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6. SURFACE: (Cont'd)

g. Portable Sawmill: (Cont'd)

Detail of Logs Sawed:

	Lineal Ft.	Board Ft. Lumber
202 Pcs. Hemlock	1,884	20,860
69 " Maple	1,088	6,377
26 " Tamarack	234	243
329 " Oak	2,957	18,279
626 Pcs.	6,163	45,759

It is estimated that there was a saving of $859.30 on the oak lumber assuming the cost of oak shipped from outside districts at $80.00 per M. There was a small loss on the hemlock, maple and tamarack but it is conservative to say the saving was in excess of $600.00. There is sufficient oak lumber on hand to last the Cleveland-Cliffs Iron Company over two years. It oak logs are available in 1940 a portable mill can be rented and more oak lumber sawed.

7. UNDERGROUND:

a. Shaft Sinking:

There was no shaft sinking in 1937.

b. Development:

Development work was underway throughout the year. Due to the heavy production schedule it was necessary to increase the number of miners on development work. The greatest increase was in the raising program on the 13th, 12th and 9th levels.

The most interesting development of the year was on the 9th level where several raises were put up to the hanging in No. 1 shaft and adjacent pillars. Contrary to expectations the old square-set rooms between the pillars were full of caved ore that was compacted so tightly that drifts could be driven across them. The exploratory work thus far undertaken has been done near the top of the pillars and nothing is known of conditions lower down in the old square-set rooms. The indications are that the pillars can be mined without danger and that some additional ore will be recovered from the caved ore in the rooms. The pillars are cut up by drifts at various elevations as timber, ties and rails have been encountered. The work here progresses slowly as it is in unknown territory where care is necessary at all times to avoid accidents.

Late in the year a raise was started to the ore body above the 9th that is called No. 2 shaft pillar. Mining was last done here in 1921 at the elevation of the old 4th level approximately 190 ft. above the 9th level. On the old maps a small ore body is shown on each side of No. 2 dike. This territory is quite wet and the development plan will depend on information gained from the raise now being put up. During the year at several places under the hanging in the main ore body the ore was found extending upward for one or more sub levels. This condition is due as a rule, to a roll in the hanging.

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7. UNDERGROUND: (Cont'd)

b-1. Rock Development:

The work of widening the plat on the 9th level to make room for a side track for empty timber trucks was completed early in the year. The rock stripping done here was equivalent to 33 ft. of a full-sized rock drift.

The tail drift at the shaft was extended 35 ft. to the south to make room for a seven-car motor train. The new haulage drift in No. 1 shaft and adjoining pillars passed through No. 1 dike which was 18 ft. in thickness. During 1937 there were a total of nine raises started on the 9th level of which seven were completed at the end of the year. In the nine raises there were 252 ft. of rock encountered of which 238 ft. was footwall material and 14 ft. hanging jasper. The summary of development work in rock on the 9th level in 1937 is as follows: Drifting 86 ft., raising 252 ft., making a total of 338 ft. All of the rock work on the 9th level is charged to E. & A. No. 735.

Widening of the 11th level plat to make room for a double track to the cage compartment was finished in January 1937. The rock stripping done in January was equivalent to 10 ft. of full-sized drift. A drift was driven in the summer on the 11th level from No. 1 cross-cut to No. 2 cross-cut to replace the west one-third of No. 2 cross-cut which had caved. This drift was 175 ft. in length of which 65 ft. was in jasper and 30 ft. in dike. The total rock drifting on the 11th level was 105 ft.

On the 12th level a rock drift was driven into the north footwall from which two raises were put up to mine the north footwall ore pillar. Total drifting here was 233 ft. The two raises advanced 48 ft. and 78 ft. respectively in footwall slate and jasper. The total rock drifting and raising on the 12th level was 359 ft.

On the 13th level the northeast haulage drift parallel with the Maas boundary was completed with an advance of 275 ft. in the footwall. In January 1937 No. 1 cross-cut was extended 48 ft. to the southwest in dike and jasper. In the summer drifting was resumed in the main footwall drift to the north which at the end of the year had advanced 315 ft. in footwall slate. During the year in the 13th level raises there was a total of 201 ft. of rock raising. The grand total rock raising and drifting on the 13th level during 1937 was 839 ft.

The grand total raising and drifting in rock (rock development) was 1,303 ft. as compared with 1,959 ft. in the previous year.

b-2. Development in Ore:

Ore Development in 1937 was slightly greater than in 1936. In both years it was much above normal. In 1936 it was due to drifting and raising in ore on the new 13th level while in 1937 it was mainly due to developing No. 1 shaft and adjacent pillars on the 9th level. The number of contracts on development work increased from two early in the year to six in the closing months. Due to the heavy production schedule in effect during 1937 development work increased and will show a further increase in 1938.

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7. UNDERGROUND: (Cont'd)

b-2. Development in Ore: (Cont'd)

On the 9th level there was 401 ft. of ore drifting on the main level and 968 ft. of ore raising in eight raises. All the raises are located in No. 1 shaft and adjoining pillars. Three contracts were raising at the end of the year and the raising program was about one-half completed.

On the 11th level there was 122 ft. of ore drifting and 68 ft. of ore raising. Ore development is now nearly completed on this level as mining is now underway only a short distance above the level. In a short time all ore mined above the 11th level will be trammed on the 12th level as 12th level raises will replace the 11th level raises now in use.

Development work in ore increased on the 12th level due to putting up raises from the 12th to the sub levels above the 11th level and to drifting in ore to maintain ventilation to the subs being mined just above and below the 12th level elevation. During the year there was 336 ft. of ore drifting on the main level and 333 ft. of ore raising in four raises that were extended from the 12th level to the 11th level and sub levels above.

Development in ore on the 13th level was confined entirely to raising during 1937. In five raises completed during the year there was a total of 276 ft. of raising in ore.

A summary of development in ore follows:

	Drifting in Ore	Raising in Ore	Total
9th Level	401'	968'	1369'
11th "	122'	68'	190'
12th "	336'	333'	669'
13th "	-	276'	276'
Total	859'	1645'	2504'

The total of 2,504 ft. in 1937 compares with a total of 2,468 ft. in 1936 and 372 ft. in 1935.

c. Stoping:

Mining in 1937 was confined to the same general areas as in 1936 and to one old area above the 9th level. On account of the increase in production it was necessary to open and mine several new areas under the hanging in the main ore body above the 13th level. Mining was started late in the year on the 9th level in No. 1 shaft pillar and then adjacent pillars. These pillars were left between the square-set rooms mined by the former operators over forty years ago. The heavy production schedule resulted in the rapid extraction of the ore and a new sub level was mined in a few months whereas a few years ago a new sub level would last for a year or longer.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

In 1937 ore was mined above the 9th level on the 764', 756' 747' and 700' sub levels in No. 1 shaft and adjacent pillars. Between the 10th and 11th levels on the 475', 460', 450' and 425' sub levels in the pillar on the north footwall adjacent to the Maas boundary, on the 460', 450' and 440' sub levels in the area between No. 1 and No. 2 dikes and on the 450', 440' and 425' sub levels in the area between No. 1 dike and the south footwall.

The main ore body was mined between the 12th and 11th levels on the 370', 360', 350', 335', 325' and 315' sub levels and also in one small area on the 12th level. Between the 13th and 12th levels the main ore body was mined on the 285' and 270' sub levels. The small ore body discovered in 1936 in the haulage drift on the 13th level beyond the main dike not far from the northwest corner of the Negaunee property was mined on the 270', 250' and 235' sub levels. In 1937 ore was mined on twenty-seven sub levels while in 1936 it was mined on seventeen.

During the first eight months of 1937 the number of contracts in the mine were increased from twenty-eight to thirty-nine. The number working on the three-shift schedule was increased from four at the end of 1936 to twenty-eight in the closing months of 1937. The average number of contracts stoping during 1937 was thirty-one. The average by division into the three general operations was as follows: Twenty slicing, six drifting and five cutting out on new sub levels making a total of thirty-one.

Most of the work done thus far above the 9th level in No. 1 shaft and surrounding pillars has been exploratory in character. Small areas have been mined on four sub levels all located under the hanging.

Subs Above 9th Level

810' Sub - No. 1 Shaft Pillar Above 9th Level

This sub level was opened in December from the top of a transfer raise in the second pillar north of No. 1 shaft pillar. The transfer raise was put up from the 756' sub level and the ore is transferred to No. 902 raise. This sub level is at the elevation of the old 4th level No. 2 shaft or 202 ft. above the 9th level. A drift is being driven northwest toward the hanging and at the end of the month was in 40 ft. in good ore. If the ore body at this elevation is small it will be mined from the transfer raise while if it proves to be quite large a raise will be put up from the 9th level in the ore pillar.

764' Sub - No. 1 Shaft Pillar Above 9th Level

This sub level was opened from No. 901 raise in June under the hanging at an elevation of 156 ft. above the 9th level on the north side of No. 2 dike in No. 1 shaft pillar. It was mined and blasted down in July. It was small in area being only 25 ft. wide by 65 ft. in length. One drift was advanced to the first stope north of the shaft pillar which was found to be filled with caved ore. The grade of ore mined here was excellant being high in iron and below .070 in phosphorous.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

756' Sub - No. 1 Shaft Pillar Above 9th Level

This sub level was opened from No. 901 raise in August at an elevation of 754 ft. but is called the 756' sub to correspond with an old sub level in the main ore body. The ore was mined to the hanging north of the raise and a drift driven to the northeast across three old stopes and two pillars north of the No. 1 shaft pillar. The old stopes were filled with caved ore and the ore pillars between the stopes were solid at this elevation. The drift encountered the jasper footwall 160 ft. from the raise. To determine the height of the ore in the second pillar a raise was put up 125 ft. from No. 901 raise. It was stopped in loose caved ore at a height of 50 ft. Late in December a sub level was opened from this raise at an elevation of 810 ft. The raise is designated as No. 756 transfer raise. It is planned to explore here and determine the size of the ore body and also if the ore goes higher before stoping is started.

747' Sub - No. 1 Shaft Pillar Above 9th Level

This sub level was opened in October under the hanging at the top of No. 920 raise. This raise is 60 ft. to the northwest of No. 902 raise and is also on the north side of No. 2 dike in No. 1 shaft pillar. A small irregular area has been mined under the jasper hanging. Near the dike caved ore was mined in the first stope south of the shaft pillar. Mining from this raise was nearly completed at the end of the year. A small drift connects this sub level to No. 902 raise to improve ventilation.

A sub level was opened from No. 901-A branch raise at this elevation in November and a drift driven 65 ft. to the southeast to the line of No. 901 raise which had been stopped 100 ft. above the 9th on account of an open stope. The drift was stopped in caved ore. No further work was done here until in December when a drift was driven west from No. 901 branch raise to No. 900 raise a distance of 60 ft. Jasper was encountered near No. 900 raise and also in a drift driven 35 ft. south of No. 900 raise. The bottom of the drift was, however, in high grade ore. It is not planned to do any further work on this sub level adjacent to No. 901 and No. 900 raise until more information is available regarding the upper part of No. 1 shaft pillar. No. 901 raise was extended through the stope in December and the last of the month was nearly up to the elevation of this sub level. No. 901 raise will be continued up to the hanging if caved ground does not interfere and make further progress too dangerous. In November a drift was driven north from No.901 branch raise 25 ft. through No. 2 dike and a connection made to the 756' sub level on the north side of the dike for a traveling road and second outlet.

700' Sub - No. 1 Shaft Pillar Above 9th Level

This sub level was opened under the hanging in October on the north side of No. 2 dike in the first pillar south of the shaft pillar. Ore has been mined 100 ft. east and south of the raise to the dike across two old caved square-set rooms and two twenty foot pillars. The rooms were filled with caved ore that was compacted by pressure so that it was necessary to drill and blast. The limit of mining to the southwest has been set at the north edge of the fourth square-set room 100 ft. south from No. 922 raise.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

Mining will be continued on lower sub levels when it is completed on the 700' sub level. One drift was driven from No. 921 raise 68 ft. southeast to the dike in No. 1 shaft pillar along the edge of the first square-set room, south of the shaft pillar. It was in caged ore from a point near the raise. No. 921 raise struck jasper at the elevation of the 700' sub level. This was quite unexpected as No. 920 raise in the shaft pillar 50 ft. to the north struck the hanging nearly 60 ft. higher or 150 ft. vertically above the 9th level. It is not planned to do any mining from No. 921 raise until No. 1 shaft pillar is mined down to the elevation of the 700 ft. sub level on the north side of the dike.

673' Sub - No. 1 Shaft Pillar Above 9th Level

In order to shorten the amount of climbing necessary to inspect the working places in No. 1 shaft pillar a drift was driven connecting Nos. 922, 921 and 920 raises at the elevation of this sub level. The connecting drift is 65 ft. above the 9th level.

9th Level

Reopening of the 9th level for mining No. 1 and No. 2 shaft pillars was started late in 1936. The old wooden shaft pocket had rotted. It was torn out and a concrete pocket built. The work on the shaft pocket was completed the last of February with the installation of steel lining plates, doors, operating cylinders, etc. Stripping of the plat to make room for a double track from the cage compartment for handling timber trucks was completed in March as also a 35 ft. extension of the tail track drift south of the shaft pocket. The extension was necessary for handling an eight-car train at the pocket. The main level tracks to No. 1 shaft pillar were repaired and badly worn rail replaced, the rails bonded, trolley wire installed, the old haulage drift cleaned and new timber installed where necessary. Air lock doors were installed in the drift to the shaft. The first raise in No. 1 shaft pillar was started the last of March. In April the tracks beyond No. 1 shaft pillar were repaired and trolley wire installed for a distance of 2,100 ft. from the shaft. The old drift from No. 2 shaft which crossed No. 1 shaft pillar 150 ft. northwest of the main haulage drift to No. 3, the present operating shaft, was caved and it was decided to drive a new drift through this territory. The work of cleaning and retimbering the old drift to the pillar a distance of 180 ft. was started in April and completed early in June. The advance was slow due to caved ground through which it was necessary to drive fore poles. The new drift to the southwest through the shaft pillar was started in June and completed in August. It was 359 ft. in length, of which 341 ft. was in ore and 18 ft. in dike. By the end of the year three raises in this drift had been completed and a fourth nearly completed up to the hanging, two of which were in No. 1 shaft pillar and two in the 20 ft. pillars between the old square-set rooms. Near the southwest end of the drift a small ventilation cross-cut was driven 56 ft. to the southeast to make a connection to an old 10th level raise. This established an airway from the 9th to 10th level through the new drift and insured good ventilation. Later in the year the haulage tracks were repaired and trolley installed 240 ft. further to the east in the main drift to No. 2 shaft and 270 ft. to the north in an old cross-cut to a point beyond No. 17

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

raise. This old raise had been put up about 1919 for a traveling road to No. 2 shaft pillar where mining was underway. Mining in this area was stopped in 1921 and nothing has been done here since. No. 17 raise was 4 ft. in diameter in the rock and had not been cribbed except in the ore which was encountered about 140 ft. above the 9th level. The raise was enlarged for a double compartment cribbed raise and at the end of the year was up 128 ft. in rock above the 9th level. Mining was stopped here in 1921 at an elevation 190 ft. above the 9th level. It will be necessary to explore the ore body and determine the best plan for mining on completion of this raise. The ore body is divided into two parts by an east-west dike and in order to handle the ore with scraper hoists it will be necessary to have a raise on each side of the dike. The area is very wet due to water coming in over the footwall from the east end of the cave to surface and some plan for cutting off the water must be worked out. No. 17 raise is about 2,640 ft. from No. 3 shaft.

The main airway raises to the 6½ level are only 200 ft. beyond the turnout to the old cross-cut in which No. 17 raise is located. Sections of the old rock drift to these raises were timbered in the summer to stop slabbing of the rock from the back which occurs in the winter due to ice forming in cracks in the rock. This condition existed wherever water came in through the rock.

A brief summary of the raising program on this level in 1937 follows:

No. 902 raise, located in main rock haulage drift beneath No. 1 shaft pillar, total height 185 ft., material - jasper and lean ore 33ft., ore 152 ft., - completed.

No. 900 raise located in main rock haulage drift beneath the first 20 ft. pillar south of the main shaft pillar; total height 166 ft., material - lean ore 20 ft., ore 146 ft., - completed.

No. 901 raise located in main rock haulage drift beneath No. 1 shaft pillar - total height at end of the year in main raise 148 ft., material - jasper and dike 85 ft., ore 63 ft., - uncompleted.

No. 901-A branch raise started in ore 80 ft. above the 9th level offset 10 ft. from No. 901 raise in the hanging and direction reversed. Total height 146 ft., material - ore and caved ore. Height above 9th level on incline 206 ft. - completed.

No. 920 and No. 921 raise located in ore drift in No. shaft pillar - total height, No. 920 raise - 163 ft. in ore, No. 921 raise - 114 ft. in ore - completed.

No. 922 raise located in ore drift in first 20 ft. pillar to the south of the main shaft pillar, height 121 ft. in ore - completed.

No. 924 raise located in ore drift in fifth 20 ft. pillar south of the shaft pillar - height at end of year 98 ft. in ore - uncompleted.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

No. 750 transfer raise located on 756' sub level - north side of dike, height 54 ft. in ore, 202 ft. above the 9th level -completed.

No. 17 raise located in old rock cross-cut 2,600 ft. from the shaft-height at end of year 128 ft. in slate, jasper and lean ore - uncompleted.

There were three single-shift contracts raising at the end of the year.

Attention is directed to the development program on the 9th level and its effect on costs and tons per man per day. The output from the mining gangs in the shaft pillar is low due to the irregularity in the jasper and caved ore contacts. Slices are short in many cases, in others some material must be graded as rock. When the upper sub levels are mined and a good timber mat obtained the output willbe normal. In some cases mining has been started and then the ore found to go higher making further exploration necessary in order to avoid the loss of ore. The whole operation thus far has been largely exploratory in character and it will require six months or more before development is completed and mining under normal conditions established. In the meantime costs and tons per man both total and the tons stoping will be below the Negaunee Mine average of the past several years. One good feature deserves comment, viz., the excellant grade of the ore. It is high in iron and low in phosphorous and will be a great help in maintaining the grade of the output.

Subs Above 11th Level

475' Sub - North Footwall Pillar Near Maas Boundary

Mining of the north footwall pillar on this sub level was completed early in 1935 except a small pillar about 25 ft. square left to support the airway raise to the 10th level. This small pillar was mined in January and February 1937.

460' Sub - North Footwall Pillar Near Maas Boundary

The small pillar left on this sub level to protect the air raise to 10th level was mined in March 1937.

460' Sub - Ore Body Between No. 1 and No. 2 Dikes

Mining was started here in January 1936 and completed in May 1937. This ore body is irregular in outline on the north side near No. 2 dike due to inclusions of jasper. The jasper masses are probably hanging material. Parts of the ore body are quite wet which interfers with scraping operations. Five contracts worked here in January 1937 and one mined the last pillar in May.

450' Sub - North Footwall Pillar Near Maas Boundary

Mining of this sub level was started in October 1935 and was completed early in January 1937 except for the small pillar left to protect the airway raise to the 10th level. Mining of this pillar was completed early in May 1937.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

450' Sub - Area Between No. 1 and No. 2 Dikes

Mining on this sub level was started at the east end near the footwall in January 1937 and all of the sub level mined except a small area at the west end. Mining of the west part of the sub level was delayed for several months due to crushing of the 11th level haulage drifts and raises into this area. Mining was resumed here after a 12th level raise was extended to this elevation. At the end of the year two contracts were working here and the sub level was 80% mined. The unmined portion of the sub level is quite wet as the water comes in through cracks in the hanging rather than on the footwall side. During the summer a cave broke through to surface above this ore body.

450' Sub - Area South of No. 1 Dike Near South Footwall

This sub level was opened for mining in September 1936 and was finished in March 1937. The ore area was much smaller than on the subs above, the decrease being approximately 40%. One contract mined the entire ore body in seven months.

440' Sub - Area South of No. 1 Dike Near South Footwall

Mining of this sub level was started in March 1937 and was completed the first week of August. It was mined by one contract in a period of five months. The ore area decreased about 20% due to flattening of the footwall jasper and widening of No. 1 dike. There was a small extension of the ore body to the west under the hanging along the dike.

440' Sub - North Footwall Pillar Near Maas Boundary

Mining on this sub level was started in October 1936 and finished in August 1937. It was mined by two contracts from 11th level raises.

440' Sub - Area Between No. 1 and No. 2 Dikes

This sub level was opened for mining at the east end in July 1937 and was 25% mined at the end of the year. One contract worked here six months and a second during the last two months. The contraction of the ore area at the east end of this sub level due to intrusion of the footwall is offset by an extension to the west under the hanging shown by mining on the sub level above.

425' Sub - North Footwall Pillar Near Maas Boundary

Mining was started on this sub level in August 1937 and was 55% completed at the end of the year. Two raises were extended to this sub level from the 12th level and the ore from this sub level is now trammed to the shaft on the 12th level. Two contracts have worked here. The slices from the raises have averaged 100 ft. in length

425' Sub - Area South of No. 1 Dike Near South Footwall

This sub level was opened in August 1937 and mining was completed in December. The ore area decreased 20% in size as compared with the sub above and is only one-third as large as this same ore body was three subs above. A further narrow extension to the west under the hanging along the dike was disclosed on this sub level but this did not offset the contraction of the rest of the sub level due to the flattening of the footwall on the south and east sides. One contract worked on this sub level.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

11th Level:

A drift was driven on the 11th level from No. 1 to No. 2 cross-cuts to provide an outlet from No. 2 cross-cut to replace the west end of this cross-cut which had crushed many times and could no longer be repaired. The drift was 175 ft. in length. The material was 65 ft. in jasper, 50 ft. ore, 30 ft. dike and 30 ft. ore. One raise was put up in ore directly south of the dike to the 425' sub level elevation where the hanging jasper was encountered. The ore adjacent to this raise was mined late in the year. (Reported under preceding paragraph).

