil operation are nearly completely worn out and several of these will be repaired and rebuilt from accumulated parts and will be used in cleaning the skip pit and track cleaning on the 4th Level.

Shaft maintenance has been less due to the small product that was hoisted. Regular inspections have been continued however and several worn out runners have been replaced in the skip roads and hardwood wearing strips fastened to the sides of the runners.

One of the top tram larry cars fell off the trestle when a fir stringer broke as the loaded car was passing over it. The car was not seriously damaged as it fell only a short distance and it was repaired and put back into service in a short time.

Some major repairs were made to the coal dock and these consisted of replacing a number of rotted fir stringers and cap pieces. Several rotted timber legs were also replaced and some new planking and guard railing was placed on top of the trestle.

b. Location

Nine cottages and the four-family apartment house were sold in 1945. One cottage and the captain's residence are the only two dwellings that were not sold. In each case the cottages were sold to the tenants who are employees at the mine. Eight of the cottages were sold for $800.00 and one for $875.00 and a discount of 10% was allowed in each case for a cash purchase. The apartment house was sold for $2,500.00 with the same discount applied for a cash purchase.

Extensive exterior repairs were made to both the captain's house and the cottage that has been retained. Siding that was in poor condition was replaced with new material and some repairs made to the porches and sheds and then both houses were given two coats of paint. The two houses were put in good condition and attractive appearance and will require very little maintenance expense for a number of years. This work was let on contract to a local contractor.

SPIES-VIRGIL MINE
ANNUAL REPORT
YEAR 1945

14. MAINTENANCE AND REPAIRS (Cont.)

b. Location (Cont.)

MAINTENANCE EXPENSE	AMOUNT			
	1945			1944
	Labor	Supplies	Total	Total
Interior Decorating, Repairs and Painting Captain's House and Cottage No. 1.	194.98	538.86	733.84	315.37

15. There was a further increase in power consumption and this is due entirely to the larger volume of water that was pumped. This resulted in a large increase in the cost per ton because of the small product. There were no delays to operations during the year due to lack of power which is purchased from the Wisconsin, Michigan Power Company.

Year	Average Maximum Demand	Rate Per K. W. H.	Total K. W. H.	Cost Per Ton
1945	498	$ .0130	2,349,980	$ .517
1944	470	.0137	2,013,233	.176

16. WATER SUPPLY

The water supply that is furnished by the Homer Mine has been satisfactory throughout the year. Water for underground drilling has continued to be obtained from the 3rd Level sump and this source has been very satisfactory for this purpose.

17. CONDITION OF PREMISES

The premises have been kept in neat condition by routine cleaning and in a similar manner, the premises around the location have been kept in good condition by the Village.

18. NATIONALITY OF EMPLOYEES

	American Born	Foreign Born	Total	Percent
English	10	8	18	22
Finnish	8	6	14	18
Swedish	9	0	9	11
Danes	3	0	3	4
Italian	4	7	11	14
Polish	5	4	9	11
French	3	2	5	6
Austrian	0	2	2)	
Irish	3	0	3)	
Belgian	1	1	2)	
German	1	2	3)	14
Welsh	1	0	1)	
Lithuanian	1	0	1)	
Total	49	32	81	100

THE CLEVELAND-CLIFFS IRON COMPANY
OPERATING AGENT FOR CANISTEO MINING COMPANY
CANISTEO MINE
ANNUAL REPORT
YEAR 1945

1. GENERAL:

Operations, involving stripping and the mining of ore, were continuous throughout the year. Employees were granted one day leaves on the holidays and there were about two days of enforced layoffs during the stripping periods, due to heavy snow storms. Working schedules of five days per week were carried during the first and last two months of the year, and six days per week during the intervening nine months.

Operating equipment was repaired when necessary and overhauled completely whenever units could be spared.

Washing plant repairs were continued from the first of the year to the beginning of the ore season, and started anew at the close of the ore season and carried on through the end of the year.

The stripping program in progress at the beginning of the year, on the north side of the pit, in the Mid-Snyder forty, was completed on April 13th, after which the equipment was moved to the pit bottom along the East Snyder and South Bovey line, where waste and lean material was removed until the end of the stripping program, on April 27th.

Subsequent to the 1945 ore season, stripping operations were resumed on October 15th, in the south side of the pit. The removal of paintrock and other lean formation was started on the pit bottom in the South Bovey forty while, simultaneously, excavations were conducted in developing a new approach up the south bank. By the middle of November, the equipment was moved up the new approach to push back the south limits of the South Bovey forty. This surface stripping program was in progress at the close of the year.

During the seven work days, from April 28th to May 5th, inclusive, a clean-up program was effected whereby slough and silt was removed to expose the underlying ore, and the sump area was improved, preparatory to ore operations.

Ore operations were started on May 7th, and continued through October 13th. A working schedule of two 8-hour shifts per day and six days per week was maintained until October 8th, when a single 8-hour shift per day became effective. Ore was mined from all three leases, however, the amount taken from the Hemmens was confined to a small tonnage available above the sump level.

The washing plant was operated on the same schedule as that established for ore operations in the pit. The low weight recovery of the crude ore treated was reflected in production, nevertheless, the plant operated quite satisfactorily, as very few mechanical delays were encountered.

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

1. GENERAL:
(continued)

Pumping was carried on continuously throughout the year from the water basin in the east end of the pit.

Exploratory and sample drilling was conducted throughout the year. Exploration holes were drilled in the Snyder and Bovey forties, on the north and south side of the pit, to justify stripping extensions in these directions, and sample drilling was subsequently done in the same forties to guide the ore operations.

