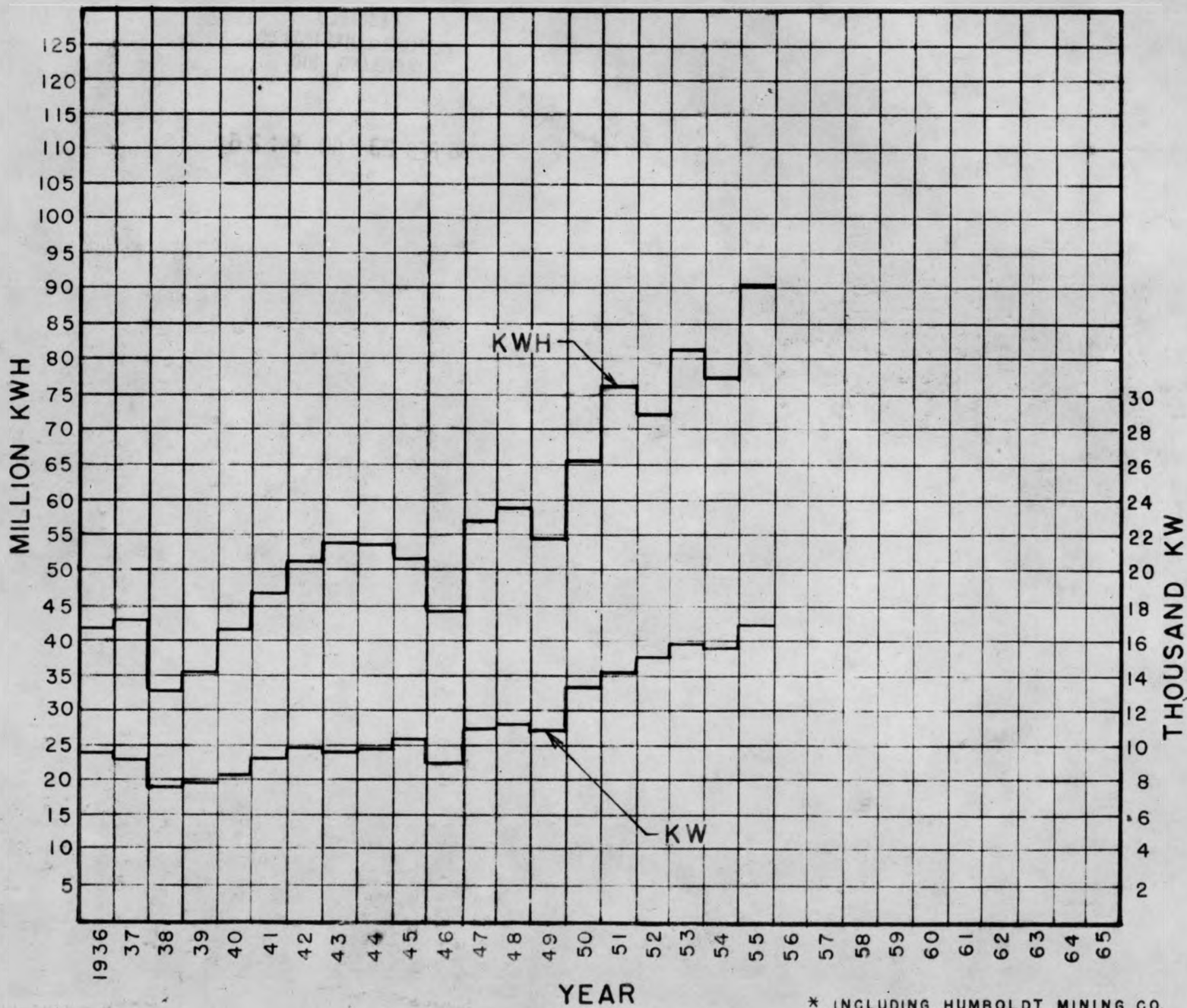


ENERGY & POWER REQUIREMENTS C.C.I. CO. OPERATIONS *



* INCLUDING HUMBOLDT MINING CO.

WELFARE DEPT. ANNUAL REPORT YEAR 1955

The Annual Report of the Welfare Department for the year 1955 is presented herewith.

The usual program of activities was carried on by this Department throughout the year 1955. These activities cover all phases of the welfare of employees of our Company, including our insurance program and the Company's association with the general welfare in the entire community.

The whole field of what constitutes general welfare in relationship to employees is the major function of the Welfare Department. The Department has been known as the Welfare Department for upwards of forty years; however, for a good many years the Department has drifted from what is purely welfare activity to the newer conception of employer relations, including the whole field of workmen's compensation; group insurance, including life, accident and hospitalization; employee retirement and pensions; matters of safety and health; public relations and Company-sponsored employee activities, police and plant protection and participation in the publication of the "Cliffs News." The Department also participates to a considerable degree to activities of a civic, community and public health nature.

Each year we usually point out in this report that this Department was first known as the Pension Department under the supervision of Mr. W. H. Moulton, who was known as the Secretary of the Department. Mr. Moulton retired on July 1, 1938 and the name of the Department at that time "The Welfare Department" has been carried as the official name of the Department. At various times a change in the name of the Department has been suggested but because of the fact that the Welfare Department seems to be as good a name as any, this Department name has been continued. For the last quarter of a century, however, many activities which would not normally come under the head of a welfare department are centered in this Department.

The Welfare Department works cooperatively with the Safety Department, under the direction of Mr. A. J. Stromquist. We have always felt that our Safety Program was the best program of its type in the iron mining industry. Mr. Walter E. Johnson, who has charge of the Compensation Bureau of this Department, as well as the insurance, has had continued service with the Company since 1911. Mr. Johnson is very well informed with matters regarding compensation and the rules and regulations both in Michigan and Minnesota. His service over the years has been exceptional and because of the fact that he is dealing constantly with people, his type of service is very important. Mr. Johnson spent at least 50% of his time in matters calling for attention in the carrying out of our Company insurance program.

Mr. Lowell C. Holmgren, whose service with the Company goes back to 1936, performs most of the detailed work in the insurance program, the pensions, the donation and retirement payrolls. Mr. Holmgren's experience with the Company, his cooperative spirit and his knowledge of the field in which he serves makes him another valuable employee and particularly because his work is so directly related to matters that are important to our employees.

Mrs. Shirley O. Mattson became the Secretary to the Superintendent of the Department in October, 1954. Previously Mrs. Mattson was employed in the Purchasing Department where she had worked for approximately nine years. We wish to report that Mrs. Mattson's knowledge of Company procedure made it rather easy for her to take over the work as Secretary in the Welfare Department and record here our appreciation of her cooperation and the efficiency in which the Department is maintained.

Presently the Department is functioning with one less employee since no one has been employed in the capacity of a clerk following the disengagement of Miss Rita Chapman in June of 1954. Mrs. Martha Saari, who was a stenographer in the Department, resigned during the year and her place was taken by Mr. Fred Olson, who was a Clerk at the Spies Mine at Iron River. Mr. Olson assists in the Compensation and Insurance Bureau and he is a very satisfactory employee.

The Police and Plant Protection Bureau is in the Welfare Department and under the supervision of Mr. Emil Hoff, who was formerly Captain of Police at Mather "A" Shaft. Mr. Hoff is an experienced and trained police officer and he is in excellent relationship with the local police department and the Michigan State Police. He confers with the Superintendent of the Department almost daily and he also makes a monthly report which is part of the Monthly Report of the Department. We wish to record our appreciation of the splendid work which Mr. Hoff is doing as Chief of our Police Department.

The personnel of the Welfare Department is as follows:

Walter F. Gries, Superintendent
Walter E. Johnson, Compensation Agent
Lowell C. Holmgren, Assistant, Compensation and
Group Insurance Division
Mrs. Shirley Mattson, Secretary to the Superintendent
Emil Hoff, Chief of Police
Fred Olson, Stenographer, Compensation Bureau.

WELFARE DEPT. ANNUAL REPORT YEAR 1955

11.
a. WORKMEN'S COMPENSATION

The direct work of the Compensation Department has been taken care of by Mr. Walter E. Johnson as has been the plan since 1926.

While there were a number of cases that required extra attention during the year most of them were largely routine. However, the following cases were a little unusual.

FRANK BOLLERO - MAAS MINE

This man was injured on February 8, 1952 while unloading timber with a hydrocrane. The bucket of the crane swung and struck him on the back. He was paid intermittent compensation until March 30, 1953 and subsequently was laid off in the general lay-off on May 31, 1954. He then filed a claim for compensation and after several conversations between his attorney and Mr. Davidson, the settlement of \$4,000 was agreed upon. This was approved by the Workmen's Compensation Department and Bollero was paid on that basis.

CARL R. AUSTIN - CAMBRIA-JACKSON MINE

This case was reviewed in the 1954 Annual Report and a notation was made that the case would come up for hearing in 1955. The hearing was held and it was determined by the referee that the loss of the leg sustained by Mr. Austin was not the result of the compensable injury he sustained on September 30, 1953 but that the cause was entirely due to the heart condition from which he suffered. No appeal was taken by Mr. Austin and eventually we paid him the group insurance disability benefits due him and the allowance for hospitalization and surgical which his insurance provided for. It was determined that the heart condition precluded him from doing any more work. That condition, coupled with his age, which is approximately 64, made him eligible for a disability pension. He is also drawing disability pension from the government as he was a World War I veteran.

EINO ISAACSON - MAAS MINE

This case was reviewed in the 1954 Annual Report and then we felt that if a reasonable settlement could be made with Isaacson that it would be to our advantage, as with the numerous back incidents which his record revealed he undoubtedly would be troublesome in the future should he return to our employ. A settlement on the basis of \$2500 was made and this was approved by the Workmen's Compensation Department.

WELFARE DEPT. ANNUAL REPORT YEAR 1955

11.
a. WORKMEN'S COMPENSATION (Continued)

LEANDER SAYRING - CAMBRIA-JACKSON MINE

This case came up for hearing in 1955, Saying having claimed that he was suffering from silicosis. While we felt that he did not have silicosis, he did have some lung pathology which according to his doctors was the result of exposure to dust. There had been a good deal of medical expense involved in this case and the potential compensation, should he win, would be \$10,500.00. It was finally agreed between his attorneys and Mr. Davidson that the case be settled on the basis of the payment of \$2,790.00. This payment was approved by the Workmen's Compensation Department and the case has been closed.

JAMES BERTINO
EMIL NICOLLE - SPIES MINE
JOSEPH GAGNE

These three men were employed at the Spies Mine at the time that property closed. They were all offered work in the Ishpeming district but all refused on the basis that they were disabled due to silicosis and they have consulted an attorney in Ironwood, Michigan. All three are more than 63 years old and we felt that they did not wish to move to Ishpeming as all their roots were in Iron River and they did not relish making the trip by automobile daily. We have gone into these cases thoroughly and it is our feeling that of the three, only Nicolle has a possible claim and we feel that possibly a settlement should be made in that case. They have all filed claims with the Workmen's Compensation Department and undoubtedly hearings will be held some time in 1956.

PAUL A. MAINO - ATHENS MINE

This man was injured at the Athens Mine on July 6, 1949 when he sustained a fracture of the lower jaw and a fracture of the left shoulder. He returned to work on November 15, 1949. He continued to work until June of 1954 when he was again paid compensation from June 7 through August 14, 1954. At that time he complained of a soreness in the shoulder and upon checking it was found that during the nearly five years that he had worked he had repeatedly complained about the shoulder and expected favored treatment while he worked since August of 1954. He has lost a great deal of time but we felt that most of it was due to the fact that he was operating a neighborhood grocery store and that the business had reached the point where he wanted to devote all of his attention to the store. However, he did work periodically but usually he complained and would take time off because

WELFARE DEPT. ANNUAL REPORT YEAR 1955

11.
a. WORKMEN'S COMPENSATION (Continued)

PAUL A. MAINO - ATHENS MINE (Cont'd.)

of the shoulder, he says. On November 10, 1955 while at work for us, he sustained an additional strain or jar of the shoulder when a bar that he was using as a pry slipped throwing excess weight on the shoulder. In view of the background noted above, it was felt that a settlement would be the only binding solution in this case and after several conversations with him it was agreed that we redeem liability for \$2000. and the case was closed on that basis.

WELFARE DEPT. ANNUAL REPORT YEAR 1955

11. a. WORKMEN'S COMPENSATION (Continued)

ANNUAL STATEMENT OF COMPENSATION PAYMENTS
FROM JANUARY 1st, 1955 TO DECEMBER 31, 1955

Compensation paid on 1955 cases	32,983.33	
Estimated compensation still pending	169,516.13	
Cost of medical and hospital service and special expenses	<u>61,530.85</u>	264,030.31
Less pending for years 1945 to 1954 inclusive	108,976.46	
Less medical and special expense on accidents occurring prior to January 1, 1955	<u>7,812.00</u>	<u>116,788.46</u>
		147,241.85
Less compensation paid on 1955 occupational disease cases		<u>1,140.99</u>
Estimated cost of 1955 accidents		146,100.86
Percentage of payrolls on accidents		.00745
Percentage of payrolls including Occupational Disease cases		.00751
Number of fatal accidents		4
Number of compensable accidents		125
Number of lost-time accidents - non-compensable		83
Number of slight accidents		979

The following occupational disease cases occurred during 1955. The cost of these cases is included in the regular compensation costs, but for statistical purposes they are not included in the accident table.

Number of deaths	0
Number of disability cases	6

During 1955, a total of \$9,119.78 was paid on occupational disease cases and it is estimated it will cost \$23,286.66 to complete payments on the four cases still active on December 31, 1955. Of these, one originated in 1952, two in 1953 and one in 1954.

WELFARE DEPT. ANNUAL REPORT YEAR 1955
 11.
 a. WORKMEN'S COMPENSATION (Continued)

Settlements on a partial disability basis were made in the following cases during 1955. The table below indicates the percentage of permanent disability and the member involved.

Joseph Uzelac	Hill-Trumbull	15% left third finger	131.25
Arne Hepola	Holman-Cliffs	10% right leg	540.00
Everett Danielson	Hill-Trumbull	10% of back	1,096.00
Einar Hamar	Canisteo	10% right hand & wrist	770.00
Steve Latkovich	Canisteo	5% left leg	385.00
Eino L. Isaacson	Maas	Redemption order 7-28-55	2,074.00
Leander Saying	Cambria-Jackson	Redemption order 7-28-55	1,220.00
Frank Bollero	Maas	Redemption order 7-5-55	3,390.00
Douglas Francis	Athens	W. C. C. order 4-5-55	562.50
Andrew Hutari	Sargent	Right arm	600.00

WELFARE DEPT. ANNUAL REPORT YEAR 195511.
a. WORKMEN'S COMPENSATION (Continued)

Following is a list of the more serious cases other than fatalities which occurred in 1955:

<u>Mine and Report No.</u>	<u>Name</u>	<u>Nature of Injury</u>	<u>Compensation Paid to 12/31/55</u>
Cliffs Shaft 1330	Ralph Young	Cominuted fracture - right ankle.	648.00
Cliffs Shaft 1331	Elmer Anttonen	Fracture left leg, left and right arms	1,680.00*
Cliffs Shaft 1336	Nels Santti	Fracture left tibia and fibula. Fracture 2nd and 3rd metatarsals - Left.	952.00*
Maas 785	Edgar Staples	Fracture 1, 2, 3 metacarpal right proximal.	1,564.00*
Maas 790	Telesphore Latendresse	Amputation tip middle finger right hand.	884.00*
Bunker-Hill 20	Andrew Nord	Fracture both bones - left ankle.	608.00*
Mather "A" Shaft 272	Nick Donato	Fracture right radius and Ulna.	1,036.00*
Mather "A" Shaft 279	Thomas J. Lawer	Contusions upper left and right arms and shoulders.	544.00*
Mather "A" Shaft 281	James Dowrick	Fracture tibia and fibula left. Puncture wounds over head and body.	360.00*
General Storehouse 88	Joseph Lafaro	Amputation ring and middle finger, left hand thru middle phalangeals.	768.00*
Agnew 44	Peter Grcevich	Fractured ribs with compli- cating pneumonia and ecchymosis of head and shoulders.	595.00
Canisteco 67	Ralph Trout	Contusion lateral side - right ankle. Ruptured blood vessel - hematoma.	440.00*

* Payments still being made.

WELFARE DEPARTMENT

WELFARE DEPT. ANNUAL REPORT YEAR 1955

11. a. WORKMEN'S COMPENSATION (Continued)Compensation Payments including Medical and Special Expense

<u>Year</u>	<u>C. C. I. Co.</u>	<u>Negaunee Mine Co.</u>	<u>Athens Iron Mining Co.</u>	<u>Cliffs Pr. & Light Co.</u>	<u>Mesaba-C. Mining Co.</u>	<u>CCI Co. Opt. Agt. Atkins</u>	<u>Humboldt Mng. Co.</u>	<u>Miscellaneous Companies</u>	<u>TOTAL</u>
1912 to 1945	1,616,381.03	296,034.79	178,447.82	22,729.17	122,047.13			10,282.71	2,246,922.65
1946	84,009.42	25,391.20	5,373.63	1,528.50	7,693.03	174.50			124,170.28
1947	76,355.69	28,582.02	14,540.71	1,153.75	9,186.43	1,353.77			131,172.37
1948	73,727.12	28,162.82	8,548.15	687.00	9,083.73	824.57			121,033.39
1949	96,910.98	37,433.06	15,401.72	916.50	9,356.57	1,248.75			161,267.58
1950	87,512.40	35,352.22	12,815.81	740.00	10,757.22	3,522.62			150,700.27
1951	111,447.53	45,102.62	10,814.25	734.50	13,757.87	1,286.55			183,143.32
1952	125,226.20	51,320.60	13,005.82	1,187.22	20,234.46	1,159.70	56.40		212,190.40
1953	119,178.56	56,553.21	14,997.55	689.20	12,392.29	336.50	343.45		204,490.76
1954	103,742.80	58,141.65	7,718.89		18,463.90		2,487.89		190,555.13
1955	<u>108,150.86</u>	<u>44,514.59</u>	<u>7,393.87</u>		<u>8,927.53</u>		<u>2,319.13</u>		<u>171,305.98</u>
	2,613,642.59	706,588.78	289,058.22	30,365.84	241,900.16	9,906.96	5,206.87	10,282.71	3,906,952.13

Detail of Miscellaneous Companies:

Holman-Cliffs Mining Company	2,131.39
Canistee-Cliffs Mining Company	2,768.69
Alexandria Mine	<u>5,382.63</u>
	<u>10,282.71</u>

WELFARE DEPARTMENT

WELFARE DEPT. ANNUAL REPORT YEAR 195511.
c. GROUP INSURANCE (Continued)

The following death claims were paid during the period from January 1, 1955 through October 31, 1955.

<u>Name</u>	<u>Mine</u>	<u>Date of Death</u>	<u>Amount of Insurance</u>
Matt Maino	Bunker Hill	6-16-55	5000.00
Urho Seppanen	Bunker Hill	7-12-55	5000.00
Kenneth Polkki	Cliffs Shaft	7-15-55	5000.00
Hjalmer B. Rytillahti	Lloyd	12-8-54	5000.00
Henry Choquette	General Roll	1-23-55	7500.00
Gust A. Kinstrand	General Storehouse	1-18-55	2500.00
John C. Coad	General Storehouse	3-8-55	5000.00
John J. Nankervis	Mather "A" Shaft	1-1-55	5000.00
Rupert Frederickson	Mather "A" Shaft	10-10-55	5000.00
Herbert Robare	Mather "B" Shaft	4-16-55	5000.00
Gaspard Malette	Mather "B" Shaft	5-28-55	5000.00
Wilfred Mallette, Jr.	Mather "B" Shaft	8-29-55	5000.00
Edwin Peterson	Mather "B" Shaft	9-12-55	5000.00
James Blee	Inactive	12-15-54	750.00
August E. Kangas	Inactive	1-2-55	1250.00
John H. Maki	Inactive	1-4-55	500.00
Ernest Palola	Inactive	6-24-54	1250.00
Victor Siedleski	Inactive	1-1-55	1250.00
William L. Lund	Inactive	1-17-55	5000.00
Rasmus Christensen	Inactive	1-12-55	500.00
James Doney	Inactive	12-6-54	1250.00
Simon Chetto	Inactive	2-3-55	1250.00
Elias Pennala	Inactive	1-4-55	2500.00
Jalmer Hendrickson	Inactive	2-16-55	1250.00
Samuel Goodman	Inactive	2-19-55	1250.00
Matt Amel	Inactive	2-18-55	500.00
Lars Olson	Inactive	3-4-55	500.00
John Savola	Inactive	3-11-55	2500.00
Victor Johnson	Inactive	3-31-55	1250.00
Joseph Pitrone	Inactive	5-30-55	1250.00
Wilfred Dumble	Inactive	5-1-55	1250.00
Charles Maki	Inactive	4-5-55	750.00
Peter Coron	Inactive	7-7-55	500.00
Patrick Kennedy	Inactive	7-31-55	1250.00
Andrew A. Nocenti	Inactive	8-26-55	500.00
William Hampton	Inactive	9-4-55	1250.00
Joseph LaBeau	Inactive	7-19-55	2500.00
Jason Whiting	Inactive	9-22-55	2000.00
Edwin Harper	Inactive	11-5-55	750.00

WELFARE DEPARTMENT

WELFARE DEPT. ANNUAL REPORT YEAR 1955

11.

c. GROUP INSURANCE (Continued)

The following statement shows the amount of Bargaining Unit claims paid during the 10-month period from January 1, 1955 to October 31, 1955.

	<u>Hospitalization</u>	<u>Health & Accident</u>	<u>Comp. Make-up</u>	<u>Death Claims</u>	<u>Total</u>
Bunker Hill	2,876.64	6,999.57	543.86	10,000.00	20,420.07
Cambria-Jackson	2,394.52	5,038.56			7,433.08
Cliffs Shaft	6,371.66	15,545.70	700.09	5,000.00	27,617.45
Elect. Power Dept.	453.30	1,208.57			1,661.87
General Storehouse	1,581.13	4,070.28	120.97	7,500.00	13,272.38
Lloyd	1,360.25	3,018.55	81.00	5,000.00	9,459.80
Maas	2,207.86	11,391.13	282.26		13,881.25
Miscellaneous	320.00	297.14			617.14
Ohio	1,695.20	131.43			1,826.63
Spies	297.50	2,577.14			2,874.64
Inactive - Pensioners before 1/1/55				32,000.00	32,000.00
Total-C.C.I. Company	19,558.06	50,278.07	1,728.18	59,500.00	131,064.31
Mather Mine "A" Shaft	7,748.74	10,395.97	705.95	10,000.00	28,850.66
Mather Mine "B" Shaft	7,191.10	10,864.28	558.59	15,000.00	33,613.97
Total-Negaunee Mine Co.	14,939.84	21,260.25	1,264.54	25,000.00	62,464.63
Hunboldt Mining Company	3,402.25	634.28	128.47		4,165.00
Total-Michigan District	37,900.15	72,172.60	3,121.19	84,500.00	197,693.94
Number of Claims	369	307	67	35	778

Hospitalization covers payments by Aetna Life Insurance made subsequent to January 1, 1955. In addition to regular hospital claims incurred prior to January 1, 1955, Aetna was also liable for obstetrical claims for the nine-month period subsequent to January 1, 1955.

WELFARE DEPT. ANNUAL REPORT YEAR 195511.
c. GROUP INSURANCE (Continued)

The following statement shows the amount of Salaried and Non-Bargaining Unit claims paid during the year December 1, 1954 to November 30, 1955.

	<u>Hospitalization</u>	<u>Health & Accident</u>	<u>Comp. Make-up</u>	<u>Death Claims</u>	<u>Total</u>
Bunker Hill	1,857.33	125.71	18.67		2,001.71
Cambria-Jackson	1,137.35	68.57			1,205.92
Cliffs Shaft	1,941.04	120.00	42.00		2,103.04
Cleveland Roll	2,787.45	244.29			3,031.74
General Roll	14,900.57	2,764.30	54.67	7,500.00	25,219.54
Elect. Power Dept.	68.25				68.25
Lloyd	1,356.65	314.29			1,670.94
Maas	873.11	252.85			1,125.96
Ohio	505.31				505.31
Spies	10.00	28.57			38.57
Tilden			48.00		48.00
Inactive	111.35				111.35
Pensioners before 1/1/55				2,750.00	2,750.00
<hr/>					
Total-C.C.I. Company	25,548.41	3,918.58	163.34	10,250.00	39,880.33
Mather Mine "A" Shaft	5,102.29	328.57			5,430.86
Mather Mine "B" Shaft	5,713.30	635.71		5,000.00	11,349.01
<hr/>					
Total-Negaunee Mine Co.	10,815.59	964.28		5,000.00	16,779.87
<hr/>					
Total-Michigan District	36,364.00	4,882.86	163.34	15,250.00	56,660.20
Number of Claims	297	45	4	4	350

11. c. GROUP INSURANCE - Bargaining Units

A new group insurance plan for bargaining personnel went into effect January 1, 1955. The Aetna Life Insurance Company of Hartford, Connecticut, is carrying the life and sickness and accident coverages under policies 55,951 and GS-55,951 in Michigan, on policies 55,690 and GS-55,690 in Minnesota. The hospitalization and surgical features of the plan are furnished through Blue Cross and Blue Shield organizations under group number 22,028.

Premium rates for the policy year, January 1, 1955 through December 31, 1955 are:

Life - .87 per thousand
 Sickness and accident - .073 per dollar
 Retired life insurance
 Pensioners before 1/1/55 - 4.94 per thousand
 Pensioners after 1/1/55 - 4.92 per employee
 Hospitalization and surgical - 7.84 per employee

Funding of the life insurance of pensioners after January 1, 1955 is a provision of the new plan. For the policy year, January 1, 1955 to December 31, 1955 the funding figure is \$1.11 per employee.

The Company's contribution toward the premium cost of this group insurance is on a contractual basis of $4\frac{1}{2}\phi$ per hour actually worked by bargaining unit employees. The employees' contribution is at a fixed rate according to schedule.