Subs Above 12th Level

370' Sub - Main Ore Body

This sub level was originally opened in a small area under the hanging in 1931. Mining was resumed in 1934 and at the end of 1936 was completed above the 1240, 1250, 1290 and 1290-A series of raises and was underway above the 1260, 1270 and 1280 series. It was completed early in June 1937. The north footwall has flattened and is decreasing the area of the sub level adjacent to the 1280 series of raises quite rapidly. In January 1937, one contract was mining from the 1280 series of raises, three from the 1270 series and one from the 1260 series.

360' Sub - Main Ore Body

This sub level was opened under the hanging in 1933 and the ore above the 1230 and 1240 series of raises mined in 1934 and 1935. Mining was resumed at this elevation in May 1936 when slicing started from the 1290 and 1290-A series of raises. By the end of 1936 mining was also underway from the 1250 series. In the early part of 1937 mining from the 1260, 1270 and 1280 series of raises was started. Mining on this sub level was completed early in December 1937. There were eight contracts working on the sub level in January 1937, the maximum number was nine in May and June, in October there were only five and in the early part of December one. The area mined in 1937 on this sub level was approximately 425' X 275' in size.

350' Sub - Main Ore Body

This sub level was opened in January 1936 and by the end of the year about two-thirds of the area under the hanging was mined. Mining was underway at the end of 1936 from three 13th level raises and one 12th level raise in the 1250 series of raises. Six raises from the 13th level replaced the 1230 and 1240 series of raises on the 12th level as mining under the hanging had reached a point near the 12th level. In 1937 mining was finished from the 13th level raises under the hanging and also at the 1250 series of raises on the 12th level. Mining was underway at the 1290, 1290-A, 1260 and 1270 series of raises. The 1280 series of raises was abandoned on this sub level as they were too far back in the footwall and all the ore between them and the 1270 series was within economical scraping distance from the 1270 series of raises. There were five contracts working on this sub level in January 1937 and nine at the end of the year. The sub level was 80% mined at the end of the year. The footwall on the north and northeast end of the sub level has flattened and cut off a considerable area as all of the 1280 series of raises and five of the seven in the 1270 series are now in the footwall.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

335' Sub - Main Ore Body

This sub level was opened in September 1936 and ore was mined for the balance of the year by two contracts, one working from a 13th level raise and one from a raise in the 1240 series above the 12th level. During 1937 the balance of ore under the hanging was mined, also the ore above the 1240 and 1250 series of raises except two small pillars adjacent to No. 1256A raise. Two contracts were working here at the end of the year. The ore body extended further to the west under the hanging on this sub level and at the nearest point was only 40 ft. from the Maas boundary.

325' Sub - Main Ore Body

This sub level was opened in January 1937 under the hanging at the top of No. 1325 raise. It is only 25 ft. above the 12th level. Mining from this raise was completed the middle of June. Mining from two other 13th level raises was started in the fall and the area adjacent to these raises was 80% mined at the end of December. Mining from No. 1330 raise from the 13th level was started in April and an area 120' X 130' mined by radial slicing entirely around the raise. The balance of this sub level will be mined when mining is finished on the two sub levels above.

315' Sub - Main Ore Body

Mining at this elevation was started under the hanging in June from No. 1325 raise and was completed in October. One contract mined an area adjacent to this raise approximately 80' X 90' in size.

12th Level

Mining at the elevation of the 12th level was started early in October from No. 1325 raise and was 80% completed at the end of the year. This is the third sub level mined this year by one gang of miners adjacent to No. 1325 raise.

During the summer a drift was driven southwest from No. 1240 cross-cut in the ore body between No. 1 and No. 2 dikes, a distance of 230 ft. At this point the dikes came together and cut off the ore. This drift provided a connection and airway to the 1320 series of raises from the 13th level. It replaced No. 1240 and No. 1230 cross-cuts on the 12th level which had crushed due to mining just above the 12th level. A connection was made from No. 1324 raise to the new drift which advanced 95 ft. in ore and 20 ft. through No. 2 dike.

Late in December 1936 a drift was started to the north from the 12th level footwall drift. This rock drift was driven 220 ft. to come under the north footwall pillar adjacent to the Maas boundary which was being mined on the third sub above the 11th level. The drift was in jasper and slate.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

12th Level (Cont'd)

Two raises, Nos. 1289 and 1290 were extended from this drift to the 425' sub level above th 11th level. The log of these two raises follows:

No. 1289 0 - 88 ft. jasper, 88 ft. to 124 ft. ore.
No. 1290 0 - 42 ft. jasper, 42 ft. to 124 ft. ore.

In the curve from the footwall drift to No. 5 cross-cut, No. 1250-A raise was extended from the 370' sub level above th 12th level to the hanging just above the 11th level elevation in the ore body between No. 1 and No. 2 dikes. This advance in 1937 was 53 ft. in ore.

On completion of No. 1250-A raise, ground was removed and timber installed for No. 1250-B raise which was located 10 ft. beyond No. 1250-A raise on the opposite side of the drift. It was extended up to the 450' sub level above the 11th level a distance of 162 ft. on an incline of 68°. This raise has been in use for several months in mining the ore under the hanging at the west end of the ore body between No. 1 and No. 2 dikes.

Subs Above 13th Level

285' Sub - Main Ore Body Under the Hanging

This sub level was opened under the hanging from No. 1310 raise in March 1937 and mining completed here in the latter part of May. The area mined around No. 1310 raise was approximately 130 ft. in length by 25 ft. in width. Only the ore directly under the jasper handing was mined. After poling and wiring the floor of the sub level a number of holes were blasted in the jasper back to break filling. A small raise was extended 25 ft. above the top of No. 1310 raise which holed to No.3 cross-cut on the 12th level and provided ventilation and a traveling road. When mining the next lower sub level from No. 1310 raise it was found that the ore extended over 100 ft. further to the south under the hanging adjacent to No. 2 dike. A test raise showed the ore to extend in one area up to the 285' sub level elevation. A new raise, No. 1311, located in the 13th level southwest haulage drift was completed to the 285' sub level elevation the last week of November and mining started here in December. This small ore body is either due to a roll in the hanging or to local enrichment of the hanging jasper. It is apparently about 50 ft. in length with width as yet undetermined. It is entirely separate from the area mined at No. 1310 raise. Mining of this small area will be completed early in 1938.

270' Sub - Main Ore Body Under the Hanging

This sub level was opened from No. 1310 raise in May and mining of the area adjacent to the raise was completed in December. The ore body extended over 100 ft. further to the southwest under the hanging. One area extended 125 ft. south of the raise and another 110 ft. west with jasper hanging in between. The riser or roll in the hanging referred to in the previous paragraph was found 100 ft. south of the raise in the area between the two legs of the ore body. The south leg extends to No. 2 dike while the west leg is cut off by the jasper hanging at a point 85 ft. from the Maas boundary.

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7. UNDERGROUND: (Cont'd)

C. Stoping: (Cont'd)

270' Sub - Small Ore Body Above 13th Level

This small ore body was discovered in 1936 beyond the main dike near the Maas boundary not far from the northwest corner of the Negaunee property. It was developed in 1936 and mined on two sub levels below the hanging. Mining on the third or 270' sub level was started in December 1936 and completed in March. The ore body was 65 ft. in length along the dike and averaged 50 ft. in width. It was slightly larger than on the sub above.

250' Sub - Small Ore Body Above 13th Level

This sub level was opened in June 1936 from No. 1341 raise and the ore mined under the hanging. The ore was found to extend to a higher elevation to the north and another raise, No. 1342, was extended 100 ft. above the 13th level and mining started on the 295' sub level elevation. During the balance of 1936 and the first three months of 1937 this small ore body was mined on the 295', 280' and 270' sub levels. Late in March 1937 work was resumed on the 250' sub level and the area under the 270' sub level mined. The area mined on this sub level in 1936, under the hanging, joined with the area that had extended up to the 295' sub level elevation made the total area more than 200% larger than on sub levels above. Mining was completed here in June.

235' Sub - Small Ore Body Above 13th Level

This sub level was opened late in June 1937 and mining was nearly completed at the end of the year. The area was approximately 100 ft. X 100 ft. or about the same as on the 250' sub level. One contract worked here.

235' Sub - Main Ore Body Under the Hanging

The connection to No. 3 cross-cut on the 12th level was lost in October due to mining from No. 1310 raise. This stopped ventilation to the area being mined from No. 1310 and No. 1311 raise. It was decided to open No. 1310 raise at a lower elevation, approximately half way between the 270' sub level elevation and the 13th level and drift 220 ft. to the east from which point a raise would be extended in No. 2 dike up to the 12th level cross-cut between No. 1 and No. 2 dikes. This would provide an inlet for fresh air to No. 1310 raise and through this raise, which would be blocked off, up to the subs above and down to the 13th level via No. 1311 raise. This ventilation drift advanced 25 ft. in December.

13th Level

At the end of 1936 No. 1 cross-cut was advancing to the southeast through the main dike. The dike was 40 ft. wide, 18 ft. of which distance was driven in 1937. The cross-cut was continued 30 ft. further to the south in rich jasper when it was temporarily stopped. A small uncribbed test raise was extended 20 ft. above the level in rich jasper but ore was not found. Explorations will be resumed here in 1938 to locate the small ore body between the main dike and the south footwall. Total advance in No. 1 cross-cut in 1937 was 48 ft.

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7. UNDERGROUND: (Cont'd)

c. Stoping: (Cont'd)

13th Level (Cont'd)

Work was resumed in April in the northeast haulage drift parallel with and 115 ft. distant from the Maas boundary which was extended 275 ft. in footwall jasper and slate. Work was completed in this drift in August. The contract cut out and installed timber for three raises also extended each raise 5 ft. above the back of the level. These raises are located beneath the 1290 and 1290-A series of raises on the 12th level. One was completed to the 350' sub level elevation, 159 ft. above the 13th level in December.

On completion of the northeast footwall drift in August work was started in the footwall drift from No. 3 cross-cut due north to hole to the northeast footwall drift. This drift had to advance 425 ft., of which 315 ft. was driven from August to the end of the year by a single-shift contract. They also installed timber and extended the first raise, No. 1340, 5 ft. above the level. A raising crew started this raise late in December and extended it 15 ft. to a height of 30 ft. above the level at the end of the year. This footwall drift has to be driven 110 ft. further to the north to complete it.

In addition to the raises noted in the preceding paragraphs, several other 13th level raises were completed in 1937.

No. 1311 raise in the southwest haulage drift near the Maas boundary was extended in ore to the 285' sub level elevation, a distance of 100 ft.

No. 1354 raise in the drift near the Maas boundary was completed in January 1937 with an advance of 3 ft. in ore to a height of 142 ft. above the 13th level.

No. 1356 raise, in the same drift, was extended in March from a height of 112 ft. where it had been stopped in 1936, 25 ft. in ore and jasper to a height of 142 ft. above the 13th level.

No. 1310 raise in No. 1 cross-cut was put up early in 1937 a distance of 100 ft. in ore to the elevation of the 285' sub level where mining was started under the jasper hanging.

d. Timbering:

The cost per ton for timber decreased 1.7% in 1937 as the feet of timber per ton of ore decreased 25% while the average cost per foot for timber increased 22%. The lineal feet of stull timber used, exclusive of cribbing and treated timber, in 1937 increased 54% while the product increased 60%. The feet of timber per ton of ore decreased 25% and the feet of board measure per ton of ore 14%. Less cribbing timber was used in 1937, also less treated timber. The main increase this year in total cost per ton for timber, lagging and poles was in the cost for poles where the increase over the cost last year was 23.7%. This was mainly due to the use of more poles in covering down the floors of sub levels on account of more mining in new areas directly under the hanging. This also caused an increase in the amount of wire fencing used in covering down the floors.

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7. UNDERGROUND: (Cont'd)

d. Timbering: (Cont'd)

The total cost for lumber, lagging, poles and wire fencing increased 6.6% in 1937 due to increase in cost per ton for poles, lagging and wire fencing.

Nine foot timber was used in all mining areas and if ten foot could have been sent underground in trucks on the cage it would have been used in certain areas where there was a good timber mat. Timber in even longer lengths than ten feet is used in top slicing on the Mesabi Range and there is no valid reason why it could not be used on this range other than the limitation imposed by length of the cage. On account of rapid mining on the three-shift schedule more timber bulkheads were built in 1937 around the raises and often some distance away from the raises opposite the point where a new slice was started. This was done as a safety measure for often the blasted timber on the sub level above would not have had time to settle before mining was underway on the next lower sub level.

Statement of Timber Used:

	Linear Feet	Avg. Price Per Foot	Amount 1937	Amount 1936
6" to 8" Cribbing	107,331	.0382	4,100.42	4,307.41
8" Stulls	113,707	.0697	7,930.91	3,894.33
10" "	169,660	.0958	16,247.02	9,019.50
12" "	70,379	.1286	9,053.96	5,126.33
Treated Timber	1,754	.3278	574.95	1,743.75
Total 1937	462,831	.0819	37,907.26	
Total 1936				24,093.32
Lagging - 7 ft.	2,184,082	.818	17,865.09	10,304.83
Poles - 9½ ft.	1,481,420	1.388	20,559.80	10,382.24
Total 1937	3,665,502	1.048	38,424.89	
Total 1936				20,687.07
Wire Fencing - Rods	460	.929	427.46	202.71
Grand Total - 1937			76,759.61	
Grand Total - 1936				44,983.10

Product	820,915	512,612
Feet of Timber per ton of ore	.564	.703
Feet of Lagging " " " "	2.661	3.53
" " " " ft. of timber	4.719	4.03
" " Wire Fencing per ton of ore	.0092	.0074
Cost per ton for timber	.0462	.0470
" " " " lagging	.0218	.0201
" " " " poles	.0250	.0202
" " " " wire fencing	.0005	.00039
" " " " total	.0935	.0877
Equivalent of stull timber to board measure	985,062	702,178
Feet of board measure per ton of ore	1.20	1.37

NEGAUNEE MINE
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YEAR 1937

7. UNDERGROUND: (Cont'd)

d. Timbering: (Cont'd)

Total Cost for Timber, Lagging, Poles, etc.

Year	Product	Amount	Cost Per Ton
1937	820,915	76,759.61	.0935
1936	512,612	44,983.10	.0877
1935	291,318	26,395.69	.0924
1934	235,664	23,441.91	.0985
1933	61,941	9,147.82	.1477
1932	84,046	8,988.22	.1069
1931	338,696	33,408.70	.0986

e. Drifting and Raising:

There was a decrease in total ore and rock drifting this year and a small increase in ore and rock raising. The net decrease in ore and rock drifting and raising was 6.4%. In 1936 there was an increase of 171% over 1935 which was much above normal due to the opening of the 13th level. This year development work on the 13th level only accounted for 26% of the total whereas last year it accounted for 95%. Drifting and raising this year was underway on the 11th, 12th and 13th levels and in addition on the 9th level which was reopened for mining the ore in No. 1 and No. 2 shaft pillars. On account of the heavy production schedule in 1937 it was necessary to do drifting and raising on all the levels where mining operations were approaching the level which make it necessary to send the ore to the next lower level. In January 1937 only two contracts were raising and drifting while in December there were eight. If another depression does not develop, the total drifting and raising in 1938 will greatly exceed the total in 1937.

	Drifting		Raising		
Year	Ore	Rock	Ore	Rock	Total
1937	859'	1062'	1645'	579'	4145'
1936	1146'	1401'	1322'	558'	4427'
Increase			323'	21'	
Decrease	287'	339'			282'

f. Explosives, Drilling and Blasting:

The average price for powder increased 8.2% in 1937 and was practically the same as in 1933. Due to a small decrease in pounds of powder used per ton of ore, the net increase in cost per ton for powder was 5.2%. The standard length of fuse was increased from 6 ft. to 7 ft. in the middle of 1936 to give more time to light the fuse when blasting. The net increase in cost for all explosives in 1937 was 6.9% due as stated above, to increase in cost for powder and the use of longer lengths of fuse for the entire year.

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7. UNDERGROUND: (Cont'd)

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

The amount of powder used per ton of ore decreased in 1937 due to use of Gelamite No. 1 to replace a portion of the 50% gelatin powder. Gelamite No. 1 has the strength of 60% gelatin but has 25% more sticks per 100 lbs. than the 50% gelatin. The actual cost per stick is slightly lower than the 50% gelatin and due to increase in number of sticks it decreased the amount of powder used per ton of ore. Its use is being gradually increased as the miners become accustomed to the different smell of the powder smoke. There is actually less noxious gas from the explosion but the natural reaction to something new and different in odor has to be overcome gradually. It has been used thus far in working places where the ventilation is above the average.

The following statement gives a comparison of costs, etc., for the past seven years:

Year	Cost per Lb. For Powder	Lbs. Powder Per Ton of Ore	Cost Per Ton Powder	Cost Per Ton Fuse & Caps	Total Cost
1937	.1195	.4270	.0510	.0110	.0620
1936	.1104	.4320	.0475	.0105	.0580
1935	.1168	.4270	.0498	.0102	.0600
1934	.1140	.4350	.0507	.0106	.0613
1933	.1196	.5110	.0610	.0130	.0740
1932	.1235	.4191	.0518	.0099	.0617
1931	.1268	.4025	.0510	.0091	.0602

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7. UNDERGROUND: (Cont'd)

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

Statement of Explosives Used: (Ore Development and Stoping)

	Quantity	Average Price	Amount 1937	Amount 1936
50% Gelatin	277,785	11.87	32,963.92	24,358.27
60% "	300	12.25	36.75	-
Gelamite #1	72,200	12.27	8,856.74	-
Total Powder - 1937	350,285	11.95	41,857.41	
Total Powder - 1936				24,358.27
Fuse - feet	1,213,218	5.65	6,858.82	4,140.82
Caps - No. 6	165,583	11.57	1,916.33	1,113.41
Tamping Bags	27,000	3.25	87.75	84.01
Fuse Lighters	21,600	6.96	150.39	74.25
Electric Detonators	45	92.90	4.18	-
Leading Wire - feet	260	10.00	2.60	-
Total Fuse, etc. - 1937			9,020.07	
Total Fuse, etc. - 1936				5,412.49
Total All Explosives - 1937			50,877.48	
Total All Explosives - 1936				29,770.76
Product			820,915	512,612
Pounds of powder per ton of ore			.427	.432
Cost per ton for powder			.0510	.0475
Cost per ton for fuse, caps, etc.			.0110	.0105
Cost per ton for all explosives			.0620	.0580

Sinking, Rock Development, Etc.

50% Gelatin	8,935	11.90	1,063.96	1,334.60
60% "	9,350	12.14	1,134.95	1,253.50
Gelamite #1	350	12.25	42.88	-
Total Powder - 1937	18,635	12.03	2,241.79	
Total Powder - 1936				2,588.10
Fuse - feet	37,759	5.68	214.45	319.00
Caps - No. 6	5,206	11.97	62.31	79.32
Electric Detonators	100	94.10	9.41	-
Total Fuse, etc. - 1937			286.17	
Total Fuse, etc. - 1936				398.32
Total Explosives for Rock Drifting - 1937			2,527.96	
Total Explosives for Rock Drifting - 1936				2,986.42
Total Explosives Used in Mine			53,405.44	32,757.18
Avg. Price per lb. for Powder			.1195	.1104

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7. UNDERGROUND: (Cont'd)

g. Mining and Loading:

The limit of economical mining from a raise has been extended each year for the past several years due to increase in size and rope speed of the scraper units. No further speed increase is anticipated as the safety limit has apparently been reached. The standard scraper unit is now the 20 H.P. with a speed of 300 ft. to 350 ft. per minute on the pull rope and 400 ft. to 450 ft. per minute on the return rope. Longer scraper hauls are now possible not only on account of increased speed but also by the use of larger scrapers. During the past fourteen months twelve cast steel scrapers have been purchased ranging in size from 48" width to 60" width and all are now in service. They have replaced an equal number of 42" home-made box-type scrapers. When loaded the new scrapers ride on the back of the cutting blade which reduces friction and eliminates the tendency to dig up the floor of the sub level. Eventually the molychrome fabricated steel scrapers will entirely replace the box-type scrapers made in the mine shop. The use of larger scraper hoists and scrapers has resulted in spacing raises further apart and hereby has decreased the development work in rock and ore. This is particularly true in flat pitching ore bodies as is the case at the Negaunee Mine. There will not be half as many raises required on the 13th level as on the 12th level which shows the progress made in the past several years in mining practice.

h. Ventilation:

Ventilation in the mine was good in 1937. Due to rapid mining of sub levels it was not always possible to maintain direct connection to the main air-way and booster fans have had to be used to force air to the sub levels. In some cases ventilation was maintained by doors on the main levels which forced the fresh air to travel up to the sub level and down to the main level beyond the doors. Some expense was incurred in 1937 in timbering a section of the 9th level main airway near No. 2 shaft. Ice that forms here during the winter has caused falls of ground from the back of the rock drift and unless stopped would in time have blacked the airway. Ventilation expense in 1937 was $8284.27 as compared with $7786.94 in 1936.

i. Pumping:

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

Month	1937	1936	1935	1934	1933	1932
January	893	886	931	815	814	942
February	866	898	953	788	808	982
March	1025*	867	898	779	751	963
April	1075	866	878	796	816	973
May	1062	992	887	807	926	1000
June	1089	798	895	826	876	835
July	1107	931	911	837	984	918
August	1148	952	917	854	882	885
September	1161	959	936	857	889	889
October	1162	951	944	859	866	786
November	1131	954	940	875	849	920
December	1105	916	927	876	826	771
Total Average	1069	914	918	831	857	905

(*) Increase due to water diverted from Maas Mine and pumped by Negaunee Mine.