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

Snyder Crude,	821,800	tons
Bovey Crude,	367,562	"
Hemmens Crude,	44,843	"
Total Crude Ore,	1,234,205	"
Snyder Non-Bessemer Concentrates,	258,281	"
Snyder Bessemer Concentrates,	176,997	"
Bovey Non-Bessemer Concentrates,	79,840	"
Bovey Bessemer Concentrates,	122,081	"
Hemmens Non-Bessemer Concentrates,	17,933	"
Hemmens Bessemer Concentrates,	4,704	"
Total Production - 1945,	659,836	"

b. Shipments:

Snyder Non-Bessemer Concentrates,	193,052	"
Snyder Bessemer Concentrates,	176,997	"
Bovey Non-Bessemer Concentrates,	79,840	"
Bovey Bessemer Concentrates,	122,081	"
Hemmens Non-Bessemer Concentrates,	17,933	"
Hemmens Bessemer Concentrates,	4,704	"
Total Shipments - 1945,	594,607	"

c. Stockpile Inventories:

Snyder Concentrates in Stockpile, January 1,1946,-	68,958	"

e. Production by Months:

	SNYDER	BOVEY	HEMMENS	TOTAL
(1) Crude Ore:				
May,	128,601	32,573	41,257	202,431
June,	179,444	84,024	-	263,468
July,	169,825	64,416	2,227	236,468
August,	139,146	92,664	1,359	233,169
September,	138,905	93,885	-	232,790
October,	65,879	-	-	65,879
TOTAL,	821,800	367,562	44,843	1,234,205

GANISTEO MINE
ANNUAL REPORT
YEAR 1945

2. PRODUCTION, SHIPMENTS & INVENTORIES: (continued)

e. Production by Months: (continued)

(2) Concentrates:

	SNYDER	BOVEY	HEMMENS	TOTAL
May, ----------	66,336	18,440	20,982	105,758
June, ----------	91,624	46,491	-	138,115
July, ----------	94,813	35,766	1,036	131,615
August, ----------	74,317	49,559	619	124,495
September, -------	75,245	51,665	-	126,910
October, ---------	32,943	-	-	32,943
TOTAL, ----------	435,278	201,921	22,637	659,836

f. Ore Statement:

A balance of 3,729 tons of Snyder concentrates was shown in stockpile as of January 1, 1945. Stocking concentrates during periods of empty car shortage in the shipping season and for an additional eight shifts after the completion of the season's shipments, added 65,229 tons of concentrates, making a total of 68,958 tons in stockpile as of January 1, 1946.

g. Delays:

An accumulation of delays reported during the ore season amounted to 56 hours and 25 minutes, of which, ten hours and thirty-five minutes were power shortages caused by electrical storms. Mechanical and electrical failures on the shovels showed a total delay of 27 hours and 30 minutes, which had only a partial effect on production, as all shovels were never down for repairs at the same time. Delays of the washing plant amounted to 18 hours and 20 minutes, of which, about one-half were entailed by electrical and mechanical failures of the machinery, the remainder being due to plugged rock chutes, railroad yard plugged with loads, and such.

3. ANALYSIS:

a. Mine Analysis of Production:

	Tons	Iron	Phos.	Sil.	Mang.	Alu.	Moist.	Fe.Nat.
Snyder N.B. Concts.	258,281	56.83	.071	11.01	.31	.58	8.12	52.22
Snyder Bess. Concts.	176,997	57.37	.037	10.86	.27	.58	8.14	52.70
Bovey N. B. Concts.	79,840	56.86	.064	11.57	.36	.59	7.91	52.36
Bovey Bess. Concts.	122,081	56.88	.036	11.53	.31	.55	7.94	52.36
Hemmens N.B. Concts.	17,933	57.58	.053	11.45	.45	.75	8.42	52.73
Hemmens Bess. Concts.	4,704	57.93	.039	11.31	.22	.82	8.41	53.07
TOTAL,	659,836	57.02	.054	11.15	.31	.58	8.08	52.41

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

3. ANALYSIS:
(Continued)

b. Mine Analysis of Shipments:

	Tons	Iron	Phos.	Sil.	Mang.	Alu.	Moist.	Fe.Nat.
Snyder N.B. Concts.	193,052	56.91	.069	10.99	.33	.61	8.19	52.25
Snyder Bess. Concts.	176,997	57.37	.037	10.86	.27	.58	8.14	52.70
Bovey N.B. Concts.	79,840	56.86	.064	11.57	.36	.59	7.91	52.36
Bovey Bess. Concts.	122,081	56.88	.036	11.53	.31	.55	7.94	52.36
Hemmens N.B. Concts.	17,933	57.58	.053	11.45	.45	.75	8.42	52.73
Hemmens Bess. Concts.	4,704	57.93	.039	11.31	.22	.82	8.41	53.07
TOTAL,	594,607	57.06	.051	11.15	.31	.59	8.09	52.44

c. Analysis of Ore in Stockpile:

	Tons	Iron	Phos.	Sil.	Mang.	Alu.	Moist.	Fe.Nat.
Snyder 1944,	3,729	55.07	.038	12.23	.72	.47	8.07	
1945,	65,229	56.60	.077	11.07	.26	.50	7.91	
Total,	68,958	56.52	.075	11.13	.28	.50	7.92	52.04

d. Analysis of Crude Ore Production:

Lease	Tons	Iron	Phos.	Silica
Snyder,	821,800	42.61	.046	33.28
Bovey,	367,562	42.11	.043	34.24
Hemmens,	44,843	42.78	.044	34.26
Total,	1,234,205	42.47	.045	33.60

e. Complete Analysis of Season's Shipments:

	Iron	Phos.	Sil.	Mang.	Alu.	Lime	Mag.	Sul.	Loss
Snyder N.B. Concts.	56.91	.069	10.99	.33	.61	.27	.20	.011	5.92
Snyder Bess. Concts.	57.37	.037	10.86	.27	.58	.28	.19	.011	5.58
Bovey N.B. Concts.	56.86	.064	11.57	.36	.59	.26	.18	.012	5.43
Bovey Bess. Concts.	56.88	.036	11.53	.31	.55	.27	.17	.012	5.62
Hemmens N.B. Concts.	57.58	.053	11.45	.45	.75	.28	.19	.012	4.22
Hemmens Bess. Concts.	57.93	.039	11.31	.22	.82	.29	.18	.012	4.15

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

4. ESTIMATE OF ORE RESERVES:

a. Developed: Ore:

Factors Used:

All Leases:

Class of Material	Rock Deduction	Cu. Ft. Per Ton	% Recovery
Wash Ore,	10%	14	60%
Lean Wash Ore,	10%	14	50%
Low Grade Wash Ore,	10%	15	60%
Lean Low Grade Wash Ore,	10%	15	50%
Rocky Wash Ore,	20%	14	60%

