23.

a. PENSION SYSTEMS (Continued)

The new pension plan, referred to elsewhere in this report as the Pension Plan of 3/1/1950 to differentiate it from our original pension plan of 1909, continued in force during the year without change. This Department continued to handle the initial processing of pension applications, referring them to the Pension Committee in Cleveland for final approval. Details of the plan may be found in the Annual Report of 1950.

Except in very rare cases it has been the policy of the Company to await voluntary retirement on the part of the employee, and in Michigan this procedure has worked out very well. The retiring employees for the most part feel that the pensions are adequate, and their attitude toward retirement is much better than it was prior to the Pension Plan of 3/1/1950.

During 1951 the following age pensions were granted:

Name	Mine	Eff. Date	Gross Pension	Net Pension
Frank Juidici	Lloyd	1/1/1951	100.00	37.00
Matt Hahka	Maas	1/1/1951	100.00	40.00
Charles K. Haltunen	"	1/1/1951	100.00	38.00
Charly Boni	Agnew	1/1/1951	84.00	25.00
Cecil Parks	Spies	4/1/1951	88.68	30.00
William J. Gjers	"	4/1/1951	113.55	53.00
Ole Stone	Agnew	1/1/1951	82.68	22.00
Otto E. Eyberg	Hawkins	1/1/1951	84.00	23.00
Frederick H. Matthews	Cliffs-Shaft	4/1/1951	122.40	59.00
William Bess	Maas	4/1/1951	100.00	40.00
Joseph Mayerle	Hawkins	12/1/1950	83.68	24.00
William K. Carlson	Gen. Storehouse	5/1/1951	107.80	47.00
John M. Johnson	Misc. P/R-Ishp. Hosp.	6/1/51	109.79	51.00
Battista Del Bono	Lloyd	6/1/1951	100.00	40.00
Elias Liupakka	Cambria-Jackson	6/1/1951	71.32	9.00
Thomas H. Craine	Lloyd	7/1/1951	65.32	9.00
Nels Wallenstein	Cliffs-Shaft	7/1/1951	103.26	42.00
Ernest Palola	Cambria-Jackson	7/1/1951	77.68	18.00
John H. Karvonen	Cliffs-Shaft	7/1/1951	108.02	43.00
Charles G. Gustafson	"	8/1/1951	100.00	39.00
Frank Sillanpaa	"	8/1/1951	89.00	26.00
Ole Asgaard	"	8/1/1951	100.00	39.00
Victor Siedlecki	Spies	8/1/1951	96.32	40.00
Nick Wester	Maas	9/1/1951	100.00	37.00
Paul Lulich	Agnew	1/1/1951	78.32	18.00
Oscar E. Engstrom	Canisteo	9/1/1951	84.68	17.00
Erick Jacobson	Gen. Storehouse	11/1/1951	100.00	42.00
Enrico Donnini	Spies	11/1/1951	100.00	38.00
John Kuivila	Maas	11/1/1951	101.84	37.00
Herman Jarvi	Mather "A" Shaft	4/1/1951	100.00	37.00
R. Walter Garrett	"	10/1/1951	100.00	40.00

23.

a. PENSION SYSTEMS (Continued)

Name	Mine	Eff. Date	Gross Pension	Net Pension
Charles P. Campain	Athens	4/1/1951	100.00	39.00
Battista Cavallo	"	4/1/1951	100.00	39.00
William J. Williams	"	4/1/1951	100.00	41.00
Peter Perucco	"	5/1/1951	94.68	33.00
Simon Chetto	"	5/1/1951	108.35	46.00
Victor Johnson	"	8/1/1951	100.00	42.00
Louis Jelicich	Hill-Trumbull	12/1/1950	100.00	41.00
Sima Simunovich	"	1/1/1951	100.00	41.00
Frank Vittori	"	1/1/1951	84.32	25.00
Harry Hart	Holman-Cliffs	1/1/1951	82.68	20.00
Daniel Fitzhenry	"	1/1/1951	83.00	17.00
Linas A. Berg	"	10/1/1951	86.00	24.00
Ervin J. Tonkin	C. P. & L. Co.	1/1/1951	100.50	39.00