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7. UNDERGROUND: (Cont'd)

i. Pumping: (Cont'd)

The following statement shows the average number of gallons pumped per minute for the past ten years:

Year	Gallons Per Minute
1937	1069
1936	914
1935	918
1934	831
1933	857
1932	905
1931	914
1930	1060
1929	1230
1928	1198

In March when the capacity of the Maas Mine pumps were taxed, about 150 gallons of water per minute were diverted from the 3rd level Maas Mine to the 12th level Negaunee and was pumped by the Negaunee Mine for the balance of the year. The ditch that was blasted on surface to prevent the mine water from spreading over a large area of swamp within 1,000 ft. of No. 2 shaft cave did not apparently have any effect in reducing the amount of water. However. there is proof that it did reduce the amount of water coming in on the 9th level in the area near No. 2 shaft but the reduction has been offset by an increase in other localities. The new cave to surface north and a little east of the mine office from mining operations in the ore body between No. 1 and No. 2 dikes has caused an increase in the mine water in this area. There has also been a small increase in the water coming in from the hanging in the main ore body above the 1260 series of raises on the 12th level. This indicates new cracks extending through the ledge to surface and a probable early settlement of ground to the west of the main Negaunee Mine cave to surface.

j. Underground in General:

The heavy production schedule in 1937 has introduced a hazard in the mine, viz., the failure of mined areas to settle before mining is underway on the next lower sub level. This hazard has been largely overcome by building solid wood pillars or bulkheads to support the back around the raises and sometimes at points where new slices are started. One area on the 11th level continued under heavy pressure until relieved by mining above. A considerable area on the 12th level is now under pressure due to mining on sub levels only a short distance above. This condition will be relieved as far as tramming is concerned with the completion of raises from the 13th level. Two areas are showing pressure on the 13th level due to irregularities in the hanging jasper in areas being mined 75 ft. above the level. These irregularities have caused pillars to be left directly over the 13th level drifts with mining on from two to three of the four sides of the jasper pillar. This condition will be corrected as soon as additional raises can be put up and mining started on a sub below the jasper.

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7. UNDERGROUND: (Cont'd)

j. Underground in General: (Cont'd)

When operating three shifts it was necessary to employ more men to clean the levels. More cleaning has also been required on account of an increase in mine water in two areas being mined as the water washes ore out of the raises. The change in operating schedule in December gave an opportunity to clean the mine on the midnight shift and it is now in a clean and better condition than in the previous months.

In 1937 City water was piped into the mine to provide drinking water and water for drill machines, spraying and cleaning cars at the shaft pockets.

8. COST OF OPERATING:

a. Comparative Mining Costs:

	1937	1936	Increase	Decrease
PRODUCT	820,915	512,612	308,303	
Underground Costs	1.030	.910	.120	
Surface Costs	.097	.115		.018
General Mine Expenses	.171	.163	.008	
Cost of Production	1.298	1.188	.110	
Taxes	.146	.210		.064
TOTAL COST	1.444	1.398	.046	
No. of Days Operated	288	272	16	
No. of Shifts & Hours	3 8-hr. to 12/6 2 8-hr. from 12/6			
Average Daily Product	2850	1885	965	

COST OF PRODUCTION:

	1937	%	1936	%	Increase	Decrease
Labor	.791	60.9	.652	54.9	.139	
Supplies	.507	39.1	.536	45.1		.029
Total	1.298	100.0	1.188	100.0	.110	

b. Detailed Cost Comparison:

(1) Days and Shifts:

Year	Days Mine Worked	Shifts & Hours	Men Employed	Total Shifts Worked
1937	288	2 & 3 8-hr.	424	102,951
1936	272	1,2 & 3 8- hr.	262	63,814
Increase	16		162	39,137

(2) Wages:

There was an increase of 6¢ per hour effective 11/16/36.
There was an increase of 10¢ per hour effective 3/16/37.

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8. COST OF OPERATING: (Cont'd)

b. Detailed Cost Comparison: (Cont'd)

(3) Comparison of Production:

Production - 1937	820,915
Production - 1936	512,612
Increase	308,303

(4) Comparison of Number of Men and Wages:

	No. Men	No. Days	Amount	Rate Per Day
1937	424	102,951	640,277.30	6.22
1936	262	63,814	325,688.13	5.10
Increase	162	39,137	314,589.17	1.12

(5) Tons Per Man Per Day:

	1937	1936	Increase	Decrease
Surface	44.91	38.61	6.30	
Underground	9.69	10.14	———	.045
Total	7.97	8.03		.006

(6) Cost of Production:

1937	1,065,396.91	Cost per ton	1.298
1936	608,896.70	Cost per ton	1.188
Increase	456,500.21		.110

	Labor	%	Supplies	%
1937	649,048.17	60.9	416,348.74	39.1
1936	334,343.91	54.9	274,552.79	45.1
Increase	314,704.26	6.0	141,795.95	
Decrease				6.0

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

	1937		1936		Increase		Decrease	
Production, Tons	820,915		512,612		308,303			
Underground Costs:	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
1. Exploring in Mine	767.31	.001	191.49	-	575.82	.001		
2. Sinking in Shaft	--	-	--		--			
3. Development in Rock	11759.92	.014	14431.77	.028			2671.85	.014
4. Development in Ore	12031.95	.015	12619.14	.025			587.19	.010
5. Stoping	337170.28	.411	159601.39	.312	177568.89	.099		
6. Timbering	224731.61	.274	121059.64	.236	103671.97	.038		
7. Tramming	101649.29	.124	44735.61	.087	56913.68	.037		
8. Ventilation	8284.27	.010	7786.94	.015	497.33	.		.005
9. Pumping	34844.12	.042	29344.47	.057	5499.65			.015
10. Compressors & Air Pipes	40577.96	.049	29753.32	.058	10824.64			.009
12. Undg. Superintendence	17576.20	.022	9986.26	.020	7589.94	.002		
14. Maint: Comprs & P. Drills	1686.62	.002	1442.82	.003	243.80			.001
15. Scrapers & M Loaders	30705.29	.037	16049.56	.031	14655.73	.006		
16. Elec. Tram Equip.	22102.42	.027	17816.87	.035	4285.55	.008		.008
17. Pumping Machinery	1605.48	.002	1726.66	.003			121.18	.001
Total Undg. Costs	845492.72	1.030	466545.94	.910	378946.78	.120		
Surface Costs:								
18. Hoisting	33966.52	.041	24469.81	.048	9496.71			.007
19. Stocking Ore	10837.59	.013	4725.17	.009	6112.42	.004		
21. Dry House	7332.26	.009	5620.35	.011	1711.91			.002
22. General Surface Expense	8332.11	.010	5763.73	.011	2568.18			.001
23. Maint: Hoisting Equipt.	10255.45	.013	6043.74	.012	4211.71	.001		
24. Shaft	2007.66	.003	1627.38	.003	380.28			
25. Top Tram Equipt.	3107.07	.004	2162.30	.004	944.77			
26. Docks Tres & Pkts.	1839.56	.002	1019.82	.002	819.74			
27. Mine Buildings	1664.59	.002	7396.47	.015			5731.88	.013
Total Surface Costs	79342.81	.097	58828.97	.115	20513.84			.018
General Mine Expenses:								
28. Mining Engineering	2323.33	.003	1907.36	.004	415.97			.001
29. Mech & Elec Engineering	2040.38	.003	1725.85	.003	314.53			
30. Analysis and Grading	16117.85	.020	10260.13	.020	5857.72			
31. Safety Department	2124.28	.003	1179.47	.002	944.81	.001		
32. Telephones & S. Devices	4003.46	.005	2640.61	.005	1362.85			
33. Local & General Welfare	5896.00	.007	3769.19	.007	2126.81			
34. Spec. Exp. Pen. & Allows.	8701.25	.011	9405.14	.020			703.89	.009
35. Ishpeming Office	19322.00	.023	11908.41	.023	7413.59			
36. Mine Office	16211.21	.019	12929.94	.025	3281.27			.006
37. Insurance	4616.69	.006	1222.43	.002	3394.26	.004		
38. Personal Injury	33071.93	.040	18503.56	.036	14568.37	.004		
39. Social Security Taxes	19801.78	.024	3427.55	.007	16374.23	.017		
40. Employees Vacation Pay	6199.00	.007	4459.80	.009	1739.20			.002
41. Prop. Gen.Sthse. Vac. Payroll	132.22		132.39				.17	
Total General Mine Expenses	140561.38	.171	83471.83	.163	57089.55	.008		
COST OF PRODUCTION	1065396.91	1.298	608846.74	1.188	456550.17	.110		
Taxes	120050.92	.146	107640.74	.210				
TOTAL COST INCLUDING TAXES	1185447.83	1.444	716487.35	1.398	468960.48	.046		

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

	1937	1936	Decrease	Increase
Days Per Week	5 & 6	5		
Shifts & Hours	3-8hr. to 12/6 2-8hr. from 12/6	2-8hr.		
Production - Tons	820,915	512,612		308,303
Avg. Daily Product - tons	2850	1885		965
Number of Days Worked	287	272		15

UNDERGROUND COSTS:

(1) Exploring In Mine:

Increase due to more time spent by Geological Department on Negaunee Mine geology work. Expenditures increased $575.82 and cost per ton .001.

3. Development in Rock:

Decrease due to less development in rock. In 1936 there were 1959 ft. compared with 1291 ft. in 1937. The cost per foot in 1937 was $9.11 in 1936 $7.37. Expenditures decreased $2671.85 and cost per ton $.014.

4. Development in Ore:

In 1937 there were 1345 shifts worked compared with 1501½ shifts in 1936. The wage and supply cost increased in 1937 while footage raising and drifting decreased. Expenditures decreased $587.19 and cost per ton $.010.

5. Stoping:

Expenditures increased $177,568.89. In 1937 there were 37,522 shifts worked compared with 19,592¼ shifts in 1936. Starting April 10th employees working more than 40 hrs. per week were paid overtime wages or time and one half. The cost for overtime was $6142.38. Labor cost increased $150,588.50 and supply cost $26,980.39. New Auger Steel charged out $3157.80, Circuit Breakers $1191.48, Cable $466.41. Increase in explosives used $21,188.05 and increase in oil, drill parts, etc. $977.00. Wage increases and increase in cost of explosives and other supplies accounts for practically all of the increase in cost per ton.

6. Timbering:

Expenditures increased $103,671.97 in 1937 and cost per ton $.038. The cost for cribbing and stull timber increased $13,813.94 and lagging and poles increased $17,737.82. Time and one-half was paid for overtime work. More poles used in 1937 and higher price paid for timber, lagging and poles. More wire fencing used for covering floors of sub levels. Increase in wages and in supply cost account of the increase in cost per ton.

7. Tramming:

Expenditures increased $56,913.68 in 1937 and cost per ton $.037. Elec. Haulage expense increased $42,731.13, also more expense for track cleaning and skip tending account larger tonnage trammed. Wage increase is the largest factor in the increased cost per ton.

8. Ventilation:

Increase of $497.33 in 1937 and decrease in cost per ton $.005. Electric current increased $251.43, also two #2½ B Anaconda Type Fans $902.62 charged in 1937, but maintenance cost for ventilation doors, repair of main airways and fans less in 1937 than in 1936.

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YEAR 1937

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

9. Pumping:

Expenditures increased $5499.65 and cost per ton decreased $.015. Cost for electric current increased $1845.55. Labor cost increased $3652.41. Number of shifts pumping in 1937 was 1433¼ compared with 1194¾ shifts in 1936, an increase of 238½ shifts. The increase in shifts was caused by reopening the 9th level which destroyed the storage dams that held the water back so that on a certain number of shifts per week it was not necessary to operate the pumps.

Number of gallons pumped - 1937	562,395,718 (1)
Number of gallons pumped - 1936	483,295,852
Increase	79,099,866

(1) Includes about 150 gallons per minute Maas Mine water pumped by Negaunee Mine since March 10th 1937. Cost of pumping Maas Mine water paid each month by Maas Mine.

10. Compressors & Air Pipes:

Expenditures increased $10,824.64, cost per ton decreased $.009. Increase in cost for electric current $7799.17. Increase in expense for Air Piping $2748.65.

Cu. Ft. Air - 1937	1,096,200,000
Cu. Ft. Air - 1936	737,716,000
Increase	358,484,000

Increased expenditures due to heavier operating schedule.

12. Underground Superintendence:

Increase in expenditures of $7589.94. Additional bosses were required and March 16th the bosses were put on a monthly salary of $175.00. In 1937 there were 2242 shifts worked compared with 1409 shifts in 1936, an increase of 833 shifts. Bosses safety bonuses amounted to $669.28. Cost per ton increased $.002.

14. Compressors & Power Drills:

Expenditures increased $243.80. In 1937 there were four RB-12 drill machines and one stopehammer machine charged amounting to $1127.45 compared with six RB-12 machines charged in 1936 amounting to $1140.75. New valves for the Ingersoll-Rand Compressor were installed in 1937.

15. Scrapers & Mechanical Loaders:

Expenditures increased $14655.73. In 1937 there were four 15 H.P. scraper hoists costing $4643.50, two 20 H.P. costing $2802.00, one 25 H.P. scraper hoist costing $1763.50 charged out also 13 Holcomb-Westeco Scrapers costing $2135.87. Increase of 38,255 ft. ½ and 3/8 inch. wire rope for scrapers amounting to $3953.02, also labor and supply increase of $4121.00 repairing scraper hoists and scrapers. In 1936 there were three 15 H.P., 1 - 20 H.P. Ingersoll-Rand scraper hoists and Holcomb scrapers amounting to $4763.04 charged out. On account of purchase of more equipment in 1937 cost per ton increased $.006.

16. Electric Tram Equipment:

Expenditures increased $4285.55 and cost per ton decreased $.008. An increase of $800.00 repairing Generator set, an increase of $384.61 for 40# rail. Labor and supplies wiring increased $628.92 and labor and supplies repairing locomotives $4130.21. In 1936 four 65 cu. ft. rocker dump cars were charged $2130.56 also $607.63 more expense for repairing cars over the cost in 1937. In 1937 two rocker dump cars $1080.00 charged. The purbhase of a new locomotive in 1937, E&A 747 made it possible to send a locomotive from the mine to the General Shops for thorough overhauling and repairs. When this locomotive was back in service another one badly in need of repairs was sent to the shops. The repair of (2) locomotives in the General Shops accounted for the increase in cost for repair of locomotives in 1937.

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

17. Pumping Machinery:
Decrease in Expenditures of $121.18. Less repairs necessary in 1937.

SURFACE COSTS:

18. Hoisting:
Expenditures increased $9496.71, cost per ton decreased $.007. Increase in labor cost $4027.46 account increase in wages and operating schedule. Increase in electric current $5312.53 account larger tonnage hoisted and more shifts operated.

19. Stocking Ore:
Expenditures increased $6112.42. Labor and supplies erecting temporary wooden trestle amounted to $1021.05. Increase in stocking ore $5091.37. There were 362,640 tons stocked in 1937 compared with 204,102 tons in 1936. Cost per ton increased $.004.

21. Dry Houst Expense:
Expenditures increased $1711.91 cost per ton decreased $.002. Increase of $856.38 heating Dry House and $855.98 in labor attending Dry.

22. General Surface Expense:
Expenditures increased $2568.18, cost per ton decreased $.001. More shifts worked, increase in wages and time and one-half for overtime. Repairing roads, cleaning grounds, mowing lawns, etc.

Maintenance

23. Hoisting Equipment:
Expenditures increased $4211.71. Ten coils for fly wheel set $1500.00, signal cable $888.00, making spherical bottom skip $1010.00, repairing skips and cages $659.00, four Whirlave Fans $154.80 to cool fly wheel set.

24. Shaft:
Expenditures increased $380.28 due to increase in wages.

25. Top Tram Equipment:
Expenditures increased $944.77, treating ties for steel trestles and installing $864.30. Increase in cost for 5/8 wire rope $79.83.

26. Docks, Trestles, & Pockets:
Expenditures increased $819.74. Labor and supplies for new decking on permanent steel trestle.

27. Mine Buildings:
Decrease in expenditures of $5731.88. In 1936 charges to extension of timber tunnel $796.45, repairing and painting shaft house $1740.00 and adjustment of shaft house fire loss $4121.73. In 1937 copper pipe and fittings and clothes lockers and hangers were installed in Dry House and also repairs to sewers amounting to a total of $944.00.

GENERAL MINE EXPENSE:

28. Mining Engineering:
Expenditures increased $415.97 due to more engineering work account increased operations and more development work.

29. Mechanical & Electrical Engineering:
Expenditures increased $314.53 due to increased operations.

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

30. Analysis & Grading:
Expenditures increased $5857.72. Increase of $4238.53 in Ishpeming Laboratory charges for analysis, $1192.00 in shipping department proportion and labor and supplies increase in mine sampling. 39,457 determinations in 1937 compared with 29,317 in 1936. Increase due mainly to more ore shipped.

31. Safety Department Expense:
Expenditures increased $944.81. 280 Lunch Kits $264.32, 420 calendars $120.44, also increase of $518.00 in proportion of Safety Dept. Expense.

32. Telephone & Safety Devices:
Expenditures increased $1362.85. Labor and supplies installing water pipe from Dry House to underground levels to provide drinking water $528.54. Increase of $136.53 for electric current. One telephone and cable $78.00 and more conduit, wire and Mazdas lamps used for main level lighting.

33. Local & General Welfare:
Expenditures increased $2126.81. Proportion of cost of the Visiting Nurse at Negaunee and other welfare expenses charged at Ishpeming Office.

34. Special Expense, Pensions & Allowances:
Decrease of $703.89.

1937		1936	
Pensions	4571.00	Pensions	4309.41
Legal	558.00	Legal and other expense	1357.85
Saranac Investigation	1451.48	Curtailment Expense	1703.11
Central Employ. & other	2114.47	Saranac Investigation	1969.75
		All Others	65.02
	8694.95		9405.14

35. Ishpeming Office Expense:
Expenditures increased $7413.59. Expense is based on labor cost. Cost per ton same as in 1936.

36. Mine Office:
Expenditures increased $3281.27, cost per ton decreased $.006. Increase in Warehouse overhead expense $963.07, also increase in salaries of clerks effective 3/16/37.

37. Insurance:
Expenditures increased $3394.26. Group Insurance increased $2542.37 in 1937, Catastrophe insurance $646.87, Riot and Civil Commotion insurance $372.24. Property insurance decreased in 1937.

38. Personal Injury:
Expenditures increased $14,568.37.

Compensation and Doctors	26618.79
Compensation Department	3423.46
Hospital Loss	3029.68
	33071.93

Increase due to larger payrolls for 1937.

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

39. Social Security Tax:
Expenditures increased $16374.23. Unemployment Insurance Tax effective January 1937 was $13325.42 and Old Age Benefit Tax increased $3048.81.

40. Employees Vacation Pay:
Expenditures increased $1739.20, cost per ton decreased $.002. Larger number of men on vacation payroll also increase in hourly rate paid.

42. Taxes:
Expenditures increased $12,989.49 account higher assessed valuation by State Tax Commission and higher City Tax Rate. Cost per ton decreased $.063 account larger product.

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9. EXPLORATIONS AND FUTURE EXPLORATIONS:

There was no diamond drilling in 1937. Next year a program of drilling must be started to determine the depth of the ore body located near the northwest corner of the Negaunee Mine property. The top of this ore body is just under the 13th level. It has been developed on the Maas Mine at the boundary to a depth of 106 ft. below the 13th level but no information is available of its total depth on the Negaunee Mine property. This information is needed to determine the elevation of the 14th level Negaunee Mine. Development of the 14th must be started in 1938.The time requiredfor development of the new level will depend on the operating schedule in effect during the next two or three years.

10. TAXES:

A comparison of taxes paid by the Negaunee Mine Company in 1937 and 1936 follows:

	1937		1936	
	Valuation	Taxes	Valuation	Taxes
Realty - 213.19 Acres	2,600,000	92,239.42	2,380,000	81,194.65
Personal-Stockpile,Equip. & Supp.	645,000	22,882.47	525,000	17,910.58
Total by Tax Commission	3,245,000	115,121.89	2,905,000	99,105.23
Collection Fees		1,151.22		991.05
Total Optg. Negaunee Mine	3,245,000	116,273.11	2,905,000	100,096.28
Rented Buildings	22,500	798.26	22,770	776.80
Collection Fees		7.98		7.77
Total Negaunee Mine Co.	3,267,500	117,079.35	292,	100,880.85
Tax Rate Per $100 Valuation		3.54767		3.41111
Total Tax City of Negaunee (Includes collection fee)		491,453.00		406,945.23
Negaunee Mine Co. % of City Tax		23.82%		24.78%

The State Tax Commission increased the valuation of the mine $340,000.00 and the Negaunee City Tax rate increased $1.3656 per $1000 valuation resulting in an increase of $16,198.50 in the taxes as compared with 1936.