A brief description of the new program follows:

1. Life Insurance -
 - (a) \$3500 to all employees
 - (b) \$1500 additional insurance at full cost to employee (optional)
2. Weekly Sickness & Accident Benefit - \$40.00 for maximum of 26 weeks -

First day accident - Eighth day sickness with provision for make-up of workmen's compensation.
3. Hospitalization - Blue Cross - semi-private service - 120 days - unlimited miscellaneous fees - \$10 per day toward private room.
4. Surgical - Blue Shield - as per schedule - \$200 maximum.
5. Retired Death Benefit - \$1250 if eligible for pension.
6. Provision has been made for continuing modified coverage to laid-off employees and for conversion privilege of hospital and surgical insurance for retired employees.

WELFARE DEPT. ANNUAL REPORT YEAR 1955

11. c. GROUP INSURANCE - Bargaining Units (Cont'd.)

7. New employees become insured on the first day of the month following the month in which employed.

SCHEDULE OF BENEFITS AND CONTRIBUTIONS:

	<u>Benefits</u>				<u>Contributions</u>	
	<u>Employee</u>		<u>Employee & Dependent</u>			
<u>Life Ins.</u>	<u>Weekly S & A Benefit</u>	<u>Daily Hosp. Benefit</u>	<u>Misc. Hosp. Charges</u>	<u>Max. Surg. Fee Benefit</u>	<u>Emp. Without Dep.</u>	<u>Emp. With Dep.</u>
\$3500*	\$40.00	Semi-private	Un-limited	\$200.	\$7.70*	\$8.95*

*\$1500 optional life insurance available at additional premium cost of \$1.31.

Reference is made to the Annual Reports of 1936 and 1937 for a description of the Company's first group insurance plan which provided only life and disability coverage.

11. c. GROUP INSURANCE - Non-bargaining Units

A group insurance plan for Michigan non-bargaining employees was continued under group policies 55,951, GS-55,951, and H-55,951 with the Aetna Life Insurance Company of Hartford, Connecticut. The plan provides for life, disability, hospitalization and surgical coverages as detailed in the Annual Report of 1954. There were no changes in benefits, employee contributions or the annual earnings schedule governing the amount of life coverage, and reference is made to the Annual Report of 1954 for these details.

The premium rates for computing the total premium cost for the policy year beginning December 1, 1955 follow:

Life	Per month per \$1,000	\$1.01
Life - Retired	Per month per \$1,000	6.19
Disability	Per month per employee	3.88
Employee Hospital- ization & Surgical	Per month per employee	2.98
Dependent Hospital- ization & Surgical	Per month per employee	7.525

These rates differ from those for the last policy year only in the retired life coverage where the rate was \$6.12 per month per \$1,000 last year.

The retirement policy for non-bargaining employees as it relates to group insurance continued without change. A retired employee may carry fifty per cent of his life insurance at the time of retirement without further premium payment on his part. He may also carry the hospitalization and surgical coverage by paying the total premium cost.

11.

c. GROUP INSURANCE (Continued)

The following table records the total premium cost of the life and disability coverages, as computed by this office, for Michigan bargaining unit personnel. The period covered is from 1/1/1955 through 10/31/1955, an abbreviated policy year which normally runs from November 1 through October 31. The "Regular" column covers the cost of the basic 3500-dollar life insurance and the 40-dollar weekly disability insurance of active employees. The "Optional" column shows the premium cost of the 1500-dollar life insurance which may be carried at the employee's option in addition to the basic 3500-dollar amount. The "Inactive" column represents the premium cost of the basic life insurance only being carried by eligible laid-off employees.

<u>Units</u>	<u>Regular</u>	<u>Optional</u>	<u>Inactive</u>	<u>Total</u>
Bunker-Hill	16,781.94	3,627.93	-	20,409.87
Cambria-Jackson	8,717.20	1,817.88		10,535.08
Cliffs-Shaft	27,287.81	5,812.49	26.10	33,126.40
Electric Power Department	2,295.09	501.15		2,796.24
General Storehouse & Shops	9,329.37	1,947.10	6.53	11,283.00
Lloyd	5,802.35	1,234.55		7,036.90
Maas	14,721.30	3,121.58		17,842.88
Miscellaneous Payroll	1,491.28	324.98	60.90	1,877.16
Ohio	1,694.07	233.61	255.14	2,182.82
Republic	596.50	107.03		703.53
Spies	3,242.61	673.42	29.15	3,945.18
Tilden	417.92	63.95		481.87
Mather Mine "A" Shaft	29,322.45	6,130.92		35,453.37
Mather Mine "B" Shaft	26,563.36	5,029.50		31,592.86
Humboldt	5,589.35	1,170.59		6,759.94
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TOTALS	153,852.60	31,796.68	377.82	186,027.10

Retired:

Barg. Unit - Pensioners before 1/1/1955	20,991.63
Barg. Unit - Pensioners Life Fund	1,167.27

WELFARE DEPT. ANNUAL REPORT YEAR 1955

11. c. GROUP INSURANCE (Continued)

The following table records the total premiums charged by Blue Cross-Blue Shield for hospitalization and surgical insurance for our Michigan bargaining unit personnel. The table covers the period from January 1, 1955 through October 31, 1955. The "Regular" column includes the actively employed employees. The "Inactive" column covers the premium cost to laid-off employees.

<u>Unit</u>	<u>Regular</u>	<u>Inactive</u>	<u>Total</u>
Bunker-Hill	22,132.32	251.88	22,384.20
Cambria-Jackson	11,540.48	47.04	11,587.52
Cliffs-Shaft	35,985.60	47.04	36,032.64
Electric Power Dept.	3,034.08	-	3,034.08
Gen.Storehouse & Shops	12,332.32	7.84	12,340.16
Lloyd	7,706.72	70.56	7,777.28
Maas	19,451.04	39.20	19,490.24
Miscellaneous Payroll	2,085.44	282.24	2,367.68
Ohio	2,220.56	956.48	3,177.04
Spies	4,335.52	54.88	4,390.40
Republic	784.00	-	784.00
Tilden	548.80	-	548.80
Mather Mine "A" Shaft	38,815.84	141.12	38,956.96
Mather Mine "B" Shaft	34,966.40	78.40	35,044.80
Humboldt	7,369.60	-	7,369.60
TOTALS	203,308.72	1,976.68	205,285.40

WELFARE DEPT. ANNUAL REPORT YEAR 1955

11. c. GROUP INSURANCE (Continued)

The following table shows the tabulation of total premium cost of group insurance, life, disability, hospitalization and surgical all combined, as carried by our salaried and non-bargaining Michigan payroll employees. The policy year from December 1, 1954 through November 30, 1955 is reflected in this report.

<u>Unit</u>	<u>Salaried</u>
Bunker-Hill	6,973.18
Cambria-Jackson	3,066.53
Cliffs-Shaft	7,653.16
Electric Power Department	1,168.97
General Storehouse & Shops	1,025.76
General Payroll-Ishpeming Office	55,626.75
Lloyd	2,169.52
Maas	4,237.68
Miscellaneous Payroll	99.70
Ohio	419.77
Republic	148.68
Spies	1,295.89
Tilden	103.50
Mather Mine "A" Shaft	11,054.64
Mather Mine "B" Shaft	10,170.17
Humboldt	496.20
	<hr/>
Total	105,710.10
Retired - Inactive Group	13,227.25

WELFARE DEPARTMENT ANNUAL REPORT YEAR 1955

23. a. PENSION SYSTEM (Continued)

Retirement Payrolls

The original purpose of the Retirement Payrolls was to supplement Social Security benefits being paid to our retired employees. The payrolls were initiated on March 16, 1939 and were the major retirement plan of the Company through February 1950 when the Pension Plan of March 1, 1950 became effective. This latter Pension Plan has all but eliminated additions to the Retirement Payrolls, and any additions now are in the nature of special cases.

A retired employee's Social Security benefit was originally supplemented by \$10.00 per month over The Retirement Payrolls. Beginning with July 1948 this amount was increased by \$10.00 per month in all cases so that the usual allowance over the payroll was \$20.00 per month. Our retired employees carry fifty per cent of the life insurance in force on their lives at the time of their retirement. Since March 1, 1950 this is done without cost to the employee.

There were no additions to the Mining Department Retirement Payroll during 1955. The following retirees, eleven in number, were dropped from the Mining Department Retirement Payroll during the year:

<u>Name</u>	<u>Ret. No.</u>	<u>Amount</u>	<u>Reason</u>
John H. Maki	29	\$ 49.00	Died 1/4/55
Rasmus Christenson	54	20.00	Died 1/11/55
Matt Amel	180	20.00	Died 2/18/55
Lars Olson	30	46.20	Died 3/4/55
Charles Maki	291	20.00	Died 4/5/55
Joseph Saari	315	20.00	Died 6/26/55
Peter Coron	83	20.00	Died 7/7/55
Andrew Nocenti	342	20.00	Died 8/26/55
Edwin Harper	78	20.00	Died 11/5/55
Albert J. Lehmann	221	20.00	Died 11/7/55
Herbert Skewes	271	20.00	Died 11/14/55

Two Retirement Payrolls are prepared in this office to handle payments to Minnesota retired employees, one for the Canisteo Mine and the other for the Mesaba-Cliffs Mining Company - Mining Department.

There were no additions or deaths on the Canisteo Mine Retirement Payroll during the year.

There were no additions to the Retirement Payroll of The Mesaba-Cliffs Mining Company - Mining Department during 1955. There was one death as follows:

Bion P. Axford	Ret. No. 1	\$20.00	Died 5/13/55
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WELFARE DEPT. ANNUAL REPORT YEAR 1955

23. a. PENSION SYSTEM (Continued)

Retirement Payrolls (Cont'd.)

A resume of the 1955 Retirement Payrolls follows:

Number of Mining Department Retired Employees 12/31/1954	137
Number of Mining Department Retired Employees 12/31/1955	126
Total Expenditure to above employees for year 1955	34,080.04
Number of Canisteo Mine Retired Employees 12/31/1954	3
Number of Canisteo Mine Retired Employees 12/31/1955	3
Total Expenditure to above employees for year 1955	720.00
Number of Mesaba-Cliffs Mng. Co. Retired Employees 12/31/54	17
Number of Mesaba-Cliffs Mng. Co. Retired Employees 12/31/55	16
Total Expenditure to above employees for year 1955	3,940
Total Number of Retired Employees 12/31/1954	157
Total Number of Retired Employees 12/31/1955	145
Total Expenditure to retired employees for year 1955	38,740.04

WELFARE DEPT. ANNUAL REPORT YEAR 1955

23. a. PENSION SYSTEMS (Continued)

Pension Plan for Salaried Employees

The Pension Plan for Salaried Employees which became effective on January 1, 1951 was revised on November 1, 1954, to correspond with the hourly-rate Pension Plan. Details of the plan as now in effect may be found under the heading "Pension Plan of March 1, 1950."

This Department handles the initial processing of all pension applications under this Plan and submits them to the Pension Committee in Cleveland for final disposition.

During the year the following pensions were granted under the Plan:

<u>Name</u>	<u>Former Occupation</u>	<u>Eff.Date</u>	<u>Gross</u>	<u>Deductions</u>		<u>Net</u>
David H. Smith	Cashier-Hibbing Office	1-1-55	130.00	85.00	SS 32.60 CR	25.00
Adolph Stark	Shift Boss	5-1-55	144.99	85.00	SS 67.61 CR	-
Fredolph J. Nelson	Supply Clerk	9-1-55	140.00	85.00	SS 60.95 CR	-
George McL. Waldie	Director, Industrial Hygiene Department	11-1-55	125.00	85.00	SS 44.59 CR	-
Thomas H. Guy	Machine Shop Foreman	11-1-55	217.91	85.00	SS 96.10 CR	37.00
Oscar T. Johnson	Mine Clerk	11-1-55	221.63	85.00	SS 84.85 CR	52.00

Code letters for deductions: SS- Social Security
 CR- Contributory Retirement-Company proportion.
 CR*- Represents total annuity payment - Company proportion not known.

23.

a. PENSION SYSTEMPension Plan of 1/1/1909

The Company's original pension system went into effect on January 1, 1909 and the forty-seventh year of its operation was completed in 1955.

No changes in the rates of pensions were made during the year. On January 1, 1933 pensions being paid were reduced by fifty per cent, those under \$20.00 remaining the same and those over \$20.00 having a minimum rate of \$20.00. There have been no additions to these payrolls since January 1, 1932.

During the time the Plan was active individual payrolls were written for the following Departments:

Mining Department
Holmes Mine Department
Republic Mine Department
Land Department
Furnace Department.

Of these only the Mining Department payroll was active during the year. There are four pensioners being paid over the Mining Department Pension Payroll at the close of 1955. This includes Frank Vierela who was formerly on the Republic Mine Department Pension Payroll. Total expenditure over the payroll for 1955 was \$936.00.

WELFARE DEPT. ANNUAL REPORT YEAR 1955

23. a. PENSION SYSTEM (Continued)

The table below shows the pension payments for the Mining Department and Holmes Mine Department combined for the years 1908 through 1955. The Holmes Mine Department payroll became inactive with the death of its last pensioner on April 23, 1949.

<u>Year</u>	<u>Old Age</u>	<u>Widows and Orphans</u>	<u>Total</u>
1908 thru 1944	784,615.39	22,547.00	807,162.39
1945	7,446.32	-	7,446.32
1946	5,648.60	-	5,648.60
1947	4,156.68	-	4,156.68
1948	3,840.68	-	3,840.68
1949	3,260.68	-	3,260.68
1950	2,400.68	-	2,400.68
1951	1,438.78	-	1,438.78
1952	1,076.00	-	1,076.00
1953	796.00	-	796.00
1954	936.00	-	936.00
1955	936.00	-	936.00
	816,551.81	22,547.00	839,098.81

Includes payment of \$2,500.00 made by the Cleveland Office in 1930.

Republic Mine Department

This payroll is inactive. During its active years - 1920 through June 1953 - a total of \$149,689.04 was expended over the Republic Mine Department Pension Payroll.

Land Department

This payroll is inactive. During its active years - 1927 through June 1953 - a total of \$6,836.88 was expended over the Land Department Pension Payroll.

Furnace Department

This payroll became inactive in 1948. During the years when it was active - 1910 through 1948 - a total of \$66,155.22 was expended over the Furnace Department Pension Payroll.

WELFARE DEPARTMENT

23.
a. PENSION SYSTEMS (Continued)

Contributory Retirement Plan for Salaried Employees

For the purpose of record it is here mentioned that the Company has had in effect for its salaried employees, since December 31, 1940, a Contributory Retirement Plan to which both the Company and the employees contribute. This Plan is carried with the Aetna Life Insurance Company of Hartford, Connecticut under group policy GA-228, and it is administered completely by the Cleveland Office. Participation upon meeting certain eligibility requirements is optional.

Pension Plan of 3/1/1950

The Pension Plan of 3/1/1950 remained in force without change through October 31, 1954. The details of the plan may be found in the Annual Report of 1950. This department handles the taking and initial processing of all pension applications. The applications are submitted to the Pension Committee in Cleveland for final action.

The Plan was revised on November 1, 1954 and remained in force, as revised, during 1955. It provides for an age pension for retiring bargaining unit employees who are at least 65 years of age with a minimum of 15 years of continuous service. The formula for computing the gross pension is as follows: one per cent of the average monthly wage (as computed over the ten year period immediately preceding the month of retirement) times the years of continuous service. Minimum gross pensions are stipulated as follows: \$140.00 for thirty or more years of service with a reduction of \$2.00 per year for each year less than thirty. The gross pension thus established is reduced by a standard social security deduction of \$85.00, by that portion of any other pension which Company contributions have purchased, and certain other types of pensions and workmen's compensation benefits. The Company pays a net pension (adjusted to the nearest dollar) which is the difference between the gross pension and the total deductions.

The Plan provides a disability pension for the retiring bargaining unit employee with fifteen or more years of continuous service who prior to age 65 becomes totally and permanently incapacitated for gainful employment of any kind. Total and permanent incapacity for employment must have existed for a period of six months before the employee is eligible to apply for a disability pension. The formula for computing the gross disability pension is the same as that for an age pension with the minimum pension being \$75.00 per month. A disability pension is reducible by certain types of other pensions and also by workmen's compensation or occupational disease benefits which are not payments for disability in the nature of a permanent disability.

WELFARE DEPT. ANNUAL REPORT YEAR 1955

23. a. PENSION SYSTEMS (Continued)

Pension Plan of 3/1/1950 (Cont'd.)

During the year the following age pensions were granted:

<u>Name</u>	<u>Mine</u>	<u>Eff.Date</u>	<u>Gross Pension</u>	<u>Net Pension</u>
Peter Luisa	Maas	2-1-55	140.00	55.00
John Hill	Maas	1-1-55	140.00	55.00
Henry White	Maas	1-1-55	140.00	55.00
Herbert Trevarton	Spies	2-1-55	140.00	55.00
James McAuliffe	Maas	1-1-55	140.00	55.00
Joseph E. Roberts	Maas	2-1-55	140.00	55.00
Richard Johns	Cambria-Jackson	1-1-55	140.00	55.00
William T. Wilcox	Cliffs-Shaft	5-1-54	100.00	42.00
Clarence Garrett	General Shops	4-1-55	140.00	55.00
Erick Turunen	Maas	4-1-55	122.67	38.00
Feare Lameare	Maas	4-1-55	132.33	47.00
Frank Catanesi	Cambria-Jackson	4-1-55	123.33	38.00
John A. Arola	General Shops	4-1-55	116.83	32.00
Joseph Scoleri	Cambria-Jackson	4-1-55	118.67	34.00
Tom Heckla	Canisteco	4-1-55	117.50	33.00
Oscar Maki	Bunker-Hill	5-1-55	116.17	31.00
Alphonse A. White	Bunker-Hill	5-1-55	148.92	64.00
Arthur Carlson	Lloyd	5-1-55	140.71	56.00
Sam Latkovich	Canisteco	3-1-55	126.33	41.00
Matt Suronen	Agnew	4-1-55	130.50	46.00
Albert Merila	Agnew	4-1-55	121.67	37.00
John Marta	Cambria-Jackson	5-1-55	123.83	39.00
John Withiel	Maas	5-1-55	138.50	54.00
Richard Uren	Maas	5-1-55	140.00	55.00
Louis Senical	Cambria-Jackson	5-1-55	116.00	31.00
Frank Lammi	Cliffs-Shaft	6-1-55	159.25	74.00
Dan Kiukas	Lloyd	6-1-55	140.00	55.00
Gustaf E. Sundberg	Cliffs-Shaft	7-1-55	140.00	55.00
Jacob E. Keranen	Maas	6-1-55	123.00	38.00
William J. Roberts	Agnew	5-1-55	130.67	46.00
Fred Brunell	Spies	7-1-55	116.17	31.00
Arthur Hoar	Spies	7-1-55	116.17	31.00
Marino Bernucci	Spies	7-1-55	115.67	31.00
William Gauthier	Maas	7-1-55	143.33	58.00
John Haapanen, Sr.	Spies	7-1-55	136.33	51.00
Eli Pokela	Spies	8-1-55	116.33	31.00
William J. Treweek	General Storehouse	8-1-55	140.00	55.00
Victor E. Nelson	General Storehouse	8-1-55	130.67	46.00
Sebastian Taetsch	Spies	8-1-55	116.67	32.00
Ernest V. Longmore	Canisteco	8-1-55	130.50	46.00
Toma Yavor	Agnew	6-1-55	130.83	46.00
Leander Saying	Cambria-Jackson	7-1-55	132.33	47.00
Frank Bertucci	Cliffs-Shaft	9-1-55	132.00	47.00
Axel Lindquist	Maas	10-1-55	138.00	53.00
Adolph G. Carlson	Cliffs-Shaft	12-1-55	140.00	55.00

WELFARE DEPT. ANNUAL REPORT YEAR 1955

23. a. PENSION SYSTEMS (Continued)

Pension Plan of 3/1/1950 (Cont'd.)

<u>Name</u>	<u>Mine</u>	<u>Eff.Date</u>	<u>Gross Pension</u>	<u>Net Pension</u>
Fred Roberts	Maas	12-1-55	138.50	54.00
Sam Beltrame	Lloyd	12-1-55	140.00	55.00
Gust Peterson	Mather "B" Shaft	1-1-55	140.00	55.00
John Gambotto	Mather "A" Shaft	2-1-55	140.00	55.00
Richard Anderson	Negaunee Mine	1-1-55	124.00	39.00
Henry Pekkala	Mather "A" Shaft	4-1-55	140.00	55.00
Andrew Guizzetti	Mather "A" Shaft	7-1-55	140.00	55.00
Jacob N. Hakala	Mather "A" Shaft	10-1-55	146.59	62.00
John Bakkala	Athens	1-1-55	140.00	55.00
Cody W. French	Hill-Trumbull	6-1-55	111.33	26.00
Andrew A. Ranger	Holman-Cliffs	8-1-55	130.50	46.00
Karl O. Pelto	Hill-Trumbull	11-1-55	118.17	33.00

There are a total of 57 age pensions listed above.

A standard Social Security deduction of \$85.00 is provided by the pension contract on all age pensions effective on or after November 1, 1954. For that reason the amount of Social Security is not shown in the above list. The Social Security deduction in the case of William T. Wilcox is \$58.50. His pension became effective May 1, 1954 but was not approved until this year and was not carried in last year's report.

The following disability pensions were approved during the year:

<u>Name</u>	<u>Mine</u>	<u>Eff.Date</u>	<u>Gross Pension</u>	<u>Net Pension</u>
George Jandron	Cliffs-Shaft	12-1-54	140.00	55.00
Viktor L. Salonen	Hawkins	12-1-54	129.83	45.00
Carl R. Austin	Cambria-Jackson	12-1-54	75.00	75.00
Frank Dushane	Cambria-Jackson	11-1-55	91.37	91.00
Carl V. Sholund	Canisteo	11-1-55	79.75	80.00
Sam Trevarton	Spies	12-1-55	79.61	80.00

WELFARE DEPT. ANNUAL REPORT YEAR 1955

23.

a. PENSION SYSTEMS (Continued)Pension Plan of 3/1/1950 (Cont'd.)

Twenty-one pensions were discontinued during the year as follows:

<u>Name</u>	<u>Mine</u>	<u>Pension No.</u>	
Samuel Goodman	Cliffs-Shaft	CC-2	Died 2/19/55
Patrick Kennedy	Cliffs-Shaft	CC-5	Died 7/31/55
Joseph Pitrone	Maas	CC-13	Died 5/30/55
William H. Hampton	Maas	CC-16	Died 9/4/55
Jalmer J. Hendrickson	Lloyd	CC-33	Died 2/16/55
Ludwig A. Lee	General Storehouse	CC-48	Died 7/31/55
Victor Siedlecki	Spies	CC-98	Died 1/1/55
Nick Kocher	Hawkins	CC-100D	Died 11/15/55
John Savala	Cambria-Jackson	CC-110	Died 3/11/55
Fred Roberts	Maas	CC-127D	Converted to age pension effective 12/1/55.
Robert R. Hosford	Sargent	CC-142	Died 11/11/55
Russell H. Hill	Lloyd	No number	Died 11/13/55
Joseph E. LaBeau	Cliffs-Shaft	CC-166	Died 7/19/55
Gustaf E. Sundberg	Cliffs-Shaft	CC-190D	Converted to age pension effective 7/1/55.
Sam Latkovich	Canisteco	CC-191D	Converted to age pension effective 3/1/55.
William M. Lund	General Storehouse	CC-198D	Died 1/17/55
Axel Lindquist	Maas	CC-199D	Converted to age pension effective 10/1/55.
August E. Kangas	Athens	AM-4	Died 1/2/55
Wilfred Dumble	Athens	AM-6	Died 5/1/55
Simon Chetto	Athens	AM-13	Died 2/3/55
Victor Johnson	Athens	AM-14	Died 3/31/55

The following table shows the number of pensions being paid under the hourly-rate pension plan as of December 31, 1955.

	<u>Age</u>	<u>Disability</u>
The Cleveland-Cliffs Iron Company	205	12
Negaunee Mine Company	26	
Athens Iron Mining Company	19	
Mesaba-Cliffs Mining Company	20	
Cliffs Power & Light Company	2	
Total	272	12

23.
i. SAFETY WORK

The Central Safety Committee carried out its usual safety program throughout the year 1955. The Committee meets regularly and Mr. Stromquist, Safety Director, presents a review of our accidents previous to the meeting and each case is gone over carefully. A study of every accident is made and at the meeting suggestions are made to lessen or eliminate, if possible, the accidents in the future. Each accident is definitely classified.

Central Safety Meetings were held on the following dates in 1955:

January 28	July 22
February 25	September 9
March 18	October 5
April 22	December 2
May 20	
June 24	

The roster of the Central Safety Committee as of December 31, 1955 was as follows:

Grover J. Holt	H. W. Rembold
J. S. Westwater	L. J. Erck
S. W. Sundeen	Max Madsen
Hugo H. Korpinen	R. M. DeGabriele
Harry C. Swanson	Ogden E. Johnson
T. A. Kauppila	Jack S. Bowen
Onnie Marjama	Walter F. Gries
Gilbert A. Dawe	Walter E. Johnson
R. L. Tobie	Arne Andelin
Kenneth Olson	B. H. Peterson
John M. Haivala	Eric Beinlich
Dr. Bert E. Moore	Emert W. Lindroos
H. W. Sundberg	A. J. Stromquist
J. D. Preston	Tom W. Hill
E. D. Cory	E. G. Bengry
R. G. Schaal	R. H. Lukkarinen
Grant Hollett	

j. MEDICAL SERVICE

The Company continues to provide coverage and care for all occupational injuries and accidents by continuing the contract which it has had with Drs. A. W. Erickson of Ishpeming and R. L. Paine of Negaunee. This program assures medical care in all cases of accidents and injuries associated with the work of our employees.

(Cont'd.)

23.

j. IRON RIVER HOSPITAL

Since we have discontinued work at the Spies Mine we will not be participating directly in maintaining the employee medical plan. During the year the Superintendent of the Welfare Department attended two meetings of the Board of Trustees of the General Hospital of the Iron River District at Stambaugh. Our Company is one of the mining companies holding stock and at the annual meeting of the Hospital Association, the request of Mr. C. W. Allen, Vice President, that we retain our stock in the company was agreed upon by the Board of Trustees. It was thought advisable to retain the stock for at least a few years, during which time the Company will know what its future program at the Spies Mine will be. The General Hospital of the Iron River District is a well managed hospital and it continues to give superior service to the community.