The following disability pensions were approved during the year:

Victor Siedlecki	Spies	11/1/1950	50.00
Richard H. Guy	Gen. Storehouse	1/1/1951	64.00
Toivo A. Saline	Cliffs-Shaft	5/1/1951	74.00
Nick Kocher	Hawkins	7/1/1951	50.00
Vincent DeToma	Cliffs-Shaft	5/1/1951	50.00
Ernest G. Harris	"	11/1/1951	80.00
Archangelo Yannone	Athens	4/1/1951	65.00
Jacob Aho	"	6/1/1951	90.00

Pensions were discontinued in the following cases for the reasons shown:

Victor Siedlecki	Spies	$50.00	Transf. from disability to age pension effective 8/1/1951
Richard H. Guy	Gen. Storehouse	64.00	Died 3/26/1951
Elrick Roberts	Maas	40.00	Died 10/28/1951
Henry V. Ollikainen	Cliffs-Shaft	43.00	Died 2/2/1951
Charles P. Campain	Athens	39.00	Died 12/3/1951
Ervin J. Tonkin	C. P. & L. Co.	39.00	Died 10/31/1951

WELFARE DEPARTMENT

23.

a. PENSION SYSTEMS (Continued)

Pension Plan for Salaried Employees

The Company has had a Contributory Retirement Plan in effect for its salaried employees since December 31, 1940 with both the Company and the employees contributing to the plan. This plan represented the major Company pension consideration for salaried workers prior to December 31, 1950.

Effective December 31, 1950 the Company announced a Pension Plan for Salaried Employees wherein they will be provided with pensions on the same formula as that which applies to hourly-wage workers with the Company paying the full cost of the pensions. Reference is made to the Annual Report of 1950 where the details of the hourly-wage formula will be found. The new plan will not eliminate or replace the Contributory Retirement Plan which will remain in force for those already participating in it and for those who choose to participate as they become eligible.

The net effect of the new plan will be to guarantee the salaried employee a pension at least equal to that of an hourly-wage employee of similar status. In the case of a retiring salaried employee who has participated in the Contributory Retirement Plan the gross pension determined by the formula mentioned above will be reduced by the employee's social security benefit and by that portion of the employee's annuity purchased by Company contribution. The balance, if any, will be paid to the employee from a trust fund similar to that set up for the hourly-wage pensioner. In the case of a retiring salaried employee who has not participated in the Contributory Retirement Plan the gross pension will be reduced by the employee's social security benefit with the balance being paid to the employee from a trust fund similar to that set up for the hourly-wage pensioner. Thus in both cases the Company bears the full cost of the salaried employees pension. The advantage to the employee who has participated in the Contributory Retirement Plan is that over the years of his employment he has purchased additional retirement income for himself through his contributions to this plan.

For the purpose of record it is mentioned that during the year the privilege of free group insurance was extended to the retired salaried employee.

As with the hourly-wage employees this Department is handling the initial processing of pension applications for salaried employees with final approval resting with the Pension Committee in Cleveland.

The following pensions were granted under the Pension Plan for Salaried Employees during the year:

Name	Former Occupation	Eff. Date	Gross Pension	Net Pension
John Peel (Disability Pens.)	Surface Foreman - Negaunee Mine	6/1/1951	111.08	72.00*
Ina E. Atkin	Visiting Nurse - Negaunee District	8/1/1951	100.00	39.00
Henry C. Scarffe (Disability Pens.)	Mining Captain - Tilden Mine	10/1/1951	150.00	150.00
James Nicholls	Lab. Foreman - C.S. Lab.	7/1/1951	129.80	10.00

* Elected to draw annuity at age 60.

23.

o. INCAPACITATED EMPLOYEES

During the year payments have continued over our Donation Payrolls to certain men who did not have sufficient service to bring them within the provisions of the original pension plan, or, more recently, who were not employed long enough under the Social Security system to bring them adequate benefits from that source. 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. Additions to these payrolls for the last few years have been at a minimum, and all are in the nature of special cases, for example, special settlement on a monthly allowance basis of questionable occupational accidents, special payment on a limited basis to the widow of one of our mine fatalities who had no group insurance, and interim payment to individuals while their pension eligibility was being studied.