11. ACCIDENTS AND PERSONAL INJURY:

The following table gives the number and classification of accidents causing personal injury during the past five years:

	1937	1936	1935	1934	1933
Fatal	1	0	0	1	0
Time Lost - Over four months	2	0	1	1	0
" " - One to four months	5	3	1	1	2
" " - Less than one month	4	1	0	1	0
Total Compensable Accidents	12	4	2	4	2
Number of cases paid compensation for accidents prior to Jan. 1st, 1937	7	7	8	10	14
Number of cases being paid difference in wages (Included in above total)	2	2	4	4	4

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11. ACCIDENTS AND PERSONAL INJURY: (Cont'd)

There were twelve compensable accidents in 1937, an increase of eight above the number occuring in any year since 1931. There were five compensable accidents in 1931 and eleven in 1930. Fortunately nine of the twelve accidents were not very serious. The nature of accidents occuring during the year were as follows: One fatal, three body contusions, four leg fractures, one fracture of bone of foot, one arm fracture, one wrist fracture and one partial loss of two fingers. At the end of the year only two of the injured men were at home, all the others had returned to work.

Fatal Accident:

I regret to report that a fatal accident occurred at 7:10 A.M., May 21st, Charles Kangas a miner in No. 2 contract being instantly killed by a fall of ground.

No. 2 contract was mining the pillar northeast of No. 1118 raise on the 450' sub level 40 ft. above the 11th level. This contract was a two-shift contract. Kangas' partners finished work at 12:00 P.M. the previous night, leaving the working place idle for eight hours before Kangas came to work. The slice they were mining lacked one set or 5 ft. of being finished. It was the fourth slice taken in the pillar, the first two had been blasted down while the third slice was open. It had been poled down and one leg of each set drilled in preparation for blasting it down as soon as the slice they were driving was finished. The previous shift removed some of the ore broken by Kangas twenty-four hours previous to the accident, put up a set of timber, put in five large fore poles and lagged above the fore poles. Some jasper ran in from the hanging on the open slice side of the breast and from 9:00 to 12:00 o'clock the miners blocked this side above the fore poles to stop the run. The ore in the back had come off up to the floor covering of the sub above except on the right or pillar side of the slice where there was a slab extending from the pillar up to the floor covering. A small opening was left in the back poles and lagging just ahead of the cap on the left or pillar side. When Kangas reached his working place he noticed that some finely broken jasper was coming from the back on the left hand side of the slice. This side of the back had been closely blocked by his partners a few hours previously but not tightly enough to stop the small pieces of jasper from filtering through. Kangas made a small opening near the left leg on the pillar side of the slice in order to look across above the fore poles and determine how he could block the jasper run. Kangas was about 5 ft. 4 inches in height and could not see over the back lagging by standing on the pile of broken ore in the slice. He caught hold of the lagging and pulled his head up in the hole and spread his arms above the lagging to support his body. His partner stated that immediately afterwards some ground fell and caught Kangas. His partner ran out to get help and when the other miners came a few minutes later it was necessary to saw off several lagging to release Kangas. The ground caved off the pillar above the timber set and crushed Kangas' head, leaving him suspended several inches above the pile of broken ore in the slice. It is evident that Kangas did not even look at the pillar side as his attention was directed to the opposite side of the

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11. ACCIDENTS AND PERSONAL INJURY: (Cont'd)

Fatal Accident: (Cont'd)

slice where the jasper was coming in. Miners always endeavor to block runs of jasper but however, are usually very cautious and look the ground over before exposing themselves to danger. Kangas virtually put his head in a noose when he pulled himself above the lagging without an inspection of the ground behind him on the pillar side. He should have cut away a few lagging to make a larger hole to give him a better chance to inspect the ground and to escape quickly. The accident was caused by Kangas making the inspection in the wrong way or it can be classed as carelessness or poor judgement on his part.

This was the first fatal accident at the Negaunee Mine since March 31st, 1934. It was the fifth fatal accident at the mine in twenty-three years, all caused by falls of ground. Each fatality occurred under different conditions so that no set of rules would apply. Good judgement on the part of the miners would have prevented most if not all of the accidents.

Kangas was a married man with three children. He was forty-nine years of age and had worked at the Negaunee Mine since 1929.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION: (Including all E. & A.'s authorized or completed in 1937)

E. & A. No. 704 - Equipment to Increase Production - 1937

	Estimated Expenditures	Expended 1937	Expended 1936	Total Expenditures	Unexpended Balance
2 Rocker Dump Cars	1080.00	1080.00		1080.00	
1 Model 220 Hoist	1343.00		1343.00	1343.00	
1 Model 215 Hoist	1305.00	1333.50		1333.50	28.50
4 Model 201-5 Hoists	4534.00	4534.00		4534.00	
8 Drill Machines	1600.00	760.00	760.00	1520.00	80.00
Freight	218.00	112.65	34.50	147.15	70.85
Total	10080.00	*7820.15	2137.50	9957.65	122.35

(*) Charged to operating cost in 1937. E. & A. completed and closed in 1937.

E. & A. No. 747 - Haulage Equipment - 1937

	Estimated Cost	Expended	Unexpended Balance
Locomotive	1500.00	1500.00	
Freight & Reconditioning	500.00	1001.23	501.23
4 Rocker Dump Cars	2160.00	2096.23	63.77
Total	4160.00	4597.46	437.46

Charged to Uncompleted Construction. E. & A. completed and closed in 1937.

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

E. & A. No. 735 - Mining No. 1 and No. 2 Shaft Pillars - 1937

	Estimated Expenditures	Amount Expended	Unexpended Balance
Trolley Lines, etc.	1200.00	1240.84	40.84
Telephone, Lights, etc.	300.00	337.50	37.50
Air and Water Pipes	800.00	504.94	295.06
Plat	250.00	278.46	28.46
Air Doors	300.00	389.32	89.32
Retimbering	2000.00	2716.54	716.54
Rail	2500.00	1808.67	691.33
General Shop Work		430.34	430.34
Drifting & Raising	15000.00	11965.42	3034.58
Scraper Hoists	6500.00	6789.50	284.50
Drill Machines	800.00	800.00	
Rocker Dump Cars	1080.00	1080.00	
Water Cut-off No. 2 Shaft	10000.00		10000.00
Rebuilding 9th Level Pockets	1500.00	2632.06	1132.06
Total	42230.00	30973.59	11256.41
Contingencies	4110.00		4110.00
Total	46340.00	30973.59	15366.41

The following were charged to E. & A. No. 735in above accounts:

3 Utility Hoists	1335.00
1 25 H.P. I.-R. Hoist	1619.50
4 20 H.P. " "	5170.00
4 RB-12 Drill Machines	800.00
2 65 cu.ft. Rocker Dump Cars	1080.00

E. & A. uncompleted at the end of 1937.

13. EQUIPMENT AND PROPOSED EQUIPMENT:

a. Steam Shovels:

No. 7 Shovel Loaded 247,571 tons
No. 43 Shovel Loaded 86,860 tons

Total Loading 334,431 tons

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13. EQUIPMENT AND PROPOSED EQUIPMENT: (Cont'd)

b. Stockpile Trestles:

Wooden Trestles:

Five bents were erected on the rock trestle late in the fall. Timber has been framed for twenty two bents on the auxiliary ore stocking trestle and partly assembled for erection. No ore will be stocked from the wooden trestle until the east steel trestle stocking grounds are filled to capacity. Four wooden bents were erected at the east end of the east steel trestle for stocking 10,000 tons of Negaunee Special Ore.

Following is the cost of erecting trestles:

Labor	799.39
Supplies	221.66
Total	1021.05

c. Scraper Hoists:

Following is a list of scraper hoists at the mine:

Company		On Hand 1-1-1937	Purchased 1937	Total	Cost for Repairs Per Machine 1937	1936
Ing-Rand	25 H.P. Elec.		2	2		
"	20 H.P. "	1	5	6	77.84	
"	15 H.P. "	8	4	12	127.03	25.76
"	10 H.P. "	6		6	78.03	39.77
Sullivan	25 H.P. "	2		2	50.35	
"	20 H.P. "	1		1	92.65	19.44
"	15 H.P. "	14		14	103.07	9.72
Gard-Den	15 H.P. "	2		2	26.49	55.11
Total		34	11	45		
Lake Shore Engine Works 25 H.P. Electric Scraper Slide		2		2		

1 - 25 H.P. Ing.-Rand scraper hoist charged to E. & A. No. 735.
4 - 20 H.P. Ing.-Rand scraper hoists charged to E. & A.No. 735.
4 - 15 H.P. Ing.-Rand scraper hoists charged to operating mine.
*2 - 20 H.P. Ing.-Rand scraper hoists charged to operating mine.
1 - 25 H.P. Ing.-Rand scraper hoist charged to operating mine.

(*) 1 - 20 H.P. scraper hoist purchased in 1936 charged in 1937.

Eleven scraper hoists were purchased in 1937 of which five were charged to E. & A. No. 735 and six charged to operating mine. Actually seven were charged to operating as one purchased late in 1936 was charged in 1937.

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13. EQUIPMENT AND PROPOSED EQUIPMENT: (Cont'd)

d. Underground Tram Cars:

Eight rocker dump four-ton haulage cars were purchased in 1937 and charged out as follows:

2 cars charged to operating mine - 13th level rock drifting.
2 " " " E. & A. No. 735 - Mining No. 1 & 2 shaft pillars 9th Level.
4 " " " E. & A. No. 747 - Additional equipment to increase production.

e. Drill Equipment:

During the year the following drill machines were purchased:

4 RB-12 Jackhammers - charged to E. & A. No. 735
4 RB-12 " - charged to operating mine
1 SAR Stopehammer - " " " "

f. Haulage Tracks:

Expenses for material for track extensions and replacements were greater than in 1936 due to reopening the 9th level. The expenditure for tracks in 1937 was as follows:

	1937	1936
40-lb. Rail	1307.57	922.96
Steel Ties & Tie Plates	104.99	117.42
Manganese Frogs	88.80	332.80
Total	1501.36	1373.18

14. MAINTENANCE AND REPAIRS:

Expenditures for "Maintenance & Repairs" in the accounts listed under "Underground Costs" were greater in 1937 by $19,063.90 - $56,099.81 compared with $37,035.91 in 1936 - Cost per ton in 1937 .068 compared with .072 in 1936, a decrease of .004. Thecost per ton decreased in four accounts and increased in one which increase was due to purchase of more scraper hoists and scrapers, more rope used and more expense for repairs of scraper equipment due to heavy operating schedule.

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14. MAINTENANCE AND REPAIRS: (Cont'd)

Following is a list of purchases and repair costs:

4 - 15 H.P. Ing.-Rand Scraper Hoists	4,643.20	
2 - 20 H.P. " " "	2,802.00	
1 - 25 H.P. " " "	1,763.50	
2 - 65 cu. ft. Rocker Dump Cars	1,080.00	
4 - RB-12 Jackhammers	761.54	
1 - SAR Stopehammer	365.91	
13 - Holcomb Scrapers	2,135.87	
2 - Anaconda Type Ventilation Fans	902.62	
Total Cost New Underground Equipment		14,454.64
Repairs to Locomotives	9,546.06	
Repairs to Generator and Wiring	3,624.57	
Repairs to Haulage Cars	1,203.36	
Haulage Tracks	6,648.43	
Repairs to Pumping Machinery	1,605.48	
Repairs to Compressor	555.00	
Repairs to Scraper Hoists, Rope, etc.	18,462.27	
Total Cost Repairs		41,645.17
Grand Total Purchases and Repairs		56,099.81

Expenditures in the accounts listed under "Surface Costs" were only $624.62 higher than in 1936 in which year expenditures were above normal due to fire in the shaft house - $18,874.33 compared with $18,249.71 in 1936 - Cost per ton .024 in 1937 compared with .036 in 1936, a decrease of .012. The cost per ton in three accounts was the same as in 1936, in one account, "Hoisting Machinery", the increase was .001 and in the account "Mine Buildings" the decrease was .013.

Following is a list of the items making up the charges in each account:

Repairs to Hoist, New Coils and Signal Cables	4,399.35
Hoisting Rope	1,574.79
Repairs to Skips and Cages	4,281.31
Repairs to Top Tram Cars	1,611.39
Repairs to Top Tram Engine, Ropes and Rollers	1,495.68
Permanent Trestles	1,514.00
Shaft Pockets and Chutes	325.56
Mine Buildings	1,664.59
Repairs to Shaft	2,007.66
Total	18,874.33

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15. POWER:

The following is a detail of electric current purchased, charged as follows - also other data;

	1937 - 12 Months Optg.		1936 - 12 Months Optg.	
	Cost	Cost Per Ton	Cost	Cost Per Ton
Stoping	1453.95	.0018	698.50	.0014
Timbering	87.25	.0001	79.32	.0002
Ventilation	6020.85	.0073	5769.42	.0112
Pumping	25308.45	.0308	23462.90	.0457
Hoisting	23465.47	.0286	18150.94	.0354
Stocking Ore	285.80	.0003	401.04	.0008
Dry House	192.12	.0002	238.02	.0005
Telephones & Safety Devices	1039.84	.0013	903.31	.0018
Mine Office	10348.93	.0001	42.95	.0001
Electric Haulage	5466.58	.0067	4551.86	.0089
Shops	221.67	.0003	329.30	.0006
Optg. Compressor	30660.25	.0373	22857.37	.0446
Total	94251.16	.1148	77484.93	.1512

Main Line Meter - K.W. (Less Maas Charge)	7,569,353	5,593.200
Separate Meter Readings - K.W.	7,389,210	5,347,263
Line Loss - K.W.	180,143	245,947
Product - tons	820,915	512,612
K.W. Per Ton (Inc. Line Loss)	9.22	10.91
Cost Per K.W. (Avg. for Year)	.01322	.01398
Load Factor " " "	68.42%	53.67%
15 Min. Demand " " "	1280	1257

The load factor was higher in 1937 due to continuous operation for twenty-four hours and therefore more favorable to the Negaunee Mine Company as regards cost per K.W. The fifteen minute demand was controlled by the installation of a peak load alarm whistle in the engine house early in 1937. The saving made in 1937 in cost of current as compared with the cost per K.W. in 1936 was $5,752.70.

17. CONDITION OF PREMISES:

a. Mine Grounds:

The mine grounds were kept clean and neat during the year. The lawn was fertilized, the shrubbery pruned and the fences repaired.

b. Negaunee Mine Houses:

Two houses were sold in 1937, leaving twelve houses owned by the Negaunee Mine Company out of twenty originally owned. The cost of repairs in 1937 was $2,148.61 and the income from rents was $2,775.75. Two garages were built, one house painted, extensive repairs to exterior siding and window frames made at one house, bath tub and hot water tank installed at another and new roofs on three houses, besides minor expense at all houses for interior decorating and repair of floors, windows and doors. There are twenty-three families living in the twelve houses.

NEGAUNEE MINE
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18. NATIONALITY OF EMPLOYEES:

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

As to Parentage	1937	- %	1936	%
English	68	16.0	55	17.6
Finnish	197	46.4	138	44.0
Italian	60	14.2	44	14.0
Swedish	37	8.8	35	11.0
French (Canadian)	32	7.6	24	8.0
French (France)	1	.2		
German	7	1.6	2	.7
Austrian	10	2.3	7	2.0
Irish	1	.2	2	.7
Belgian	3	.7	1	.3
Norwegian	4	.9	1	.3
Polish	1	.2		
Danish	4	.9	4	1.4
Total	425	100.0	313	100.0

As to Birth	American Born		Foreign Born	
	1937	1936	1937	1936
English	47	35	21	20
Finnish	117	76	80	62
Italian	30	22	30	22
Swedish	22	21	15	14
French (Canadian)	31	23	1	1
French (France)	1	-	-	-
German	5	-	2	1
Austrian	8	5	2	2
Irish	1	2	-	-
Belgian	3	1	-	-
Norwegian	3	-	1	1
Polish	1	-	-	-
Danish	4	3	-	1
Total	273	189	152	124

NORTH JACKSON MINE
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1. GENERAL:

This property has been idle for twenty-nine years.

6. SURFACE:

The stone boiler and shop building is leased to the City of Negaunee for storage of highway equipment. The office building, converted from barracks for the State Constabulary into a four-flat residence building several years ago, was repaired and painted in the summer. The appearance of the building has been greatly improved and repairs should be low for the next several years.

In 1937 the fences around the open pits were rebuilt with new posts and new barb wire.

10. TAXES:

	1937		1936	
	Valuation	Taxes	Valuation	Taxes
47% of Jackson Realty Sec. 1-47-27	$ 220,900	$ 7836.80	$ 199.750	$ 6813.77
Collection Fees		78.37		68.13
Total		$ 7915.17		$ 6881.90
Rented Buildings				
Old Jackson Office	$ 700	$ 25.08	$ 630	$ 21.69
Grand Total		$ 7940.25		$ 6903.59
City of Negaunee Tax Rate Per $100.00		$ 3.54767		$ 3.411

SOUTH JACKSON MINE
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1. GENERAL:

There was no change in conditions at this idle property in 1937.

4. ESTIMATE OF ORE RESERVES

a. Available Ore:

Above present pit available by present system of mining:

On Southwest Side	35,000 tons
North of Lucy Pit	5,000 "
South and Southwest of Lucy Pit	3,000 "
Total	43,000 "

Below present pit and above drainage tunnel available by milling:

West of Crusher	186,000 tons
Area below bottom of present pit shown by churn drilling	105,226 "
Total	291,226 "
Grand Total	334,226 "

c. Estimated Analysis:

	Iron	Phos.	Silica	Alum.	Mang.	Lime	Mag.	Sul.	Igni.	Moist.
Natural	34.55	.066	36.00	1.42	2.00	.435	.175	.010	2.00	7.00

6. SURFACE:

There has been no watchman at this property since 1931. Regular periodic inspections are made of the fences around the open pits and the shaft at the crusher building. A small expense was incurred in 1937 for repairing the fences around the open pits. All the buildings on the property have been dismantled with the exception of the lower part of the crusher building.

10. TAXES:

	1937 Valuation	1937 Taxes	1936 Valuation	1936 Taxes
53% of realty as described, Sec. 1-47-27	$ 249,100	$ 8837.25	$ 225,250	$ 7683.60
Collection Fees		88.37		76.83
Total		$ 8925.62		$ 7760.43
City of Negaunee Tax Rate Per $100.00		$ 3.54767		$ 3.411

JACKSON LEASE
CAMBRIA MINE
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1. GENERAL

The average monthly production for the first ten months, with the exception of August, was 6,161 tons. In August, due to the breakdown of the old steam-propelled air compressor, the production was only 2,134 tons. The output in November and December dropped off considerably because of mine curtailment, and an extra amount of development work in rock. Up to November the mine was operated on a 2-8-hour shift - 5 day a week schedule. In November this was cut to a 4 day a week schedule, and in December to 3 days.

The aforementioned breakdown necessitated the closing down of mining operations for three weeks. This time was used to good advantage to make much needed repairs in the shaft. Several shaft sets were replaced and a large footage of skip runners renewed. There is still a lot of work to be done to put the shaft in first class condition.

During the forepart of the year, several weight tests were made to determine a factor to be used for the capacity of underground cars. The average tonnage per car, secured from weighing fifteen cars, was found to be 2.481 tons. The average weight obtained from shipping 1842 cars from the pocket was 2.46 tons. From these tests it was mutually agreed that a factor of 2.4 tons per car be used henceforth for calculations of production. This to allow for a small percentage of overrun.

Preparatory to opening a new level, 200 ft. below the present 6th level, a winze was started just south of the shaft. It was decided to sink the winze 280 ft. to the elevation of the proposed skip-pit level, drift underneath the shaft, raise up to the present skip-pit level and strip it down. The actual sinking of the winze was started the latter part of April, and is now down approximately 218 ft.

2. PRODUCTION
SHIPMENTS &
INVENTORIES

a. Production by Grades

Grade	Tons	% of Product
Cambria (non-Bessemer)	66,116	100
Violet (Bessemer)	0	0
	66,116	100

The production from the property since lease became operative is as follows:

Grade	1937 Tons	1936 Tons
Cambria	66,116	7,791

b. Shipments

Grade	Pocket Tons	Stockpile Tons	Total
Cambria (non-Bessemer)	38,308	22,700	61,008
Violet (Bessemer)	0	0	0
	38,308	22,700	61,008

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

b. Shipments (Cont.)

Shipments from the property since the lease became operative are as follows:

Grade	1937 Tons	1936 Tons
Cambria (non-Bessemer)	61,008	2,324

c. Stockpile Inventory

On December 31, 1937, the stockpile balance was as follows:

Grade	Tons
Cambria (non-Bessemer)	10,574

e. Production by Months

Month		Tons
January	-	5,070 tons
February	-	6,010 "
March	-	6,422 "
April	-	5,610 "
May	-	5,607 "
June	-	7,186 "
July	-	6,158 "
August	-	2,134 "
September	-	6,886 "
October	-	6,498 "
November	-	4,978 "
December	-	3,557 "
	Total	66,116 tons.