LEASE	RESERVE JAN.1,1945	MINED 1945	BALANCE	DEVELOPED BY DRILLING	RESERVE JAN.1,1946
Bovey:					
S½-NE- Sec.30,	116,744	-	116,744		116,744
NW-SE- Sec.30,	235,100		235,100		235,100
NE-SE- Sec.30,	447,898		447,898		447,898
NE-NE- Sec.31,	622,633	201,921	420,712		420,712
Total Bovey,	1,422,375	201,921	1,220,454	-	1,220,454
Hemmens:					
SW-SW- Sec.29,	1,560,790	22,637	1,538,153	-	1,538,153
Snyder:					
SE-SW- Sec.30,	1,091,685	-	1,091,685	-	1,091,685
SW-SE- Sec.30,	1,042,545	375,620	666,925		666,925
SE-SE- Sec.30,	1,078,155	59,658	1,018,497		1,018,497
Total Snyder,	3,212,385	435,278	2,777,107	-	2,777,107
GRAND TOTAL,	6,195,550	659,836	5,535,714	-	5,535,714

c. Estimated Analyses:

The following tabulation shows the estimated analyses of the reserve ore for the several leases:

Lease	Tons	Iron	Phos.	Sil.	Meng.	Alu.
Bovey:						
Bessemer Concs.	185,718	58.10	.033	9.47	.26	.46
Non-Bess.Concs.	1,034,736	56.76	.080	11.20	.29	.49
Hemmens:						
Bessemer Concs.	637,573	58.44	.034	9.87	.22	.52
Non-Bess.Concs.	900,580	56.78	.053	12.08	.27	.57
Snyder:						
Bessemer Concs.	1,075,979	60.68	.039	8.66	.20	.37
Non-Bess.Concs.	1,701,128	58.34	.060	10.25	.28	.45
Total Bess.Conc.	1,899,270	59.68	.037	9.16	.21	.43
Total Non-" "	3,636,444	57.50	.064	10.97	.28	.49
GRAND TOTAL,	5,535,714	58.25	.055	10.35	.26	.47

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

5. LABOR AND WAGES:

a. Comments:

The labor shortage prevailed throughout the year and, at times, was so acute that it was necessary to conduct the lean and waste ore operations on the third shift, with partial crews. With the return of some veterans, towards the end of the year, the situation was eased considerably.

In accordance with a directive order of the War Labor Board, adjustments in shift differential and vacation pay became effective during the year. The adjustments, retroactive to January 4th, of 1944, were granted in December and paid currently thereafter. Several petty grievances, presented by the union during the year, were readily settled to the satisfaction of labor and management. However, labor unrest and threats of strike reached acute stages at the close of 1945.

b. Comparative Statement of Wages and Product:

PRODUCTION:	
Direct Shipping,	-
Concentrates Shipped,	594,607 tons
Concentrates in Stock 12-31-45,	65,229 "
Concentrates in Stock 12-31-44,	3,729 "
Total Production,	659,836 "
Number of Days Operated, (128 days two 8-hour shifts; 6 days one 8-hour shift)	134
Average Daily Product,	4,942
Average Wages Paid Per Day,	8.03
Amount paid for Labor,	$ 137,605.13

6. SURFACE:

a. Buildings, Repairs:

Aside from two small shelter shacks for dumpmen, there was nothing but ordinary maintenance work on mine buildings and dwellings during the year.

c. Roads, Transmission Lines, etc:

About 1,600 feet of road was built in the development of a new approach up the south bank of the pit. The lower 400 feet of the road was developed by rock-filling a mined out area of the pit bottom, the intermediate 700 feet by excavation through lean formation, and the upper 500 feet by cleaning up slough along the toe of the old surface slope.

Two power poles, with about 500 feet of transmission line, were removed and replaced in the North Bovey part of the pit to facilitate some ore-scramming operations in the old pit bottom.

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

7. OPEN PIT:

a. Stripping:

The stripping operations during 1945 were conducted on the north side of the Mid-Snyder forty, extending the pit limits in the vicinity of the old approach; in the pit bottom on the south side, in the East Snyder and South Bovey forties, and in the south bank of the pit; extending the pit limits southward in the South Bovey lease. Two 3-1/4-yard electric shovels and seven to nine 15 and 20-ton rear-dump trucks were used during the greater part of the season. However, this was cut to one shovel and six to seven trucks during the short time allowed for shovel repairs. In January, November and December, the work was all conducted on a 40-hour per week basis, three 8-hour shifts per day and five days per week. During the balance of the year, the basis was 48 hours per week, or three 8-hour shifts per day and six days per week. A total of 965,545 cubic yards of surface and waste and lean ore materials was removed in 152 days. This did not include 30,755 cubic yards of clean-up work in the pit bottom, just previous to the ore season, and charged to ore operations. In view of the pit operating conditions and of the fact that the equipment had not had a thorough overhauling for several years, satisfactory stripping costs were secured.

The pit extension in the north side of the Mid-Snyder forty, which was started in December, 1944, was carried forward from the first of the year until April 13th. Two shovels were used until March 12th, when one was taken to the shop for some badly needed repairs. The work in this area was then completed with one shovel. The material was hauled to the stripping dump on the North Bovey, a short distance north of the concentrating plant. Operating conditions were tough, for a heavy layer of blue clay, spotted with water pockets, was encountered immediately under the sand and gravel of the upper lift. Haulage conditions in the newly-stripped area were soft and slippery, and considerable difficulty was encountered in handling the wet material in both the shovel bucket and truck boxes during freezing weather. In addition, there were numerous shovel delays, due to working in tough frost conditions, with shovels badly in need of repair. Approximately 4,000 tons of low grade painty merch. ore were taken from a thin layer in the paintrock horizon and stocked near the washing plant. A total of 289,926 cubic yards of surface and 193,795 cubic yards of waste ore material was hauled to the north dump. In addition, 38,485 cubic yards of lean ore were hauled to the lean ore dump in the pit, making a total of 520,206 cubic yards of stripping removed from the area during the year.

On completion of the work in the North Snyder, the shovel was moved to the pit bottom, where up until April 27th, 57,196 cubic yards of lean and waste material were removed and hauled to the proper dump in the pit. This developed underlying ore areas and completed

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

7. OPEN PIT:

a. Stripping: (continued)

a water channel for pit drainage in that area. 20,300 cubic yards of waste ore material and 6,216 yards of lean ore were taken from the south side of the East Snyder and 12,270 cubic yards of waste and 18,410 yards of lean ore from the north side of the South Bovey. With but one shovel in operation and wet haulage conditions, the progress was slow.