Dr. L. E. Irvine continued to give medical attention when necessary to our employees in the Iron River District. He was in charge of the physical examination program both for new employees and for employees who were examined periodically.

PHYSICAL EXAMINATION OF EMPLOYEES

Dr. George McL. Waldie, Director of our Industrial Hygiene Department since 1939, retired in October, 1955 and Dr. Bert E. Moore, his assistant, has become the Director in our Industrial Hygiene Department. The Department has been moved from the Ishpeming-Negaunee Hospital to the Clinic of Dr. R. G. Williams in the 8th Addition in Ishpeming.

Dr. Moore, who had an opportunity to serve under Dr. Waldie for several years, carries on the program effectively and courteously. The records of our Industrial Hygiene Department contain much valuable information regarding the physical condition of our employees. Monthly reports are submitted covering the work of this department and these reports are submitted to the Central Office.

(Cont'd.)

23.

j. PHYSICAL EXAMINATIONS OF EMPLOYEES

The total of examinations made through December, 1955, is as follows:

	<u>1955</u>	<u>Total</u>
Cleveland-Cliffs Iron Company	1,449	24,364
Negaunee Mine	-	4,098
Mather Mine "A" Shaft	411	5,184
Mather Mine "B" Shaft	586	2,958
Athens Mine	-	4,408
Electric Power Department	31	1,045
Land Department	3	54
Inland Steel Company	274	5,504
Pickands Mather	-	149
Jones & Laughlin Steel Corp.	54	369
Oliver Iron Mining Company	-	725
Marquette County Road Comm.	-	10
Hercules Powder Company	-	391
Humboldt Mine	42	170
Other Companies - Miscellaneous	-	3,118
	<hr/>	<hr/>
TOTAL	2,850	52,547

k. COMMUNITY HEALTH

Health conditions in Marquette County continued to be very good. There have been no serious epidemics locally although we had over 100 cases of polio in the Northern Peninsula of Michigan during the year 1955. Morgan Heights Sanatorium, the Marquette County Tuberculosis Hospital, under the direction of Dr. James A. Acocks, continues its superior service to the community. Dr. Acocks is considered one of the leading men in the field of tuberculosis treatment and we are fortunate to have his services at our Sanatorium in Marquette County.

Each of the three cities in Marquette County employ a health officer and a full time school nurse. The County of Marquette also has a full time nurse whose services are available to the township districts, mostly through the schools.

City health officers in Marquette County are:

W. A. Corcoran, M. D. - Ishpeming
 R. L. Paine, M. D. - Negaunee
 A. L. Swinton, M. D. - Marquette

For several years some thought has been given to the creation of a Marquette County Health Unit under the direction of a full time doctor. Marquette County is one of the few counties in the Northern Peninsula which does not have a full time County Health Department.

(Cont'd.)

23.

k. COMMUNITY HEALTH

The Superintendent of the Welfare Department feels that a County Health Department for a full time health officer should be established. Some effort is being made now to have this matter considered by the Marquette County Board of Supervisors.

The Northern Michigan Children's Clinic at Marquette, now under the supervision of St. Luke's Hospital, continues to provide necessary treatment for afflicted children from the Northern Peninsula counties.

The camp for handicapped and underprivileged children, known as Bay Cliff Health Camp at Big Bay in Marquette County, had a very successful year in 1955. This Camp has served handicapped children in the Northern Peninsula for the past twenty-five years. It is a free camp which operates about seven weeks during which time children from the fifteen counties of Northern Michigan requiring special attention because of various deficiencies, are cared for at the camp. The following types of cases are accepted: convalescent poliomyelitis cases, rheumatic hearts, other cardiac conditions, diabetics, children having speech and hearing difficulties and those suffering from malnutrition. The Superintendent of the Welfare Department has been Chairman of the Board of Directors of Bay Cliff Health Camp for the past twenty years.

1. RELIEF WORK

Direct relief is extended only in emergency cases. There are no regular recipients of direct relief.

The following is a statement of assistance rendered in 1955. This statement does not include cash assistance.

	<u>Ishpeming</u>	<u>Negaunee</u>	<u>Total</u>
January			\$27.40
February			35.60
March			21.20
April			21.00
May		\$44.00	108.46
June			21.00
July			-
August	\$15.00		27.00
September	45.70		45.70
October			-
November			15.00
December		45.01	85.01
	<hr/>	<hr/>	<hr/>
TOTAL	\$ 60.70	\$ 89.01	\$ 407.37

23.

m. EMPLOYMENT

The Welfare Department cooperates in every way possible with the Employment Office, which is under the supervision of Mr. H. W. Sundberg. Applications for employment which come to the Welfare Department are discussed with Mr. Sundberg and the best interest of the Company is kept in mind.

n. IMPROVEMENT WORK

Mr. Peter DeRoche is in charge of our landscape gardening and improvement of grounds. He succeeded Mr. Payen in 1954. Mr. DeRoche has had excellent training under Mr. Payen and he supervises a program covering all phases of landscaping and grounds improvement.

o. COMMUNITY SERVICE WORK

Each year we mention in our report the American Legion Building in Negaunee which is leased from our Company. Periodical inspections are made and we try to keep the building in good condition. Many community activities are centered in the Negaunee Legion Clubhouse.

In the area there are a great many fraternal organizations and associations. The various nationality groups have their own organizations and many of the fraternal orders maintain their own clubrooms and considerable community activity centers around these organizations.

p. OUTDOOR ACTIVITIES

Each each indicates some increase in the great interest in outdoor activities in the Ishpeming-Negaunee area. The Winter Sports Club with its clubhouse and ski area north of Ishpeming seems to become more popular each year. Not only local people participate in the outdoor programs but many people come on weekend trips to participate in the winter programs. Because of the more than normal snowfall in late 1955 the activities centering around skiing were greater than they ever were. The 68th Annual Ski Tournament of the Ishpeming Ski Club was held in February.

q. THE MATHER INN

The Mather Inn, under the management of Mr. Jules Casperson, who came late in 1955, seems to have increased its services to the community and to the public. Many types of organizations and associations are using the Mather Inn to hold their meetings.

23. o. INCAPACITATED EMPLOYEES (DONATION PAYROLL)

During the year payments were continued to certain men who did not have sufficient service to bring them within the provisions of the Pension Plan of 1/1/1909 but whose cases had merit and to other men who retired under Social Security but had so little employment under that system that their benefits were inadequate. These payments were made over the Donation Payroll. Some of these men were totally disabled through mine accidents while others became incapacitated from illness or disease and required assistance because of large families. There have been very few additions to the payroll over the past few years, and the payroll is employed now only to take care of very unusual cases.

On February 1, 1947 direct relief in the form of grocery, clothing, and fuel orders was discontinued as a regular practice, and allowances over the Donation Payroll were granted in their place. At the close of 1955 only one such recipient - Mrs. Johanna Forstrom - remained on the payroll.

The Holmes Mine Department Donation Payroll became inactive on June 30, 1953. During its active years - January 1932 through June 1953 - a total of \$18,920.92 was expended over the Holmes Mine Department Donation Payroll.

After being granted, the Furnace Department donations were paid originally by the Furnace Department itself and later by the Cliffs-Dow Chemical Company. By direction from Cleveland on September 1, 1937 the donations were paid by this office over the Furnace Department Donation Payroll. The payroll became inactive in August 1950 with the death of its last payee, and it will remain inactive. During its active years - September 1937 through August 1950 - a total expenditure of \$11,910.00 was made over the Furnace Department Donation Payroll.

The Mesaba-Cliffs Mining Company Donation Payroll remained inactive during the year. The last payment over this payroll was made in March 1948. From the date of origin, January 1, 1946, through March 1948 a total expenditure of \$795.00 was made over The Mesaba-Cliffs Mining Company Donation Payroll.

There are four widows receiving Donation payments, all on the Mining Department Payroll. Two of these widows, Mrs. J. H. Tregoning and Mrs. Fiina Kampinen, were granted regular donations; one, Mrs. Johanna Forstrom appears on the payroll because of the conversion of direct aid orders to monetary allowances; and one, Mrs. Lyda M. G. Turgeon, is being paid over this payroll rather than under the Pension Plan of 3/1/1950.

23. r. VARIOUS DEPARTMENTS AND ACTIVITIES

During the year 1955 the Superintendent of the Welfare Department completed his service as President of the Michigan Tuberculosis Association and his term as President of the Michigan Society for Crippled Children & Adults, Inc. He continues as a member of the Executive Committee of both of these organizations. Service as a member of the State Board of Education continues - election to this office was in April of 1953 for a six-year term.

The Superintendent of the Welfare Department, during the year 1955, was elected Grand Chancellor of the Knights of Pythias of Michigan which term is for one year. He was also elected to the position of Potentate of Ahmed Temple of the Shrine which is for the year 1956. The Superintendent of the Welfare Department continues to serve as a member of the Advisory Consultant Staff to the State Department of Public Instruction on community planning and programing.. During the year he was also selected as a member of the survey committee of the National Probation and Parole Association which is part of a national project which will carry on its work for a period of three or four years. This Association is made up of a number of men from various field, including business, education, medicine, religion and management from the State of Michigan.

The employees of the Central Office held their annual Christmas Party on December 23, 1955.

s. POLICE DEPARTMENT

The Police Department carried on its work throughout the year under the supervision of the Superintendent of the Welfare Department and under the supervision of Mr. Emil Hoff, our Police Chief. Conferences regarding police and plant protection were held almost daily with Mr. Hoff and he submitted a monthly report. We try to select our police force carefully and we believe it is an efficient unit.

t. APPRECIATION

As Superintendent of the Welfare Department I wish to express my appreciation for the continued cooperation, the assistance, guidance and understanding which has been given this Department by Mr. G. J. Holt, General Manager; Mr. J. S. Westwater, Manager of Michigan Mines; Mr. C. W. Allen, Vice President and former General Manager; and Mr. O. E. Johnson, Director of Industrial Relations.

The excellent cooperation which is given by the staff of the Safety Department and its director, Mr. A. J. Stromquist, is appreciated. We shall continue to exert every effort to maintain cooperation and efficiency within this Department and with those departments closely associated with it.

REPORT OF GEOLOGICAL DEPARTMENT FOR YEAR ENDING
DECEMBER 31, 1955

The following is a report of the Geological Department for the year 1955:

CONTENTS

- I. Staff
- II. Geological and Geophysical Field Work
- III. Exploration Drilling Division
- IV. Surface Exploration
- V. Underground Exploration
- VI. Land Offers and Outside Explorations
- VII. Microscopy
- VIII. Other Departmental Highlights

This report has been prepared through the cooperative efforts of each of the staff members. The geologist in charge of each project prepared the summary of his assignment. The editorial board consisted of Gerald J. Anderson, Eric J. Rex, E. Richard Randolph and Burton H. Boyum.

I. STAFF

A. Distribution

As in the past, Ishpeming continued to be the headquarters and base from which the Company's exploration activities operated, not only for Michigan, but for the other geographical areas. Minnesota exploration headquarters have been at the Hibbing office while Canada centered around our Canadian Cliffs office at Port Arthur, Ontario.

During the year 1955, Mr. E. L. Derby, Jr. former Chief Geologist, continued as a Geological Consultant, devoting all of his time to matters pertaining to the Federal Taxation, retiring completely on December 1, 1955.

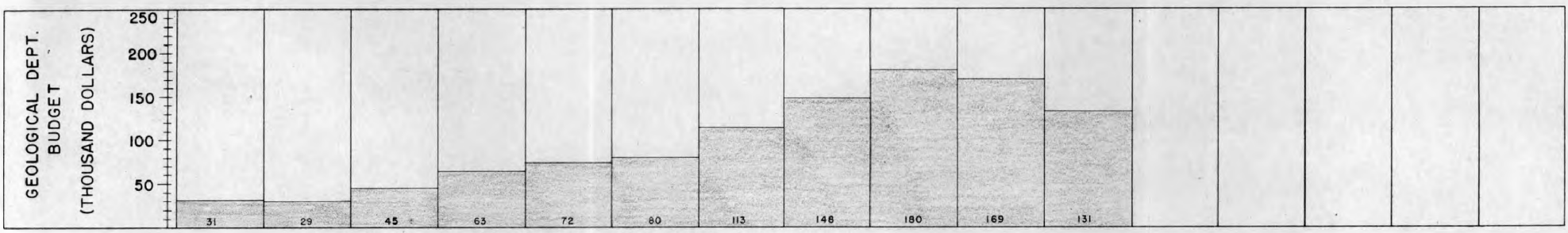
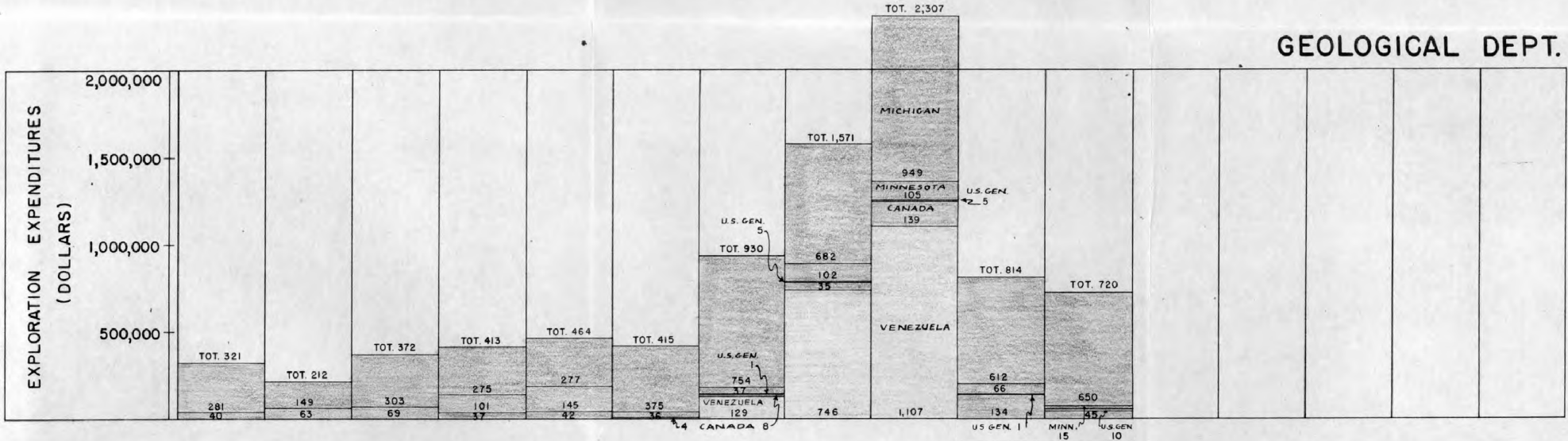
The Company's exploration activities diminished in the year 1954 and were reduced further in 1955. Staff reductions were made both years. The Department was reduced in size to the approximate magnitude during the year 1950. The relative comparison in the exploration expenditures, the departmental budget and the personnel is shown in Figure 1 as well as in Table I.

February 24, 1956

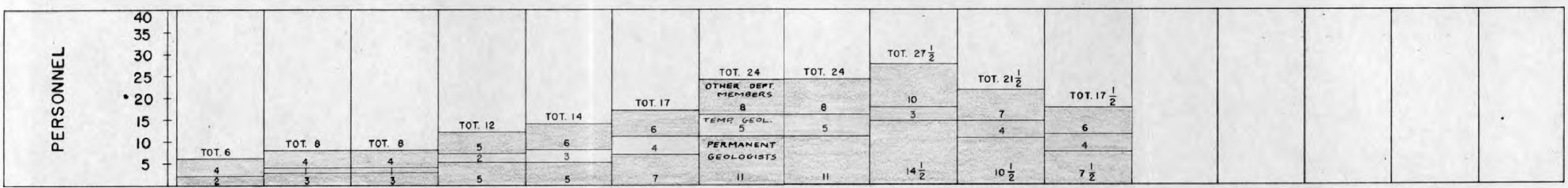
FIGURE 1

BUDGET DATA

GEOLOGICAL DEPT.



ACCOUNT 35 OR 426 MICHIGAN, U.S. GENERAL, AND FOREIGN



1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960

Mr. Burton H. Boyum continued as Chief Geologist, devoting his activities principally to Michigan exploration, but with a significant amount of time spent on Minnesota, U. S. General and Canadian exploration.

Mr. Gerald J. Anderson continued as Michigan District Geologist, co-ordinating Michigan exploration and drilling activities. Mr. Kenneth G. Maikkula was laid off in February, 1955, thus greatly increasing Mr. Anderson's work load. Mr. Eric J. Rex spent the first part of the year as Party Chief on the Cameo Project and the latter part of the year on field reconnaissance pertaining to our U. S. General program. Mr. Rex was succeeded by Mr. Robert W. Riedel, who served as Acting Party Chief from June until the end of December. At the end of December, Mr. Riedel became a permanent employee and will continue as Resident Party Chief on the Cameo Project. Mr. Rolland L. Blake had been granted a leave of absence when he returned to school at the University of Minnesota on a U. S. Bureau of Mines fellowship. Mr. Blake was able to work as a temporary summer employee on a phase of our Minnesota exploration during the summer months.

In addition to Mr. Kenneth G. Maikkula, Messrs. Layton C. Binon and David M. Bennett were laid off in February. These men were not replaced during the year.

Also during the year, three of the permanent geologists resigned to take employment elsewhere, namely; Mr. Charles R. Pace, Jr. resigned April 15th and was replaced by Mr. Bruno J. Haas; Mr. Joseph L. Patrick resigned November 30th without replacement; Mr. Donald L. Gilbert resigned November 30th and was replaced by Mr. Gordon E. Frantti during November.

Mr. George M. Olson was transferred to the Engineering Department on August 15th. Mrs. Betty M. Herman resigned effective January 28th and was replaced by Miss. Klara Marie Hult on January 10th.

Mr. Robert M. Becker, Operating Engineer at the Cliffs-Shaft Mine, was reassigned to the Geological Department budget even though none of his activities were in the department. He resigned from the Company effective August 31st.

Dr. Melville W. Bartley continued as Resident Manager for Canadian Cliffs, Ltd. with headquarters at Port Arthur, Ontario. He was assisted during the summer by Dr. James M. Neilson, Geological Consultant.

TABLE I

GEOLOGICAL DEPARTMENT

Burton H. Boyum, Chief Geologist

Gerald J. Anderson, Michigan District Geologist
Eric J. Rex, U. S. General Geologist

EXPLORATION DRILLING DIVISION

Gerald J. Anderson, Supervisor
Kenneth G. Maikkula, Drilling Engineer (A)
Swante Merrila, Foreman
Carl Ostlund, Foreman
Alvin Nelson, Foreman (B)
Eino O. Kujala, Diamond Drill Clerk

TECHNICIANS

George M. Olson (J)
Robert W. Ryan

DRAFTSMEN

Pat S. Johnson
John V. Larson
Donald R. Nankervis

GEOLOGISTS.

David M. Bennett (C)
 Layton C. Binon (D)
 Donald L. Gilbert (E)
 Gordon E. Frantti (F)
 Bruno J. Haas (G)
 James P. Meyers
 Charles R. Pace, Jr. (H)
 Joseph L. Patrick (I)
 E. Richard Randolph

MICHIGAN FIELD ASSISTANTS, TEMPORARY

Robert W. Riedel, Geologist, (N)
 Robert H. Mount, Geologist
 Thomas L. Longacre, Geologist
 Donald F. Anderson, Compassman-Notekeeper
 Owen D. Marjama, Compassman-Notekeeper
 Robert L. Kelly, Compassman-Notekeeper

MINNESOTA FIELD ASSISTANTS, TEMPORARY

Rolland L. Blake, Geologist (O)
 Tony Spanish, Compassman-Notekeeper (P)

- (A) Laid off February 15, 1955 - Continued as a temporary employee until March 15, 1955.
- (B) Hourly rate Foreman until November 1, 1955, thereafter monthly salary.
- (C) Laid off on February 15, 1955 - Continued as a temporary employee until May 6, 1955.
- (D) Laid off on February 15, 1955 - Continued as a temporary employee until May 13, 1955.
- (E) Resigned November 30, 1955.
- (F) Started November 1, 1955.
- (G) Started April 25, 1955 as a temporary employee and became permanent on October 31, 1955.
- (H) Resigned April 5, 1955.
- (I) Resigned November 30, 1955.
- (J) Transferred to Engineering Department on August 15, 1955.
- (K) Started January 10, 1955.
- (L) Resigned January 28, 1955.
- (M) Shared one-half with Metallurgical Department.
- (N) Resumed temporary employment on June 13, 1955. Became permanent Geologist on January 1, 1956.
- (O) Employed as temporary summer geologist from June 13 to September 16, 1955.
- (P) Employed as temporary summer Notekeeper and Compassman from June 13 to September 16, 1955. Transferred to Engineering Department on September 16, 1955.

SECRETARIAL

Mrs. Belle Bloch, Office
 Secretary
 Miss. Klara Marie Hult (K)
 Mrs. Betty M. Herman (L)

MICROSCOPY

Tsu-Ming Han (M)

CONSULTANTS

Dr. James M. Neilson, Canada

B. Man-Hour Summary

The following Table II is the hourly rate personnel carried on the General Storehouse payroll as members of the Exploration Drilling Department:

TABLE II

DISPOSITION OF HOURLY RATE PERSONNEL
GENERAL STOREHOUSE PAYROLL

Total Days Worked (5 Day Week)	- 255
Saturdays & Sundays	- 105
Holidays	- 5
Days Lost to Strike, etc.	- 0
Total	365

<u>Descrip- tion</u>	<u>Total No. of Men</u>	<u>New Hire</u>	<u>Separa- tions</u>	<u>Total Hours Worked</u>	<u>Statist- ical Men</u>	<u>Labor Cost</u>
Runners	19	-	3	36,748.5	19.25	\$ 87,638.76
Helpers	20	23	8	36,903.0	19.50	74,559.42
Total	39	23	11	73,651.5	38.75	\$ 162,198.18

Table III shown below is a recapitulation of the various components of the Exploration staff:

TABLE IIIMAN-HOUR SUMMARYMICHIGAN

<u>Geological (Account 426)</u>	<u>Men</u>	<u>Hours</u>	<u>Dollars</u>
Permanent	21	29,841	\$ 79,751.45
Temporary	11	5,677	14,028.71
Sub-Total	28	35,518	\$ 93,780.16

Drilling Division (Account 435)

Labor	39	73,651.5	\$ 162,198.18
Supervisors and Clerk	5	6,951	17,418.25
Sub-Total	44	80,602.5	\$ 179,616.43

MINNESOTA (Account 326)

Temporary plus prorated share of B. H. Boyum	3	1,431	\$ 3,952.17
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U. S. GENERAL AND FOREIGN (Account 436)

Prorated share of B. H. Boyum and E. J. Rex	2	1,228	\$ 4,289.00
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Grand Total	75	118,779.5	\$281,637.76
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The following tabulation, Table IV, shows the distribution of the professional members of the Geological Department by projects, during part or all of 1955:

TABLE IV
DISTRIBUTION OF PROFESSIONAL EXPLORATION STAFF
DURING PART OR ALL OF 1955

MICHIGAN

Operating Mines

Bunker Hill (Athens)-----	Joseph L. Patrick
Cambria-Jackson-----	Bruno J. Haas
Cliffs-Shaft-----	James P. Meyers
Lloyd Mine-----	Donald L. Gilbert
Maas-Pioneer & Arctic-----	Joseph L. Patrick
Mather Mine "A" Shaft-----	Donald L. Gilbert
Mather Mine "B" Shaft-----	Bruno J. Haas
Humboldt-----	Burton H. Boyum (Part time)
Ohio-----	
Republic-----	
Spies-----	Gerald J. Anderson
Tilden-----	

Exploration Projects

Allen-Carlson-----	Gerald J. Anderson
Belleview-----	E. Richard Randolph
Cascade-----	"
Eagle Mills-----	"
Empire-----	"
Fitch-----	"
Osier-----	Eric J. Rex & Robert W. Riedel
Perkins-----	" "
Rock-----	" "
Section 10, 47-27-----	J. P. Meyers
South Sturgeon-Indian Lake---	Robert W. Riedel
Titan-----	Gerald J. Anderson
Trenary-----	Robert H. Mount

C. GENERAL SUMMARY

Throughout the greater part of 1955, the Geological Department operated with a total of 17½ persons, all based from Ishpeming. This number is the approximate size of the Department in the year 1950. The exploration expenditures in 1955 were not quite double that of the year 1950. It is our belief that the magnitude of the Company's exploration program determines the size of the exploration staff.

In a different sense, one may point to the ratio of professional staff members engaged at the respective operating properties to those working on general exploration. In 1955, four of the seven and one-half geologists were working at operating mines. At the year's end, Mr. Riedel became a permanent employee and shifted the ratio in favor of exploration rather than operations. 1955 was the first year since 1952 that we have not had a resident staff member in Hibbing on the Minnesota exploration program.

II. GEOLOGICAL & GEOPHYSICAL FIELD WORK

As in previous years, our field work has been done by two-man parties. One member acted as the geologist and the other as the compassman, or with one member as the geophysicist and the other as the notekeeper. In general, the reconnaissance work was done with sundial compass survey lines, together with the mapping of outcrops, dumps and pits, the sampling of iron-formation, and the collecting of representative hand specimens of various rock types encountered.

This Section II is subdivided into three principal areas in which geological and geophysical field work has been done.

A. Michigan

Field work in 1955 in Michigan was in two general areas, Marquette Range and Cameo Project, with permanent personnel doing the necessary spot work on the Marquette Range. On the Marquette Range, field parties were not composed of definite groups, the work being done determining the size and structure of the crew. Geologic mapping was done by one or two men. EM work was conducted by two men and seismic profiles were run using two to five men. Three is the normal complement of a seismic crew, but winter work was accelerated with the additional help.

On the Cameo Project we employed 2 two-man field parties, together with part of our permanent staff conducting field work. Both Messrs. Robert W. Riedel and Robert H. Mount had thesis subjects for their Masters Degree which were field problems in which the Company was interested. They worked partly on their own time on these problems for credit on their degrees.