ANALYSIS

The following are the analyses on the Cambria ore produced from the Jackson Lease since September 1st. These figures were obtained from the averages of our daily report of production and analysis by underground cars of each contract for each day's operation. These daily reports were started the 1st of September, which accounts for the shortage of analyses prior to Sept., 1st 1937.

Month	Grade	Cars	Dried Iron	Dried Phos.
September	Cambria	2,860	57.54	.097
October	"	2,584	59.63	.113
November	"	2,074	59.38	.102
December	"	1,482	59.22	.101

6. SURFACE

Due to the aforementioned breakdown of the air compressor in August, a new compressor doundation was built, just south of the engine house, upon which a new electric air compressor was erected and inclosed with a temporary wood building.

JACKSON LEASE
CAMBRIA MINE
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6. SURFACE (CONT.)

The stockpiles were practically depleted when shipping season closed, there being only a few hundred tons of Jackson ore in stock. A new stocking trestle was erected, and they continued to mix the ore produced on the Jackson property with that of the Cambria, and it is either shipped or stocked as Cambria Ore (Non-Bessemer). To date, no ore of a Bessemer grade has been produced on the Jackson.

7. UNDERGROUND

a. General

The ore on the Jackson Lease consists of three separate deposits, for reference in the future, I will call these the East, Center and West deposits. These deposits all dip to the south and pitch to the southwest, and the hanging being much flatter than the foot, indicates that there will be a big increase in ore areas at greater depth.

At the end of the year, there were 11 contracts at work on the Jackson side of the line, the number having been increased from 6 in January.

b. Development

The development work on the 6th level consisted of five drifts, two in the Center deposit, one in the east wing of the West deposit, and two in the west wing of the West deposit. The two drifts in the Center deposit were driven east and west, along the hanging wall, from the main haulage drift. The one to the east was breasted in ore 70 ft. from the main drift and the other, 55 ft. west in hanging wall material.

The drift in the east wing of the West deposit is a continuation of the old haulage drift and was advanced 150 ft. east along the hanging. This drift is utilized for haulage of ore developed on the 120 ft. and 135 ft. sub-levels.

The two drifts driven on the west wing of the West deposit were just put in for haulage purposes. The one was carried southwest through the ore body to the main east-west dike which is the south limit of the ore. A small dog drift was driven south through the dike at this point and encountered lean ore and jasper. The other drift was driven west through the center of the deposit and was breasted at a big north-south fault, which is the west boundary of the ore. This portion of the West deposit is approximately 300 ft. long at the property line and the most southerly limit is 125 ft. south. Developments for sub-level stoping of this ore is now in progress.

JACKSON LEASE
CAMBRIA MINE
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7. UNDERGROUND (CONT.)

c. Stoping

East Deposit
The south trend of this body of ore has brought a portion of it across the property line and is being sliced by two contracts, one on the 135' sub-level and the other on the 150' sub-level. This deposit is 190' long where it crosses the lease line.

Center Deposit
Sub-level stoping has been carried on, all year in this deposit. All of the ore in this body is practically mined from the 150' sub up to an elevation of +225' at the property line. The little ore remaining above the 150' sub is now being taken, preparatory to slicing below this elevation.

West Deposit
The east wing of this deposit is being stoped from the 120' and 135' sub-levels, the upper portion having been mined from the 150' sub-level.

The west wing was discovered by drifts and cross cuts on the 135' sub, and is the big find of the year. This portion of the west deposit has been developed for sub-level stoping and stoping is now in progress. The ore along the fault on the west side is approximately 115' above the 6th level and of very good quality.

FRANCIS MINE
ANNUAL REPORT
YEAR 1937

1. GENERAL

This mine was abandoned in 1924. The steel headframe is the only structure remaining on the property. The ore remaining in stock is on an adjoining forty, the NE¼ of the SE¼ of Section 28,45-25.

2. PRODUCTION SHIPMENTS & INVENTORIES

		1937	1936	Decrease
b. Shipments				
	Franport	36,366	57,308	20,942
c. Stockpile Inventories				
	Franport	16,005m	52,371	

The above are book figures of ore in stock. The engineer's estimate shows 9,581 tons, or an underrun of 6,424 tons.

3. ANALYSIS

b. Complete Analysis of Ore Shipped (Dried at 212° F.)

Franport Grade	Tons	Iron	Phos.	Sil.	Mn.	Al.	Lime	Mg.	Sul.	Loss	Moist
Mine Analysis	36,366	57.30	.260	6.70	.61	4.65	1.10	1.44	.063	2.45	

8. COST OF OPERATING

	1937	1936	Incr.	Decr.
General Mine Expense	449.44	436.76	12.68	
Loading & Shipping	4,112.09	4,005.95	106.14	
Taxes	1,173.27	1,881.84		708.57
Social Security Tax	85.70m		85.70	
Total cost at Mine	5,820.50	6,324.55		504.05

The cost per ton for loading and shipping in 1937 was $ .110 as compared with $ .069 in 1936.

10. TAXES

	1937		1936	
	Valuation	Taxes	Valuation	Taxes
SW¼ of NW¼, Sec.27,45-25		2.98		2.98
SW¼ of Sec.27,45-25	Trans.Land Dept.		500	9.26
Personal Property	63,000	1,158.70	100,000	1,851.00
Total	63,000	1,161.68	100,500	1,863.24
Collection Fee		11.59		18.60
Total Taxes		1,173.27		1,881.84

GARDNER MACKINAW MINE
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1. GENERAL

The mine production showed a decrease for the year, with a total of 172,823 tons as compared to 185,954 tons for 1936. By proportioning the total tons and number of working days of each year, the results show a considerable increase. On July 10th, and until August 30th, the mine was closed to production as explained in the following main heading. These thirty-five working days, together with reduced working schedule, would more than compensate for the decrease in production.

Development and mining operations continued on all levels below the 5th, and particularly so on the 7th and 10th Levels. Relative to the latter, development is continuing at the northwest extremity of the level and as yet we have no indication that the end of the ore has been found.

The larger share of production resulted from mining operations above the 8th Level. The control of the phosphorus and sulphur content by mixing ores from different sections of the mine was continued throughout the year. With the great amount of development work on the 7th, 8th, 9th and 10th Levels, there has been an upward trend of the phosphorus and sulphur content and it is making it more difficult to meet our guarantee on account of these two elements.

The dip of the formation carried the ore into the Gardner Lease, the NE$\frac{1}{4}$ of the SW$\frac{1}{4}$ of Section 35,45-25, on the 9th and 10th Levels. This lease was secured from the Chicago & North Western Railway Company in 1937 and while considerable development has taken place on the lower levels, the ore is of such character that it must be classed as unmerchantable, due to the above mentioned high phosphorus and sulphur content.

2. PRODUCTION SHIPMENTS & INVENTORIES

a. Production by Grades

Grade	1937	1936	Decrease
Gardner Ore	0	0	0
Mackinaw Ore	172,823	185,954	13,131
Total	172,823	185,954	13,131

The decreased production resulted from the reduced mining schedule in effect during the last two months of the year, as well as the closing of the mine during a part of July and August.

GARDNER MACKINAW MINE
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2. PRODUCTION
SHIPMENTS &
INVENTORIES (Cont.)

b. Shipments

Grade of Ore	Pocket Tons	Stockpile Tons	Total Tons	Total Last Year
Gardner	-	-	-	3,645
Mackinaw	83,390	69,226	152,616	148,372
Total	83,390	69,226	152,616	152,017
Increase 1937	-	27,089		
Decrease 1937	26,490			

c. Stockpile Inventories

Grade of Ore	Dec.31,1937	Dec.31,1936	Incr.	Decr.
Gardner	-	-	-	-
Mackinaw	90,692	70,485	20,207	-
Total	90,692	70,485	20,207	

d. Division of Product by Levels

	1937	%	1936	%
6th Level	23,481	13	15,432	8
7th Level	38,806	23	32,580	18
8th Level	28,342	16	60,093	32
9th Level	38,944	23	48,387	26
10th Level	43,250	25	29,462	16
Total	172,823	100	185,954	100

e. Production by Months

	Mackinaw Ore Tons
January	16,928
February	16,276
March	16,044
April	19,309
May	18,194
June	20,096
July	6,550*
August	1,313*
September	17,571
October	14,091
November	12,241
December	14,210
Total	172,823

Small product in July and August due to mine being idle July 10 to August 30.

GARDNER MACKINAW MINE
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2. PRODUCTION SHIPMENTS & INVENTORIES

f. Ore Statement

	Gardner	Mackinaw	Total	Total Last Year
On hand Jan.1,1937	-	70,485	70,485	33,150
Product for Year	-	172,823	172,823	189,352
Total	-	243,308	243,308	222,502
Shipments	-	152,616	152,616	152,017
Balance on hand	-	90,692	90,692	70,485
Increase in Output				47,483
Decrease in Output		13,131	13,131	-
Increase in ore on hand		20,207	20,207	37,335

1937 - Jan. 1 to July 10, 3-8 hr. shifts per day, when Mine suspended operations until August 30, the men being transferred to the Ishpeming-Negaunee Districts, while heavy repairs, etc. were made to the skip-road and shaft of the auxiliary or incline shaft.
3-8 hr. shifts were then maintained until October 8 when the mine was put on a 2-8 hr.shift for 5 days per week until December 31.

g. Delays

	Tonnage Lost
Jan. 5 - 2 hr. delay - car off track.....	40
Feb. 3 - 5 hr. delay - skip off track a/c broken rail	200
Mar.10 - 2 hr. delay - skip wheel broken.....	40
11 - 2 hr.ddelay - changing skip wheel, south side	60
16 - 14 hr. delay - skip off track & skiproad damaged	550
17 - 24 hr. delay - repairing skip road.....	800
18 - 24 hr. delay - " " "	800
19 - 24 hr. delay - " " "	800
29 - 1 hr.delay - cutting off rope	50
Apr. 9 - 3¼ hr. delay - changing smoke stack (heating plant) when jin pole fell across elec.wire	150
May 25 - 1¾ hr. delay - U.G.hoist controller out of order	75
June 23 - 2 hr. delay - trouble with hoisting engine	50
July 7 - 4 hr. delay - changing rope - incline shaft..	200
Oct.11 - 2 hr. delay - water pipe bursting in shaft...	100
18 - 2 hr. delay - motor out of commission,top tram plant.....	75
Nov.13 - Repairing compressors	

GARDNER MACKINAW MINE
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2. PRODUCTION
M SHIPMENTS &
INVENTORIES (Cont.)

h. Delays from Lack of Current

There were no delays under this heading.

3. ANALYSIS

a. Average Mine Analysis on Output

Grade	Tons	Iron	Phos.	Sil.	Sul.
Mackinaw	172,823	59.16	.510	.308	.951

These figures represent a decrease in iron and an increase in the phosphorus and sulphur contents as compared with 1936. The development in progress on the 7th, 8th, 9th and 10th Levels is largely responsible for the increase in phosphorus and sulphur as well as the corresponding small decrease in iron. Perhaps another contributing cause might be due to the general narrowing of the vein of ore being mined in the stopes.

b. Average Analysis on Straight Cargoes

As all shipments, both from the pocket as well as the stockpile, were graded with other ores, there were no straight cargoes forwarded during the year.

c. High Sulphur Ore

As mentioned in the detailed underground report, a large tonnage of developed ore remained in various stopes above the 6th Level. At the time the original development took place, there was an oversupply of high sulphur ore in evidence. However, during 1937 this ore had to be mined in an effort to reduce the phosphorus content of the ore from the various levels. Thus, this high sulphur materially increased the sulphur analysis in the year's production. It might also be added that the new development was marked by absolutely no variation in sulphur between foot and hanging walls as was usually experienced in previous development as well as stoping.

d. High Phosphorus Ore

Undoubtedly, the material increase in phosphorus in the mine production for 1937, as well as the ore developed, proved to

GARDNER MACKINAW MINE
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3. ANALYSIS (Cont.)

d. High Phosphorus Ore (Cont.)

be the most disappointing feature of the year. To date a very small tonnage has been developed which could be considered as merchantable ore. While most of this year's development has been more or less along the footwall of the northwest ore body and while there has been no apparent change as the hanging wall approached, it is hoped that this condition may be altered with a further exploration toward the footwall.

4. ESTIMATE OF ORE RESERVES

a. Developed Ore

Assumption: 12 cu. ft. equals one ton
10% deduction for rock
10% deduction for loss in mining
Estimate is of available ore (merchantable), as well as high phosphorus ore, (non-merchantable).

Non-Bessemer	Merchantable Tons	Non-Merchantable Tons
5th to 6th Level	7,318	-
6th to 7th Level	78,077	69,606
7th to 8th Level	80,021	79,216
8th to 9th Level	31,828	90,544
9th to 10th Level	7,413	268,838
Below 10th Level	13,415	91,884
Total developed ore Dec. 1937.	218,072	600,088

Statement Showing ore reserves and new ore developed for the following years:

	1933	1934	1935	1936	1937
Ore in Mine Jan.1	71,312	164,858	382,337	306,116	309,082
Production	3,405	78,353	138,471	185,954	172,823
Balance	67,907	86,505	243,866	120,162	136,259
Ore in Mine Dec.31	164,858	382,337	306,116	309,082	218,072
New ore developed	96,951A	295,832B	62,250C	188,920D	81,813E

A. Increase due to sinking of incline shaft.
B. Large increase due to development of 8th and 9th Levels.
C. Increase due to northwest end development of 8th and 9th Levels.
D. Increase due to development of 10th Level.
E. Decrease due to elimination of high phosphorus ore from estimate.

GARDNER MACKINAW MINE
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4. ESTIMATE OF ORE RESERVES (Cont.)

c. Estimated Analysis

Ore Reserves: Approximate Expected Natural Analysis

Developed Ore

	Iron	Phos.	Sil.	Mang.	Alum.	Lime	Mag.	Sul.	Ign.	Moist.
Mackinaw	51.76	.438	2.70	.21	1.64	1.88	1.20	.883	2.45	12.50

Ore in Stock: Average NaturalAnalysis

Mackinaw	53.86	.351	3.09	.22	1.68	1.93	1.11	.861	2.52	10.03

There was a general change in the expected analysis for the year. The iron was slightly reduced, the phosphorus was increased from .400 to .500, the sulphur from .800 to .900 (in the latter case the exact reverse of 1936.) This is largely due to the generally poorer grade of ore encountered between the 9th and 10th Levels, as well as that developed in the northwest ends of the 7th, 8th, 9th and 10th Levels.

5. LABOR AND WAGES

a. Comments

1. Labor

There was an abundant supply of labor throughout the year. Wages increased practically 10¢ per hour or 80¢ per shift effective March 16, 1937, with exception of General Surface, which was increased 12½¢ per hour to $5.00 per day compared with $4.00 formerly. Also the following individuals or groups were increased as shown:

Master Mechanic -	Mar.16,1937	$172.00 to $190.00		
Surface Foremen,-	"	142.00 to $157.90	then $170.00	5-16-37
Mine Electrician-	"	145.00 to 160.00	then 175.00	5-16-37
Timber Foreman -	"	175.00		
Shift Bosses -	"	175.00		

2. New Construction

During the year there was no new construction which might come under this heading.

b. Comparative Statement of Wages & Product

	1937	1936	Incr.	Decr.
Product	172,823	185,954		13,131
Number shifts & hours	3-8 hr.	3-8 hr.		

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5. LABOR AND WAGES

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

	1937	1936	Incr.	Decr.
AVERAGE NO. OF MEN WORKING				
Surface	26	32		6
Underground	110	122		12
Total	136	154		18
AVG. WAGES PER DAY				
Surface	5.37	4.45	.92	
Underground	5.96	4.90	1.06	
Total	5.84	4.81	1.03	
AVG. WAGES PER MONTH	(21 days)	(20 days)	(1 day)	
Surface	112.77	89.00	23.77	
Underground	125.16	Y98.00	27.16	
Total	122.64	96.20	26.44	
PRODUCT PER MAN PER DAY				
Surface	25.27	25.00	.27	
Underground	7.01	6.73	.28	
Total	5.49	5.30	.19	
LABOR COST PER TON				
Surface	.213	.178	.035	
Underground	.850	.729	.121	
Total	1.063	.907	.156	
AVERAGE PRODUCT MINING				
Stoping	115,723	124,254		8,531
Ore Development	& 57,100	Y 61,700		4,600
Total	172,823	185,954		13,131
AVERAGE WAGES CONTRACT LABOR	6.304	5.195	1.108	
TOTAL NUMBER OF DAYS				
Surface	6,839¾	7,439¾		600
Underground	24,649¾	27,649¼		2,999½
Total	31,489½	35,089		3,599½
AMOUNT FOR LABOR				
Surface	36,181.95	33,090.37	3,091.58	
Underground	146,976.62	135,561.40	11,415.22	
Total	183,158.57	168,651.77	14,506.80	

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5. LABOR AND WAGES (Cont.)

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

	1937	1936	Incr.	Decr.
AVG. WAGES PER MO. BASED ON MEN CARRIED ON MINE PAYROLL				
Surface	112.77	89.00	23.77	
Underground	125.16	98.00	27.16	
Total	122.64	96.20	26.44	

Proportion of Surface to Underground Men

1937 - 1 to 3.60 - 3-8 hr. shifts, Jan.1 to July 10. Mine idle July 10 to Aug.30; 3-8 hr. shifts Aug.30 to Oct. 8; then 2-8 hr. shifts to Dec. 31st.

1936 - 1 to 3.81 - 3-8 hr. shifts; 2-8 hr. shifts Jan.1 to July 1 mining and 1-8 hr. hoist for 4 days per week. During this time mine worked 3-8 hr. shifts per day 2 days per week shaft sinking. After shaft completed mine worked 3-8 hr. shifts 5 days per week, 2 mining and 1 tramming.

1935 - 1-to 3.42 - 1-8 hr. shift; 2 days per week Jan.1 to Feb.28 3 days per week Mar.1 to Dec.31.

1934 - 1 to 4.48 - 1-8 hr shift; sinking auxiliary shaft, Jan.1 to Feb.18, 2 days per week Feb.19 to Aug.31. 2 days per week Sept.1 to Dec.31.

6. SURFACE

a. Building, Repairs

General repairs on all mine buildings were made when needed. The shaft house, which had been covered by fireproof Ferro board during 1936, was painted in October.

The Captains office building was also painted and repaired.

The water storage tank for the mine was reinforced with 12" x 12" timber and later painted.

Late in November, the heating plant boiler was discarded due to its general poor condition and replacedby one from the Central Shops.

b. Roads

No new roads were constructed during the year and general maintenance of the old roads was carried on as their condition warranted.

c. Stockpiles & Trestles

The stocking trestle was dismantled during the shipping season, all portions were salvaged and used this fall. Twenty one bents were erected to take care of the winter stocking program. This trestle lies north of and parallel to the old one.

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7. UNDERGROUND

a. Shaft Sinking

In past years, it has been necessary to sink the incline shaft one level per year in order to keep pace with mining. Each level has developed approximately 400,000 tons, of which 50% is mineable. However, during 1937 with the large amount of development on the northwest ends of the 7th, 8th, 9th and particularly the 10th Levels, further shaft sinking has not been necessary.

b. Development

Extensive development of all levels from the 5th through the 10th was carried on during the year. This development was entirely confined to the wider section at the Northwest end of the ore body or at points on the various levels where development had terminated in 1936. The total footage of main level drifting amounted to 2278' for the year with the larger portion of it being carried on on the 10th Level.

At the 5th Level elevation, an attempt was made to determine the extent of the ore at the extreme northwest end of the level and in September, two drill holes were driven by a deep hole machine toward the northeast in an effort to locate the footwall. However, after drilling a distance of 40' and encountering only lean ore, the work was abandoned. Later in the month a small drift was driven slightly west of north at a point near #19 raise. This small drift extended a distance of 26' in lean ore. In this vicinity, slightly below the 5th Level elevation and to the northwest, there is a decided roll of the hanging wall from approximately 45° to an almost horizontal position. As this roll is below the 5th Level, it is improbable that future development on the 5th Level would bring to light the extension of the ore.

There was very little development on the 6th Level during the year with the exception of a small drift which was driven from the top of No.23 7th Level, raise to the 6th Level middle drift. This work disclosed a good grade of ore although it was slightly below the 6th Level elevation. Later in the year, a small drift was started to the northwest in the top of No. 23 raise. This work likewise has encountered ore of an excellent grade.

Development at the 7th Level elevation consisted of extending the main level drift a distance of 334' to the north. It should be noted that heretofore all main level development had been carried on in a generally northwest direction. However, after progressing about 70', the black slate footwall was encountered which indicated a definite turning to the north. As a result, the development on this level, as well as the 8th and 10th Levels, has been carried on in a generally northerly direction.

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7. UNDERGROUND (Cont.)

b. Development

The extension of the 8th Level to the north was started in September and by the end of the year had covered a distance of 402'. This drift also paralleled the footwall which was encountered at several different points. In October, cross-cuts to the foot and hanging walls were driven and as expected a black slate footwall was found at a point 20' from the center line of the main level. A slate hanging wall was encountered at a point 28' from the center of the level, disclosing the fact that there was either a pronounced off-set of about 120' with the narrowing of the ore body or else the material encountered was merely a false hanging wall. In this case, it is possible that ore might be found to the west of this rock lying under the true hanging wall.

In December, the formation took a decided turn to the west, a slate hanging was encountered and there was a general narrowing of the ore body.