For the purpose of record it is mentioned that on February 1, 1947 those individuals who were receiving regular Company aid in the form of grocery, fuel, or clothing orders were granted monetary allowances over this payroll.

The Mining Department Donation Payroll included 27 people on December 31, 1950 and on December 31, 1951 there were 20 payees. The total expenditure over this payroll for the year was $9,272.80.

The following additions were made to the payroll during the year:

Dorothy Hewitt	Monthly Allowance -	$50	Effective 1/1/1951
John Peel	" -	$160	" 1/1/1951
Lyda M. G. Turgeon	" -	$49	" 9/1/1951

The following men were dropped from the payroll during the year:

Andrew Erickson	Monthly Allowance -	$15	Died 2/18/1951
Edward Van Langenhoven	" -	$20	Died 2/19/1951
Philip DePetro	" -	$10	Died 3/14/1951
Fred Carlson	" -	$16	Died 4/27/1951
John Peel	" -	$160	Transf. to Disability Pension 6/1/51
John Vercoe	" -	$30	Died 7/20/1951
Victor Johnson	" -	$50	Transf. to Age Pension 8/1/1951
Simon Luoma	" -	$30	Transf. to Ret. Payroll 10/1/1951
Gust Wernholm	" -	$30	" " 12/1/1951
Hilmer Lerlie	" -	$25	Died 12/15/1951

WELFARE DEPARTMENT

23.

o. INCAPACITATED EMPLOYEES (Continued)

The Furnace Department donations, after being granted, were paid originally by the Furnace Department itself and later by the Cliffs-Dow Chemical Company. By directions from Cleveland on September 1, 1937 the donations were paid by this office until the payroll was closed out in August 1950 with the death of its last recipient. The roll will undoubtedly remain inactive.

The Mesaba-Cliffs Mining Company Donation Payroll continued inactive during the year. The last payment over this roll was made in March 1948.

There are six widows receiving Donation payments, all included on the Mining Department payroll. Two of these widows, Mrs. J. H. Tregoning and Mrs. Fiina Kampinen, have been granted regular donations; three, Mrs. Johanna Forstrom, Mrs. Charles Hill, and Mrs. Hilma Maunula, appear on the payroll through the conversion of direct aid orders to monetary allowances; and Mrs. Dorothy Hewitt has been granted a temporary allowance because her husband was fatally injured in a mine accident prior to his group insurance taking effect. Mrs. Lyda M. G. Turgeon, a seventh woman, appears on the payroll pending final disposition of her application for an age pension.

Amount of Mining Department Donations (including widows)	$9,272.80
Amount of Holmes Mine Donations	240.00
	$9,512.80

WELFARE DEPARTMENT

23.

b. REPUBLIC MINE FUNDS

Each year we have recorded in our Annual Report the history of the Republic Mine Funds. Since this fund is no longer in assistance we recommend where any information desired at any time regarding these funds may be reviewed by referring to the statement made in our 1949 Annual Report.

c. SUSPENSE FUNDS

This fund has been closed out and in case it becomes necessary to review the background, the statement made in our 1949 Annual Report will give information and reference.

d. VISITING NURSES

Our visiting nurses continued their usual services throughout the year 1951. These services, particularly since we have had fewer doctors, have been especially necessary to the employees and their families. Each nurse presents a monthly report showing activities during the month. The type of service which our industrial nurses render is a very fine example of social medical service extended to employees and helps develop good public relations. We are fortunate in having industrial nurses who have been with us a long time. They are experienced and tactful people. Their work during the past year was especially heavy, as indicated by their reports. We wish to express our appreciation for the fine work which has been conducted throughout the years by our industrial nursing staff.

The out-patient work carried on by our industrial nurses is a very important part of our medical plan. The industrial nurses are not charged to the medical plan but are charged against the operation of the Welfare Department. It is felt that this part of our services to our employees is highly appreciated.

The work of the visiting nurses was started in Ishpeming on May 1, 1908, and in Negaunee on September 8, 1912. These services were also available in Gwinn from September 1, 1910 until October 1, 1927, when the Gwinn mines were closed.