Clean-up operations in the pit bottom were then conducted for a week, just previous to the ore season, and 30,755 cubic yards of waste and lean ore material were removed from the South Bovey and East Snyder bottoms. Of this amount, 1,278 cubic yards of lean ore were taken from the former, 17,551 yards of waste material and 7,371 yards of lean ore from the latter.

Upon completion of the ore program, stripping was resumed October 15th, on a 3 shift, 6 day per week basis, until November 1st, when a 40-hour per week basis was put into effect on all the Mesaba Range properties operated by the company. Two shovels and eight trucks were used in removing waste and lean ore materials to develop underlying ore in the East Snyder and South Bovey pit bottoms, and in building an approach to the surface stripping operations in the south bank. The approach was completed on November 12th, and one shovel was moved up to develop the surface stripping operations. The second shovel continued in the pit bottom until November 24th, when it likewise was moved up to the south bank. 174,209 cubic yards of material were removed from the area. This consisted of 102,099 cubic yards of waste and 61,493 yards of lean ore from the South Bovey; 7,492 yards of waste material and 3,125 yards of lean ore from the East Snyder. This material was all taken to the proper dump in the pit.

The surface stripping operation carried forward from November 12th to the end of the year, was an extension of the pit limits in the southwest side of the South Bovey. This carried the stripping to the ultimate pit limits in this area. The work was conducted with two shovels and eight or nine trucks, on a 40-hour per week basis, three 8-hour shifts per day and five days per week. Digging was tough, working conditions cramped in a restricted area, and it was necessary to use a 10% grade out of the pit. However, despite these conditions, and numerous shovel breakdowns, good progress was made and 213,934 cubic yards of surface material were removed and hauled to the south dump.

The following tabulation show, by leases, the yardages of the various materials stripped during 1945 at the Canisteo Mine:

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

7. OPEN PIT:

a. Stripping: (Continued)

LEASE	SURFACE	WASTE	LEAN ORE	TOTAL
Snyder,	289,926	221,587	45,826	557,339
Bovey,	213,934	114,369	79,903	408,206
Total (Cu.Yds.)	503,860	335,956	125,729	965,545

f. Explosives, Drilling and Blasting:

Statement of Explosives Used:

ORE OPERATIONS:	QUANTITY	PRICE	AMOUNT
25% duPont Quarry Gel. 5 x 16	66,400#	$10.00	$6,640.00
40% duPont R. C. Extra 5 x 14	56,250#	10.00	5,625.00
Total and Average,	122,650#	$10.00	$12,265.00
Plain Primacord,	30,000'	32.00	960.00
Total Caps, Fuse, etc.			$ 960.00
TOTAL ORE OPERATIONS,			$13,225.00
STRIPPING OPERATIONS:			
25% duPont Quarry Gel. 5 x 16	65,350#	10.00	$ 6,535.00
40% duPont R.C. Extra 5 x 14	61,250#	10.00	6,125.00
No. 4 Bag Powder,	1,000#	10.00	100.00
Total and Average,	127,600#	10.00	$12,760.00
No.14 Leading Wire,	750'	18.00	13.50
Plain Primacord,	57,500'	32.00	1,840.00
Total Caps, Fuse, etc.			$ 1,853.50
TOTAL STRIPPING OPERATIONS,			$14,613.50
GRAND TOTAL EXPLOSIVES, 1945,			$27,838.50

g. Open pit Mining and Loading:

Ore production was started in the pit on May 7th, and continued through October 13th. Shipments were completed on September 26th and, thereafter, the concentrates were placed on stockpile. Ore operations, throughout the period, were conducted on a 6-day per week basis and two 8-hour shifts per day, except during the last week, when production was curtailed to a single 8-hour shift per day. A total of 1,234,205 tons of crude ore was mined and washed, to produce 659,836 tons of concentrates, showing an average weight recovery of 53.46%. The low recovery resulted from large proportions

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

7. OPEN PIT:
(continued)

g. Open Pit Mining and Loading: (continued)
of limonitic ores absorbed in the mixture to counteract the high silica of the hematite ores. Two shovels were operated simultaneously for mixing ores at varying proportions, to meet the grading requirements. In addition to the two 3-1/4-yard Canisteo shovels, a 2-yard Marion was rented from the Mesaba-Cliffs. The spare shovel simplified grading problems in providing a third source of ore, and minimized shovel moving, with a resulting increase in efficiency.

To facilitate ore operations, a small crew made shovel moves and sorted and removed lean and waste materials from the working areas on the third shift. Due to the manpower shortage, it was necessary to eliminate this operation for a two weeks period, in August.

Mining operations were conducted in the North and South Bovey forties, in the East and Mid-Snyder forties and in the west end of the Hemmens. In addition, about 85,000 tons of concentrates were secured from the Bovey and Snyder lean ore stockpiles in the pit. Here, the upper layers were mined off to remove crude ore which had some natural concentration, as the blocky materials rolled to the bottom of the pile, leaving the higher grade fines at the top of each lift. The 435,279 tons of Snyder concentrates produced during the season consisted of 17,000 tons taken from the lean ore pile and the remainder mined in about equal proportions from the East and Mid-Snyder forties. In the Bovey, 68,000 tons of concentrates were secured from the lean ore pile, 128,629 tons from the South Bovey and 5,292 tons from a scram operation in the bottom of the North Bovey pit.

In the Snyder operations in the bottom of the East forty, low grade limonitic ores were mined from the upper horizon, immediately below the paintrock, and higher grade hematite was mined along the taconite bottom. Considerable clean-up work was completed along the bottom taconite, in the southwest corner of the East forty, and carried over the line into the mid-forty. This necessitated considerable drainage work and the operation of a secondary sump. In the newly-stripped area, on the north side of the Mid-Snyder, the lean upper ores were all mined and the high grade lower hematite was used sparingly in grading, conserving as much as possible for later years. The usual grading problems were encountered, but satisfactory concentrates were secured.

In the South Bovey, the bulk of the crude ore was mined above the paintrock layer, mixing upper lean limonitic material with higher grade intermediate hematite ore. Some high grade crude ore was secured from a concentrated trough in the blocky paintrock horizon,

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

7. OPEN PIT:
(Continued)

g. Open Pit Mining and Loading: (continued)
where the low grade material at either side of the trough required considerable sorting of rock.