Development on the 9th Level was confined to the extension of the hanging wall drift toward the northwest. The total footage amounted to 333', and unlike the 7th and 8th Levels, the hanging wall was found to be very uniform, or running in the usual northwest direction. After covering a distance of 145', the hanging wall was encountered and the drift was directed more to the north in an effort to remain about 20' from the hanging wall. At a point 300' from where the drift was started, cross-cuts were driven to the foot and hanging walls. This work disclosed an actual ore width of only 25', although the drifts were both extended into the lean ore a distance of 15'. The results of this work were very disappointing, inasmuch as the ore bodies, both above and below, are considerably wider. In October, a small drift was extended from the breast of the main level to the northwest a distance of 25' in a brecciated lean ore. The breast disclosed black slate striking about East and West and dipping towards the South. Further development at this elevation was halted pending the results of the 8th and 10th Levels.

Drifting was in progress at the southeast end of the 10th Level at the turn of the year and was continued a distance of 46' in ore. This final portion was marked by a narrowing of the ore to about 9'. A black graphitic slate formed the foot and hanging walls and with further narrowing, operations were halted.

In December of 1936, the northwest end of the 10th Level was being driven in rock, however, ore was soon encountered. Early in January, No. 20 raise was started in ore toward the 9th Level, disclosing an ore width of about 7'. After holing through, the raise

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7. UNDERGROUND (Cont.)

b. Development (Cont.)

was converted into a traveling and ventilation way. The main level was then extended 30' to a point where it was thought that sufficient ore had been encountered to warrant a hanging wall drift. This drift was started at a point slightly southeast of the corresponding point on the 9th Level. However, after driving the drift 75' the hanging wall was encountered, indicating a slight change of the ore body from that outlined on the 9th Level. The main level was then extended to the northwest and from time to time small cross-cuts were driven to the foot and hanging walls outlining the width of ore at this elevation. For the most part, the 10th Level was driven with the formation and by the end of the year the drift had made a decided turn toward the West. After progressing a distance of 620' and outlining the foot and hanging walls by cross-cuts, a third cross-cut was driven to the north a distance of 140' at which point the black slate footwall was encountered, thus indicating a general westerly trend of the ore body. With further progress of the main level, a large horse of black slate was encountered which presumably divides the ore body in two. On continuing to the west, this horse which had an original dip of 65° turned to a vertical wall and formed the north side of the level for the remaining distance.

In December with progress of 64', the formation commenced to turn slightly back to the north. The rock on the north side of the drift was lost and the formation dipped to the southwest about 78°.

In summing up the 10th Level development, perhaps the outstanding feature was the more or less variable analysis, as well as complex geology. The ore was by no means uniform and despite the fact that drifting was with the formation, the character of the ore was very changeable in Iron as well as in Phosphorus and Sulphur. It is rather difficult to say just what can be expected as to the extent of the ore in this direction.

c. Stoping

Stoping operations were confined to levels below the 5th as in 1936. The proportion of the product resulting from actual stoping operations was greatly reduced during the past year and amounted to approximately 55% of the total. The product by levels indicated that the major part of the mining took place on the 10th Level, with the 9th Level in second place, followed by the 7th and 8th. As stoping operations progressed during the year, it became increasingly difficult to find

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

high phosphorus and low phosphorus ores which would balance to come within the guaranteed percentage. Heretofore, ore which has carried high phosphorus correspondingly carried low sulphur as well as the reverse. However, the development during this year has been marked by material consisting of both high phosphorus and high sulphur. It is quite evident that the limits which govern the phosphorus and sulphur contents will have to be materially raised if normal mining is to be continued.

A more detailed description of the stoping operations follows:

6th Level

Northwest of Incline Shaft

Late in 1936, it was found necessary to discontinue mining above the 6th Level due to the then high sulphur but low phosphorus content of the ore remaining in the developed stopes. For the reverse reason, it became necessary to reopen the stopes in an effort to balance the high phosphorus material produced by the development of the northwest extremities of the lower levels. The product from this development also produced comparatively high sulphur ore, however, this was materially aided by the lower level ores.

As mentioned above, all stopes on the 6th Level had been developed and partially mined. In an effort to make these working places accessible, it was necessary to drive a raise from the 6th Level hanging wall drift to and connecting the small drift which intersects each stope above the 6th Level. Soon after its completion, mining operations were continued in No. 21 stope. The stope was developed by a hanging wall as well as a foot wall raise and after completing mining operations above the hanging wall raise, the stope was continued and completed to a height of 110' above the 6th Level along the footwall, the average width 23' and the approximate stoping thickness of 46'. As previously mentioned, the hanging wall became flatter as the 5th Level elevation was approached. Brecciated material was encountered at a height of 112' and it became necessary to discontinue the stope.

Operations were continued in No. 19 stope in April and as in No. 21, it was necessary to mine above the hanging wall raise before commencing on the footwall. At a point 125' above the 6th Level, a drift was driven to the footwall a distance of 38' where a raise was started, holing into the 5th Level footwall drift a distance of 60'. Stoping operations were then resumed and by December they were completed to the 5th Level. As in No. 21 stope, there was an apparent roll of the

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

hanging wall, however in this case, the roll occurred at the 5th Level elevation, allowing the stope to be completed at this elevation. The average stoping width was 26' while the stoping thickness was 52'.

No. 17 stope was continued in September and by the end of 1937 was completed to the 5th Level elevation, a distance of 172', a width of 24' and a stoping thickness of 40'. The completion of these stopes marked the last of the known low phosphorus areas. However, it is probable that more ore can be secured above the 6th Level hanging wall drift to the northwest.

7th Level

With the comparatively thick ore body encountered on the 6th Level, it was reasonable to believe that the narrowing of the ore on the 7th Level, directly below, would increase in width as it approached a higher elevation. Therefore, No. 18 raise was started in October and was completed preparatory to stoping to the 6th Level. These operations produced a comparatively low phosphorus ore but was characterized by the similarly high sulphur found directly above.

Operations were started at No. 20 raise early in September and the following month holed to the north side of the 6th Level hanging wall drift. Stoping immediately followed and by the end of the year had advanced a distance of 121' above the 6th Level, the width being 32' with a stoping thickness of 25'. It might be added at this point that the ore directly below the hanging wall carries little phosphorus and as mining continues toward the foot a noticeable increase in phosphorus is evident.

At the end of 1936, raising operations were underway at No. 23. This work was continued on to a point about 10' below the 6th Level elevation where a small drift was driven to the southeast and connected to the 6th Level middle drift. Stoping operations followed and were pointed to the southwest in an effort to hole to No. 23 hanging wall stope. Thereafter, each successive cut removed the floor of the old No. 23 stope directly above. Thus, while the stoping thickness was 58', the actual stope height was 85'. Late in September, a rock capping was encountered which had similarly cut off mining operations in the old hanging wall stope just above. With further progress, the actual stoping height was reduced to 21'. Mining

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

was then stopped and the contract commenced driving an exploratory drift to the northwest at the top of the raise. After driving a distance of 70', a raise was driven to the northeast to explore the area about 150' northwest of the 6th Level. This work has produced, thus far, an excellent grade of ore and it is hoped that mining operations will continue in this vicinity and produce a low phosphorus ore on completion of those stopes above the 6th Level.

At a point 30' north from where the 7th Level development drift was started, No. 24 raise was driven a distance of 142' to eventually hole to the exploratory raise described in the above paragraph. This raise will serve as an outlet for the ore while development continues and in the future for stoping operations.

8th Level

Northwest of Incline Shaft

Late in 1936, No. 15 stope had reached an inclined height of 45' above the 8th Level. This had previously been connected by a traveling road to No. 14 stope to the southeast. Early in January of 1937, a raise was started and driven to the 7th Level to provide both for ventilation and traveling. Stoping operations were immediately resumed and were completed later in April. The total incline height being 163', an average stope thickness of 24' and a width of 32'. It might be added at this point that, to the northwest of No. 15 stope, both the foot and hanging walls were contacted by the 8th Level drift and most of the material was high in phosphorus. Therefore, while stoping was in progress, a small dog drift was driven into this area to the northwest a distance of 12' from the stope in an effort to determine whether the ore widened as the 7th Level was approached. While #15 stope was in progress, the 5' of ore which protects the hanging wall commenced slabbing. If this were allowed to continue and dilute the already broken ore remaining in the stope, further drawing would have to be suspended, thus it was necessary to draw the broken ore from this stope as quickly as possible.

Due to the above mentioned narrowing of the ore body, it was necessary to leave a gap of 270' between No. 15 stope and the location of No. 19 raise. This raise was started in February and a connection was made with No. 20 stope then in progress. The primary purpose in driving No. 19 raise was to locate the southeast boundary of the merchantable ore at this point. The raise was completed to the 7th Level elevation in March for a total inclined height of 161'. The

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

analysis from this operation indicated that the material was too high in phosphorus to mine. Since that time, No. 19 raise has been converted into a ladder road for traveling between the 7th and 8th Levels, independent of the incline shaft.

No. 20 raise, started in November of 1936, was completed to the 7th Level early in 1937. Stoping immediately followed and was carried to the 7th Level elevation, an inclined distance of 138'. At this location, there is a definite widening of the ore to the northwest, the ore thickness increasing from 21' in No.19 raise to 30' in No. 20 stope. The average analysis of the broken ore showed an iron content of 60%, phosphorus .5% and sulphur 1%. After stoping operations were suspended in No. 20 stope, it was necessary to do considerable scraping from time to time to allow the ore to be drawn.

No. 23 stope, while originating on the 9th Level, has extended above the 8th and will be covered under the 8th Level heading. This stope, during 1937, produced more ore than any other four stopes during the year. No. 23 stope is located in the widest known section of the ore body and nearly parallels the lean brecciated zone which bounds the northwest end of the Mackinaw ore body. During 1936 while the stope was being worked between the 8th and 9th Levels, several bunches of lean ore were encountered on the northwest side. However, for the most part, during that period as well as the year just passed, the ore has been well above average. At the turn of the year, this stope had been carried above the 8th Level and had mined out the hanging wall portion of the level. Thereafter, each successive cut holed to and removed the floor of the previously mined No. 23 hanging wall stope. At a point 35' above the 8th Level footwall drift, a raise was started toward the 7th Level. After progressing a distance of 93' the raise was directed to the southeast and holed to the 7th Level footwall drift. Stoping operations were then resumed and carried a distance of 120' above the 8th Level. At this point, the stoping width which had previously averaged about 30' was reduced to 21'. This reduction being caused by a large horse of lean material striking about northeast. With further progress there was a definite turning of the formation to the north. In June of this year, the stope was continued in a northerly direction, and it was thought that at any time during its progress the ore would be cut off by the usual brecciated lean material that is so common in this area. The stope was extended largely for exploratory purposes at a width of 32', a height of 12' and by December a length of 220', which was the limit of scraping facilities. The result of this operation prompted the extending of the 7th and 8th Levels both above and below the stope. For a distance of approximately 100' from

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

the turn the west side of the stope was bounded by the same lean ore and slate which was previously described. With further advance, this lean material seemed to strike to the west and it has not been encountered since. At a point 90' from the bend of the stope, a raise was driven in an easterly direction holing to the hanging side of the 7th Level. Directly opposite this in the stope, a small raise was started toward the hanging, but was stopped by the hretofore mentioned lean ore which had served the west boundary of the stope thus far.

9th Level

Northwest of Incline Shaft

Comparatively speaking, the actual 9th Level has produced a very small tonnage of ore. This might be attributed to the fact that the extent of the ore southeast of the shaft was considerably less than that experienced on the levels both above and below. As on the 8th Level, the gap which marked a decided reduction in ore thickness was approximately 275'.

By the end of the year, No. 22 raise had been driven to an inclined height of 55' above the 9th Level. Operations were continued in 1937 and the raise was holed to the then 8th Level footwall drift, a distance of 180'. Stoping operations immediately followed and were carried to an inclined height of 95' where a wedge-shaped horse of jasper was encountered. However, this was found to be relatively local and stoping continued to an inclined height of 130' where the encountering of lean ore and jasper necessitated the suspension of mining operations. The stope width was carried at an average of 30' in ore approximately 32' thick.

At a point southwest of No. 22 stope on the 9th Level hanging wall drift, a raise was started to discover the ore thickness between the level and the hanging wall. However, after raising a distance of 37', a jasper hanging wall was encountered indicating that a slight roll of the hanging wall had taken place. With this knowledge, it was impossible to stope due to the flat lying formation which would entail considerable scraping.

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

10th Level

Southeast of Incline Shaft

Mining operations at this southeast end of the ore body were very disappointing throughout the year. Four raises were started preparatory to stoping and after covering a short distance toward the 9th Level, it was necessary to conclude mining operations due to the greatly reduced ore thickness.

No. 4 raise was started in January of 1937 and was driven to an incline height of 50' in ore equal to the height of the raise, or about 6'. On the whole, the phosphorus content of the ore in this region was considerably lower than that of the stoping operations to the northwest.

No. 5 raise was then started and at a height of 40' was connected with a traveling road which had also joined No. 4 raise. No. 5 raise was completed to the 9th Level late in February and due to the graphitic slate on the foot which has a tendency to swell when exposed to air, further stoping operations had to be abandoned.

No. 6 and 7 raises were started simultaneously and after raising 40' were connected by a raise and traveling road. Raising operations continued and after No. 6 had reached an inclined height of 105', operations were stopped due to the apparent pinching out of the ore by the foot and hanging. No. 7 was continued to an inclined height of 152' and holed into the hanging side of the 9th Level. Here again, the ore thickness was considerably reduced as compared to that encountered directly above on the 9th Level. Stoping operations were commenced in both Nos. 6 and 7 in an effort to mine as much ore as possible despite the fact that in some places the ore thickness was only 7'. No. 6 stope was completed to an inclined height of 88',stoping just 17' short of the top of the raise. No. 7 stope continued to the 9th Level at an average width of 36'.

No. 8 stope which was being worked at the end of the year and had reached an inclined height of 150' in ore approximately 30' thick was continued to the 9th Level. The total inclined distance being 145' and an average width of 25'. It might be added at this point that all stopes so far opened at the 10th Level elevation have had a structural weakness and for future protection as well as safe working conditions, it has been found necessary to leave a thickness of ore on the hanging wall. In some cases, after the completion of a stope, this ore would begin to slab off, exposing the graphitic slate. In a very short time this would swell and peel off, thus

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

diluting the remaining broken ore. Thus, on completing the stope, it is necessary to pull this broken ore as soon as possible.

Early in January, No. 9 stope had been advanced an inclined height of 50'. Stoping was continued and completed to the 9th Level early in February to an inclined height of 165', a width of 28' and a 30' thickness of ore. At this time, the back had already begun to slab near the bottom of the stope, thus making it necessary to convert the traveling road into a chute,and scrape the ore from the stope down a dirt compartment in the connecting raise.

Northwest of Incline Shaft

No. 11 stope, in progress at the turn of the year, was advanced to a height of 130' where it was found nedessary to suspend operations due both to the slabbing off of the hanging wall as well as the appearance of cracks in the pillar which protects the incline shaft. No further disturbance was noted and to date No. 11 stope still contains considerable broken ore.

No. 12 stope was completed in January to an inclined height of 150', a width of 30' and a stope thickness of 30'. As previously mentioned the arched back commenced slabbing, However, there was very little loss of ore inasmuch as this condition did not exist until after operations had been terminated.

No. 13 and 14 raises were commenced simultaneously in February and after being connected by a traveling road, were holed to the 9th Level, an approximate distance of 152'. These two operations produced an excellent grade of ore and have been very important in maintaining a balanced analysis in phosphorus and sulphur while ores varying in these elements were being found on the several level extensions. The stopes were completed in September and enough ore was allowed to remain below the 9th Level for a supporting pillar. Just before the completion of No. 14 stope, it was necessary, due to the slabbing hanging wall, to drive a drift from No. 15 raise holing to a point 75' above the level. This small drift entered the stope just above the graphitic slate material which had fallen from the back. Thereafter, it was necessary to scrape this ore from the stope through the drift into No. 15 chute.

No. 15 raise was started preparatory to stoping in July and later holed to the 9th Level, a distance of 178'. This operation has likewise

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7. UNDERGROUND (Cont.)

c. Stoping (Cont.)

produced an excellent grade of ore. After the completion of this raise, a drift was driven to the northwest from the traveling road, a distance of 58'. The purpose of this operation was to discover if it would be possible to start No. 16 raise in a sufficiently thick ore body. No. 16 raise location marks the northwest extremity of what is known as the central ore body and it is very evident that it will be the last stope in this direction. At a point approximately 650' northwest of No. 20 ventilation raise, a raise primarily for ventilation and traveling was started toward the 9th Level. Inasmuch as the Level at this point is almost vertically over the 10th Level, it was necessary to direct this raise toward the hanging at an angle of 56° and after a progress of 80' turn it in an easterly direction at an angle of 45°, a distance of 88'. The completion of this raise very materially improved the ventilation both on the 10th Level and 9th Level as the air in this case as well as on the levels above was able to travel along the northwest extremity of the ore body, where a majority of the operations are taking place.

In summing up developing and stoping operations at the Gardner Mackinaw Mine below the 5th Level, it might be stated that during 1937 the future stoping possibilities have been materially reduced and in contrast with past years, when developing was well in advance of stoping, the outlining of the tremendous ore body on the 10th Level has actually shown up more ore than had previously been developed in any one year since the mine's operation. Despite the fact that for the most part the ore contains considerable phosphorus, drifting is being continued in hopes that a more favorable ore may be found.

The Gardner Mackinaw Mine has always produced a graded product necessitating the mixing and balancing of high and low phosphorus and sulphur ores. Thus, the developing of a low phosphorus ore body, similar to that in the vicinity of the incline shaft, would immediately render the 10th Level ore body definitely merchantable ore.

d. Timbering
Statement of Timber Used

	Lineal Feet	Amount 1937	Amount 1936
8" to 9" Timber	2,709	177.37	194.08
10" to 12" "	5,403	510.41	176.04
12" to 14" "	1,402	192.20	350.44
14" to 16" "	54	9.58	
Total Timber	9,568	889.56	720.56

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7. UNDERGROUND (Cont.)

d. Timbering (Cont.)

	Lineal Feet	Amount 1937	Amount 1936
5' Lagging			326.25
7' Lagging	28,559	203.97	46.40
Total Lagging	28,559	203.97	372.65
9' - 6" Poles	62,456	792.40	634.62
Total Lagging and Poles		996.37	1,007.27
Product		172,823	185,954
Feet of Timber per ton of ore		.0055363	.0044332
Feet of Lagging per ton of ore		.0165250	.0349898
Feet of Lagging per foot of timber		6.5275920	7.8944321
Feet of Poles per ton of ore		.3613871	.2865547
Cost per ton for timber		n.0051473	.0038749
Cost per ton for lagging		.0011802	.0020040
Cost per ton for Poles		.0045850	.0034128
Total cost per ton - All timber		.0109125	.0092917
Equivalent of stull timber to board measure		34.4121271	29.6653926
Feet of Board measure per ton of ore		.1991177	.1595308
Total cost for timber, lagging and poles		$ 1,885.93	$ 1,727.83

SUMMARY

Year	Amount	Cost per Ton
1937	1,885.93	.0109
1936	1,727.83	.0092
1935	1,103.59	.0080
1934	1,184.87	.0212
1933	174.68	.0513
1932	238.81	.0097
1931	876.67	.0110
1930	2,300.66	.0184
1929	1,722.04	.0147

e. Drifting and Raising

	Drifting			Raising			Combined
	Ore	Rock	Total	Ore	Rock	Total	Total
1936	1,804	185	1,989	2,148	0	2,148	4,137
1937	3,480	89	3,569	2,471	0	2,471	6,040

The year 1937 was marked by a substantial increase in both raising and drifting. Very little rock work was necessary and the material from the above 89' was dumped in the old stopes. All ore produced by drifting operations was included in the mine production.

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7. UNDERGROUND (Cont.)

f. Explosives, Drilling & Blasting

Statement of Explosives Used

	Quantity	Avg.Price	Amount 1937	Amount 1936
50% Gelatine special	133,600	.1155	15,434.30	18,138.50
45% Gelex A	1,000	.1225	122.50	
Total Powder	134,600	.1155	15,556.80	18,138.50
Fuse	293,575	.5558	1,631.63	1,646.41
Caps	38,400	1.1814	453.66	593.60
Connecting Wire	36	.4000	14.40	12.80
Tamping Bags	12,350	.9919	12.25	22.76
Exploders	650	1.0064	65.42	180.22
Fuse Lighters	8,200	.6029	49.44	48.60
Total Fuse, etc.			2,226.80	2,504.39
Total All Explosives			17,783.60	20,642.89
Avg.Price per hundred for Powder			.1155	.1106
Product			172,823	184,954
Pounds of Powder per ton of ore			.7788	.8867
Tons of ore per pound of powder			1.2839	1.1338
Cost per ton - powder			.0901	.0976
Cost per ton - Fuse, caps, etc.			.0129	.0135
Cost per ton - all explosives			.1030	.1111

Summary showing percentages of different grades of powder used during the past six years:

99.3% of all powder used in 1937 was	50%
.7% of all powder used in 1937 was	45%
100.0% of all powder used in 1936 was	50%
95.1% of all powder used in 1935 was	50%
4.9% of all powder used in 1935 was	60%
11.2% of all powder used in 1934 was	50%
88.8% of all powder used in 1934 was	60%
100.0% of all powder used in 1933 was	60%
26.6% of all powder used in 1932 was	40%
4.3% of all powder used in 1932 was	45%
56.5% of all powder used in 1932 was	50%
12.7 of all powder used in 1932 was	60%

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m

7. UNDERGROUND (Cont.)

f. Explosives, Drilling & Blasting (Cont.)