The following areas are detailed:

1. Eagle Mills District - E. Richard Randolph

Four days were spent making 19 Refraction Seismic shots deep in the woods with 2 feet of snow on the ground. Satisfactory records were obtained despite the proximity of a fleet of bulldozers, earthmovers and trucks. The overburden was determined to be uniform material ranging from 50' to 220' deep, which was proven by the three water test wells sunk on the basis of seismics into ledge channels at different points. The sand proved to have low permeability however, and 100 gpm pure drinking water was the maximum produced. The cost of the seismic survey was \$621.30 or \$32.70 per shot. A complete 400' profile of ledge is provided by each pair of shots.

2. Negaunee District - E. Richard Randolph, Geologist

a. Belleview - Since the Belleview area had been mapped only by reconnaissance parties in the early part of the century, the start of exploration for low grade ore in this area presented an opportunity to map the geology from scratch. A total of 7600' of line was cut for geological and superdip exploration. Five days were spent, three on geology plus office work at a cost of \$424.24, and two on magnetics, at a cost of \$99.80. A total of \$471.02 was charged by engineering for survey control.

b. Empire - Only miscellaneous field mapping was conducted in the Empire area during 1955. No field time was charged against it.

c. Mather Mine "B" Shaft Surface Subsidence - Ground water problems on the Mather Mine "B" Shaft Surface necessitated a comprehensive Seismic survey which resulted in a ledge contour map of the area. A definite ledge channel was discovered which has guided subsequent pumping tests. Five and one-half days were spent making 29 shots for a total cost of \$326.76 or \$11.20 per shot.

3. Cascade District - E. Richard Randolph, Geologist

a. Cascade East-End - Fifty-six hundred feet of EM surveying was used to guide the interpretation from drilling. Results were partly disappointing in that the Palmer fault did not show as an anomaly. Cost of the survey was \$97.55.

4. North Lake-Saginaw District - E. Richard Randolph, Geologist

a. Fitch Area - Some geological mapping was available in this area, but it did not pinpoint the hangingwall quartzite-iron-formation conglomerate contact. Seven thousand feet of EM traverse plus 600' of EM random reconnaissance was used to delineate the contact prior to drilling. Experience showed that the anomaly peak was shifted approximately 100' to the iron-formation side. The cost of the two days' work was \$81.89.

5. East Central Upper Peninsula (Cameo Project) - Robert W. Riedel, Party Chief

Exploration continued throughout 1955 on this project and because of the Paleozoic cover overlying the Pre-Cambrian iron-formation, the field work was entirely geophysical in attempting to delineate the iron-formation ranges and the ore pockets within them.

The geophysical tools employed in this endeavor consisted of the vertical intensity magnetometer, the airborne magnetometer, the static gravimeter, the electromagnetic induction (EM) technique, and an unsuccessful attempt to determine the depth to the Pre-Cambrian "ledge" with high resolution reflection seismic equipment. The project is divided into separate areas, but in each, the general field technique was the same; i.e., ground magnetics to pinpoint the aeromagnetic anomalies, gravity observation of selected magnetic traverses to aid interpretation, and EM reconnaissance to aid correlation and drilling. This field work was accomplished by various members of the permanent staff, augmented by three, two-man crews during the summer field season. The physical characteristics of the areas disclosed by this exploration are as follows:

a. Perkins - High (+20,000 to +31,700 gammas) magnetic anomalies are found associated with moderate (+0.20 to +0.30 mgals.) gravity anomalies, both of which decrease gradually to the west but abruptly to the east of Section 26, 42-22. Low magnetic (0 to +3000 gammas) anomalies accompany low (0 to 0.20 mgals.) gravity anomalies elsewhere as in Section 24, 42-22.

b. Osier - This area contains a moderately high (+10,000 to +15,000 gammas) magnetic anomaly the configuration of which indicates considerable structural complexity and is associated with a moderately high (+0.30 to +0.50 mgals.) gravity anomaly. The anomalies are largely confined to Section 18, 43-21, and Sections 13 and 14, 43-22.

c. Rock - This area contains a regular, easily traceable, moderate (+2,000 to +6,000 gammas) magnetic anomaly running for some six miles east of Rock; the associated gravity anomaly is usually a low to moderate positive one. West of Rock and Highway M-35 is an area comprised wholly of low magnetic and low gravity anomalies. The configuration of the iron-formation, which the anomalies are presumably an expression of, is not at all clear - considerable structure is indicated.

d. Trenary, O.E. 1159 - Ground magnetics disclose a low magnetic anomaly associated with what appears from unreduced data, to be a high positive gravity anomaly.

e. South Sturgeon-Indian Lake, O.E. 1164 - Compared to the above four, this is a large area and contains within itself all possible combinations of high to low magnetic anomalies associated with high to low gravity anomalies. When it is considered that the Paleozoic cover over this area probably averages some 1000 feet compared to the 600 to 700 feet over the above areas, the moderately magnetic anomalies associated with high (+1.00 to 1.50 mgals.) gravity anomalies take on added interest.

An approximate recap of the magnitude of the geophysical field work during the year is as follows:

Area	Miles of Magnetometer traverse	No. of Magnetometer stations	Avg. Density in Sta. Per Mile	Miles of Gravity Traverse	No. of Gravity Sta.	Avg. Dens. in Sta. Per Mile
Combined Perkins & Rock-Osier	86	2500	29	17	421	25
Trenary	40	400	10	3.5	35	10
South Sturgeon-Indian Lake	<u>180</u>	<u>1300</u>	<u>7</u>	<u>180</u>	<u>1300</u>	<u>7</u>
Totals	306	4200	13.8	200	1756	8.8

f. Rapid River, O.E. 1162 and Gladstone-Cornell, O.E. 1160 - No ground work was done on these two anomaly areas. Further definition of the magnetic anomalies was made by the airborne magnetic survey in June, 1955. We plan to work on these areas in 1956.

g. General Airborne Magnetic Reconnaissance - In April the Aero Service Corporation of Philadelphia was engaged to conduct additional airborne magnetic reconnaissance of the Upper Peninsula from the area done in 1954 easterly to Detour. The work emphasized the South Sturgeon-Indian Lake anomaly. A total of 1,840 miles at \$7.85 per mile was flown and recorded. In addition, 722 miles at \$7.65 per mile was flown to augment the 1954 work in detailing the previously known anomalies. The 1954 survey was 1848 miles at \$8.05 per mile. No other major anomalies were found to the east, by the 1955 survey.

B. Minnesota

1. General

On June 13th, Mr. Rolland L. Blake, Geologist and Mr. Tony Spanish were engaged for temporary summer work based at the Hibbing office. Both men worked until September 16th when Mr. Blake returned to the University of Minnesota and Mr. Spanish was transferred to the Engineering Department. Throughout the year, Mr. Boyum visited the Hibbing office in connection with the Minnesota Exploration program.

2. Mesaba Range

Field work was confined to the area North and West of Grand Rapids, specifically on Land Offer 2928, the Holding Company and Land Offer 2918, the Trask Lands. On the Holding Company lands, Messrs. Blake and Spanish cut two sundial compass lines and ran electromagnetic induction traverses for a total of 9600'. This data plus the review of the old drill logs and recent stratigraphic and metallurgical information, helped in planning for the drill holes which were started late in the year. In the fall, Mr. E. R. Randolph put in additional lines on the Trask Land for electromagnetic induction survey. A total of 5500' of line was run.

3. Northeastern Itasca County

Northeastern Itasca County, O.E. 1107 consisted of magnetic and geological reconnaissance of several magnetic anomalies detected by airborne means in the general project sponsored by both the Federal and State Geological Surveys. During the winter, ground magnetics were obtained along roads and trails and the area was scouted by Messrs. Blake and Spanish during the summer. Hand Specimens and ore samples were collected of the iron-formation.

C. United States General - Eric J. Rex, General Exploration Geologist

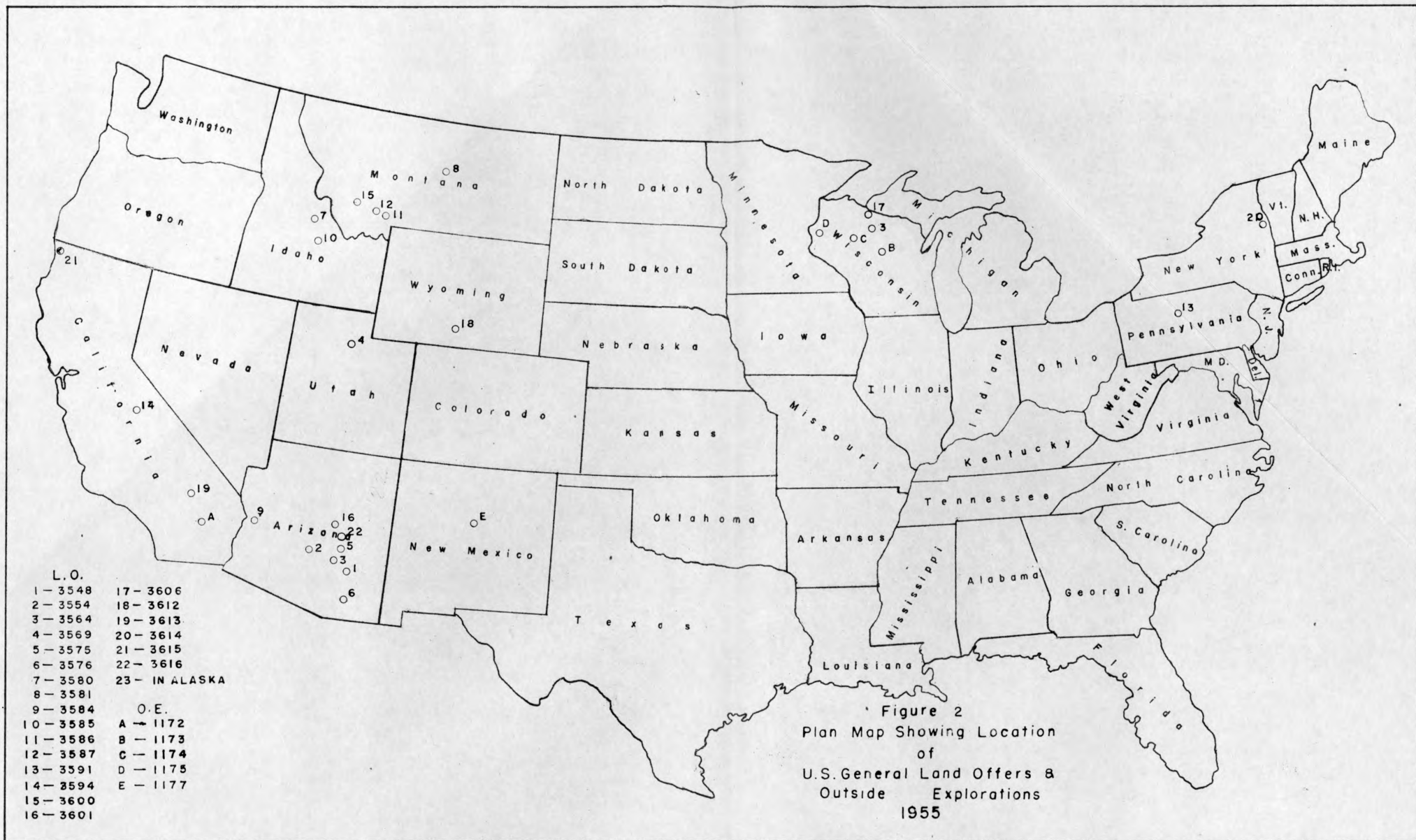
Section VI of this Annual Report covers the general subject of Land Offers and Outside Explorations.

During 1955 a total of 23 mineral land offers originated in the United States, including one in Alaska, but exclusive of Michigan and Minnesota. Locations are shown in Figure 2.

1. Land Offers

a. Arizona, L.O. 3548, Manganese Iron Deposits in South-Central Arizona - Early in 1955 Mr. Gus Karrington of Globe, Arizona, obtained options on a number of manganese and iron properties near Globe and Tucson, Arizona. These properties were later offered to Cliffs through Mr. Ed. Christofferson of Duluth and Long Beach, and examined and reported by Mr. B. H. Boyum. Of the original deposits offered, one was reassigned a new land offer number and the remainder declined. One deposit was examined by Mr. Rex, but no great amount of mineralization was seen. It is possible that Mr. Rex was not shown the more attractive part of the deposit.

b. Alaska, L.O. 3549, Copper Deposit on Cedar Bay, Alaska - This Land Offer was also submitted through Mr. Ed. Christofferson. It consists of a group of copper claims on Cedar Bay near Valdez, Alaska.



This land offer was not pursued.

- c. Arizona, L.O. 3554, Various Mineral Deposits other than Manganese and Iron in Arizona - Through Mr. Christofferson, a group of specimens of metallic and non-metallic minerals was sent to our Ishpeming office from Arizona. The specimens were examined and placed on file, but the deposits were not pursued.
- d. Wisconsin, L. O. 3564, Iron Ore Lands in Northern Wisconsin - Early in the year, a Mr. Giesen of Chicago offered Cliffs through the Cleveland office, a property in Northern Wisconsin. This property is held under leases by a Mr. Walter Thiede, also of Chicago. Mr. Thiede consented to visit Ishpeming to discuss the property, but has not yet appeared.
- e. Utah, L.O. 3569, Eklund Manganese Deposit near Ogden, Utah - The Higley Mining Company, through a partner, Mr. Peter Eklund of Roy, Utah, offered a manganese property about 25 miles northeast of Ogden. This property was examined and sampled by Mr. Rex. It was found to contain concentrations of manganese oxide in the conglomerate. A sample of a six foot thickness of ore contained 19.3% manganese.
- f. Arizona, L.O. 3575, Watts Iron Claims near Young, Arizona - This land offer consists of a group of claims on a magnetite deposit between Globe and Young, Arizona. It is a tabular deposit ranging in thickness from about 18 feet to 5½ feet. On the basis of mining difficulty, tonnage probability, and transportation difficulty, Mr. Rex has recommended that this land offer be declined.
- g. Arizona, L.O. 3576, Crescent Manganese Deposit near Winkelman, Arizona - The Crescent Manganese Mine is located about 12 miles south of Winkelman. During the fall, the owners were shipping their production to Deming, New Mexico, where it was purchased by the Government DMPA program. This land offer was examined in May by Mr. B. H. Boyum and again in late summer by Mr. Rex while the latter was in the vicinity examining other land offers.
- h. Idaho, L.O. 3580, Cooper Iron Deposit near Salmon, Idaho - The E. A. Young Corporation offered this hematite deposit in southeastern Idaho. Mr. Rex conducted a magnetic survey on the property as well as the usual mapping of geology and sampling. This deposit was found to be a replacement of a conglomerate by specular hematite.
- i. Montana, L.O. 3581, Running Wolf Iron Deposit near Stanford, Montana - In 1952, this property was offered to Cliffs by one of its owners. At that time it was examined by Mr. Rex and declined because of its relatively small tonnage and high transportation costs. In 1955, it was again offered to Cliffs, but this time by the E. A. Young, Inc., who had leased it on the assumption that it could prove economic with the increases in ore prices and the favorable freight rate to lake ports with its possible lump grade and relative ease of mining being a significant factor.

It was examined by Mr. W. A. Pakkala of the Hibbing Office and Mr. Rex during the summer. Late in the fall, an appropriation was made for drilling the more favorable area. Drilling was commenced in November, but unseasonable cold weather forced the abandonment of the drilling program for 1955.

j. Arizona, Iron and Manganese Properties near Bouse, Arizona - Mr. Ed. Christofferson of Long Beach and Duluth submitted a number of claims near Bouse for their optioner. These claims were scheduled for examination by Mr. Rex, but urgency of the Montana drilling forced the cancellation of the early examination.

k. Montana, L.O. 3585, Ausich Magnetite Deposit near Mackay, Idaho - The E. A. Young Corporation submitted a group of claims about 9 miles from Mackay, Idaho. These claims were originally worked for copper. However, two samples taken across a 35 foot width showed a maximum of .015% copper. Apparently, the copper mineralization is confined to the wall of the magnetite. This deposit presently has potential as a lump ore producer.

l. Montana, L.O. 3586, Cooper Chrome Deposit near Sheriden, Montana - Also offered through E. A. Young, Inc., this chrome property was given a preliminary examination by Mr. Rex. A microscopic examination by Mr. Tsu Ming Han, Mineralogist, showed the chromite itself to have a low chrome-iron ratio with insufficient chrome to meet minimum specifications as a chrome concentrate.

m. Montana, L.O. 3587, Gage Iron Deposit near Sheriden, Montana - These claims, apparently long ago expired, were offered through E. A. Young, Inc. by Mr. Cooper and associates. The former owner, Mrs. Gage, had these claims staked on the recommendation of a W.P.A. engineer, who said they were chrome bearing. After having them analyzed, it was found that the samples taken were high in iron, but contained no chrome.

After two attempts to locate these claims, Mr. Rex made no further attempt. Mr. Cooper and his associates are scheduled to make another trip to attempt to locate these claims with Mrs. Gage.

n. Pennsylvania, L.O. 3591, Lead and Zinc in Central Pennsylvania - This land offer was submitted by Mr. Arthur C. Dale, Attorney, of Bellefonte, Pennsylvania, for his principal, Mr. A. B. Dally, Jr. of Pittsburgh. The offer consists of a partially developed zinc and lead property in Central Pennsylvania. The original offer was submitted through Mr. D. K. Campbell, Project Engineer, but it was subsequently declined.

o. California, L.O. 3594, Tungsten near Fresno, California - Mr. Ed. Christofferson, acting as agent for the owners, submitted this Land Offer consisting of a tungsten deposit near Fresno. It was anticipated that should Mr. Rex be in the vicinity of Fresno during the summer, he would make a preliminary examination of this property. The drilling program initiated in Montana prohibited this examination.

p. Montana, L.O. 3600, Helahan Iron Deposit near Melrose, Montana - The Helahan property was submitted by E. A. Young, Inc. The iron in this deposit was found to be in a ferruginous shale. This material was found to be spread over a wide area, but the grade was low and heavy media separation was impractical. The iron was chiefly in the form of earthy goethite with some hematite. Mr. Rex examined this deposit and took one sample which showed some manganese oxide. This deposit is about 8 miles northeast of Melrose, Montana. In the early twenties, it had been used as a source of flux iron for the nearby Hecla Smelter.

q. Arizona, L.O. 3601, Haught Iron Claims near Young, Arizona - While in Globe, Arizona, Mr. Rex was offered a group of iron claims near Young, Arizona, in the vicinity of the Apache Indian Reservation. The preliminary examination by Mr. Rex showed the thickness of hematitic iron-formation of about 10 feet and the material was seen to outcrop intermittently for a distance of about three-quarters of a mile. Except for two deposits in Wyoming, this is the only western deposit which Mr. Rex has seen which appears like the Michigan hematite deposits and may be of the same genesis. On the basis of the limited thickness and relatively low grade, this offer was declined.

r. Wisconsin, L.O. 3606, Mineral Land in Iron County, Wisconsin - Mr. Anton Bugni of Hurley, Wisconsin, submitted an offer of two forties in Iron County, Wisconsin. This property was found to be off of the iron-formation and was subsequently declined.

s. Wyoming, L.O. 3612, Pattison Iron Claims in the Seminoe Mountains, Wyoming - In 1954, Mr. Rex wrote to Mr. Byron Pattison of Arcadia, California, asking him if he was interested in offering his Wyoming iron property. In reply at that time, Mr. Pattison wrote that it was under option. Nearing the close of 1955, Mr. Pattison wrote again; this time offering the property. Since then he has had two samples sent to Ishpeming, which are now being tested.

t. California, L.O. 3613, Bessemer Iron Magnetite Deposit near Lucerne Valley, California - In 1955, Mr. Paul Honberger, Attorney of Los Angeles, again offered the Bessemer Iron Deposit in the Mojave Desert of California. This property was first offered in 1947 with a group of claims called the Morris Claims. Twenty of the original Morris Claims have been taken up by the Kaiser Steel Corporation.

u. New York, L.O. 3614, Shortworth Company Graphite Deposit near Whitehall, New York - At the close of 1955, the Shortworth Company offered a graphite deposit said by them to contain five million tons of graphite ore. This offer has been referred to Mr. Rex for review.

v. California, L.O. 3615, Heavy Mineral Deposit in Northern California - In addition to the graphite deposit, L.O. 3614, the Shortworth Company also offered a heavy mineral deposit in Northern California. This deposit is said to contain titanium, thorium, and zirconium. It has been referred to Mr. Rex for review.

w. Arizona, L.O. 3616, Uranium Deposit near Young, Arizona - This Land Offer was submitted by a Mr. Leo Shinken, Attorney, of Milwaukee, Wisconsin. It consists of a 70% ownership in what Mr. Shinken refers to as a mine owned by a client. Apparently this deposit is in the vicinity of our L.O. 3575, the magnetite deposit belonging to Mr. Tom Watts. This Land Offer has been referred to Mr. Rex for review.

2. Outside Explorations

a. British Columbia, Canada, O.E. 1126-C, Texada Island, British Columbia - In August, Mr. Rex accompanied Dr. M. W. Bartley of Canadian Cliffs on a visit to the Texada Mine in British Columbia. The mine, mill, and the loading facilities were studied and a report of the examination prepared by Dr. Bartley.

b. California, O.E. 1172, Kaiser Steel Mine and Mill - During the summer, Mr. Rex visited the Kaiser Corporation mine at Eagle Mountain and their steel mill at Fontana. While at the mine, Mr. Rex made a study of the geology, the mining operations, milling operation, and their general exploration procedures. He was escorted on a short trip through the mill while at Fontana. Also, while at Fontana, he discussed with the Superintendent of Raw Materials, the problems of grades of ores and the obtaining of raw materials.

c. Wisconsin, O.E. 1173, Thorium Deposit near Wausau, Wisconsin - Mr. E. Richard Randolph, Geologist, spent three days in the field near Wausau (Settin Township) reconnoitering thorium prospects controlled by the Warber-Rumbuc Combine and the Titan Mining Company. Fifteen thousand feet of reconnaissance scintillometer survey and 7,500 feet of more detailed survey were conducted. He also sampled the various test pits opened by the above organizations. Total geologic costs of the investigation, including negotiations, was \$379.94.

d. Wisconsin, O.E. 1174, Olson Iron Property near Bruce, Wisconsin - Mr. E. Richard Randolph conducted an investigation of outcrops, test pits, and drill core from the O. L. Olson property and was convinced that although the material present was merely ferruginous argillite, it definitely indicated the presence of Huronian type rocks, some members of which were highly enriched with iron. He concluded that a full investigation of rock types in the area might prove up a good iron-formation and possibly ore.

e. Wisconsin, O.E. 1175, Magnetite and Ilmenite Deposit near Clam Lake, Wisconsin - Mr. E. Richard Randolph also examined this outside exploration and reports as follows: The Inland Steel Company had recently completed a wildcat drill hole at the time Cliffs' personnel visited the site and the only evidence which remained was sludge. A careful sample was examined petrographically by Mr. Tsu Ming Han, Mineralogist, who computed approximately 8% of the deposit was easily liberated ilmenite. The remaining fraction was titaniferous magnetite and gangue. Subsequent discussion with Mr. Alan Broderick of the Inland Steel Company disclosed that he believed it to be a magnetic gabbro of little value to them.

D. Canada - Canadian Cliffs, Ltd.

The Canadian Cliffs staff consists of the Resident Manager, Dr. M. W. Bartley and Chief Clerk, Mr. Les Dack, who are retained on an annual basis at Port Arthur. Liason with Cleveland-Cliffs is provided through Mr. Burton H. Boyum, Chief Geologist, especially on matters pertaining to exploration emphasis and financial matters. Canadian Cliffs, Ltd. engaged Dr. J. M. Neilson, Consultant, for summer exploration in Eastern Canada, and Mr. E. J. Rex of Cleveland-Cliffs, Ishpeming office for a short reconnaissance in British Columbia. Other personnel were engaged at various times on a part time basis for specific projects.

During the calendar year 1955, Canadian Cliffs, Ltd. undertook exploration in and examination of various areas and properties throughout Canada. The program was restricted due to limited availability of funds and the need for economics wherever possible.