In the North Bovey, scram operations cleaned up a small trough of ore in the taconite bottom, immediately east of the pit pocket. The crude ore salvaged from the lean ore dump in the North Bovey was largely limonitic, with a low phosphorous and a fairly low silica content. This material was used in the production of Bessemer concentrates. The crude ore mined in the Hemmens was secured from an enriched area in the blocky formation in the south-east corner and from the upper lean ores immediately below the paintrock.

Both Bessemer and Non-Bessemer grades were produced in all of the areas worked. The spotty nature of the ore necessitated constant changes in the mix for grading. The use of a spare shovel, rented for that purpose, kept shovel moves at a minimum.

k. Drainage:
As during the previous year, the water level of the main sump, in the east end, was maintained at about the 490 foot elevation. On the other side of the main haulage road, the secondary sump was sunk and pumped to the 467 elevation, to facilitate bottom clean-up in that vicinity. The berm and ditch, retained along the south side of the secondary sump, bypassed most of the south side seepage and run-off through the water channel and into the main sump, reducing considerably the volume of secondary pumping.

With future developments of the South Bovey forty to its permanent southerly limits, the secondary sump regions will afford a more suitable location for the main sump.

8. COST OF OPERATION:

a. Comparative Mining Costs:

	BUDGET ESTIMATE	COST PER TON 1945	COST PER TON 1944
PRODUCT:			
Concentrates, (tons)	600,000	659,836	567,146
Average Tons Per Shift,		2,528	2,344
Tons Per Man Per Day,		38.49	34.74
Days Operated,		134	125

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

8. COST OF OPERATION: (Continued)

a. Comparative Mining Costs: (continued)

	BUDGET ESTIMATE	COST PER TON 1945	COST PER TON 1944
COST:			
Open Pit Mining,	$ .171	$ .182	$ .171
General Pit Expense,	.143	.112	.168
Concentrating,	.128	.135	.113
Stocking & Loading Concentrates,	.003	.002	.003
General Mine Expense,	.082	.077	.076
Idle and Winter Expense,	.170	.154	.171
Cost of Production,	$ .697	$ .662	$ .702
Depreciation- Plant & Equipment,		.115	.116
Depreciation- Motorized Equipment,		.066	.041
Amortization- Stripping,		.260	.250
Taxes - Ad Valorem,		.132	.141
Taxes - Occupational,		.076	.072
Taxes - Royalty,		.037	.031
Total Cost at Mine,		$1.348	$1.353
Administrative Expense,		.050	.050
Miscellaneous Expense and Income,		.003	.035
GRAND TOTAL,		$ 1.395	$ 1.368

d. Detailed Cost Comparison:

(1) Product:

The similarity of operations during the seasons of 1944 and 1945 afforded a good basis for cost comparisons, although the latter was favored in general, due to the advantage of greater production. On the other hand, the two-year retroactive pay, of revised vacations and shift differentials, was all absorbed in the 1945 costs, creating an increase of $.030 per ton of concentrate, which was prorated throughout the various captions in that year's cost set-up. The budget estimate for 1945 was based, largely, on the previous year's costs and showed an anticipated slight net saving for the total cost of production. The actual saving was substantially greater than anticipated, even though the 1945 costs absorbed the additional burden of retroactive pay; however, a slight advantage in the actual was presented by an increase in production over the estimate.

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

8. COST OF OPERATION: (Continued)

d. Detailed Cost Comparison:

(2) Open Pit Mining:

In mining crude ore, the budget was set up equivalent to the 1944 costs and proved adequate for the 1945 operations, until the adjustment of the retroactive pay was applied, which resulted in an excess of $.007 per ton of crude ore mined. This excess cost was further magnified in the conversion of the crude ore to a concentrate basis, resulting in an actual cost of $.182, as compared with $.171 per ton of the budget and the 1944 costs. Under this main heading, an increase in "Power Shovel Maintenance" during 1945 was more than offset by a saving in "Trucks Operating".

(3) General Pit Expense:

Under this heading, a budget cost of $.143 per ton, as compared with $.168 in 1944, was set up in anticipation of a smaller clean-up program. The 1945 actual cost amounted to $.112 per ton of concentrates, including a six mill proration of retroactive pay. The saving occurred mainly in "Pit Clean-up" and "Stocking Lean Materials". There was also a lesser saving in the other captions under this main heading.

(4) Concentrating:

The previous year's concentrating cost of $.113 was increased to $.128 in the budget estimate, due to the anticipation of some additional cost in experimenting with new selective media concentrators. The application of the retroactive pay raised the final cost for 1945 to $.135.

(5) Stocking and Loading Concentrates:

The 1945 cost for Stocking and Loading Concentrates was $.002 per ton, as compared with a budget cost of $.003, based on a similar figure for the previous year.

(6) General Mine Expense:

The budget for 1945, under this heading, was estimated at $.082, as compared with $.076 in 1944, due to an anticipated increase in the "Analyses and Grading" for the experimental work with the new concentrators. The actual 1945 cost amounted to $.077 per ton, including the distribution of the retroactive pay.

(7) Winter and Idle Expense:

Under this caption, the cost of $.170 was estimated, as compared with the previous year's figure of $.171 per ton. The actual cost of $.154 per ton which was realized, was due mainly to increased production.

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

9. EXPLORATIONS AND FUTURE EXPLORATIONS:

The total of 3,657 feet of structure drilling completed during the year, consisted of 1,987-1/2 feet of exploratory work, and 1,669-1/2 feet of sample drilling. In the former, there was 875 feet in the Snyder lease and 1,112-1/2 feet in the Bovey. One Snyder hole was sunk through barren formation to quartzite, west of the shops, to prove up a barren area for dump space. The balance of the Snyder exploratory work was conducted in the middle forty to justify the extension of the ore body to the north. The Bovey explorations were scattered on the north and south sides of the pit. On the north side, two barren holes were drilled to quartzite, in the NW¼ of the NE¼, to justify the disposal of waste on this area, and one hole was put down in the NW¼ of the SE¼, just across the line, while probing possible extension of the Mid-Snyder north limits. On the south side, several holes were put down at the extreme south limits of the pit, in an effort to outline the ultimate pit limits. These holes proved marginal, and with the drilling completed in 1944, proved that it will be necessary to shift the Great Northern and D. M. & I. R. tracks, either in 1946 or 1947. On the whole, the exploratory program will indicate a gain in tonnage, proving up a pit extension in the Mid-Snyder and ore at depth in the South Bovey.