The following summary shows the cost per ton for explosives for the past seven years, exclusive of rock development:

Year	Cost per Ton	Product
1937	.1030	172,823
1936	.1111	185,954
1935	.0863	138.471
1934	.1188	78,353
1933	.1688	3,405
1932	.0841	24,769
1931	.1959	79,439

The decrease in cost per ton in 1937 over 1936 was due to less powder used per ton and a lower cost per pound for powder.

i. Ventilation

There was no apparent change in the ventilation during the year and with the greater amount of work in the northwest end, air raises were driven between the various levels to aid the ventilation in this section. The Mackinaw shaft by natural circumstances is downcast, which is most satisfactory as this is both the ore and man shaft. The Gardner shaft is upcast. This may be reversed, however, by the operation of the electric fan on the 3rd Level of the Gardner Mine.

j. Faults

The fault contact which apparently was thought to form the northwest boundary of the ore body, was intersected by the 7th, 8th and 10th Levels. Considerable ore was found to the north of this zone, but as yet no sharply defined contact has been disclosed.

k. Pumping

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

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7. UNDERGROUND (Cont.)

k. Pumping (Cont.)

Month	1937	1936	1935	1934	1933	1932
January	123	137	143	174	210	241
February	121	126	142	169	205	223
March	119	130	138	170	205	236
April	119	130	138	166	203	244
May	117.9	133	140	158	181	231
June	118	125	140	156	184	223
July	115	130	137	147	181	225
August	98	123	134	155	180	222
September	106	124	135	149	172	128
October	114	124	135	143	199	218
November	112	119	134	149	224	215
December	117	123	133	146	221	211
Total Avg.	115	127	138	157	196	225

8. COST OF OPERATING

a. Comparative Mining Costs

	1937	1936	Incr.	Decr.
Product - Tons	172,823	185,954		13,131
Underground Costs	1.177	1.091	.086	
Surface Costs	.277	.225	.052	
General Mine Accounts	.224	.171	.053	
Cost of Production	1.678	1.487	.191	
Depreciation-Plant Acct.	.032	.051		.019
Depreciation-Dev. "	.033	.051		.018
Taxes	.023	.020	.003	
Cost on Stockpile	1.766	1.609	.157	
Loading and Shipping	.093	.061	.032	
Adjustment Supply Inventories	.000	.006		.006
Total Cost on Cars	1.859	1.676	.183	
Number of days operating	225	287	62	
Number of shifts and hours	3-8 hr.	3-8 hr.		
Average daily product	768	648	120	
Cost of Production				
Labor	1.063	.907	.156	
Supplies	.615	.580	.035	
Total	1.678	1.487	.191	

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8. COST OF OPERATING(Cont.)

b. Detailed Cost Comparison

	1937	1936	Increase	Decrease
Days per Week	5	5		
Shifts and Hours	3-8 hr.	3-8 hr.		
Production, Tons	172,823	185,954		13,131
Average Daily Production, Tons	768	648	120	
Number of Days Worked	225	287		62

Underground Costs	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton	Amount	Per Ton
1. Exploring in Mine	372.99	.002	138.15	.001	234.84	.001		
2. Sinking in Shaft			14,652.99	.079			14,652.99	.079
4. Development in Ore	57,928.90	.335	45,500.65	.245	12,428.25	.090		
5. Stoping	59,580.92	.345	66,126.25	.356			6,545.33	.011
6. Timbering	12,370.35	.072	9,912.28	.053	2,458.07	.019		
7. Tramming	42,912.63	.248	39,101.57	.210	3,811.06	.038		
8. Ventilation	20.75	.000	295.26	.002			274.51	.002
9. Pumping	10,016.55	.058	9,341.93	.050	674.62	.008		
10. Compressors & Air Pipes	3,593.49	.021	2,629.53	.014	963.96	.007		
12. Underground Suptnce.	7,918.92	.046	6,914.25	.037	1,004.67	.009		
14. Maint.Compressors & Power Drills	572.57	.003			572.57	.003		
15. Maint.Hand Tram.Scrapers	1,513.73	.009	1,151.17	.006	362.56	.003		
16. Maint.Elec.Tram Equipt.	5,622.63	.033	6,082.74	.033			460.11	.000
17. Maint.Pumping Machinery	928.64	.005	917.94	.005	10.70	.000		
Total Underground Costs	203,353.07	1.177	202,764.71	1.091	588.36	.086		
Surface Costs								
18. Hoisting	21,389.62	.124	19,384.53	.103	2,005.09	.021		
19. Stocking Ore	4,627.82	.027	3,851.04	.021	776.78	.006		
21. Dry House	5,048.93	.029	3,989.45	.021	1,059.48	.008		
22. General Surface Expense	1,098.92	.006	1,289.46	.007			181.54	.001
23. Maint.Hoisting Equipt.	7,010.62	.041	8,334.83	.045			1,324.21	.004
24. Maint.Shaft	3,662.28	.021	354.55	.002	3,307.73	.019		
25. Maint.Top Tram Equipt.	904.11	.005	1,096.48	.006			192.37	.001
26. Maint. Docks,Trestles,etc.	1,264.12	.007	573.93	.003	609.19	.004		
27. Mine Buildings	2,818.09	.017	3,099.09	.017			281.00	.000
Total Surface Costs	47,824.51	.277	41,964.36	.225	5,860.15	.052		
General Mine Expense								
Vacation payroll	2,829.90	.016	2,432.04	.013	397.86	.003		
Safety Awards	312.00	.002	190.00	.001	122.00	.001		
28. Insurance	2,609.98n	.015	1,198.21	.007	1,411.77	.008		
29. Mining Engineering	2,019.52	.012	1,189.98	.006	829.54	.006		
30. Mech.& Elec.Engrg.	323.70	.002	244.55	.001	79.15	.001		
31. Analysis & Grading	4,560.86	.026	3,843.47	.021	717.39	.005		
32. Personal Injury	4,176.71	.024	3,896.09	.021	280.62	.003		
33. Safety Department	517.65	.004	446.12	.002	71.53	.002		

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

	1937 Amount	1937 Per Ton	1936 Amount	1936 Per Ton	Incr. Amount	Incr. Per Ton	Decr. Amount	Decr. Per Ton
34. Telephones & Safety Dev.	540.93	.003	284.87	.002	256.06	.001		
35. Local & Gen.Welfare	1,537.50	.009	1,590.38	.009			52.88	.000
36. Spec.Exp.Pensions,Allow.	2,276.43	.013	3,856.31	.020			1,579.88	.007
37. Ishpeming Office	5,749.00	.003	6,622.92	.036			873.92	.003
38. Unemployment Ins.Tax	5,715.41	.033	1,763.74	.010	3,951.67	.023		
39. Mine Office	5,581.03	.032	4,171.80	.022	1,409.23	.010		
Total Gen.Mine Expense	38,750.62	.224	31,730.48	.171	7,020.14	.053		
COST OF PRODUCTION	289,928.20	1.678	276,459.55	1.487	13,468.65	.191		
40. Taxes	3,903.33	.023	3,749.96	.020	153.37	.003		
TOTAL COST	293,831.53	1.701	280,209.51	1.507	13,622.02	.194		
41. General Supplies	5,257.03	.030	5,942.70	.032			685.67	.002
42. Iron & Steel	2,565.90	.015	4,575.41	.025			2,009.51	.010
43. Oil & Grease	1,312.36	.008	1,106.06	.006	206.30	.002		
44. Machinery Supplies	8,171.58	.046	6,632.63	.036	1,538.95	.010		
45. Explosives	17,783.60	.103	20,592.19	.111			2,808.59	.008
46. Lumber & Timber	5,847.99	.034	4,164.85	.022	1,683.14	.012		
47. Fuel	2,366.91	.014	1,899.32	.010	467.59	.004		
48. Electric Power	32,060.58	.185	37,286.97	.200			5,226.39	.015
49. Sundries	3,722.54	.022	2,638.70	.014	1,083.84	.008		
50. Other Mines & Accts.	568.26	.003	427.90	.002	140.36	.001		
Total per Cost Sheet	78,520.23	.454	84,410.93	.454			5,890.70	.000

Comparative Supply Balance

	1-1-38	1-1-37	Incr.	Decr.
1. General Supplies	1,661.42	2,512.25		851.83
2. Iron & Steel	534.76	376.47	158.29	
3. Oil & Grease	198.02	277.56		79.54
4. Machinery Supplies	1,770.52	1,830.59		60.07
5. Explosives	0	6.78		6.78
6. Lumber & Timber	3,106.62	2,292.60	814.02	
7. Fuel	1,907.66	1,793.17	114.49	
Total	9,179.00	9,089.42	89.58	

1. Exploring in Mine
Ishpeming office charge.

2. Sinking in Shaft
No shaft sinking was done during 1937.

3. Development in Ore
Extensive development,raising, drifting,etc. in 1937, also large increase in wages.

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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

5. Stoping
Decrease due to curtailment of operations, July 10 to Aug. 30 inclusive.

6. Timbering
More timbering of drifts, etc. plus wage increase, resulting in increase as shown.

7. Tramming
Increase due to 80¢ per day increase in wages effective Mar. 16, 1937

8. Ventilation
In 1936 a new ventilating fan was installed on 3rd Level Mackinaw Mine, explaining large decrease for 1937.

9. Pumping
More expense for pumping account increase in wages.

10. Compressors & Air Pipes
More extensions to air lines.

12. Underground Superintendence
Large increase due to increase in wages from 72½¢ per hour to $175.00 per month and bonus effective May 16, 1937.

14. Maintenance, Compressors & Power Drills
Three new Auger drill machines purchased in 1937.

15. Maint: Scrapers
More repairs to scraper hoists, etc. during 1937.

16. Maint: Electric Tram Equipment
Less repairs to U.G. cars and locomotives during the year.

17. Maint: Pumping Machinery
About same amount expended on repairs to pumping machinery for both 1937 and 1936.

18. Hoisting
Increase due primarily to increase in wages of 80¢ per day or shift, effective May 16.

19. Stocking Ore
More ore stocked in 1937, viz: 89,433 in 1937, 74,607 in 1936.

GARDNER MACKINAW MINE
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YEAR 1937

8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

21. Dry House
More fuel used and wage increase from $4.00 to $5.00 per shift, effective Mar.16,1937.

22. General Surface Expense
Less improvements to mine premises in 1937.

23. Maint: Hoisting Equipment
Less repairs to hoisting equipment during 1937.

24. Maint: Shaft
While mine was idle from July 10 to Aug. 30 heavy repairs were made to skip-road,incline shaft, which accounts for increase.

25. Maint: Top Tram Equipment
Less repairs to top tram equipment in 1937.

26. Maint: Docks, Trestles & Pockets
Extensive repairs to permanent trestles in 1937.

27. Mine Buildings
During 1936, ferro board was put on Mackinaw shaft house, while only painting of shaft house was undertaken in 1937, resulting in decrease in this item.

Vacation Expense
Increase due to increase in wages of 80¢ per shift.

Safety Awards
In 1936 $190 was allowed for Safety Awards. In 1937 $40.00 per month was allowed when no lost time accident occurred, which resulted in an increase of $122.00 over 1936.

28. Insurance
Ishpeming office charge.

29. Mining Engineering
More engineering work done due to more extensive development in raises, drifts, etc.

30. Mechanical & Electrical Engineering
Ishpeming office charge.

31. Analysis and Grading
Large increase due to more determinations made and samples now being hauled by station wagon to Ishpeming laboratory every operating day instead of mailing same in powdered form.

GARDNER MACKINAW MINE
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8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

32. Personal Injury
Ishpeming office charge.

33. Safety Department
More safety supplies used.

34. Telephones & Safety Devices
Heavy repairs and extensions to telephones & U.G. lighting system in 1937.

35. Local and General Welfare
Ishpeming office charge.

36. Special Expense, Pensions & Allowances
Ishpeming office charge

37. Ishpeming Office
Ishpeming office charge.

38. Unemployment Insurance Tax
Ishpeming office charge

39. Mine Office
Increase in salaries and employing supply clerk full time.

40. Taxes
Ishpeming office charge.

41. General Supplies
Less general supplies used due to curtailment, July10 to Aug. 30.

42. Iron & Steel
Less iron and steel used due to curtailment.

43. Oil and Grease
More gasoline consumption account of shipping season, etc.

44. Machinery Supplies
Three new auger drills, several new hoisting ropes, 1" and 2" air pipe for air line extensions and 8 ft. bicycle sheave, all charged out in 1937.

45. Explosives
Less explosives used due to curtailment.

GARDNER MACKINAW MINE
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YEAR 1937

8. COST OF OPERATING (Cont.)

b. Detailed Cost Comparison (Cont.)

46. Lumber and Timber
More timber used due to erecting portable trestle and timbering drifts, etc. in 1937.

47. Fuel
Fuel consumption larger and increased price of coal.

48. Electric Power
Less current used account mine practically idle for period July 10 to August 30.

9. EXPLORATIONS AND FUTURE EXPLORATIONS

A rather odd condition was found to exist in the lower levels as a result of the development during the year. The 7th and 8th Levels were extended approximately 360' during the year. This work disclosed an average ore thickness of about 50' in a northerly direction. However, there is reason to believe that a large cherty horse has divided the ore body in this area in two parts. The rodk exploration drift on the 7th Level is being driven into this cherty horse and further knowledge may be gained in the near future. On the 9th Level, an entirely different condition was found to exist. This level was extended 350' to the northwest, disclosing an ore thickness of only 25' about 300' west of the 8th Level ore body. Further exploration at the extreme northwest end may bring to light another ore body, however, this work has not been started as yet. The northwest end of the 10th Level which is just 122' below the 9th Level, is in ore well over 200' thick. Therefore, it is rather apparent that the ore on the 7th and 8th Levels is segregated from that on the 9th and 10th Levels. It may be necessary during the coming year to explore this region by the use of diamond drills.

10. TAXES

	1937		1936	
GARDNER MINE - C.&.N.W.LEASE	Valuation	Taxes	Valuation	Taxes
SE¼ of SE¼, Sec.35,45-25.....	2,000	36.79	5,000	92.55
NE¼ of SW¼, Sec.35,45-25.....	1,000	18.39	80	1.48
NW¼ of NE¼, Sec. 2,44-25.....	1,000	18.39	80	1.48
Personal Property.....	125,000	2,299.00	90,000	1,665.94
Total.....	129,000	2,372.57	95,160	1,761.45
Collection Fees.....		23.72		17.61
Total Taxes.....		2,396.29		1,779.06

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10. TAXES (Cont.)

MACKINAW MINE - D.M.& N.LEASE	1937 Valuation	1937 Taxes	1936 Valuation	1936 Taxes
N½ of SE¼ & SW¼ of SE¼,Sec.35,45-25	80,000	1,471.43	105,000	1,943.47
S½ of SW¼ of Sec.35,45-25.....1....	1,125	20.69	250	4.62
Total.....	81,125	1,492.12	105,250	1,948.09
Collection Fees.....		14.92		19.48
Total Taxes		1,507.04		1,967.57
Total Gardner Mackinaw Mine	210,125	3,903.33	200,410	3,746.63

11. ACCIDENTS AND PERSONAL INJURY

Early in the year two minor accidents occurred in the mine. One was the result of loose material falling from the back of a stope and injuring the miner's legs, the other while repairs were being made in the incline shaft. In this case the workman's left arm was caught between the skip and the hanging wall timbers. Since that time, no other accidents have occurred.

In 1937 the Gardner Mackinaw Mine once more stood at the head of the list of Company mines, having the best safety record. The mine is now flying one of the banner safety flags given out by the Company to represent its record. This is particularly encouraging due to the fact that the type of mining being used in the Gardner Mackinaw Mine is considerably more hazardous than in any of the other mines.

12. NEW CONSTRUCTION AND PROPOSED NEW CONSTRUCTION

There was no new construction during the year and thus far no new construction contemplated for 1938 except for the usual maintenance at the mine buildings and crusher.

13. EQUIPMENT AND PROPOSED EQUIPMENT

a. Steam Shovels
Necessary repairs to steam shovels were made in the spring before the opening of navigation. There were no serious delays due to this equipment during the season.

b. Stockpile Trestles
Shipments from the Mackinaw stockpile were not as large as anticipated and it was necessary to erect 21 bents to provide room for the winter stocking.

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13. EQUIPMENT AND PROPOSED EQUIPMENT

c. Pumping Equipment
When the Mine was shut down during July and August, an electric pump was installed on the 10th Level plat. This was operated when the compressor was not running but as the sump was the main shaft, its use was discontinued when the mine started operating on regular schedule.

d. Hoist at Incline Shaft
There were no serious delays due to the incline shaft hoist during the year.

e. Compressor
As mentioned in last year's report, the mine is equipped with but one compressor. This is sufficient to supply the air needed but as several coils burned out several years ago, it is expected that we may have trouble at any date. A supplementary compressor of smaller capacity should be provided for emergency service.

15. POWER

Electric power was furnished by the Cliffs Power & Light Company at varying rates throughout the year. The detail of power used in 1937 and 1936 follows:

K.W.H. USED

	1937	1936	Incr.	Decr.	Remarks
Gardner Hoist	0	0			Mine idle
Mack.Hoist & Lighting	367,319	412,484		45,165	Curtailment 7/10-8/3
Compressors	1,232,290	1,552,290		320,000	"
Electric Haulage	171,400	155,710	15,690		Repr.Incline Shaft
Shops	2,928	3,100		172	Curtailment
Top Tram Mackinaw	26,099	11,571	14,528		
Underground Hoist	149,520	177,860		28,340	Curtailment
Pumping & Lighting	210,588	274,121		63,533	"
Analysis (crusher)	71	120		49	"
" (drier)	9,480	12,597		3,117	
Flood Light-Mackinaw	0	1,595		1,595	
Heating Plant	1,659	1,585	74		
Dry House	3,689	3,736		47	
Office	526	566		40	
Timbering	2,100	2,490		390	
Total	2,177,669	2,609,825		432,156	
In Cash	$32,060.58	$37,286.97		$ 5,226.39	
Cost per KWH	.0147	.0142			

GARDNER MACKINAW MINE
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17. CONDITION OF PREMISES

The premises were kept as neat and clean as possible and the flowers, shrubs and trees which were planted in 1936 have been maintained by the surface crew.

18. NATIONALITY OF EMPLOYEES

As to Parentage	1937	%	1936	%
English	10	6.8	12	7.5
Finnish	50	34.2	49	30.6
Italian	29	19.9	43	26.9
Swedish	19	13.0	19	11.9
Canadian (French)	19	13.0	22	13.8
German	3	2.1	4	2.5
Norwegian	10	6.8	7	4.4
Dutch	2	1.4	1	.6
Belgian	2	1.4	2	1.2
Austrian-Hungarian	2	1.4	1	.6
Total	146	100.0%	160	100.0%

As to Birth	Total		American Born		Foreign Born	
	1937	1936	1937	1936	1937	1936
English	10	12	5	7	5	5
Finnish	50	49	20	18	30	31
Italian	29	43	10	15	19	28
Swedish	19	19	10	11	9	8
French-Canadian	19	22	15	15	4	7
German	3	4	3	4	0	0
Norwegian	10	7	7	5	3	2
Dutch	2	1	2	1	0	0
Belgian	2	2	2	1	0	1
Austrian-Hungarian	2	1	0	0	2	1
Total	146	160	74	77	72	83
Percentages			51%	48%	49%	52%

GWINN DISTRICT GENERAL
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1. GENERAL

The general conditions and activities in the Gwinn District remained about the same as a year ago.

From January 1st, 1937 to July 1st, 1937, the Mackinaw Mine worked five days per week, three eight hour shifts per day, two of which were mining and three shifts hoisting.

On July 10th, 1937, the mine was shut down. A few men were retained for repairs to the incline shaft and also for repairing the Princeton No. 3 timber shaft. The balance were transferred to the Ishpeming and Negaunee Districts to replace the men who were taking their weekly vacations. The mine resumed operations again on August 30th, 1937 and continued on its regular schedule of five days, three shifts per week, until October 8th. On that date the working schedule was reduced to two shifts per day, five days per week, until December 8th. On this date the number of shifts per week were kept the same but the men were only permitted to work four days per week. This schedule permitted our increasing the number of men employed by about 30.

Due to the mine being shut down during the period mentioned above, the mine operated 4,319½ less days in 1937 than in 1936, as shown under heading No. 5, "Labor and Wages."

Several small timber jobbers operated in the district during the year, getting out pump wood, etc. Emil Railo, who bought a large stumpage from the Land Department south of the Gardner Mackinaw Mine, is still operating. He is employing about 125 men.

C.C.C. Camp #1620 located about 18 miles west of Gwinn, continued operating throughout the year.

The Gwinn State Savings Bank showed an increase of about $40,000 in deposits over the previous year. The year 1936 showed an increase of about $48,000 over 1935 and 1935 increased $24,000 over 1934. The total deposits on December 22nd, 1937 were $419,371.52.

The Gwinn School continued its full time schedule throughout the year. The 1935-1936 enrollment was 638 as compared with 621 for 1936-1937. During the year the ventilating system was changed and modern equipment installed. In addition to this, a new roof was placed on the building.