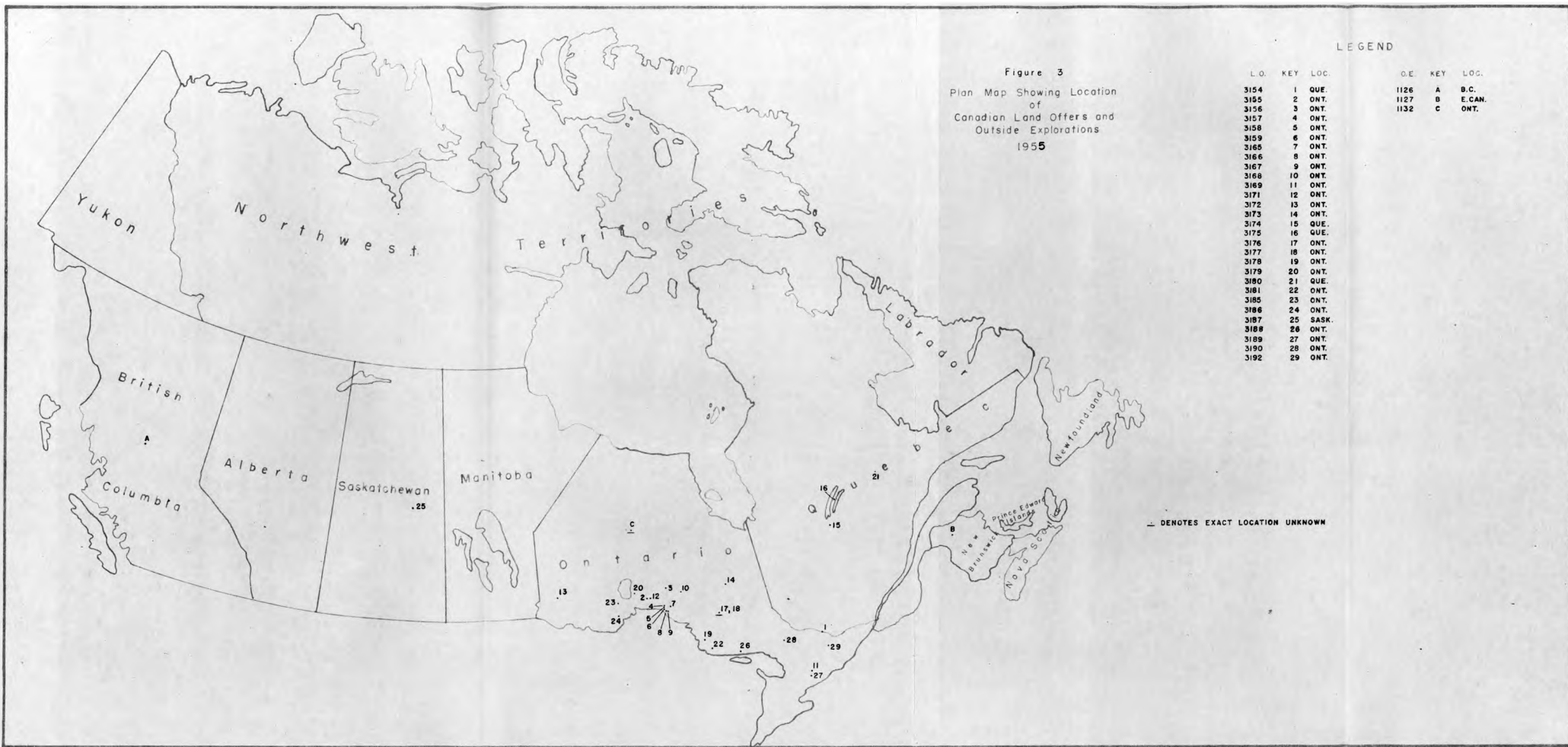


Figure 3
 Plan Map Showing Location
 of
 Canadian Land Offers and
 Outside Explorations
 1955

LEGEND

L.O.	KEY	LOC.	O.E.	KEY	LOC.
3154	1	QUE.	1126	A	B.C.
3155	2	ONT.	1127	B	E.CAN.
3156	3	ONT.	1132	C	ONT.
3157	4	ONT.			
3158	5	ONT.			
3159	6	ONT.			
3160	7	ONT.			
3166	8	ONT.			
3167	9	ONT.			
3168	10	ONT.			
3169	11	ONT.			
3171	12	ONT.			
3172	13	ONT.			
3173	14	ONT.			
3174	15	QUE.			
3175	16	QUE.			
3176	17	ONT.			
3177	18	ONT.			
3178	19	ONT.			
3179	20	ONT.			
3180	21	QUE.			
3181	22	ONT.			
3185	23	ONT.			
3186	24	ONT.			
3187	25	SASK.			
3188	26	ONT.			
3189	27	ONT.			
3190	28	ONT.			
3192	29	ONT.			

— DENOTES EXACT LOCATION UNKNOWN

The exploration consisted of a reconnaissance investigation through parts of Quebec and the Maritime Provinces by Dr. J. M. Neilson, and a cursory investigation of the iron ore possibilities in British Columbia by Dr. Bartley and Mr. E. J. Rex. Land Offers from various provinces were considered but only a few were examined.

During the 12 month period 4 Outside Explorations and 38 Land Offers came under review. Only 17 Land Offers were given serious consideration, 7 of which were new in 1955 and the balance carried over from previous years. All Outside Explorations were abandoned on December 31, 1955, and those considered of sufficient interest to continue investigation will be reassigned as Land Offers in 1956 and re-initiated in these new categories. All but 7 of the Land Offers have been declined and 7 will be carried over into 1956 for consideration and disposal.

Figure 3 shows the locations of the Land Offers and Outside Explorations originating in 1955.

III. MICHIGAN DRILLING DIVISION - Gerald J. Anderson, Supervisor

A. General Highlights

An attempt was made during the year to try out new equipment and experiment with new techniques in an effort to find ways to reduce costs in the Drilling Division.

The new equipment items which were of major importance during the year included the Longyear Wireline Core Barrel, a new deep hole string, new types and new sources of core barrels, and the Tro Pari Compass. The new technique items included experiments in air and mud drilling.

1. Longyear Wireline Core Barrel

During August and September, the E. J. Longyear Company permitted our Drilling Division to use their wireline core barrel equipment on a trial basis in our Cameo Exploration. Although the mechanical performance of the equipment was satisfactory, there was no apparent saving in the drilling costs over conventional coring equipment. The one single advantage in using this type of equipment was the saving in time in not having to lower and hoist the rods after each coring run. Some of the many disadvantages were: higher bit costs because of bit design, slower penetration rate because of a wider curf bit, more frequent blocking because of small clearances in core barrel design, and the necessity of a very high depreciation rate because of the initial high cost of the equipment. These factors more than offset any time saved by not having to hoist and lower the rods.

2. New Drill String

In September, Messrs. Boyum and Anderson made a trip to the Joy Manufacturing Company in Michigan City, Indiana, to discuss the design of a new drill string to be used chiefly for deep hole drilling. The design of this drill string is different in that the rods are much heavier and sturdier than conventional drill rods which it is hoped will contribute to straighter drill holes. The clearances are greater both inside and outside of the rods which will permit efficient drilling with both air and mud. The rods employ tool joints which are many times sturdier than the threads on standard drill rods and also eliminates the use of elevator hoisting plugs.

Five hundred feet of these rods were purchased in order that experimental work could be conducted. Drilling with these rods had just begun in one of the Cameo Project drill holes at the end of the year.

3. New Types and New Sources of Core Barrels

During October, Messrs. Anderson and Ostlund visited Christenson Brothers Plant in Salt Lake City primarily to inspect their complete line of core barrels. As a result, an order was placed for two mud barrels to be used with the new drill string mentioned above, and an order was also placed for some of their conventional rigid tube core barrels which delivered in Ishpeming around \$20.00 per barrel cheaper than our other sources. If these barrels work satisfactorily, our Drilling Division will definitely take advantage of this saving by ordering more.

During the year, the idea of having small job shops manufacture our core barrels was explored through the cooperation of Mr. Iver Johnson. As a result, an order for 50 BX barrels was placed with the Bronson Company of Chicago. A saving of approximately \$20.00 per barrel was realized in this transaction.

4. Tro Pari Compass

Upon completion of the drilling on the Carlson Exploration in December, Hole #92 was tested at several elevations using Inland Steel's Tro Pari Compass and Cliff's Haliburton Reel. This cooperative testing by the two companies gave Cliffs personnel an opportunity to see the advantages of the Tro Pari Compass over the Maas Compass.

5. Air Drilling Experiments

During October, Messrs. Ostlund and Anderson made a trip to the Colorado Plateau to study the air drilling techniques that are widely used in that area. It was hoped that the technique of using air as a media for removing the cuttings could be adapted to drilling the Paleozoic section in the Cameo Area. A climax of this visit to the Colorado Plateau was an actual field testing of the technique in the Perkins Area using the Drilling Division's trailer rig, tricone bits, and a 315 C.F.M. air compressor. It was found that the rotary type tricone bit would cut the Paleozoics and with a good bit life, that the air would remove the cuttings very readily even though there was water in the hole, and that the penetration rate would be satisfactory if the proper sufficient pressures could be applied to the bits. On the strength of this experiment, funds were requested for the purchase of an oil field type Joy Model 225 rotary rig.

6. Mud Drilling Experiments

Early in the year, certain unforeseen difficulties arose in our standard mud drilling practices while attempting to drill through the Paleozoic section of the Cameo Area. The drilling mud tended to flocculate due to contaminants from the Paleozoic rocks, and there was considerable dilution of the mud by water entering the hole through the formations. Experiments with commercial additives and fuel oil proved that the flocculating of the mud could be avoided. The addition of a conventional weighting material to the mud checked the inflow of water that was causing dilution of the mud.

This work was supervised by Mr. Eric J. Rex, Party Chief. These experiments proved that considerable money can be saved if good mud drilling practices are followed.

7. Core Barn

Although limited by personnel shortages, the organization and permanent storage of core in the diamond drill core barn is now almost caught up with current operations. A goal of June 15, 1956, has been set for completing this phase of the project.

B. Specific Details

1. Diamond Cost

The following Table V represents an analysis of the diamond bit costs at the various locations and the respective hole sizes.

TABLE V
PER FOOT COST OF DIAMOND BITS USED IN 1955
SURFACE

PROJECT Sec.	T&R	Hole	EX			AX			BX			NX			Total Footage	Total Bit Cost	
			Ft.	Amt.	Per Ft.	Ft.	Amt.	Per Ft.	Ft.	Amt.	Per Ft.	Ft.	Amt.	Per Ft.			
10	47-27	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
19	47-26	19	-	-	-	-	-	97	\$ 183.12	\$ 1.89	-	-	-	855	\$ 2,584.16	\$ 3.02	
21	48-31	2	-	-	-	-	-	53	65.00	1.23	45	205.65	8.94	97	-	-	
24	47-28	1	-	-	-	749	\$1,539.22	\$2.06	24	85.45	3.56	-	-	98	-	-	
24	47-28	2	361	\$ 818.09	\$2.27	645	2,636.24	4.09	27	334.42	12.39	-	-	773	1,624.67	-	
27	47-26	33	122	381.77	3.13	-	-	-	-	-	-	-	-	1,033	3,788.75	-	
27	47-26	34	-	-	-	-	-	961	2,953.25	3.07	153	1,388.60	9.08	122	381.77	-	
27	47-26	35	-	-	-	-	-	-	-	-	182	570.31	3.13	182	570.31	-	
27	47-26	36	-	-	-	-	-	519	1,665.09	3.21	1,003	5,072.38	5.06	1,522	6,737.47	-	
27	47-26	37	-	-	-	-	-	242	360.44	1.49	1,051	7,185.38	6.84	1,293	7,545.82	-	
27	47-26	38	-	-	-	-	-	592	3,449.73	5.83	9	114.03	12.67	601	3,563.76	-	
27	47-26	39	-	-	-	-	-	-	-	-	442	3,263.61	7.38	442	3,263.61	-	
22	42-22	1	-	-	-	-	-	-	-	-	868	404.91	.47	868	404.91	-	
22	42-22	2	-	-	-	167	113.79	.68	505	982.30	1.95	795	317.50	.40	1,467	1,413.59	-
24	42-22	1	-	-	-	-	-	196	312.53	1.59	712	903.60	1.27	908	1,216.13	-	
26	42-22	3	-	-	-	-	-	785	1,741.06	2.22	280	146.09	.52	1,065	1,887.15	-	
26	42-22	4	-	-	-	503	693.90	1.38	328	640.39	1.95	735	336.46	.46	1,566	1,670.75	-
26	42-22	5	-	-	-	606	2,712.60	4.48	143	473.44	3.31	765	533.47	.70	1,514	3,719.51	-
31	43-22	1	-	-	-	-	-	691	1,854.18	2.68	689	1,351.49	1.96	1,380	3,205.67	-	
TOTAL			483	\$1,199.86	\$2.48	2,670	\$7,695.75	\$2.88	5,163	\$15,100.40	\$ 2.92	8,584	\$24,377.64	\$ 2.84	17,054	\$48,511.22	

Experimental Holes

Sec.	T&R	Hole	3 7/8" & 4 1/4" Tricone			3 1/8" Christenson Bortz Bit		
			Ft.	Amt.	Per Ft.	Ft.	Amt.	Per Ft.
26	42-22	6	234	\$150.00	\$.64	-	-	-
4	42-23	1	-	-	-	154	\$137.57	\$.89

2. Diamond Inventory - Hand Setting

The following Table VI shows the distribution of carbon and ballas bortz for the year 1955.

TABLE VI

DIAMOND INVENTORY (Hand Setting), December 31, 1955

	CARBON (Hand Setting)			BALLAS BORTZ (Hand Setting)		
	Kts.	Amount	Per Kt.	Kts.	Amount	Per Kt.
On Hand 1/1/55	799.00	\$62,902.46	\$78.73	40.89	\$4,077.47	\$99.72
Purchased 1955	-	-	-	-	-	-
TOTAL	799.00	\$62,902.46	\$78.73	40.89	\$4,077.47	\$99.72
Used 1955	7.34	577.85	78.73	-	-	-
Adjustment to Market Value	-	54,408.01	-	-	3,668.57	-
On Hand 12/31/55	791.66	\$ 7,916.60	\$10.00*	40.89	\$ 408.90	\$10.00*

DISTRIBUTION OF INVENTORY: Loose Carbon, Carbon set in bits, Loose Ballas (C. C. I. Co.)
 *Not definitely decided. Refer to Mr. S. W. Sundeen's letter of February 21, 1956 to Mr. R. P. Probeck.

3. Diamond Inventory - Mechanical Setting

The following tabulation shows the over-all distribution of all types of diamond used and on hand during the year 1955.

TABLE VII

DIAMOND INVENTORY (Mechanical Setting), December 31, 1955

	SCRAP CARBON		SCRAP BORTZ		LONGYEAR		"R" GRADE		"G" GRADE		CONGO		TOTAL	
	Kts.	Amount	Kts.	Amount	Kts.	Amount	Kts.	Amount	Kts.	Amount	Kts.	Amount	Kts.	Amount
On Hand 1/1/55	252.94	\$3,814.97	1,608.55	\$2,883.57	211.73	\$2,329.03	25,708.01	\$175,652.20	4,094.49	\$34,746.68	272.42	\$1,585.27	32,148.14	\$221,011.72
Purchased 1955	-	-	3,081.77	5,501.08	-	-	5,984.90	49,580.64	-	-	-	-	9,066.67	55,081.72
Transfer & Exchange	-	-	-	-	-	-	3,326.97	27,355.20	-	-	-	-	3,326.97	27,355.20
TOTAL	252.94	\$3,814.97	4,690.32	\$8,384.65	211.73	\$2,329.03	35,019.88	\$252,588.04	4,094.49	\$34,746.68	272.42	\$1,585.27	44,541.78	\$303,448.64
Used 1955 (loss)	2.01	40.20	185.17	332.64	35.83	394.13	8,956.44	85,207.43	224.68	2,471.48	-	-	9,404.13	88,445.88
Scrap Credit	-	-	-	-	-	-	-	4,683.54	-	28.78	-	-	-	4,712.32
Transfer & Exchange	-	-	-	-	-	-	-	-	2,950.28	25,769.93	272.42	1,585.27	3,222.70	27,355.20
On Hand 12/31/55	250.93	\$3,774.77	4,505.15	\$8,052.01	175.90	\$1,934.90	26,063.44	\$162,697.07	919.53	\$ 6,476.49	-	-	31,914.95	\$182,935.24

DISTRIBUTION OF INVENTORY IN KARATS

	SCRAP CARBON	SCRAP BORTZ	LONGYEAR	"R" NEW	"R" USED	TOTAL "R"	TOTAL "G"	TOTAL INVENTORY
Loose (Mfr's. Possession)	232.75	2,296.11	-	20.00	5,440.49	5,460.49	-	7,989.35
Loose (C.C.I.Co. Possession)	-	1,400.50	-	-	103.76	103.76	-	1,504.27
Salvage Reports Pending	-	-	-	-	632.46	632.46	-	632.46
Bits in Stock or Issued to Contracts	18.18	808.53	175.90	-	19,866.73	19,866.73	919.53	21,788.87
TOTAL	250.93	4,505.15	175.90	20.00	26,043.44	26,063.44	919.53	31,914.95

4. Plant Account

Table VIII shows our comparative status with reference to depreciation of the Department owned drilling equipment.

TABLE VIII

	<u>Schedule "A"</u>	<u>Schedule "B"</u>	<u>Schedule "C"</u>	<u>Total</u>
December 31, 1954	\$23,241.78	\$206,019.57	\$189,198.29	\$418,459.64
December 31, 1955	<u>23,132.26</u>	<u>208,577.23</u>	<u>191,566.08</u>	<u>423,275.57</u>
Net Change	-\$ 109.52	+\$ 2,557.66	+\$ 2,367.79	+\$ 4,815.93
Income from "Per-Shift Charges"				
Total year 1954			\$ 38,803.06	
Total year 1955			59,243.16	
Expense from "Per-Shift Charges"				
Depreciation 1955			\$ 46,746.72	
Repairs & Maintenance 1955			<u>23,114.89</u>	
			\$ 69,861.61	
Net loss for year 1955			10,618.45	
Total equipment book value, 1955			\$423,275.57	
Total in Depreciation Reserve Fund, 1955 including \$46,746.72 above			<u>216,502.11</u>	
Net			\$206,773.46	

The above tabulation shows that although the income from per shift charges was substantially greater in 1955 due to an increased rate, it was still insufficient as indicated by a net loss of \$10,618.45

This may be contributed to a change that was made in 1955 by which the Diamond Drill Department bore all the expenses of repairs and maintenance which it was believed would be taken care of by the increased per shift charges. Prior to 1955 most of the repairs were charged directly to the job on which the equipment was operating. This was unfair in many cases in that a machine might break down after only a week or two on the job which had been worn out on a prior job. In most cases it was too late to charge the repairs to the earlier job due to closed accounts, etc.

One other important factor during 1955 was an excessive amount of repairing that had to be done on two medium hole drill rigs in order to keep them operating. These rigs, because of their age and condition, should have been scrapped or used only on a standby basis instead of regular service; however, because of a constant demand for this type of rig it was impossible to take this step. One new medium hole rig was purchased in 1955 and another rig will be received in January of 1956. The plan is to replace any equipment which has reached a stage where excessive wear is causing major break-downs.

It is felt that the per shift charges are high enough at the present; however, it is possible that steps will have to be taken early in 1956 to arrive at a fair way of distributing the repair charges on the equipment.

IV. SURFACE EXPLORATION

The projects discussed in this section of the Annual Report are those involving drilling in addition to geological and geophysical field work. The details of the geological and geophysical field work have been covered in Section II of this report.

A. Michigan

1. The following Table IX is a summary of the surface drilling including the cost analysis. Each of the areas are discussed separately.

TABLE IX
SUMMARY OF SURFACE DRILLING - COST ANALYSIS

<u>LOCATION</u>	<u>HOLES</u>	<u>RIGS</u>	<u>OVER- BURDEN</u>	<u>DIAMOND DRILLING</u>	<u>TOTAL</u>	<u>1ST CLASS ORE FOOTAGE</u>	<u>%</u>	<u>MET. ORE FOOTAGE</u>	<u>%</u>	<u>TOTAL COST "A"</u>	<u>COST/FT "A"</u>	<u>TOTAL COST "B"</u>	<u>COST/FT "B"</u>
a. Marquette Range													
1'. Eagle Mills	2	C.C.I.	0	14	14	--	--	--	--	--	--	\$ 1,840.31	\$131.45
2'. Empire	19	C.C.I.	0	97	97	--	--	97	100.00	\$ 6,033.96**	\$62.21	9,672.50**	99.72
3'. Cascade East End Metallurgical	34,35,36,37,38,39	C.C.I.	187	3,093	3,280	--	--	2,148	65.5	62,924.73	19.18	69,420.80	21.16
Direct Shipping	33,34,35,36,37	C.C.I.	0	2,421	2,421	109	4.5	--	--	45,007.91	18.59	49,928.78	20.62
Sub Total Cascade	33-39, 7 holes	C.C.I.	187	5,514	5,701	109	2.0	2,148	39.0	107,932.64	18.93	119,349.58	20.93
4'. Mather "B" Surface	153	C.C.I.	110	895	1,005	--	--	--	--	--	--	5,158.20	5.13
5'. Section 10, 47-27 Deep	29	C.C.I.	30	825	855	--	--	--	--	12,659.59	14.81	12,824.36	15.00
6'. Fitch	1,2	C.C.I.	22	1,811	1,833	--	--	825	45.0	21,785.36	11.89	25,528.82	13.93
7'. Humboldt Mine	4,5	C.C.I.	0	275	275	--	--	235	85.5	--	--	1,782.00	6.48
8'. Republic Townsite	1	C.C.I.	49	0	49	--	--	--	--	--	--	466.37	9.52
9'. Titan	2	C.C.I.	35	86	121	--	--	--	--	3,241.62	26.79	4,207.85	34.78
Sub Total Marquette Range	17 holes	C.C.I.	433	9,517	9,950	109	1.1	3,305	51.2	151,653.17*	17.62*	180,829.99	18.17
b. Menominee Range													
1'. Carlson	92	Odgers	116	1,735	1,851	--	--	--	--	23,713.80	12.81	23,722.43	12.82
2'. McColeman	1	Odgers	13	180	193	--	--	--	--	1,975.00	10.23	2,137.20	11.07
Sub Total Menominee Range	2 holes	Odgers	129	1,915	2,044	--	--	--	--	25,688.80	12.57	25,859.63	12.65
c. Cameo Project													
1'. Osier	1,2	Odgers	35	3,060	3,095	--	--	904	29.5	30,262.37	9.78	36,306.37	11.73

TABLE IX CONT'D

LOCATION	HOLES	RIGS	OVER-BURDEN	DIAMOND DRILLING	TOTAL	1ST CLASS ORE FOOTAGE	%	MET. ORE FOOTAGE	%	TOTAL COST "A"	COST/FT "A"	TOTAL COST "B"	COST/FT "B"
2'. Perkins													
a'. Perkins, Sec. 22	1,2	C.C.I.	26	2,352	2,378								
b'. Perkins, Sec. 24	1	C.C.I.	19	911	930								
c'. Perkins, Sec. 26	3,4,5,6	C.C.I.	37	4,389	4,426								
Sub Total Perkins	7 holes	C.C.I.	82	7,652	7,734	--	--	--	--	145,692.61	18.84	162,214.87	21.05
3'. Rock													
a'. Rock, Sec. 31	1	C.C.I.	3	1,389	1,392								
b'. Rock, Sec. 4	1	C.C.I.	7	154	161								
Sub Total Rock	2 holes	C.C.I.	10	1,543	1,553	--	--	--	--	20,892.81	13.45	25,701.23	16.55
Sub Total Cameo Project	11 holes	C.C.I. & Odgers	127	12,255	12,382	--	--	904	7.3	196,847.79	15.90	224,222.47	18.11
GRAND TOTAL ALL DRILLING	30 holes	C.C.I. & Odgers	689	23,687	24,376	109	0.4	4,209	17.3	\$374,189.76*	\$16.25*	\$430,912.09	\$17.68

* Includes only those footages where total occur
 ** Includes all charges closing out Phase I drilling

2. Recapitulation by Organization

The following table permits an analysis of our Michigan drilling both as to the organization that did the drilling and also the type of drilling.

TABLE X

	NO. RIGS	FOOTAGE	% OF SUB TOTAL	% OF TOTAL	TOTAL COST "B"	% OF SUB TOTAL COST "B"	% OF TOTAL COST "B"
<u>DEEP HOLE DIRECT SHIPPING</u>							
Department	1	855	31.6	3.5	\$ 12,824.36	35.1	3.0
Contract	1	1,851	68.4	7.6	23,722.43	64.9	5.5
TOTAL	2	2,706	100.0	11.1	\$ 36,546.79	100.0	8.5
<u>SHALLOW HOLE DIRECT SHIPPING</u>							
Department	5	12,776	88.0	52.4	\$245,309.76	92.4	56.9
Contract	1	1,740	12.0	7.1	20,290.38	7.6	4.7
TOTAL	6	14,516	100.0	59.5	\$265,600.14	100.0	61.6

TABLE X CONT'D

	<u>NO. RIGS</u>	<u>FOOTAGE</u>	<u>% OF SUB TOTAL</u>	<u>% OF TOTAL</u>	<u>TOTAL COST "B"</u>	<u>% OF SUB TOTAL COST "B"</u>	<u>% OF TOTAL COST "B"</u>
<u>METALLURGICAL DRILLING</u>							
Department	6	5,606	78.4	23.0	\$110,611.97	85.9	25.7
Contract	<u>1</u>	<u>1,548</u>	<u>21.6</u>	<u>6.4</u>	<u>18,153.19</u>	<u>14.1</u>	<u>4.2</u>
TOTAL	7	7,154	100.0	29.4	\$128,765.16	100.0	29.9
TOTAL DEPARTMENT SURFACE	12	19,237		78.9	\$368,746.09		85.6
TOTAL CONTRACT SURFACE	<u>3</u>	<u>5,139</u>		<u>21.1</u>	<u>62,166.00</u>		<u>14.4</u>
GRAND TOTAL ALL SURFACE	15	24,376		100.0	\$430,912.09		100.0

Note: Cascade East End Holes 33-37 are counted for both met. and direct shipping.

Osier Holes 1, 2 are counted for both met. and direct shipping.

Shallow hole direct shipping department includes 1005' subsidence drilling Mather "B" Surface.

3. Summary of Results

a. Marquette Range

1'. Eagle Mills, Section 35, 48-26 - E. R. Randolph, Geologist

The Eagle Mills project entailed finding a suitable aquifer which could be pumped as a water supply to the Agglomerating Plant. Although the ledge topography was not suspected to be highly irregular, a definite channel was sought which would probably contain stream gravels and a plentiful water supply. In contrast to the even, almost flat surface of uniform sand, the ledge contours were found to be very irregular and of high relief. Three test wells were unsuccessful at locating gravel horizons in the low spots located by refraction seismics, although enough water was developed to supply personal needs at the plant.

Fourteen feet of core drilling was conducted in conjunction with the water well test drilling. The value of the wagon-mounted core drill was again emphasized as it was moved in rapidly to confirm that the cable-tool driller had really reached ledge, not merely boulders which would probably have been associated with a good aquifer. High per foot costs were due to the very small footage thrown against the setting up charges.

2'. Empire - E. R. Randolph, Geologist

Phase I of the Empire Mine drilling program ended the first week of January, 1955, with the end of Hole #19. This hole cored typical Empire type magnetic beneficiating ore.

Phase II, or widespread exploration drilling to discover extensions to the orebody, was not begun in 1955. The total footage drilled in Hole #19 was 97' and a total of \$6,033.96 was charged against drilling in this year.

3'. Cascade East-End - E. R. Randolph, Geologist

Drilling continued in the Cascade East-End for both high grade and metallurgical ore. As has been our practice in the past, the upper 600' of the deep holes are tested for beneficiating characteristics, as well as drilling special metallurgical holes. In 1955, 5501' were drilled, of which 3280' was for metallurgical ore and 2421' was credited towards the direct shipping ore phase of the project. Of this amount, 2148' of potential beneficiating ore was recovered, mainly in Holes #34, #36, #37 and #38, which were grouped in one area. Also 109' of excellent soft ore was drilled, mainly from Hole #34 above the relatively shallow (1049') footwall of diorite. This ore is believed to be an extension of the orebody cored in Holes #32 and #33 north of the Isabella Dike. Whether it is continuous with the ore in the latter holes is not yet known, but the spread is over 800' laterally.