The sample drilling conducted during the year was merely used as a guide in mining and grading operations.

Future drilling will outline the ore boundaries of the Hemmens and the possibility of an ore extension in the East Bovey to the Oliver Iron Mining Company line.

10. TAXES:

The following statement shows the Canisteo Mine taxes and the average annual rates for 1945 and 1944:

	1945	1944	Increase	Decrease
Canisteo Mine,	$ 82,868.60	$75,473.34	$7,395.26	
Washing Plant Lands,	595.60	525.08	70.52	
Personal Property,	3,211.29	2,473.56	737.73	
Total,	$ 86,675.49	$ 78,471.98	$8,203.51	
Village Lots,	216.54	191.59	24.95	
GRAND TOTAL,	$ 86,892.03	$ 78,663.57	$8,228.46	
Average Tax Rate,	122.23	108.14	14.09	

The general increase in 1945 was due to a higher rate of taxation, and a revised estimate, showing an additional tonnage of ore in the S½ of SE¼ of Section 30, 56-24.

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

11. ACCIDENTS AND PERSONAL INJURY:

There were two lost-time accidents at the Canisteo Mine during the year. These are described as follows:

NAME: Anselm Luoma Date: September 24th.
CAUSE: It was understood shovel #48 would be moved after loading a few more trucks. Luoma, shovel oiler, had stepped off the shovel and was standing on the ground, at the rear of the machine, for the purpose of throwing in the clutch, which is the customary duty of the oiler when the shovel is to be moved. Evidently, he leaned against the crawling mechanism of the shovel and caught off guard when the shovel revolved while the operator was loading a truck, he was caught between the shovel house and the "cats" of the crawling mechanism, a space of approximately 7 or 8 inches. He was squeezed somewhat.

NATURE: Contusion of upper right chest. No fracture. Difficulty in breathing. Possible internal injuries.

TIME LOST: Forty-one days.

COMPENSATION: $ 164.00

NAME: Arthur T. Forrest Date: October 5th.

CAUSE: Forrest, together with a fellow workman, was engaged in moving the 12-ton traveling crane from the front end of the shop, to the rear of the shop, where they were to use same in turning over a shovel dipper for repair. The traveling crane is manually-operated by hand chains on either side. The traveling crane is also equipped with a 2-ton hoist and a 12-ton hoist. As the crane neared its destination, Forrest saw that the load chain hook on the 2-ton hoist was about to "snag" a lamp cord which was being used on a tractor nearby, and in order to save the extension cord from being damaged, he hurriedly moved toward the tractor to move the load chain. In so doing, he stepped into the hand chain of the 12-ton hoist and fell to the ground, causing injury to his right foot. The loop of the hand chain was 4" above the ground.

NATURE: Fracture of lateral malleolus of fibula- (right).

TIME LOST: Seventy-five days.

COMPENSATION: $ 300.00.

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION:

No new construction took place during the year, and none is planned for the near future.

13. EQUIPMENT AND PROPOSED EQUIPMENT:

New equipment received during 1945 consisted of a mechanical stoker for the shop boiler, two 20-ton Euclid trucks, a 600-gallon self-priming Carver mud pump, and a new 125-B Bucyrus electric shovel, which was being erected at the close of the year. A second-hand conveyor and loader were also purchased during the year to handle stoker coal from the car to the pocket. Two selective media concentrators were purchased for experimental work, but proved unsatisfactory and were dismantled and removed from the plant.

The equipment recommended for purchase and delivery early in 1946 will consist of a 5-yard heavy duty "International" dump truck for rock rejects at the washing plant, a Willys jeep for general use between the shops and the pit, two additional 20-ton haulage trucks and a new 1,000-gallon self-priming pump for use in pit drainage.

14. MAINTENANCE AND REPAIRS:

The two 85-B electric shovels were given some much needed repairs alternately, over a two-month period during the spring and clean-up operations. The 2-yard spare shovel required considerable maintenance during the operating season. Maintenance and repair work on all motorized equipment was carried on continuously during the ore and stripping seasons.

The churn drills were overhauled completely during the winter and spring months.

The usual overhauling of the washing plant machinery and equipment was completed during the winter months, preparatory to the 1945 ore season, and post-season repairs were again started in the fall.

19. WASHING PLANT OPERATIONS:

The washing plant was operated a total of 134 days, from May 7th to October 13th, inclusive, the schedule coinciding with the pit operations. The plant worked on a 48-hour per week basis, two 8-hour shifts per day until October 8th, when a single shift per day

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

19. WASHING PLANT OPERATIONS: (Continued)

became effective. Of the 262 shifts of plant activities, only one shift was devoted to emergency repairs.

A total of 1,234,205 tons of crude ore was washed during the year, to produce 659,836 tons of concentrates, showing an average weight recovery of 53.46%. The comparatively low recovery was the result of using a large proportion of limonitic ore in the crude mixtures. Plant production was retarded somewhat by the low recovery and by the handling of wet ores from the pit bottom. There were but few machinery delays during the entire season and, on the whole, the plant operation was very satisfactory.

Two selective media concentrators were installed, experimentally, in a comparative test with Akins classifiers. However, they proved that their operation was not applicable to wash ores. At the end of the season, they were again removed from the washing plant.

In order to avoid operating delays, concentrates were stocked during periods of empty car shortages and, at the end of the shipping season, concentrates were mined and stocked for eighteen shifts, in order to build up a reserve stockpile for spring shipments. A total of 65,229 tons of Snyder concentrates was added to the stockpile during the year, bringing the total on hand at the end of the year, up to 68,958 tons.