Arrangements were made this year whereby the Wells Township schools are transporting 21 pupils to the Gwinn school. The work of transporting these pupils is assumed by the Wells Township School District. In addition to this, there are 26 students from the Carlshend District, Skandia Township, who are attending school in Gwinn.

GWINN DISTRICT GENERAL
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1. GENERAL (Cont.)

The Gwinn Theater, located in the east store of the hotel block, was operated throughout the year by J. L. LeDuc. High class pictures are shown and the attendance has been very satisfactory. The rent revenue for the year for this room amounted to $420.00.

On March 9, 1937, a combination restaurant and store was started in the vacant store room next to the theater. This was discontinued in August 1937. The rent revenue received from this amounted to $123.75.

During the year a new, modern theater, known as the "Hiawatha" was erected by Adolph Peterson, and its opening was held on December 16th. This is a very creditable theater, is air-conditioned, has modern lighting effects and very comfortable seating.

The Marquette County Road Commission constructed a new fence along the north side of the highway where it parallels the East Branch of the Escanaba River near the Railroad station. This is neat in appearance and gives needed protection at this point.

John Mussatto, who operates the Phillips 66 Gas station on Pine Street, erected a new fire proof garage adjoining the gas station.

During 1937 the following Company houses were sold at the Gardner Mackinaw Location: Cottage No. 3; Capt. House No. 18; Double House No. 7 and 9; Double House 44 and 45; Double House No. 6 and 8; Double House No. 2 and 4.

There are now only the following houses remaining on the property: Double House No.46 and 47 which will be dismantled early in December. This work will be done by company carpenters and the lumber saved will be used for repairing houses at other locations in the district; Cottage No. 1 and Cottage No. 2.

Houses sold in the Austin Location were Double House No. 5 and 6; and Double House No. 38 and 39.

In the Gwinn Townsite, House No. 111, Maple Street, known as "Peterson House", located on Lot 1 of Block 14, was sold.

John Duca, who operates the Gwinn Oil Station on the southwest side of Pine Street in Block 4, secured a lot on either side of his station for the purpose of widening the driveways.

During the year 8 cars of coal were purchased through the company and distributed to 112 families in the district.

In September a fire started in the business section of the town of McFarland, located about 15 miles south of Gwinn. The Gwinn Fire Department was called upon and through its efforts saved the little town.

GWINN DISTRICT GENERAL
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1. GENERAL (Cont.)

a. Statement Showing Total Ore Produced in District by C.C.I.Co. 1903 to 1937 Inclusive.

Year	AUSTIN	PRINCETON	STEPHENSON	GWINN	FRANCIS	GARDNER MACKINAW	TOTAL
Total to 1937	1,589,018	1,584,333	3,835,157	988,665	504,667	1,067,471	9,569,311
1937						172,823	172,823
	1,589,018	1,584,333	3,835,157	988,665	504,667	1,240,294	9,742,134

b. Statement Showing Total Ore Shipments by C.C.I.Co. from 1905 to 1937

Year	AUSTIN	PRINCETON	STEPHENSON	GWINN	FRANCIS	GARDNER MACKINAW	TOTAL
Total to 1937	1,589,018	1,454,564	3,718,089	988,325	452,296	1,000,382	9,202,674
1937	-	8,813	35,806	0	36,366	152,616	233,601
	1,589,018	1,463,377	3,753,895	988,325	488,662	1,152,998	9,436,275

c. Ore In Stock at Mines, December 31, 1937

Princeton	Stephenson	Francis	Gardner Mackinaw	Total
120,956	75,272	16,005	90,692	302,9255

5. LABOR AND WAGES

The number of shifts worked by employees in the district in 1937 was 31,489½ as compared with 35,809 in 1936.

There was a general increase in wages effective March 16, 1937. Surface labor was increased 12½¢ per hour or 25%, changing the rate from $4.00 to $5.00 per eight hour day.

Other labor was increased 10¢ per hour or 80¢ per eight hour day.

10. TAXES

The following statement gives the taxes in detail for 1937 and 1936 for all company properties in the district. The mine taxes, in the summary, shows totals only, as the detail for each mine is included in the mine report.

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

GWINN DISTRICT GENERAL
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YEAR 1937

10. TAXES (Cont.)

Forsyth Township Mineral Lands, Gwinn	1937 Valuation	1937 Taxes	1936 Valuation	1936 Taxes
SW¼ of SW¼ of Sec.26,45-25, 45 A.	100	1.85	80	1.48
S½ of SE¼ of Sec. 27,45-25, 80 A.	Land Dept.		160	2.96
NW¼ of SE¼ of Sec.27,45-25, 40 A.	"	"	80	1.48
NE¼ of SE¼ of Sec.28,45-25, 40 A.	100	1.85	80	1.48
N½ of NE¼ of Sec. 34,45-25, 80 A.	200	3.68	160	2.96
SE¼ of NE¼ of Sec.34,45-25, 40 A.	100	1.85	80	1.48
NE¼ of NW¼ of Sec.34,45-25, 40 A.	100	1.85	80	1.48
NE¼ of SE¼ of Sec.34,45-25, 40 A.	100	1.85	80	1.48
NW¼ of Section 35, 45-25, 160 A.	400	7.35	320	5.92
Lots 1,2 & 3, Sec. 36,45-25,52 A.	125	2.31	105	1.96
Lots 7, 8 & 9,Sec. 36,45-25,98.92 A.	260	4.80	210	3.89
Lot 11, Section 36,45-25, 13.3 A.	25	.45	20	.37
S½ of N½ of Sec. 22,45-25, 160 A.	500	9.20	500	9.26
S½ of NE¼ of Sec. 28,45-25, 80 A.	142	2.62	130	2.41
N½ of NW¼ of Sec. 22,45-25, 87.08 A.	100	1.84	90	1.66
NE¼ of Section 2,45-25 165.61 A.	200	3.67	190	3.51
Total	2,452	45.17	2,365	43.78
Collection Fee		.45		.44
Total Taxes		45.62		44.22
Gwinn Townsite - Surface Only				
NE¼ of SW¼,Sec.21,45-25, not included in Plat, 6 acres.....	100	1.85	100	1.86
NE¼ of SW¼,Sec.21,45-25, 27.4 acres	150	2.76	150	2.77
That part of S½ of NW¼,Sec.21,45-25 not included in Plat of Gwinn,25.01 A.	200	3.68	200	3.70
E½ of SE¼ of Sec.21,45-25, 65.84 A.	150	2.76	140	2.59
That part of W½ of SE¼,Sec.21,45-25 not included in Plat of Gwinn,38.80 A.	300	5.52	300	5.56
Gwinn Townsite Plat.....	89,345	1,645.74	89,345	1,654.20
Part of W½ of SE¼,Sec.21,45-25, Supts. residence, 1/2 acre.....	3,000	55.18	3,000	55.53
NW¼ of NE¼,Sec.21,45-25, except 5 acres in cemetery, 35 acres.....	100	1.85	100	1.86
Part of S½ of NE¼,Sec.21,45-25,50.99A.	300	5.52	300	5.56
Lot 20, Block 7 (Previous years)...				3.92
Total	93,645	1,724.86	93,635	1,737.55
Collection Fee		17.24		17.34
Total Taxes		1,742.10		1,754.89

GWINN DISTRICT GENERAL
ANNUAL REPORT
YEAR 1937

10. TAXES (Cont.)

	1937		1936	
Gardner Mackinaw Dwellings	Valuation	Taxes	Valuation	Taxes
N½ of NE¼ of Sec.35,45-25, 87.35 A.	5,000	91.97	5,000	92.55
Collection Fee		.92		.93
		92.89		93.50
Central Water Plant,NW¼ of NE¼ of Sec.28,45-25	400	7.42	400	7.47
Personal District Office	500	9.29	500	9.34
District Crusher,N½ of NW¼,Sec.27, 45-25	1,000	18.57	1,000	18.70
	1,900m	35.28	1,900	35.51
Austin Location				
Part of Lot 5,SW of NE,Sec.20,45-25	3,500	64.37	3,500	64.77
NW¼ of SE¼ of Sec.2,45-25	5,000	91.97	5,000	92.55
NE¼ of SW¼ of Sec.20,45-25 BH	260	4.78	260	4.81
Total	8,760	161.12	8,760	162.13
Collection Fee		1.61		1.62
Total Taxes		n162.73		163.75
Summary				
Stephenson Mine	127,100	2,361.00	127,060	2,375.14
Princeton Mine	246,260	4,574.98	236,260	4,416.66
Francis Mine	63,000	1,173.27	100,500	1,881.84
Gardner Mackinaw Mine	210,125	3,901.84	200,410	3,746.63
Austin Location	8,760	162.73	8,760	163.75
Mineral Lands	2,452	45.62	2,365	44.22
Gwinn Townsite	93,645	1,742.10	93,635	1,754.89
Gardner Mackinaw Location	5,000	92.89	5,000	93.48
Central Water Plant	400	7.42	400	7.47
Personal District Office	500	9.29	500	9.34
District Crusher	1,000	18.57	1,000	18.70
Total C.C.I.Co. Including 1% Fee	758,242	14,089.71	775,890	14,512.12
Less: Francis,Paid by Cleveland		2.98		2.98
Lot 2,Block 7, Previous Yrs.				3.92
Refund: C.& N.W.(NE of SE,Sec.35		1.49		
To pay1		14,088.22		14,512.12
The Cliffs Power & Light Co.	98,600	1,831.97	98,191	1,835.69
	856,842	15,920.19	874,081	16,347.81

GWINN DISTRICT GENERAL
ANNUAL REPORT
YEAR 1937

10. TAXES (Cont.)

Taxes Levied - Forsyth Township

	1937	1936	1935	1934
Forsyth Township Valuation....	1,446,395	1,429,110	1,478,347	1,469,033
Rate pern $100.00.....	1.839	1.851	1.851	2.206
Amount of Tax Roll				
State Tax.....			7.61	852.48
County Tax.....	9,437.28	10,003.77	10,130.05	9,136.94
County Debt Service.....	405.87	494.36	548.03	800.00
County Road.....	2,375.04	928.92	1,114.30	734.52
Township Tax.....	3,635.11	4,215.87	4,368.58	4,700.91
Township Debt Service.....	805.86	800.00	818.23	
School.....	6,344.02	6,288.08	6,684.35	6,610.64
School Debt Service.....	3,712.87	3,704.48	3,742.34	9,000.00
Road Repair Tax.....			3.81	
Highway Improvement Tax.....			3.66	
Rejected.....		187.92		175.76
Total.....	26,716.05	26,623.40	27,420.96	32,011.25
Amount paid by C.C.I.Co.....	15,920.19	16,347.81	16,798.32	
Percent paid by C.C.I.Co	59.59%	60.08%	60.66%	

16. WATER SUPPLY
GWINN DISTRICT

The pumping plant at the Kidder shaft, has been in commission about one year. It has two pumps, a 1,000 gallon Layne-Western and a 500 gallon Ingersoll-Rand Cameron. The latter was part of the equipment of the old Escanaba River pump station. These pumps can be operated together or separately. At the present time, the 500 gallon pump is taking care of the load satisfactorily, feeding the mains supplying Gwinn and the Austin Location and also the booster pump, located at the Austin Location. The latter supplies the central office and the Princeton location.

The new system is giving an excellent supply of clear water which requires no chlorinization. Samples are sent weekly to the State Health Department laboratory at Houghton.

The cost of operating the new pumping station for 1937 showed an increase of $1781.11 over the cost of operating the Escanaba River station in 1936. The main reason for this increase was due to installing a new iron main from the Austin booster station through to the Princeton Location. Since this new pipe has been put in, the

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YEAR 1937

16. WATER SUPPLY
GWINN DISTRICT

cost for repairs to water mains, also cost of electric current consumed at the Pumping Plant, has decreased very materially. It has made the pumping facilities beyond the Austin booster station more satisfactory, in that a more regular pressure has been maintained; water has beem distributed with only the 500 gallon centrifugal pump.

The wood mains of the water system were installed thirty years ago and are giving continual trouble due to leaks. By cutting down the pressure and the use of the booster pump, it is expected thw cost of main line repairs will be greatly reduced.

The old road to the Kidder mine which formerly ran along side of the new pumping plant has been changed. A new road some distance from the plant has been graded, thus eliminating a possible source of contamination.

The following gives the cost of operating pump station for the years 1937 and 1936:

	1937	1936	Incr.	Decr.
General Expense	38.35	59.15		20.80
Maintenance Labor	2,363.88	1,375.87	988.01	
" Material	2,034.77	554.02	1,480.75	
Operating Labor	607.85	1,783.91		1,176.06
Operating Supplies	5,461.12	4,951.91	509.21	
Total	10,505.97	8,724.86	1,781.11	

General Expense
The small decrease in this account is from the fact that the rate for telephone rental is less at the new pump station.

Maintenance Labor
The increase is due to more repairs to water lines in 1937 and laying a new iron pipe from the Austin booster station through to the Princeton location.

Maintenance Material
The increase here is the same as under Maintenance Labor.

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YEAR 1937

16. WATER SUPPLY
GWINN DISTRICT (Cont.)

Operating Labor
The decrease in this account is due to less attendance labor necessary at the new pump station in Gwinn, as compared with the old pump station at Princeton.

Operating Supplies
The increase is practically all for electric power, and was accumulated during the first few months the new pumping plant was in operation. It has been noticed that since the new pipe lines have been laid from Austin to Princeton Location, the pressure has been cut down and the 1000 gallon pump used only occasionally.

Operating costs were charged off as follows:

	1937	1936
1. C. C. I. Mines	127.50	22.50
2. Water Charges Receivable	2,230.51	2,122.21
3. Gwinn Townsite Expense General	8,147.96	6,580.15
	10,505.97	8,724.86

17. CONDITION OF PREMISES

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

Gwinn Townsite	1937	1936	1935	1934
Number of Houses (122)				
Rents Accrued	11,590.99	10,391.71	7,604.74	7,708.63
Repair Expense (1)	14,887.99	5,945.19	2,558.91	1,508.26
Accrued rent over repair cost	3,297.00	4,446.52	5,045.83	6,200.37
Actual rent collections	11,123.67	9,095.45	6,162.81	5,636.79
Amount credited by men owing back rent	276.54	632.29	2,095.93	
Total Collection	11,400.21	9,727.72	8,258.74	

Single House #111 Maple Street, located on Lots 1 and 2, Block 14 was sold to E. E. Bjork.

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17. CONDITION OF PREMISES

In the Gwinn Townsite, during the year 12 double houses were raised and new sills, set on concrete posts, were installed.

Fourteen double houses and four single houses were painted. Exterior woodwork on the Gwinn Hotel Block, Bank Building and Club House buildings was also painted.

Practically no painting of company houses has been done in Gwinn for years. All were in bad condition and this summer's work not only preserved the houses but added greatly to their appearance.

During the coming year twelve or fourteen houses should be levelled up and painted in Gwinn and three or four in the Austin Location.

Austin Location	1937	1936	1935	1934
Number of Houses (41)	37	32	32	30
Rents Accrued	1,684.08	1,463.97	1,168.25	1,114.00
Repair Expense (1)	1,441.05	436.30	1,328.68	92.63
Accrued rent over repair cost	243.03	1,027.67	160.43	1,021.47
Actual rent collection	1,710.07	1,596.49	1,022.13	909.00
Amount credited by men owing back rent (2)	0	7.04	294.28	
Total Collection	1,710.07	1,603.53	1,316.41	909.00

Princeton Location	1937	1936	1935	1934
Number of Houses (13)-Occupied	9	9	11	10
Rents Accrued	596.00	581.90	437.50	495.00
Repair Expense (1)	468.40	165.99	436.66	80.11
Accrued rent over repair Cost	127.60	415.91	.84	414.89
Actual rent collection	635.00	471.59	458.00	427.50
Amount credited by men owing back rent (2)	0	7.04	114.18	
Total collection	635.00	578.63	572.18	427.50

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YEAR 1937

17. CONDITION OF PREMISES (Cont.)

Gardner Mackinaw Location	1937	1936	1935	1934
Number of Houses (4)				
Number occupied	0	2	5	5
Rents accrued	104.00	279.90	245.50	257.50
Repair Expense	15.27	91.00	88.21	27.79
Accrued rents over repair cost	88.73	188.90	157.29	229.71
Actual Rent collections	80.98	237.90	262.00	277.00

During the year were sold Double Houses Nos. 2-4;6-7;8-9;44-45; also single house #18, known as Captains House, and Cottage #3.

Statistical Statement of Rented Buildings 1937

Location	Vacant	Occupied	Total	Cost of Repairs	Repair Cost per house	Rent Accrued	Rent Collected
Princeton	4	9	13	468.40	36.03	596.00	635.00
Austin	4	37	41	1,441.05	35.15	1,684.08	1,710.07
Gardner Mackinaw	4	0	4	15.27	3.82	104.00	80.98
Gwinn Townsite	5	117	122	14,887.99	122.03	11,590.99	11,400.21
	17	163	180	16,812.71 (1)	93.40	13,975.07	13,826.26 (2)

(1) Actual cash expenditure for repairs 16,768.71
For labor performed in house repairs not a cash expenditure 44.00
As above 16,812.71

(2) Actual cash received 13,786.26
Amount credited by journal voucher and credited to house rents 40.00
As above 13,826.26

Included in the above total rent collection there is an amount of $385.54 which was credited to rent and water accounts which have previously been charged off the books.

Excessive cost was due to large program for painting, etc.

19. GWINN ASSOCIATION
GWINN HOTEL

1. Gwinn Association

The Association Clubhouse located at Gwinn continues to serve the people of that district as a community center. Practically all

GWINN DISTRICT GENERAL
ANNUAL REPORT
YEAR 1937

19. GWINN ASSOCIATION
GWINN HOTEL (Cont.)

1. Gwinn Association (Cont.)
social and recreational activities carried on in the district by the different organizations, such as the school, the churches and the club, are held in the Association building. Besides operating the clubhouse, the Association supervises or sponsors by furnishing equipment for the activities carried on at three different playgrounds, the ice skating rink and Bass Lake cottage and grounds.

A survey of the activities show that the program of the Association is such that practically every person in the district receives some benefit or there is within the reach of every person (should they desire to take part) an activity to take care of their leisure time.

As in other years, during July and August the demand is for outdoor programs, which is very convenient for the club employees, as it gives them an opportunity to place the building in good condition for the winter season. During the year all floors were revarnished, a new hot water tank installed and plumbing repaired, all outside woodwork painted by company employees, some rooms redecorated and general repairs made where necessary.

During the summer the donor of the building, Mr. Wm. G. Mather, accompanied by Mrs. Mather, paid an inspection visit to the building.

A detailed annual report of the Association is furnished to the Cleveland-Cliffs Iron Company Welfare Department, so only a brief synopsis of the report is here given.

The same arrangement existed with the local Board of Education for the use of the building for their physical education program, i. e., the Superintendent of the Association supervises all physical educational programs for the Forsyth schools for which, and the use of the Association building, the schools pay $2500.00 per year. They also donate one car of coal per year for the use of two rooms for kindergarten.

The attendance at the building was about the same as the year previous, but the report shows that there is a greater tendency for those using the building to take part in the activities, rather than to attend as spectators. The estimated attendance was 66,400. The memebership roll showed an average monthly membership of 237 of which 160 were employees of the Gardner Mackinaw Mine and the remainder were local townsmen.

GWINN DISTRICT GENERAL
ANNUAL REPORT
YEAR 1937

19. GWINN ASSOCIATION
GWINN HOTEL (Cont.)

1. Gwinn Association (Cont.)
Indoor activities includes: bowling leagues for men and women, a 48 man cribbage league, a cribbage league and bridge league for women, a library and reading room, 2 Girl Scout and 1 Boy Scout troops, billiard and bowling (no charge) instruction for high school boys and girls, free dancing parties for students during vacation, a club basketball team, a 10 team junior basketball league, an opportunity for members to play badminton, handball, volley ball, basketball and miscellaneous games in the gym. Total number of meetings or social events 364. Seven of these are annual affairs. Church organizations used the building for 61 meetings or socials; 3 Scout troops held 131 meetings; 25 dances were held, 11 general committee meetings; 21 educational classes; and other organizations, such as owmen's study club, Town club, Sportsmen's Association, play rehearsals, supervised card playing and miscellaneous meetings numbered 108.

The outdoor program included the supervision of the inter-county baseball league, equipment for softball and baseball leagues, tennis, loopball, horsehoe courts, sponsorship of the ice skating rink and Supervision of Bass Lake camp grounds.

It is estimated 12,850 persons (either as participants or spectators) enjoyed the Association's supervised outdoor program.

The Association band discontinued rehearsals owing to a lack of cornet players. However, they were able to get together for the Memorial Day service. There is some indication of an effort to reorganize this winter. The local school band filled in when band music was required.

Bass Lake Camp
The attendance at the grounds this season was below other years due to the fact that the Lake property was posted to the effect that the camp grounds were to be used only by Cleveland-Cliffs Company employees and residents of Gwinn. The posting was necessary on account of the large number of outsiders using the grounds.
Summary:

114 - basket picnics
934 - bathers
533 - fishermen and visitors holding basket picnics.

Use of Cottage	Number
Girl Scout Troup #1	16
Girl Scout Troup #2	15
Boy Scout Troop #1	20
4 families	45
High School Girls	6
Maas Mine surface crew picnic	40
2 - church picnics	200
Sportsmens annual rabbit feed	45
2 Town club picnics	40
Total attendance at cottage and grounds	1400