Expenditures during 1955 were \$119,349.58 for an average of \$21.16 per foot for metallurgical drilling and \$20.62 per foot for soft ore exploration.

- 4'. Mather Mine "B" Shaft Surface - Bruno J. Haas, Geologist
E. Richard Randolph,
Geologist

Ground Water and Subsidence

The Mather Mine "B" Shaft Surface project is concerned with the possibility of water problems upon the break-through of the subsidence zone. Strenuous efforts were advanced to intercept all possible surface water, both in movement and in storage. The basic guide for all work was the ledge contour map developed from drill hole information and refraction seismics. Test wells in the ledge channel have shown a significant amount of water in fractured ledge, and work is continuing to solve this problem of intercepting and removing it.

Pumping of the North Jackson underground workings continued throughout 1955. This area overlies a portion of the Mather Mine "B" Shaft underground workings. A new hole was drilled in June and a second pump added in order to speed up the draining of the workings. By August, the stopes were drained and it was only necessary to continue with one pump to offset the normal ground water recharge.

In recent years, the Geological Department has experimented with several preparations to consolidate the ground in order to restore lost circulation zones in drill holes and also to seal off permeable areas to control the ground water with variable results and cost experiences. In July, 1955 the Department learned about another sealing compound called Chemject, through the E. J. Longyear Company. We invited their representatives to visit us and as a result of the meetings, it was decided to conduct some experiments. In the Chemject process, a catalyst is added to a polymer (acrylamide methylene bis acrylamide-American Cyanamid Stabilizer A.M.-955--with or without calcium acrylate from Rohm and Haas Chemical Company; plus the catalyst of Sodium Hypochlorite and an optional colored dye).

These re-agents are such that the setting up time to form a gel can be controlled closely by varying the amount of catalyst added. It was visualized that if the material could be injected into the overburden and fractured ledge through a number of injection holes, that a water-tight stable seal could be accomplished. The experimental work was directed towards finding the proper combination of the catalyst to the polymer ratio and determining the relative spacing of drill hole centers needed.

The Chemject Company contributed part of the cost of the experimental work and drilled two holes for injection and testing. It was proven that the polymer would gel in the overburden. Additional controlled testing is planned for 1956.

The greater part of the subsidence studies were conducted underground; however, one important subsidence hole was drilled from surface during the year, Hole #153, located near the collar of Surface Hole #137. This hole was drilled at -45° and due South along the subsidence cross-section 7800 W. This hole is above the two underground holes S-170 (4th Level) and S-300 (2nd Level). It was bottomed at 1005'.

In the fall an attempt was made to survey this hole with the Bureau of Mines drill hole caliper and camera. Since this hole is a -45° hole, it required modification of the Bureau of Mines equipment. It is planned to conduct this work in 1956, with the improved gear.

5'. Section 10, 47-27 - Deep Exploration - J. P. Meyers,
Geologist

In 1955 diamond drilling for deep soft ore was commenced in Section 10, 47-27, Cliffs-Shaft Mine. The first hole was located on the basis of the geology predicted in the Deep Soft Ore Study. Any future holes will also be located on the basis of the Deep Soft Ore Study and with consideration of the knowledge gained in the first hole.

D.D.H. #29 is located on the old Lake Mine surface on the north shore of Lake Angeline in the $NW\frac{1}{4}$ of the $SE\frac{1}{4}$ of Section 10, 47-27. At the end of the year, 60 feet of oxidized iron-formation and 754 feet of diorite have been cored. Expected maximum depth is 5000 feet.

6'. Fitch - E. R. Randolph, Geologist

Two holes were drilled in the old Fitch Mine area in 1955 to determine the thickness and extent of the iron-formation and to test for the Magnetic Oxide Conversion characteristics. The goal of the exploration was to find material that would yield a very low silica grade concentrate.

Hole #1 cut a considerable thickness of iron-formation conglomerate which was lean, but concentratable. The iron-formation was hard, but blue cherty material, richer than the conglomerate and concentratable. The crude ore cut by Hole #1 was complicated by numerous intrusives and argillite seams which would affect the mining.

Hole #2 was located 1200' East and cut essentially the same conglomerate and iron-formation sequence, but much less intrusive and argillite waste rock. A total of 1833' of diamond core drilling was done, of which 1326' was in iron-formation. Of this total, 825' was concentratable by the MOC process. The concentrate had a standard silica grade of approximately 10% or less. This would be interesting if there was a greater extent to the iron-formation although it would not yield the very low silica grade material which was sought. The cost of the drilling was \$20,691.01 or \$11.29 per foot.

7'. Humboldt Mine - Burton H. Boyum
Robert H. Mount

In the spring of 1955, Mr. Boyum visited the property on several occasions and started reconnaissance mapping since no mapping had been done after May, 1954. During these several visits, he proposed a dike numbering system and also found two significant areas of crude ore outside of the assumed pit limits. This necessitated the moving of the pole lines and led to the drilling of

Holes #4 and #5, which confirmed the presence of concentrating material.

Two holes were drilled with the wagon drill to determine the extent of the area containing un-stripped metallurgical ore. Results were geologically satisfactory and the ease of spotting the rig in the pit is illustrated by the low (\$6.48 per foot) cost, which includes setting up and transport from the warehouse and back.

Later in July, Messrs. Robert H. Mount and Burton H. Boyum conducted plane table mapping in order to adequately map the geological features of the mine. Fifty feet to the inch plan maps were made of the 1585' and 1625' benches, including interpretation.

8'. Republic Townsite, Section 19, 46-29 - E. R. Randolph,
Geologist

The water well drilling by Julian and Hakala encountered some high grade hard ore material. Our trailer-mounted drill was moved in to determine whether or not this material was a boulder or ledge. It was found to be a boulder.

9'. Titan Exploration, Section 21, 48-31 - G. J. Anderson,
Geologist

One hole was drilled on the Titan property to further determine the westward extent of the Ohio Mine type concentratable ore. Un-oxidized iron-formation was recovered, and the evidence now indicates no further oxidation to the west. As a result of this drilling, this lease has been surrendered.

b. Menominee Range

1'. Allen-Carlson Drilling-Section 24, 43-35 (Spies Mine) -
G. J. Anderson, Geologist

Drilling was started in Hole #92 on the Carlson Forty early in September and the hole was stopped in December at a depth of 1851'. This hole was designed to explore the downward extension of the ore cut in Inland Steel's Hole #4017 which was drilled on their McDonald property lying to the south. The main body of iron-formation was drilled with no evidence of oxidation, so a fault has been interpreted cutting the area between the two holes. The completion of this hole concluded the drilling on this exploration.

2'. McColeman Exploration, Section 17, 44-35 - G. J. Anderson,
Geologist

One hole was drilled on an EM anomaly on the McColeman property. The anomaly was similar to the one over the orebody on the same property. No outcrop information was available. Pyritic and non-pyritic slates were cored. The EM anomaly evidently was at the contact of these horizons, which was also the crest of a ridge.

c. Cameo Project - Robert W. Riedel, Party Chief

At the beginning of 1955, two Company-owned drills were

active in the Perkins Area. In June, a third rig owned by the Odgers Drilling Company was added to start exploration in the Osier Area. In August, one of the Perkins drills was moved to the east side of the Rock Area.

Table XI shows the recap of the drilling in terms of the Paleozoic cover of limestone and sandstone and also the Pre-Cambrian material including the iron-formation. Attention is directed to the "success factor", namely the percentage of drilling in iron-formation.

TABLE XI

RECAP OF DRILLING

A. Perkins (42-22)

Hole No.	Sec.	Overburden & Paleozoic Cover	Pre-Cambrian		Total	% in I.-Fm.	Grand Total
			Non-I.-Fm.	I.-Fm.			
<u>1954</u>							
1	26	590	131	-	131	-	721
2	26	695	86	799	885	90.3	1580
3	26	323	-	-	-	-	323
Total		1608	217	799	1016	78.6	2624
<u>1955</u>							
3	26	505	435	125	560	22.3	1065
4	26	840	546	201	747	26.9	1587
5	26	785	755	-	755	-	1540
6	26	234	-	-	-	-	234
Sub-Total		2364	1736	326	2062	15.8	4426
1	22	915	-	-	-	-	915
2	22	873	590	-	590	-	1463
Sub-Total		1788	590	-	590	-	2378
1	24	895	35	-	35	-	930
Grand Total		5047	2361	326	2687	12.1	7734

B. Osier (43-21)

1	18	684	398	1010	1408	71.7	2092
2	18	880	123	-	123	-	1003
Total		1564	521	1010	1531	66.0	3095

C. Rock (43-22)

1	31	695	402	295	697	42.3	1392
1	4	161	-	-	-	-	161
Total		856	402	295	697	42.3	1553

TABLE XI CONTINUED

D. Total all three areas 1955

Hole No.	Sec.	Overburden & Paleozoic Cover	Pre-Cambrian		Total	% in I.-Fm.	Grand Total
			Non- I.-Fm.	I.-Fm.			
11 Holes		7467	3284	1631	4915	33.2	12,382

E. Total all three areas 1954 and 1955

13 Holes		9075	3501	2430	5931	41.0	15,006
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1. Perkins

Diamond core drilling which commenced in 1954 with the drilling of Holes #1, #2, and a portion of #3 in Section 26, 42-22, was continued through 1955. Holes #3, #4, and #5, Section 26, 42-22, were completed, as were Holes #1 and #2, Section 22, 42-22. Hole #1, Section 24, 42-22, was drilled to a depth of 930'.

The geologic significance of this drilling is set forth by Messrs. Burton H. Boyum and Tsu-Ming Han in Geology Report No. 8, "The Lithology and Stratigraphy of the Perkins Iron Range," dated October 6, 1955. The rocks have been divided lithologically into ten units and designated by a letter for each rock type: C, ferruginous quartzite; D, ferruginous argillite; E, quartzite; F, laminated martitic schistose argillite; G, hard martitic cherty iron-formation; H, intermediate schist and argillite; I, hard magnetic to martitic cherty iron-formation; J, south schist; R, quartz mica garnet schist; M, quartz; (A and B have been reserved for units to the north as yet undrilled). In this area these rocks seem to be dipping steeply to the north, striking about west-northwest, and the stratigraphically younger units (early letters in above system) are to the north.

The two iron-formation units G & I thicken respectively from about 50 and 30 feet to 250 and 130+ feet in 1600 feet along the strike to the east in Section 26. Hole #5 proved that this trend is cut off farther to the east, presumably by a major fault; the iron-formation in Section 22 and to the west has not been explored. What presumably is the northward faulted segment of this iron-formation is being explored in Section 24 which had just entered the Pre-Cambrian and encountered a sericitic schist at year's end.

2. Osier

Diamond core drilling of the magnetic and gravity anomaly of this area was initiated with Hole #1, Section 18, 43-21. This hole was completed and Hole #2 had just entered the Pre-Cambrian during 1955. Hole #1 cut a surprising thickness of iron-formation, some 1291' of which 276' was composed of a basic intrusive rock in 18 small discrete dikes. The iron-formation is a medium to coarse-grained magnetite laminated with chert and/or iron silicates; this iron-formation responds favorably to simple magnetic separation. Hole #2 is to explore this iron-formation eastward along its strike. At the present time, we are hampered in drilling its westward extension because of adverse mineral ownerships. This iron-formation cannot, at the present, be correlated with the Perkins area.

3. Rock

During 1955 one hole was completed in this area. Hole #1, Section 31, 43-22, which explored the moderate, generally east-west, magnetic and gravity anomaly disclosed by the geophysical field work. The hole cut two separate iron-formation units totaling 313 feet and the entire sequence of rocks cut, correlates well with the E, F, G, H, and I units of the Perkins area with the addition of a large basic intrusive of some 146 feet between the G and H units. These rocks dip steeply to the south and presumably are the north limb of an east-west syncline of which the Perkins area represents a part of the south limb.

Hole #1, Section 4, 42-23, west of Rock and 4 miles west of Hole #1, Section 31 above, is to explore the magnetic and gravity lows in what is possibly the west end of the above-mentioned syncline. The hole had drilled only 161 of Paleozoics by December 31.

4. Summary

Because of the Paleozoic cover over the Pre-Cambrian rocks of these areas, the field exploration is entirely geophysical. As proof of the point that geological and geophysical exploration is the cheapest exploration method, we point to the fact that of the total footage of holes drilled to date, the sought after iron-formation constituted 41% of the Pre-Cambrian rock cut; and much of the remaining rock was dike material within the iron-formation. All of these holes were located from the geophysical data.

B. Minnesota

1. Operating Mines

During the year drilling was conducted at the operating properties as follows:

<u>TABLE XII</u>				
<u>Property</u>	<u>Holes</u>	<u>Footage</u>	<u>Cost</u>	<u>Cost per ft. "B"</u>
a. Canistee (Snyder)	C.869-873 incl.	344'	\$5,204.39	\$15.13
b. Holman (Bingham)	H.430-434 incl.	928'	\$13,946.58	\$15.03
North Star	1-10 incl.	200'	-	-
c. Sargent	S.51-58 incl.	1474'	\$20,672.70	\$14.02

Details of the above drilling are contained in the individual mine annual reports.

2. Grand Rapids Exploration

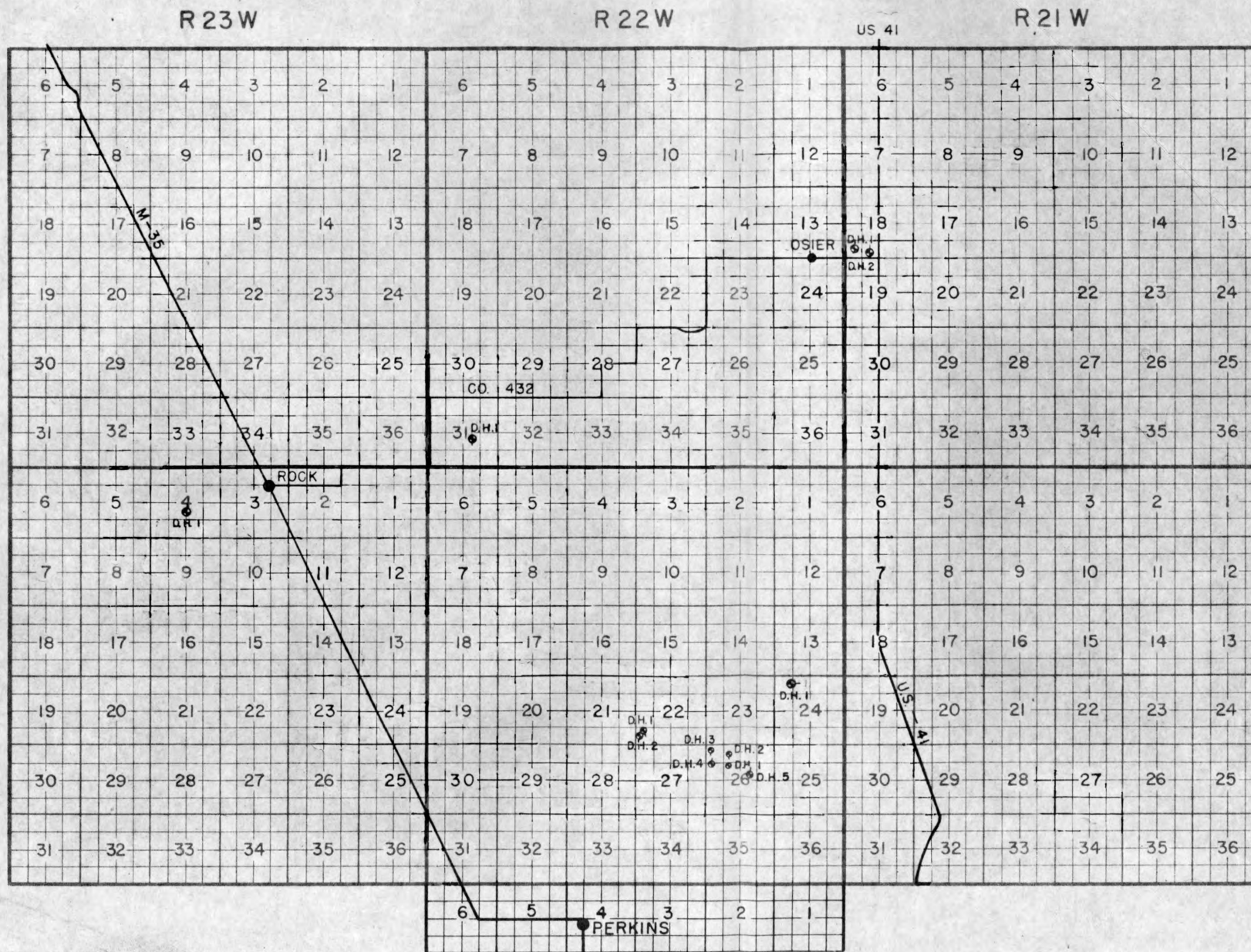
a. Holding Company, Section 9, 55-25 (E & A, CC-664)

The field work has been discussed under Section II of this report.

THE CLEVELAND-CLIFFS IRON CO.

Figure 4

EXPLORATION DEPARTMENT



T 43 N

T 42 N

Drilling started in December cutting 155' of glacial drift overburden in the hole. Cretaceous material was encountered from 155' to 168'. The balance of the year's drilling has been in oxidized iron-formation to a depth of 240'. The 240' of hole cost \$2,122.18 or \$8.84 per foot.

b. Trask Lands, Section 8, 55-25 (E & A, CC-665)

Only field work was done on these lands and drilling is planned for 1956.

C. U. S. General - Eric J. Rex, General Exploration Geologist

A plan of exploration drilling was formulated for the Running Wolf Iron Deposits of Montana (L.O. 3581) in the fall by Mr. W. A. Pakkala of the Hibbing office and Eric J. Rex. In the first week of November, drilling was commenced by Mr. O. C. Thatcher, Drilling Contractor of Stanford, Montana.

A total of 30' of hangingwall material was drilled and unseasonably cold weather and snow forced the abandonment of drilling operations for the present winter.

D. Canada

The principal exploration project in Canada for 1955, conducted by Canadian Cliffs, was in Central Ontario. Here in the neighborhood of Kowkash (L.O. 3128-C) on the Canadian National Railway. Two exploration diamond drill holes, totaling about 500' were drilled. The limited thickness of the iron-formation here, forced the abandonment of the exploration.

V. UNDERGROUND EXPLORATIONA. Michigan1. Summary of Drilling

The following tabulation, Table XIII, is a summary of underground drilling.

<u>TABLE XIII</u>											
<u>UNDERGROUND EXPLORATION</u>											
<u>LOCATION</u>	<u>HOLES</u>	<u>RIGS</u>	<u>DIAMOND DRILLING</u>	<u>1ST CLASS ORE FOOTAGE %</u>		<u>2ND CLASS ORE FOOTAGE %</u>		<u>TOTAL COST "A"</u>	<u>COST/FT "A"</u>	<u>TOTAL COST "B"</u>	<u>COST/FT "B"</u>
Arctic 4.57 Acre Parcel Exploration	4	C.C.I. (Dept.)	260	17	3.0						
Water Hole	5	C.C.I. (Dept.)	305	--	--						
Bunker Hill	38-46,49,50	C.C.I. (Dept.)	3,469	1,189	34.0						
	47-48,51-57	C.C.I. (Mine)	1,338	574	43.0						
Bunker Hill Mine Total	22 holes	Dept.-Mine	5,372	1,780	33.0	--	--	\$32,171.96	\$ 5.988	\$ 32,483.17	\$ 6.047
Cambria-Jackson	220-231	C.C.I. (Dept.)	2,332	552	23.6	--	--	--	--	30,145.82	12.927
Cliffs Shaft	917-926	C.C.I. (Mine)	1,054	140	13.3	167	15.84	5,627.82	5.330	9,092.74	8.620
Lloyd	191-192	C.C.I. (Mine)	586	61	10.4	--	--	3,735.21	6.374	4,620.36	7.884
Maas	82-87	C.C.I. (Dept.)	1,729	869	52.0	--	--	16,766.00	9.697	18,048.54	10.439
Mather Mine "A" Shaft	274,277-281,283-285, 287,288,290,290-A,291, 293,295,296,298,299, 302-304,307-310,314, 315	C.C.I. (Mine)	6,695	2,211	33.0	--	--	46,133.95	6.891	57,834.92	8.638
Mather Mine "B" Shaft Exploration	275,282,286,289,292, 294,297,301,305,306, 311-313	C.C.I. (Mine)	4,042	1,280	31.6	--	--	50,344.59	12.455	72,130.02	17.845
Percussion		C.C.I. (Mine)	(3,036)					--	--	3,893.53	1.282
Subsidence	300	C.C.I. (Mine)	1,500					--	--	36,401.74	24.268
Mather "B" Total	14 holes & perc.	C.C.I. (Mine)	8,578					--	--	112,425.29	13.106
Spies Mine Allen-Carlson U.G.	87	Odgers	1,524					20,592.89	13.512	22,982.05	15.080

2. Recap by Organization

The following tabulation, Table XIV, is the recap by organization:

TABLE XIV

<u>ORGANIZATION</u>	<u>NO. OF RIGS</u>	<u>FOOTAGE</u>	<u>PER CENT</u>
a. C.C.I. Co.			
1. Department	3	9,433	38%
2. Mine	6	13,877	56%
b. Contract	<u>1</u>	<u>1,524</u>	<u>6%</u>
Total	10	24,834	100%

3. Summary by Properties - Marquette Range Underground

a. Bunker Hill Mine - J. L. Patrick, Geologist (by Ted Engel, Geologist)

The drilling program continued at a slightly increased rate throughout the year. During 1955, 5,382' were drilled as compared to 4,325' in 1954. This includes 565' of drilling in the Arctic Parcel for the year 1955 and 2,197' in 1954. The object of nearly all of the program was to determine the extent and position of the ore structures on 10th and 12th Levels from the 2200 W. to the 3000 W., north-south sections. Arctic Hole #5 was drilled due north at -50° as a water hole to connect 10th Level with the Bunker Hill 2500 Cross-cut.

The following is a summary by North-South sections of the drilling program:

2200 W. Section - Five holes were drilled from this section to explore the south orebody. Holes #38 and #39 were drilled to determine the width of the ore structure and the position of the Athens dike. Holes #43, #47 and #48 were drilled from the 2400 Cross-cut to check for the position of the footwall-ore contact and the position of the flat-lying intrusive which cuts the south orebody. Arctic Hole #4 was drilled from this section to explore ore structures in this parcel.

2600 W. Section - Exploration from this section was directed toward the outlining of the ore structures above and below the flat-lying intrusive. Holes #40, #41 and #42 were drilled to determine the width of the ore zones, position of the intrusive and hangingwall area above 10th Level. Holes #44, #45 and #46 were drilled to determine the position of the footwall. Hole #49 was drilled to explore the area north of the Bunker Hill Fault. It was stopped in the Athens Dike. The ore structure north of the Bunker Hill Fault was explored at the 12th Level elevation by Hole #50.

2930 W. Section - Six holes No's 51 through 56 were drilled from this section on 10th Level to outline the ore block in this area and to determine the attitude of the flat-lying intrusive.

The results of the drilling program indicate the following:

1. The structure above 10th Level is a relatively flat-lying orebody dipping to the northwest.
2. The ore structure north of the Bunker Hill Fault decreases in size.
3. The ore structure for 12th Level between 2500 W. and 2800 W. will be relatively narrow. Beyond the 2800 W. mining will be in the wide upthrust orebody south of the Bunker Hill Fault.
4. The orebody is considerably reduced by the Bunker Hill Fault. Up-thrusting along the fault has created the new structure referred to as the upper 10th Level orebody. Drilling has shown that the displacement along this structure carries the ore to the 12th Level elevation.

Drifting in the 1700 Cross-cut extension cut argillite and seams of lean argillaceous ore. The indications are that the strike of the footwall in the 10th Level south orebody is changing more to the southwest. Such a change in strike may have a favorable bearing upon the amount of ore in the area.

b. Cambria-Jackson Mine - Bruno J. Haas, Geologist

A total of 12 diamond drill holes were drilled in 1955. The drilling program was divided into two phases. Phase I, which was completed in the first half of 1955 was designed to explore for a possible eastward extension of the orebody below 7th Level and for a possible build-up along the fault plane which cuts through this area at the East end of 7th Level. Results of drilling 5 holes showed that no mineable ore is present in the area.

Phase II of the program was designed to explore and outline the orebody below Cambria-Jackson 8th Level which extends down dip into the Mather Mine "B" Shaft 5th Level mining area. Analysis of the drilling have shown that the ore above approximately -300 elevation is standard grade ore while the ore below the -399 elevation is high sulfur ore. A total of 7 holes were drilled from the -180 Sub-Level and from the 8th Level. The information available at present from Mather Mine "B" Shaft 5th Level and Cambria-Jackson 8th Level drilling indicates that approximately 1,800,000 tons of ore have been outlined by the end of the year's exploration.

The net ore reserves as of December 31, 1955 were 372,121 tons, a decrease of 40,987 tons from the previous year. Although the yearly production was 234,000 tons the slight net decrease reflects the increase in reserves due to exploration drilling and development in the East deposit between the 7th and 8th Levels. All of the ore reserves at the Cambria-Jackson Mine are located in the Jackson Strip.

c. Cliffs-Shaft Mine - James P. Meyers, Geologist

No drilling for hard ore was conducted upon the Cliffs-Shaft Mine surface in 1955.

Underground drilling during the year was guided by the 1952 "New Shaft" ore estimate and the 1955 revision of this estimate. Underground drilling was done predominantly in the old Moro Mine or "A" Shaft East and Southeast areas of the mine. Several holes were drilled for development purposes only, e.g. detailed outlining of an orebody.

The old Moro Mine workings have now been investigated sufficiently for all practical purposes. Drilling in this area did not reveal any ore structures of significant value. Upon further study of maps and investigation, the "B" Shaft Far West workings were regarded as not worthy of further diamond drilling.