The tonnage and analyses of the plant rejects for the season are compiled below:

	5 x 14 Screen Rejects			
Lease:	Tons	Iron	Phos.	Silica
Snyder,	16,731	30.27	.040	51.82
Bovey,	9,208	30.75	.036	51.07
Hemmens,	1,737	32.02	.029	50.58
Total,	27,676	30.54	.038	51.49

	36" Belt Rejects			
Lease:	Tons	Iron	Phos.	Silica
Snyder,	5,556	27.53	.041	56.45
Bovey,	5,067	27.55	.034	56.32
Hemmens,	1,104	29.38	.037	53.48
Total,	11,727	27.71	.038	56.11

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

19. WASHING PLANT OPERATIONS: (Continued)

Tabulated below is the pit rock sorted at the shovels and hauled to the waste dump:

Lease:	Cubic Yards	Tons	Iron
Snyder,	3,884	6,796	31.53
Bovey,	1,358	2,377	28.47
Total,	5,242	9,173	30.74

Compiled below are the totals of lean materials and slough sorted and removed from the ore areas during the ore season and the spring clean-up period:

	Lean Ore		
Lease	Cubic Yards	Tons	Iron
Snyder,	26,223	45,887	38.71
Bovey,	7,550	13,209	38.64
Hemmens,	2,458	4,301	36.48
Total,	36,231	63,397	38.54

	Waste Materials		
Lease	Surface Cu.Yds.	Waste Ore Cu.Yds.	Total Cu. Yds.
Snyder,	20,307	35,776	56,083
Bovey,	1,374	5,377	6,751
Hemmens,	-	23,270	23,270
Total,	21,681	64,423	86,104

The analyses of products from the various mill machines for the year 1945, were as follows:

	Iron	Phos.	Silica
Snyder Mill Machines:			
Log Washer,	56.23	.058	12.09
Classifier,	56.71	.053	11.80
Tailings,	21.66		
Bovey Mill Machines:			
Log Washer,	56.20	.053	12.29
Classifier,	56.73	.048	11.94
Tailings,	21.50		
Hemmens Mill Machines:			
Log Washer,	56.56	.045	12.19
Classifier,	55.93	.046	12.16
Tailings,	19.55		

CANISTEO MINE
ANNUAL REPORT
YEAR 1945

19. WASHING PLANT OPERATIONS: (Continued)

	Tonnage	% of Total Mined	% Dried Iron	Tonnage Recovery	Iron Unit Recovery
Materials removed in mining operations, (exclusive of surface, stripping and waste)	1,334,451	100.00	41.96		
Less: Lean ore stocked in mining,	63,397	4.75	38.54		
	1,271,054	95.25	42.13		
Less: Pit rock wasted,	9,173	.69	30.74		
Total transported to mill,	1,261,881	94.56	42.20		
Less: Rock rejects in screening plant,	27,676	2.07	30.54		
Crude ore entering mill,	1,234,205	92.49	42.47		
Concentrates produced,	659,836	49.45	57.02	53.46	71.77
Rock rejects on mill picking belt,	11,727	.88	27.71		
Tailings (by deduction)	562,642	42.16	25.71		
Total heads, as above (Entering Mill)	1,234,205	92.49	42.47		
Total pit rock, screening plant rejects and lean ore,	100,246	7.51	35.62		
Total,	1,334,451	100.00	41.96		

HOLMAN-CLIFFS MINE
ANNUAL REPORT
YEAR 1945

1. GENERAL:

Operations at this property were conducted during the year 1945 in the same cycle as in previous years. Mining, concentrating, and stripping were carried on in their respective seasons with maintenance, pumping, and explorations carried on continuously.

The 1945 ore season started with the loading of Bingham direct ore from the pit and concentrates from stockpile, on April 2nd. Direct ore was loaded intermittently throughout the ore season. Stockpile loading was completed for the season in April.

The mining and washing of ore was started on May 1st and continued until October 27th. These operations were conducted on a schedule of two 8-hour shifts per day, six days per week. All ore was produced from Bingham lease until the last week in September, when operations were transferred to the Holman-Brown No. 2 pit bottom.

Concentrating of ore in the washing plant was carried forward on the same schedule as ore operations in the pit. Due to inadequate railroad service, it was necessary to stockpile on numerous occasions.

Stripping operations, carried forward from 1944, were confined to the Bingham lease from the first of the year until the ore season. This stripping consisted of moving surface, lean ore and waste ore which occurred over the wash ore. During the summer, an attempt was made to carry on a surface stripping program in the east end of the Brown No. 2 pit, but a lack of truck drivers caused suspension of this work until the end of the ore season, when this operation was carried forward on a 20-shift per week basis, with swing crew, until the end of the year.

Sample and exploratory drilling was carried on during the entire year, under contract, with both exploratory and sample holes on the Bingham lease and exploratory holes only on the Brown No. 1, Brown No. 2 and Holman leases.

All pit equipment and washing plant equipment was overhauled during the year.

HOLMAN-CLIFFS MINE
ANNUAL REPORT
YEAR 1945

2. PRODUCTION, SHIPMENTS & INVENTORIES:

a. Production by Grades:

Holman Crude,	58,203	tons
Brown Crude,	150,679	"
Bingham Crude,	1,027,817	"
TOTAL CRUDE,	1,236,699	"

Production by Grades:

Holman-Non-Bessemer Concentrates,	13,722	tons
Holman Bessemer Concentrates,	23,377	"
Brown Non-Bessemer Concentrates,	24,024	"
Brown Bessemer Concentrates,	71,824	"
Bingham Non-Bessemer Concentrates,	254,668	"
Bingham Bessemer Concentrates,	393,149	"
Bingham Non-Bessemer Direct,	69,056	"
Bingham Bessemer Direct,	29,945	"
TOTAL PRODUCTION,	879,765	"

b. Shipments:

Holman Non-Bessemer Concentrates,	13,722	tons
Holman Bessemer Concentrates,	23,377	"
Brown Non-Bessemer Concentrates,	24,024	"
Brown Bessemer Concentrates,	71,824	"
Bingham Non-Bessemer Concentrates,	201,737	"
Bingham Bessemer Concentrates,	416,169	"
Bingham Non-Bessemer Direct,	69,056	"
Bingham Bessemer Direct,	29,945	"
TOTAL SHIPMENTS,	849,854	"

c. Stockpile Inventories:

Bingham Non-Bessemer Concentrates,	71,468	"

The following is a statement of the lean materials in stock:

Concentrating Material above 25%

	Tons	Iron	Phos.	Silica
Holman,	26,896	32.16		
Brown,	256,908	30.85		
North Star,	20,658	26.29	.046	49.24
Bingham,	234,873	31.67	.036	49.09