One second class ore structure proved a failure during the year and the structure outlined in the Northeast area of the mine in 1954 was considerably reduced. In both cases development of the bodies revealed inconsistency in iron values and numerous contaminating seams or beds of argillite together with widely varying orebody thicknesses.

In September, 1955, the last hole, U.H. #926, was completed and the remaining diamond drill rig was removed from the mine. Any further diamond drilling at Cliffs Shaft Mine will either be for deep soft ore or an occasional hole for operational purposes.

The diamond drill incentive system, which was formulated and instituted in May, 1954, again proved successful. Since the incentive was started, 19 holes have been drilled under the system. Of the 19 holes drilled, 13 were drilled at a rate above the base task. The savings in direct labor for the 13 holes in which the drillers made over base task was \$1,084. Average advance per shift was 24.7 for these 13 holes and the average core recovery was 83%. The savings per foot in direct labor costs for the 13 holes was 51 cents. Also under the incentive system, bit wear was determined to be comparable or equivalent to that experienced prior to the incentive system. The experience with the diamond drill incentive at the Cliffs-Shaft Mine proves that incentives are applicable in this type of work and should serve as a basis or at least can be used as an example in the preparation of any future diamond drill incentive plans.

Referring to Table XIII, it is noted that the cost per foot for drilling in the mine increased from \$4.411 per foot in 1954 to \$8.620 per foot in 1955. The increase is due to four factors:

1. Longer moves and therefore longer moving time.
2. Longer distances to travel to and from the working place and therefore less actual working time.
3. Increased ground hardness.
4. Greatly increased indirect drilling costs.

d. Lloyd Mine - Gordon E. Frantti, Geologist

The 1955 diamond drill program at the Lloyd Mine totaled 586'. Underground Hole #191 failed to locate mineable ore east and above the 10th Level #3 East Cross-cut. Underground Hole #192 was drilled below the 10th Level #3 Cross-cut and encountered only 22' of first class ore.

A study was made concerning the driving of an extension drift to the east on 8th Level elevation. This drift would provide drilling

sites for exploring the area to the east. However, this plan was discouraged because of the rapid depletion of the Lloyd orebody. As a result of this exhaustion of ore, the Lloyd Mine was officially closed on November 21, 1955.

e. Maas Mine - J. L. Patrick, Geologist (by Ted Engel, Geologist)

Exploration of the Pioneer & Arctic property by diamond drilling began in July. Six holes have been drilled to determine the extent of the ore structures in this area. A total of 1,729' were cored with 869' of first class ore.

The following is a summary by levels of the drilling program:

-145' Sub-Level - Three holes were drilled on the 2400 W. coordinate to extend the ore structure on the Pioneer & Arctic Parcel. The exploration here has added a significant amount of ore to the Phase I Area of the Maas mining program.

7th Level - Two holes were drilled from the 2700 W. section to explore the ore structure in the Pioneer & Arctic Parcel Phase I area. They have confirmed the ore outline originally determined by the holes drilled on the -145' Sub-Level. The ore is limited on the south by a fault. U.H. #87 was drilled on the 3000 W. Section to determine the extent of the orebody in that area.

f. Mather Mine

1'. "A" Shaft - Gordon E. Frantti, Geologist

The 1955 diamond drill program for Mather Mine "A" Shaft totaled 6695'. A major portion of this drilling was carried out from the 8th and 9th Levels with the remainder being distributed among the 3rd, 6th and 7th Levels.

As of December 31, 1955, the ore reserves were increased by 2,237,543 tons over the 1954 estimate. The increase consists primarily of reserves proven by 8th and 9th Level drilling. By surface diamond drilling and underground development, 6,362,300 tons have been proven between the 7th and 8th Levels and 2,709,697 tons below the 8th Level. Of the year's production approximately 70% came from the 7th Level and 25% from the 8th Level.

3rd Level - One hole was drilled from a cutout on the -225' Sub-Level and it failed to locate enrichment on the east side of a fault which was uncovered in a mining drift on the -260' Sub-Level.

6th Level - One hole was drilled from the 6th Level during the year to test for ore outlines above 7th Level. It was drilled from the 6700 Cross-cut and failed to find enrichment below the level.

7th Level - Three holes were drilled between 6th and 7th Levels to detail ore outlines prior to mining development. Two holes drilled on the Mather "B" side resulted in no change in outlines, and a third hole, drilled from above the 7100 Cross-cut on the -800' Sub-Level, indicated insufficient reserves to warrant development.

8th Level - A major portion of the diamond drilling was centered on the 8th Level during the year. Of the total of 15 holes; 8 holes further outlined the large orebody extending into Section 1, 47-27, 6 holes were drilled from 8th Level Cross-cuts to outline the footwall below 8th Level to facilitate planning of the 9th Level development, and one hole was drilled above 8th Level to locate the footwall contact for mining development. Drilling and development near the Mather Mine "B" Shaft line have encountered an extensive intrusive dike pattern, as well as fractured ground, which are complicating mining activities.

9th Level - During the year 8 holes were drilled from 9th Level east of the Mather Fault. The drilling proved a continuation of enrichment down dip from 8th Level. The drilling indicated a 40' displacement, south side up, along an east-west dike and a flattening of the footwall dip, possibly influenced by the major Negaunee Shaft Fault. The 9600 Cross-cut is being driven to the south to the vicinity of the major east-west fault zone, thus providing drilling stations for exploring this structure.

2'. "B" Shaft - Bruno J. Haas, Geologist

Subsidence

A diamond drill hole S-300 was drilled from the 2nd Level over the mined out area on the east end of the workings. This hole is designed to supplement the 4th Level subsidence hole in making subsidence studies. Geophones have been installed.

In November, caving of undetermined nature and extent was discovered in the 4th Level subsidence hole at approximately 880' from the collar of the hole. At the end of the year a diamond drill was being employed to penetrate the hole and get information as to the nature and magnitude of the caving.

Exploration

The diamond drill program carried out at Mather Mine "B" Shaft during 1955 was reduced by 2,000' in comparison to last year's drilling program. The major portion of the drilling was carried out from 8th Level with the remainder being distributed on 2nd, 7th and 10th Levels. In the latter quarter of the year the emphasis was placed on 10th Level exploration and outlining the 10th Level orebody. The program was designed to cover the following objectives:

1. 2nd Level subsidence studies.
2. Detailing 7th Level ore.
3. Outlining and detailing 8th Level ore.
4. Exploring and outlining 10th Level ore.

2nd Level - One hole was drilled from the 2nd Level cutout for the purpose of installing geophones for subsidence studies. One geophone was installed in the hole to record the frequency and intensity of rock movements over the mining voids. Results to date have shown that the microseismic counts are very weak from this level.

The hole was started at $+5\frac{1}{2}^{\circ}$ at S. 60° W. for a distance of 1500' in order to locate it over the large stopes above 6th and 7th Levels. The collar of the hole is at +506' but at 1,500' the elevation of the hole is figured to be approximately +379' due to conditions encountered during drilling. This would place the bottom of the hole at approximately 930' above the top of the 6th Level stope. This hole along with the 4th Level subsidence hole, which was drilled in the same direction, will be used for geophone triangulation.

7th Level - Only one hole was drilled from 7th Level during the year, and the hole was drilled to test for the height of an extent of the orebody above 7th Level within the western edge of the shaft pillar.

8th Level - Diamond drilling was primarily centered on 8th Level from which twelve holes were drilled. Of this total, seven holes were drilled to outline and detail the ore prior to block development and for extension of the cross-cuts. Four holes were drilled to test for footwall contacts below 8th Level and for a possible ore build-up for 9th Level mining development. One hole was drilled to explore the 10th Level orebody west of the Cambria-Jackson Fault.

10th Level - Two holes were drilled from 10th Level to outline the 10th Level orebody. In the 1956 drilling program emphasis will be placed on outlining the 9th and 10th Level orebodies and exploring for the orebody west of the Cambria-Jackson Fault on 9th and 10th Levels.

Ore Reserves

The net ore reserves in 1955 totaled 15,157,855 tons, a decrease of 4,077,573 tons from the previous year. Of these total reserves, 989,604 tons are located in the shaft pillar and to the east of the shaft pillar and will not be mined at present. The reserves were decreased primarily because of structural changes which were not anticipated in 1954.

4. Summary of Underground Exploration - Menominee Range

a. Spies Mine - Gerald J. Anderson, Geologist

The drilling during 1955 was confined to exploring on the Allen Forty from the 6th Level Virgil drift. All of the drilling was in U.H. #87 which was a flat hole to the south from this drift. The drilling completed during the year, was from 433' to 1947' at which point Cleveland-Cliffs stopped and Inland Steel took over and continued from 1947' to 2313'. The entire Allen Forty was crossed in the drilling done by Cliffs without encountering any enrichment, however, Inland Steel cored 72' of first class ore from 2196' to 2268' which was within the boundaries of their McDonald property. This concluded the underground drilling at the Spies Mine.

B. Minnesota

1. Mesaba Range

a. Agnew Mine

In December, Mr. Boyum made a brief reconnaissance of the Agnew Mine orebody as relates to the fault structure and a proposal was made with the mine staff of Mr. Viant, Superintendent and Mr. Hartman, Engineer, and Mr. Michels, Chief Engineer, to drill 2 or 3 holes from underground to test the balance of the Lower Cherty Horizon to the Pokegama Quartzite adjacent to the Agnew Fault.

VI. LAND OFFERS AND OUTSIDE EXPLORATIONS

A. Land Offers

1. During 1955, the Geological Department continued to process the various Land Offers submitted to the Company. A total of 85 Land Offers were submitted by various owners and agents in 1955. They may be divided into five geographical groups as follows:

<u>Area</u>	<u>No.</u>	<u>Percent of Total</u>
1. Michigan	19	22.4
2. Minnesota	10	11.8
3. Canada	29	34.1
4. U. S. General	23*	27.0
5. South & Central America	<u>4</u>	<u>4.7</u>
Total	85	100.0

*Includes 1 Alaska Land Offer

The trend of the greatest proportion of total new Land Offers to be in Canada, which was begun in 1952, continued in 1955; however, the percentage decreased again in 1955 as it had in 1954. Michigan and South and Central America showed decreases in both number and percentage of total. U. S. General with over twice as many offers in 1955 as in 1954, better than doubled its increase in percentage. Total offers increased from 77 in 1954 to 85 in 1955.

During the year 1954, a total of \$26,474.74 was spent by Canadian Cliffs, Ltd. for the investigation of Land Offers and metallurgical testing and analyses of samples from them. Cleveland-Cliffs spent \$652.53 on Minnesota Land Offers, \$454.92 on those in Michigan, and \$9,716.89 on those classified under U. S. General. (The last group is all United States except Michigan and Minnesota, and includes Alaska.) Figure 5 shows the 5 year trend of Land Offers.

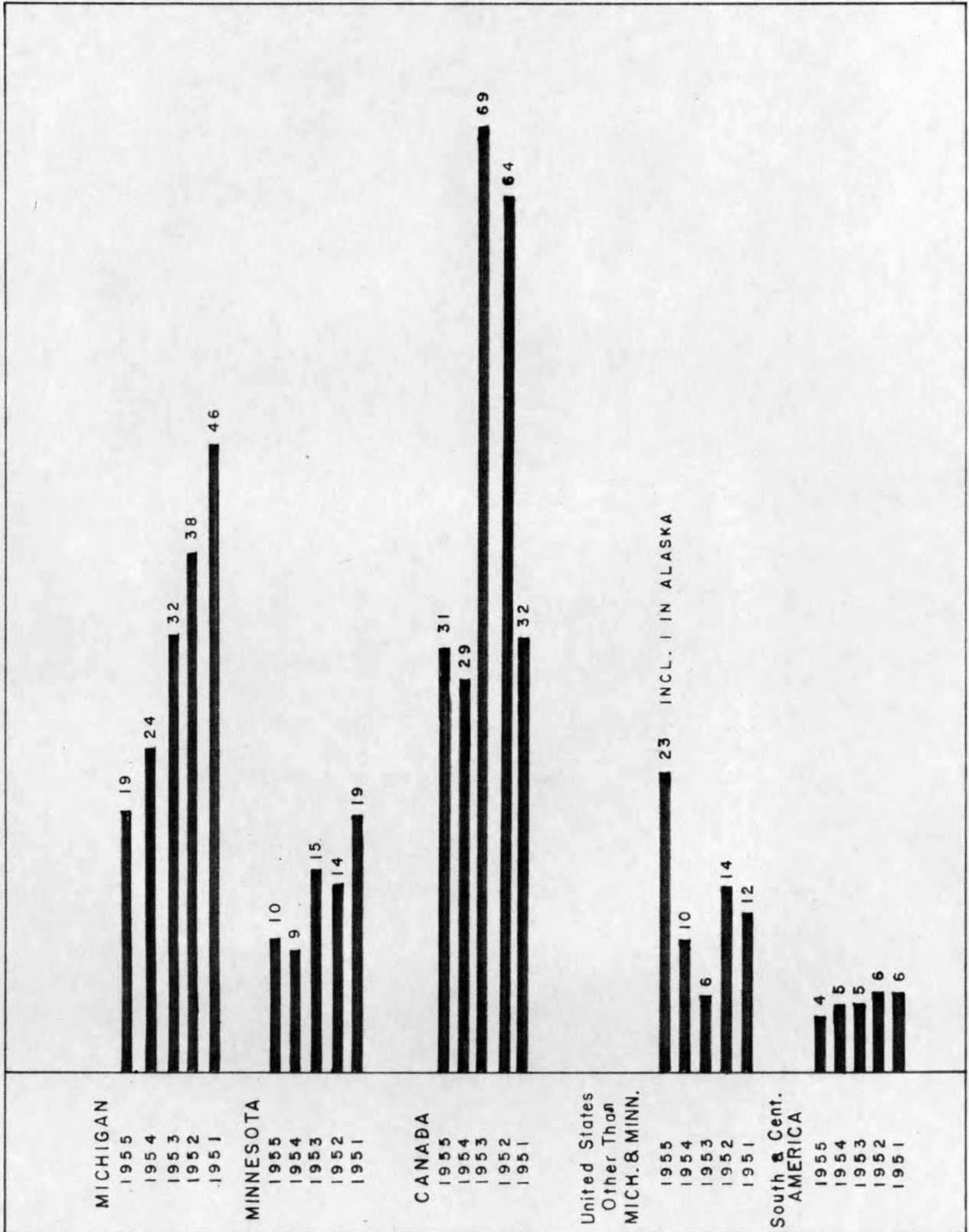
2. Late in 1955, Mr. Boyum proposed a basic charge in handling Land Offers in Michigan. Since we have a large proportion of non-mineral Land Offers, the suggestion was to start a new series of non-mineral numbers, such as X-1, etc. This plan was approved locally and in Cleveland and was initiated in December. These offers will be processed by Messrs. Robert G. Fountain and Leo Holmgren.

B. Outside Explorations

Mineral areas and deposits which were not actually offered to Cliffs, but still studied as deposits for later acquisition or on the basis of their

Figure 5

GRAPH SHOWING RATE OF
MINERAL LAND OFFERS
1951-1955 incl.



potential as a source of valuable information are classified as Outside Explorations. The distribution of Outside Explorations, new in 1955, is as follows:

<u>Area</u>	<u>No.</u>	<u>Percent of Total</u>
1. Michigan	1	11.1
2. Minnesota	0	-
3. Canada	3	33.3
4. U. S. General	5	55.6
5. South and Central America	0	-
Total	9	100.0

The number of new Outside Explorations considered in 1955, 9 was a significant drop from that of 31 in 1954, and from the all-time high in the past five years of 46 in 1951.

Until 1954, the greatest proportion of Outside Explorations was in Canada, in that year Michigan lead in number considered. In 1955, U. S. General proved the source of the greatest number.

Figure 6 shows the distribution of Outside Explorations for the past five years.

VII. MICROSCOPY - Tsu-Ming Han, Geologist

During the year 1955, our work in microscopy continued to be an important part of the Departmental activities. For the most part, this work was carried out by Mr. Tsu-Ming Han, Mineralogist, employed jointly by the Geological and Metallurgical Departments. In as much as possible, this microscopy work is coordinated with field work and core drilling. We are also interested in the beneficiating implications of these studies. The following areas have received attention during the year:

A. Michigan

1. Marquette Range

a. Metallurgical characteristics of the cherty martite iron-formation in the Cascade District.

An intensive microscopic study has been conducted on drill core specimens from DDH #36, Section 27, 46-26, Cascade District. The purpose of the study was to explain why some material responded favorable to concentration while others did not respond to concentration. The results revealed that the concentrability of ore particles is primarily governed by ore size, ore texture, mineralogy, and degree of oxidation, shown in Plate 1 and Plate 2.

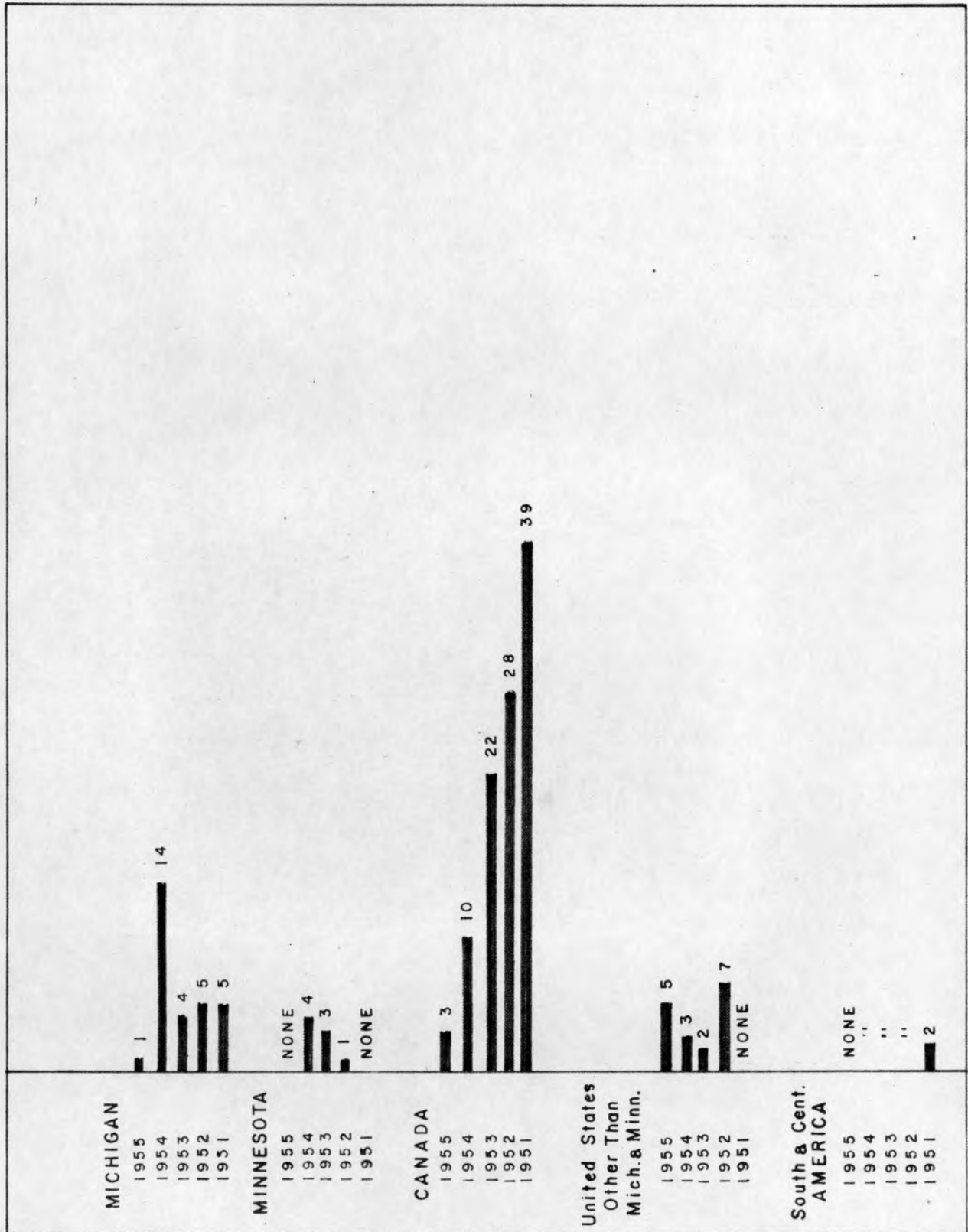
b. Petrographic examination of materials from exploration projects and operating mines.

Hand specimens, drill cores, and samples have intermittently been

Figure 6

GRAPH SHOWING RATE OF
OUTSIDE EXPLORATIONS

1951-1955 incl.



submitted by geologists for petrographic examinations. The materials were from various current operating mines including the Humboldt Mine, Mather Mine "A" and "B" Shafts and Cliffs-Shaft, and from various exploration projects including Empire, Fitch and Republic.

The objectives of the study were to determine the rock types and intended to ascertain the origin or stratigraphic horizons of the rocks. This work was generally done in relation to the drilling program.

2. Menominee Range

a. Lithology in the Perkins-Rock Area.

A microscopic study of the lithology of the Perkins-Rock Area has been conducted. This study was made in conjunction with field investigations in an attempt to establish a stratigraphic column for that area. The common ore particles in the iron-formation are shown in Plates 3 and 4.

b. Magnetic iron-formation in the Osier Area.

The magnetite in the magnetic silicate iron-formation in the Osier Area is rather coarse-grained in comparison with the magnetite from the Empire Area of the Marquette Range. The study revealed that it can be economically liberated by grinding to -100 mesh, shown in Plate 5.

B. Minnesota

A suite of rock and iron-formation specimens collected from Northeastern Itasca County and listed under Outside Exploration 1107, were intermittently received for microscopic examination. The magnetite in some iron-formation rocks appeared to be concentratable by grinding to 325 mesh, shown in Plate 6.

C. U. S. General

1. Oregon

A sample of "Chromite Beach Sands" collected from Seven Devils Mine and listed under Land Offer 3521, was investigated in detail. The conclusion reached was that the sample contains no more than 1% chromite and does not contain any of the other desired minerals such as zircon and ilmenite. This sample could not be concentrated economically to produce a specific concentrate having an acceptable grade by employing presently known mineral dressing techniques.

Another sample identified as Sample No. MX-1644, was collected from the same general area. Although microscopically they are identical in all aspects, Sample No. MX-1644 consists of chromite sands.

2. Arizona

Several hand specimens from Humboldt, Arizona, Land Offer 3553, was received for microscopic examination. It was concluded that the specimens are not favorable for beneficiation.

3. Montana

Two chromite samples listed under Land Offer 3586 from Sheridan,

Montana were submitted for microscopic study. The result of the investigation shows that although the chromite is metallurgical treatable, chemically the amount of chromium in the chromite, does not satisfy the present market, shown in Plate 7.

4. California

Iron ore hand specimens from Eagle Mountain, California, O.E. 1172, were examined. The purpose of the examination was an attempt to ascertain the origin of the iron deposits in the Eagle Mountain District. The microscopic evidence indicated that the iron ore in the Eagle Mountain District was formed under pyrometasmatic conditions.

5. Wisconsin

A sample identified as MX-416, O.E. 1174, near Bruce, was examined microscopically. It was concluded that this sample was not desirable as a beneficiating material for iron ore at the present time, shown in Plate 8.

Several magnetic samples were collected by Mr. Richard Randolph from Clam Lake, O.E. 1175, and were submitted to the Microscopy Section for examination. The conclusion was that although the magnetite is highly titaniferous, an appreciable amount of ilmenite in the sample may be considered to be valuable, shown in Plate 9.

D. Canada

Two samples collected from Quebec, Canada, L.O. 3174-C, a pyrite ore, and L.O. 3175-C, a lead-zinc ore, was submitted for mineralogic study. The results indicated that the ore contains no independent silver or copper minerals and the pyrite ore contains no lead, zinc, and gold minerals.

E. Special Research

During the months of January to March, Mr. Tsu Ming Han worked jointly with Messrs. Burton Boyum and Gerald J. Anderson on the paper entitled "Progress Report on the Primary Features of the Negaunee Iron-Formation", which was presented by Mr. Boyum at the Lake Superior Mining Geology Meeting in Minneapolis, Minnesota, last April 1, 1955.

A special study was also made on the subject of "The Occurrence of Phosphorous in the Iron-Formation of the Humboldt Area". It was Mr. Han's personal interest to study the phosphorous occurrences in the Humboldt Area and to attempt to find the source of phosphorous. The investigation revealed that the apatite, if present, is generally intimately associated with the specular hematite, magnetite and sericite along the fractures or grain boundaries of the specular hematite-chert ore, shown in Plate 10. It is impossible to distinguish between the non-phosphorous and phosphorous ores by the naked eye, therefore, it must be either tested chemically or examined petrographically.

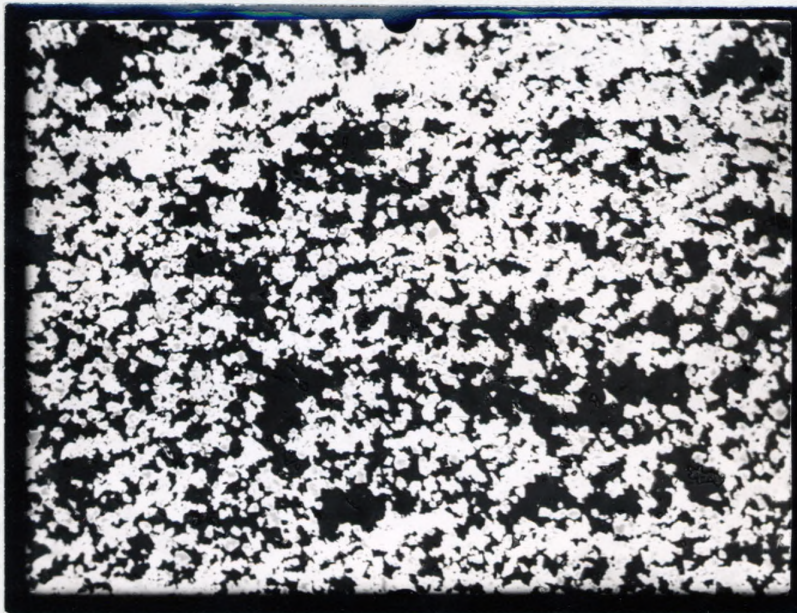
ILLUSTRATIONS

Plate 1
Cascade

D.D.H. #36, Section 27, 47-26 - Depth 265 feet.
Fine-grained martite embedded in chert. 125 x.
Martite, white; magnetite, grey; gangue, dark;
and pits, black.
Polished Section No. 714. Photomicrograph No. 504.

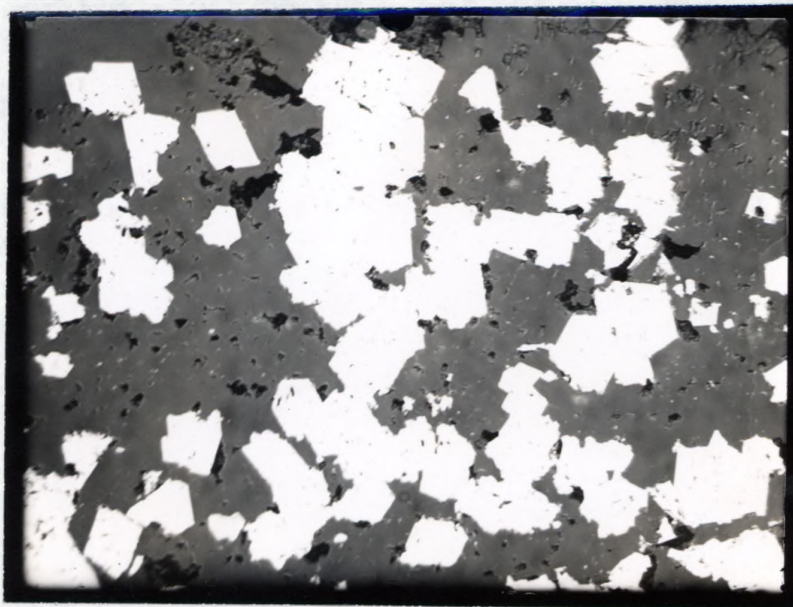


Plate 2
Cascade

D.D.H. #36, Section 27, 47-26 - Depth 302 feet.
Coarse-grained martite embedded in chert. 125 x.
Martite, white; gangue, grey; and pits, black.
Martite Size: -200 +325 Mesh.
Polished Section No. 718. Photomicrograph No. 506.

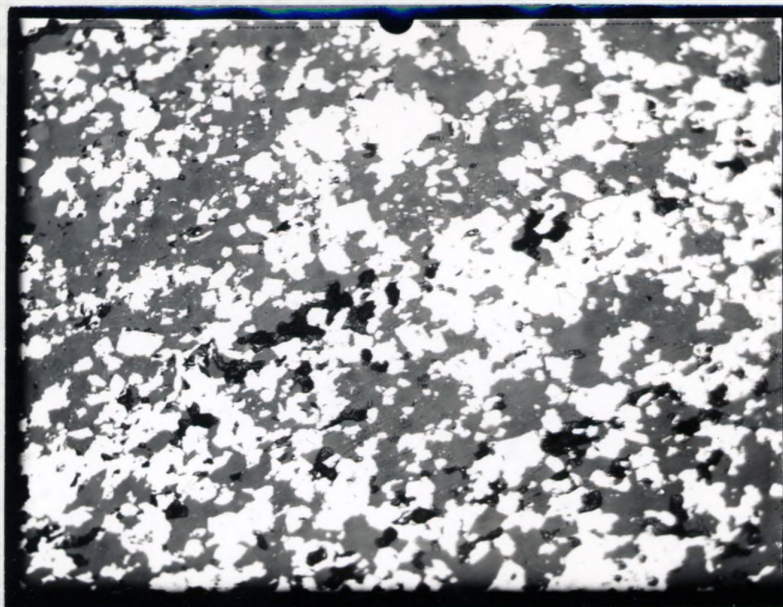


Plate 3
Rock Exploration

D.D.H. #1, Section 31, 43-22 - Depth 890 feet.
Martite-Cherty Iron-Formation. 125 x.
Martite Size: -325 Mesh to less than a micron.
Martite, white; gangue, grey; and pits, black.
Polished Section No. 1305. Photomicrograph No. 556.

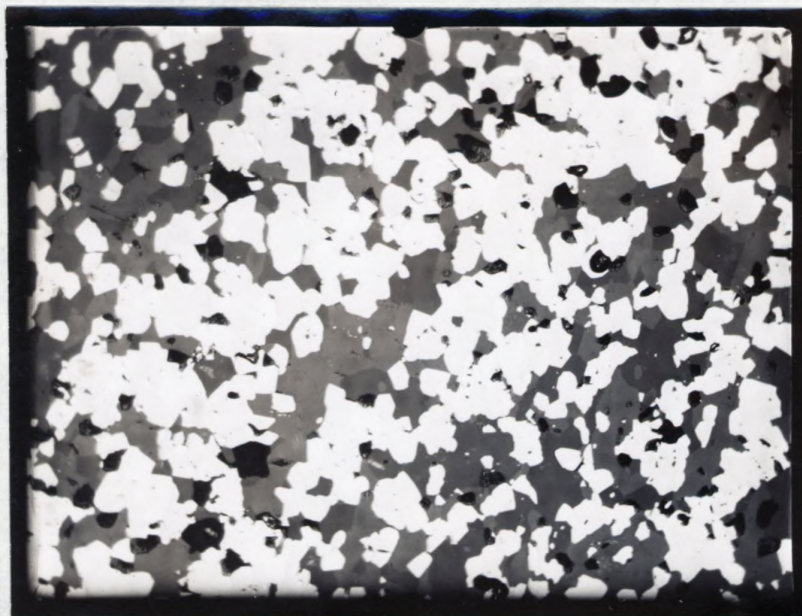


Plate 4
Perkins Explora-
tion

D.D.H. #2, Section 26, 42-22 - Depth 1545' feet.
Magnetic Cherty Silicate Iron-Formation. 125 x.
Magnetite, white; gangue, grey; and pits, black.
Magnetite Size: 325 Mesh.
Polished Section No. 1261. Photomicrograph No. 555.

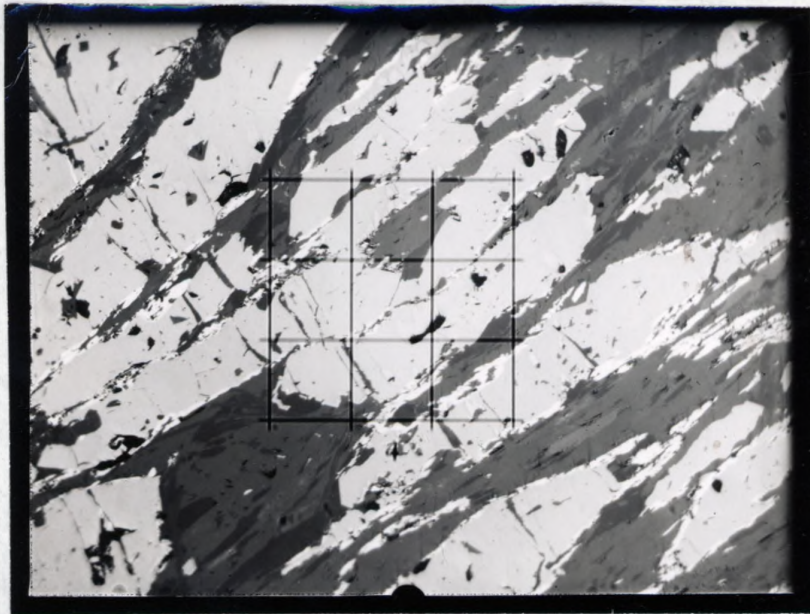


Plate 5
Osier Exploration

D.D.H. #1, Section 18, 43-21 - Depth 773 feet.
Magnetic Schist. Showing the elongated magnetite
bodies parallel to schistosity of the rock and the
oxidation of magnetite to hematite along rims of
the elongated bodies.
Magnetite, greyish white; hematite, white; gangue,
grey and dark grey; and pits, black.
Screen Size: 170 Mesh
Polished Section No. 1256. Photomicrograph No. 497.

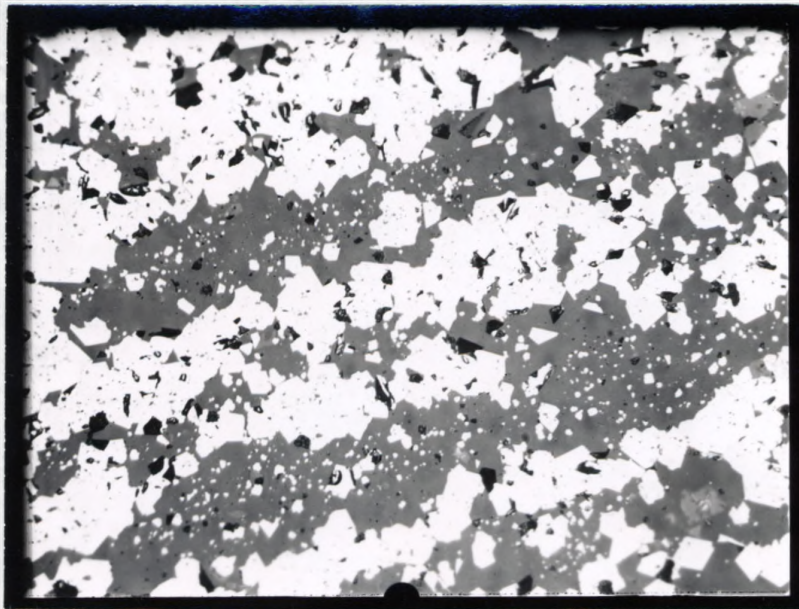


Plate 6
O.E. 1107
N.E. Itasca Co.,
Minnesota

Specimen #451 - O.E. 1174
Magnetitic Cherty Iron-Formation. 125 x.
Magnetite, white; gangue, grey; and pits, black.
Magnetite Size: -240 Mesh to less than a micron.
Polished Section No. 1258. Photomicrograph No. 557

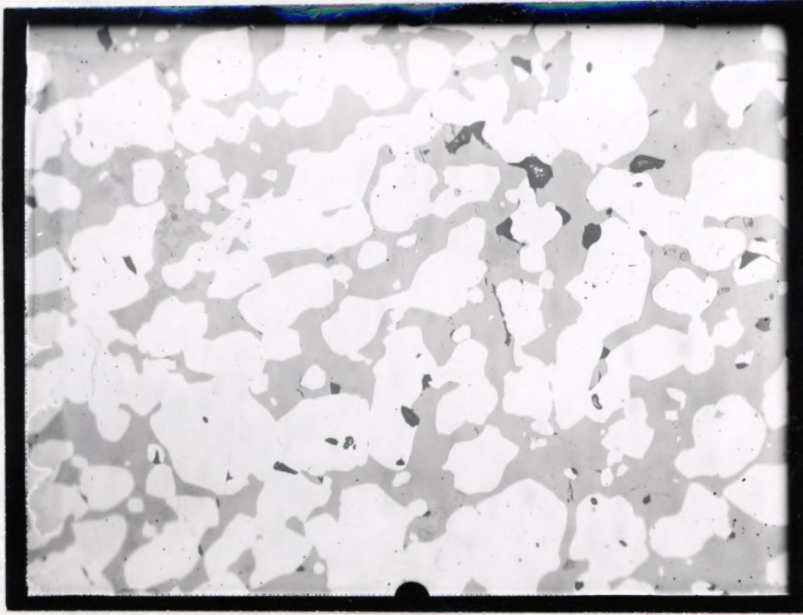


Plate 7
Montana Chromite
L.O. 3586

Granular chromite in Sample No. MX-1564
Chromite, greyish white; gangue, light grey;
and pits, black.
Common Chromite Size: 100 Mesh to 325 Mesh.
Polished Section No. 1312. Photomicrograph No. 534.

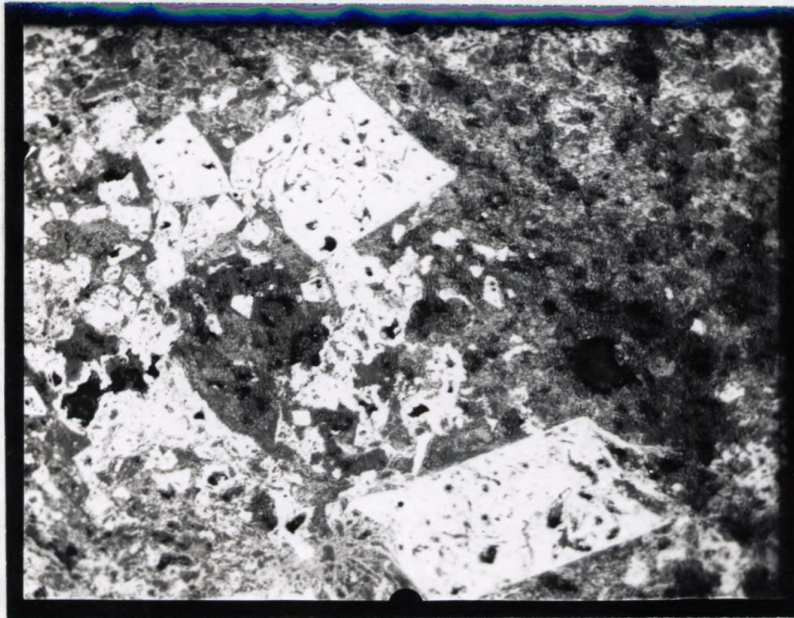


Plate 8
Wisconsin Iron
O.E. 1174

Sample MX-416, O.E. 1174, Bruce, Wisconsin.
Fine-grained oxidized silicate containing coarse-
grained martite. 125 x.
Martite Size: -65 Mesh.
Martite, white; hematite, white; and pits, black.
Polished Section No. 1320. Photomicrograph No. 558.



Plate 9
O.E. 1175
Wisconsin Iron and
Titanium

O.E. 1175, Clam Lake, Wisconsin.
Titaniferous Magnetite. 125 x.
Titaniferous magnetite, and ilmenite, white;
gangue, grey; and pits, black.
Titaniferous Magnetite Size: -65 Mesh +100 Mesh.
Polished Section No. 1297. Photomicrograph No. 528.

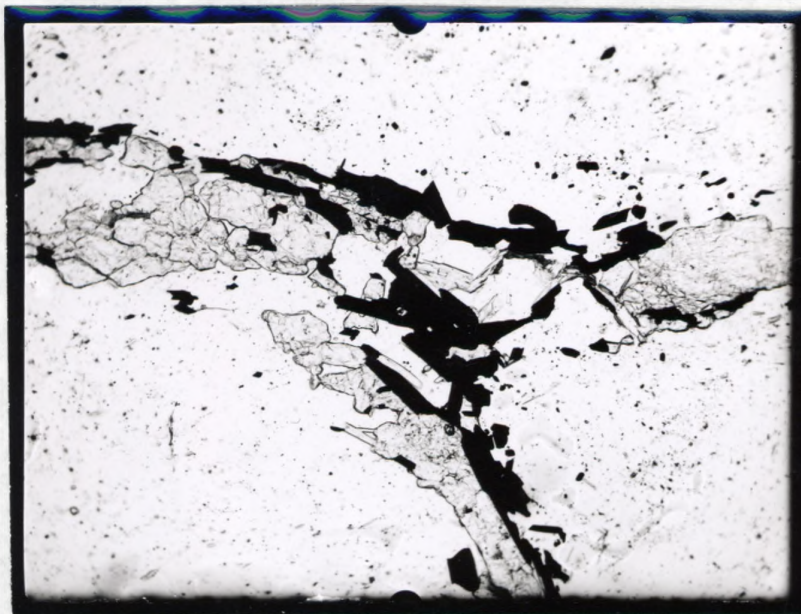


Plate 10
Humboldt Mine

Humboldt Mine, D.D.H. #7, Section 11, 47-29 -
Depth 390 feet.
This Plate shows the intimate association of
specular hematite, apatite and sericite along the
fractures of the recrystallized chert. 80 x.
Thin Section No. 1429. Photomicrograph No. 430.

VIII. OTHER DEPARTMENTAL HIGHLIGHTS

A. Budget Control

During 1955 the Budget Control system was put into operation. Three separate accounts were employed:

1. Account 326 - Minnesota Exploration
2. Account 426 - Michigan Exploration
3. Account 435 - Michigan Drilling

We had also requested a separate budget account for the Departmental activities pertaining to areas other than Michigan and Minnesota during the year 1955. These outside activities were included in Account 426.

In each of the three accounts shown above, we were able to operate at less than our budget figure. While this was generally characteristic of other departments and mines, a concerted effort was made within the Department to avoid all unnecessary expense and this effort was successful.

B. Ore Reserves

In the fall of 1955, the so-called 1975 Special Reserve Study was re-activated and new tables prepared for both Michigan and Minnesota. Canada appeared in the table for the first time with the inclusion of the Albanel-Sandspit Areas. Emphasis was placed on a uniform system of classification of the ore reserves and also for the keeping of master files in both Hibbing and Ishpeming.

C. Program Emphasis

In September and October, an appraisal was made of the Company's exploration activities. Several basic aspects of this program, such as the relative magnitude and the geographical distribution, were shown in graph form. This was also interrelated with the personnel situation.

Two important meetings were held in November. The first was with Messrs. G. J. Holt, C. W. Allen and F. Brown, Jr., and the second meeting with the entire Program Committee. A later meeting was held in Cleveland on December 28th when the exploration program for 1956 was decided. We felt that much good came from these conferences and it is our hope that they will be held semi-annually.

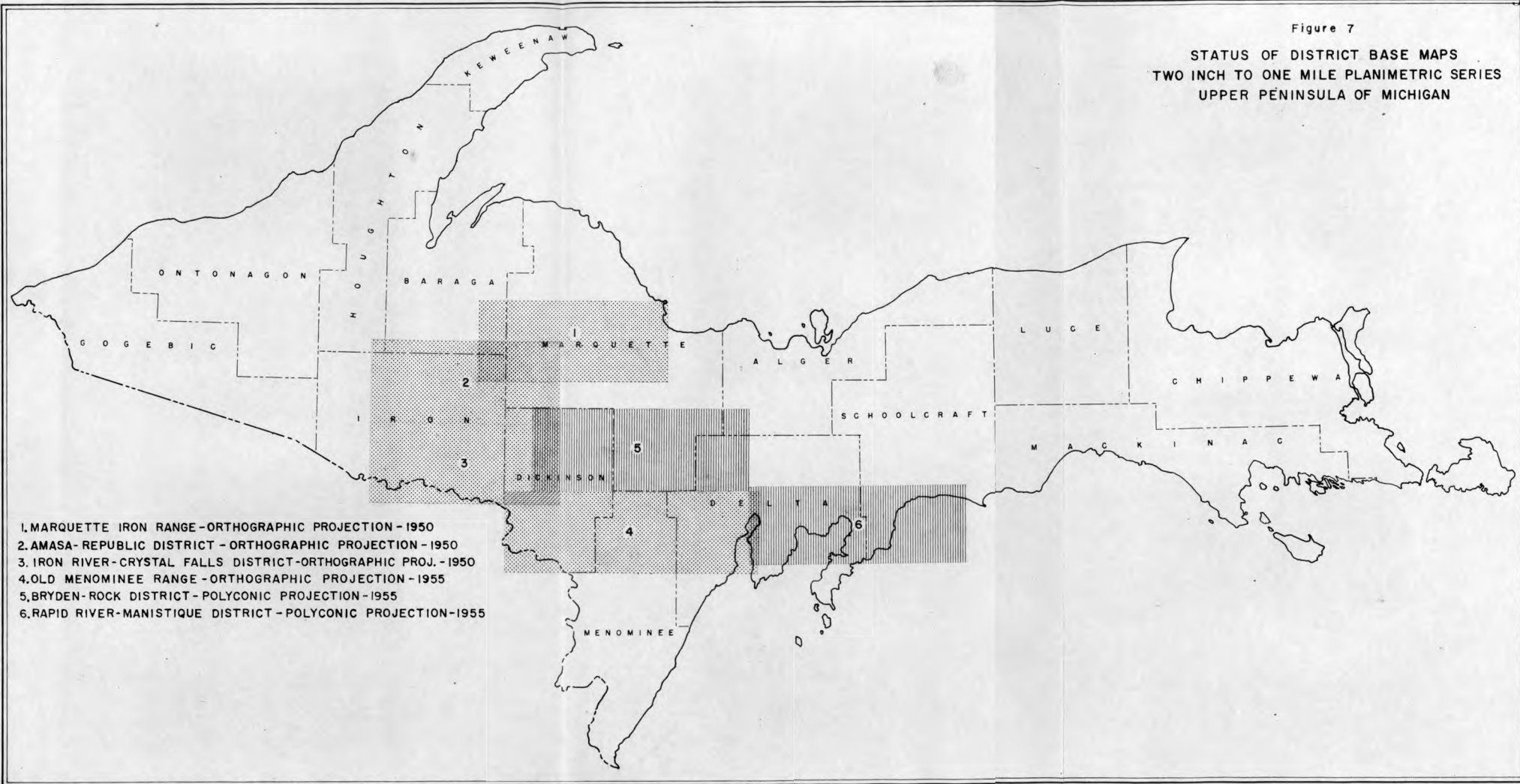
D. Cartography

Messrs. P. S. Johnson and D. R. Nankervis resumed the making of district maps in conjunction with our Cameo Project. Figure 7 illustrates the six major district base maps which we have. A seventh map north of #6 will be made in 1956. Mr. Johnson is to be congratulated for these maps as they represent the finest quality of cartographic effort as employed by the mining companies. Aerial photographs, geodetic surveys and other sources are used in the preparation of these valuable maps.

E. Subsidence

During the year the Subsidence Committee continued to guide the mine

Figure 7
STATUS OF DISTRICT BASE MAPS
TWO INCH TO ONE MILE PLANIMETRIC SERIES
UPPER PENINSULA OF MICHIGAN



- 1. MARQUETTE IRON RANGE-ORTHOGRAPHIC PROJECTION -1950
- 2. AMASA- REPUBLIC DISTRICT -ORTHOGRAPHIC PROJECTION -1950
- 3. IRON RIVER-CRYSTAL FALLS DISTRICT-ORTHOGRAPHIC PROJ.-1950
- 4. OLD MENOMINEE RANGE -ORTHOGRAPHIC PROJECTION -1955
- 5. BRYDEN-ROCK DISTRICT -POLYCONIC PROJECTION -1955
- 6. RAPID RIVER-MANISTIQUE DISTRICT -POLYCONIC PROJECTION -1955

subsidence program in Michigan. The Geological Department continued in its role, particularly with reference to subsidence sections, the microseismic recording, geophysical studies and cooperation with the Engineering Department and the U. S. Bureau of Mines. The following items are of interest for the year 1955:

1. Mather Mine "A" Shaft, DDH #65 - Gordon E. Frantti, Geologist

The U. S. Bureau of Mines and The Cleveland-Cliffs Iron Company's cooperative subsidence study continued at DDH #65 during the year. Daily recordings of the microseismic activity were made and the low level of activity apparently indicates no serious failures occurred in the capping. The hole continued to take its approximate average of 70 c.f.m. of air, but the flow of water into the hole at the greenstone-iron-formation contact (+520' elevation) decreased to a negligible amount in June.

A Bureau of Mines field crew conducted a camera and caliper logging of the hole in September. The drill hole caliper is shown in Plate 11. Plate 12 shows the Bore Hole Camera and Plate 13 shows the recording gear set up on the drill hole, together with the two representatives of the U. S. Bureau of Mines. A useful caliper log was obtained, but water conditions clouded the camera lens, resulting in an uninterpretable photographic record. Future periodic logging of this type is planned, so that by comparison of successive records, additional information may be obtained.

At the conclusion of the year, plans were being made to reenter Hole #65 in an attempt to drill to the present void. In conjunction with this, a tentative underground drilling program has been proposed, consisting of two diamond drill holes from the 3rd Level and one from the 1st Level.

2. Mather Mine "B" Shaft - Bruno J. Haas, Geologist

The mine subsidence program is discussed under IV-A-3-a-4' and V-A-3-2' of this report.

View of Borehole Caliper

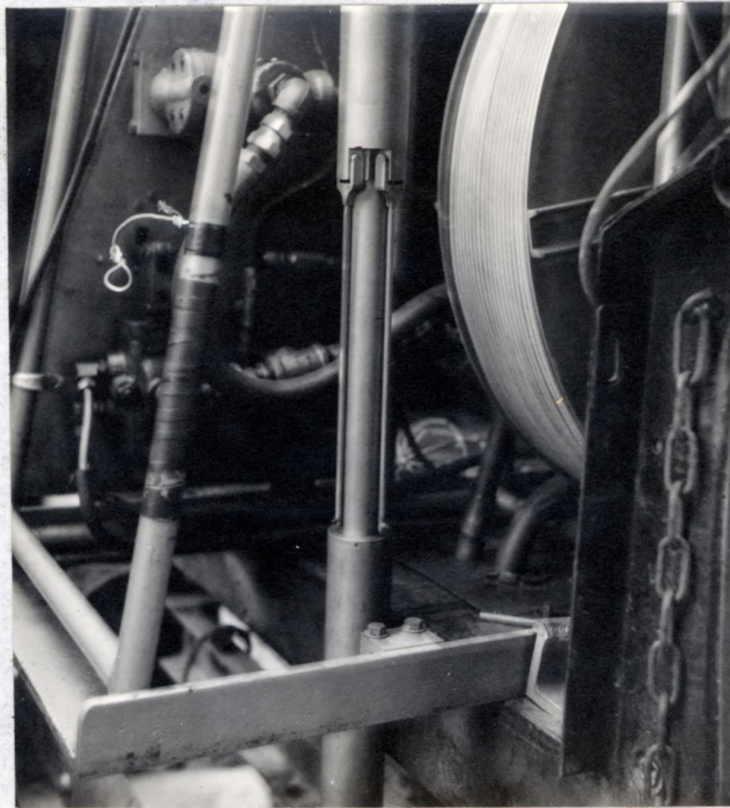


Plate 11

Note actuating arms in retracted position

View of Borehole Camera



Plate 12

MINE SUBSIDENCE

View of Recording and Hoisting Equipment



Plate 13

Set up at D.D.H. 65, Mather Mine "A" Shaft
Same unit used for caliper and borehole camera
October, 1955