Coarse Non-Concentrating Material Above 40%

	Tons	Iron	Phos.	Silica
North Star,	585	48.89	.044	24.50

HOLMAN-CLIFFS MINE
ANNUAL REPORT
YEAR 1945

2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

c. Stockpile Inventories: (Continued)

Paint Rock Above 25%

	Tons	Iron	Phos.	Silica
Bingham,	52,797	47.22	.042	25.87

e. Production by Months:

(1) Crude Ore:

	HOLMAN	BROWN	BINGHAM	TOTAL
May,			230,198	230,198
June,			242,157	242,157
July,		3,506	213,434	216,940
August,			207,352	207,352
September,	10,269	34,224	132,111	176,604
October,	47,934	112,949	2,565	163,448
TOTAL,	58,203	150,679	1,027,817	1,236,699

(2) Concentrates and Direct Ore:

	HOLMAN CONCTS.	BROWN CONCTS.	BINGHAM CONCTS.	BINGHAM DIRECT	TOTAL
April,			2,635	34,235	36,870
May,			150,221		150,221
June,			155,821		155,821
July,		2,251	135,336	26,031	163,618
August,			123,973	9,668	133,641
September,	6,375	22,368	78,427	4,995	112,165
October,	30,724	71,225	1,404	24,072	127,425
November,		4			4
TOTAL,	37,099	95,848	647,817	99,001	879,765

f. Ore Statement:

On January 1st, 1945, there were 41,557 tons of Bingham concentrate remaining in stockpile. These were loaded out in April and 71,468 tons of Bingham concentrate placed in stock during the 1945 season, making a stockpile balance on December 31st, 1945, of 71,468 tons of Bingham concentrate.

g. Delays:

The following is a statement, on a cumulative basis, of the delays during the year 1945:

HOLMAN-CLIFFS MINE
ANNUAL REPORT
YEAR 1945

2. PRODUCTION, SHIPMENTS & INVENTORIES: (Continued)

g. Delays: (continued)

Time Lost Hours	Time Lost Minutes	Cause:
14	50	Inadequate railroad service on empty cars and loads.
23	-	Transportation troubles, derailment, track and locomotive repairs.
7	-	Power failure due to storms and mechanical trouble.
3	15	Pit Ramp, repairs and material lodged in pocket.
7	-	Repairing washing plant equipment.
5	-	Washing plant operating delays, sticky ore and low power during storms.
60	05	

The notes giving cause of delays are self-explanatory.

3. ANALYSIS:

a. Mine Analysis of Production:

	Tons	Iron	Phos.	Sil.	Mang.	Alu.	Moist.	Fe. Nat.
Holman N.B. Concts.	13,722	57.01	.047	12.73	.17	.49	6.92	53.07
Holman Bess. Concs.	23,377	57.86	.036	12.24	.15	.49	6.55	54.07
Brown N.B. Concs.	24,024	57.28	.046	12.62	.15	.49	7.00	53.27
Brown Bess. Concs.	71,824	57.98	.037	12.23	.14	.48	6.58	54.17
Bingham N.B. Concs.	254,668	57.62	.046	12.92	.18	.66	7.54	53.28
Bingham Bess.Concs.	393,149	58.18	.035	12.47	.15	.62	7.14	54.03
Bingham N.B. Direct,	69,056	57.26	.050	11.71	.21	2.49	13.47	49.55
Bingham Bess. Direct,	29,945	58.15	.041	10.85	.20	2.34	13.54	50.28
TOTAL,	879,765	57.88	.039	12.47	.17	.82	7.90	53.31

b. Mine Analysis of Shipments:

Holman N.B. Concs.	13,722	57.01	.047	12.73	.17	.49	6.92	53.07
Holman Bess. Concs.	23,377	57.86	.036	12.24	.15	.49	6.55	54.07

HOLMAN-CLIFFS MINE
ANNUAL REPORT
YEAR 1945

3. ANALYSIS:
(Continued)

b. Mine Analysis of Shipments: (continued)

	Tons	Iron	Phos.	Sil.	Mang.	Alu.	Moist.	Fe.Nat.
Brown N.B. Concts.	24,024	57.28	.046	12.62	.15	.49	7.00	53.27
Brown Bess. Concts.	71,824	57.98	.037	12.23	.14	.48	6.58	54.17
Bingham N.B. Concts.	201,737	57.74	.046	12.44	.20	.70	7.60	53.35
Bingham Bess. Concts.	416,169	58.19	.035	12.44	.16	.63	7.16	54.02
Bingham N.B. Direct,	69,056	57.26	.050	11.71	.21	2.49	13.47	49.55
Bingham Bess. Direct,	29,945	58.15	.041	10.85	.20	2.34	13.54	50.28
TOTAL,	849,854	57.94	.040	12.31	.17	.83	7.93	53.35

c. Mine Analysis of Ore in Stockpile:

Bingham Concentrates,	71,468	57.30	.036	13.78	.16	.59	7.39	53.07

d. Average Analysis of Crude Ore Production:

	Tons	Iron	Phos.	Silica
Holman,	58,203	45.38	.032	30.50
Brown,	150,679	44.65	.032	31.34
Bingham,	1,027,817	45.18	.030	31.43
Total,	1,236,699	45.13	.030	31.38

e. Complete Analyses of Season's Shipments:

	Iron	Phos.	Sil.	Mang.	Alu.	Lime	Mag.	Sul.	Loss
Holman N.B. Concts.	57.01	.047	12.73	.17	.49	.27	.18	.011	4.46
Holman Bess. Concts.	57.86	.036	12.24	.15	.49	.27	.17	.012	3.80
Brown N.B. Concts.	57.28	.046	12.62	.15	.49	.30	.15	.011	4.22
Brown Bess. Concts.	57.98	.037	12.23	.14	.48	.29	.15	.010	3.66
Bingham N.B. Concts.	57.74	.046	12.44	.20	.70	.31	.20	.010	3.40
Bingham Bess. Concts.	58.19	.035	12.44	.16	.63	.32	.19	.011	2.91
Bingham N.B. Direct,	57.26	.050	11.71	.21	2.49	.33	.19	.011	2.99
Bingham Bess. Direct,	58.15	.041	10.85	.20	2.34	.34	.18	.012	2.77