During 1951 the following nurses were employed:

Ishpeming - Miss Myrtle Welander
Negaunee - Miss Ina E. Atkin and
Mrs. Elizabeth Cain

Miss Ina Atkin retired after 37 years of service in October 1951.

We submit a monthly report from our visiting nurses. The monthly report for the month of December is attached.

WELFARE DEPARTMENT

23.

f. NORTH LAKE CLUBHOUSE

The North Lake Clubhouse has been deeded to the Catholic Diocese of Northern Michigan and is now being used for the services of the Catholic Church in the North Lake district.

g. GWINN ASSOCIATION

The Board of Education of Forsyth Township at Gwinn transferred, during the year, the Clubhouse to the Forsyth Township Board and the Township Board is now directing the activities in the building.

h. ISHPEMING Y.M.C.A. BUILDING

The Ishpeming Y.M.C.A. building has now been taken over by the State and has become a National Guard Armory.

i. SAFETY WORK

Under the direction of Mr. A. J. Stromquist, Safety Director, the Central Safety Committee held monthly meetings during 1951. Mr. Stromquist submits brief reviews of all accidents previous to the meetings and a general discussion is had at the meetings and a study is made of the possibility of preventing like accidents in the near future. Each accident is then classified. Meetings were held on the following dates in 1951:

January 12	July 20
February 9	August 10
March 9	September 14
April 20	October 19
May 18	November 9
June 8	December 14

The following are members of the Central Safety Committee:

C. W. Allen	Dr. G. M. Waldie
H. O. Moulton	E. D. Cory
W. R. Atkins	Carl Brewer
C. R. Sundeen	R. G. Schaal
F. J. Haller	H. H. Korpinen
Onnie Marjama	Hl C. Swanson
J. S. Westwater	J. S. Bowen
John Trosvig	L. J. Erck
W. F. Gries	H. W. Rembold
A. J. Stromquist	G. T. Hollett
H. F. Rogers	A. E. Lillstrom
W. E. Johnson	M. A. Swanson
L. C. Holmgren	R. M. DeGabriele
J. D. Preston	J. M. Haivala
H. W. Sundberg	LeRoy Hosking

WELFARE DEPARTMENT

23.

j. HOSPITALS AND MEDICAL SERVICE

The Superintendent of the Welfare Department served in the capacity of Administrator of the Ishpeming Hospital and maintained almost daily contact with the hospital and the Negaunee Dispensary. He also serves on the Board of Trustees of the General Hospital of the Iron River District and contacts are made with that hospital at regular intervals. Throughout the year the Ishpeming Hospital Advisory Administrative Committee continued to meet and the following men make up the committee; F. J. Haller, Manager; J. S. McNabb, Chief Clerk; W. F. Gries, Supt., Welfare Dept; Ray Satterley, Supt., Inland Steel Co.; Joseph Cameron, Manager, Hercules Powder Co., H. S. Peterson, Supt., Jones & Laughlin Ore Co.; Dr. A. W. Erickson, Chief of Staff; and Mrs. Miriam Thomas, R.N., Superintendent of the Hospital.

Our visits to the Gwinn District are less frequent since the closing of the Princeton Mine. Occasionally, however, we contact some of our employees in the district who may have special problems. We also keep in contact with Dr. S. J. Green who takes care of the medical needs of our employees in the Gwinn area.

For the purpose of the record we note here that in June of 1946, the monthly medical fee for employees who subscribe to our medical plan was raised from $1.50 per month to $2.00 per month. The $2.00 per month rate is still in force.

Dr. R. A. Burke who was associated with us for many years as a member of our medical staff passed away in the fall of the year. The Cambria-Jackson employees for the remainder of the year and up to the change in the policy were cared for by Dr. G. O. Knudsen.

ISHPEMING HOSPITAL

A review of the reports for the year will indicate that the Ishpeming Hospital had a very busy year. The hospital continues to maintain its high standard and has again been granted membership in the American Hospital Association and in the American College of Surgeons. Most of the time the full capacity of the hospital is in use.

Our staff of nurses, while fewer in number than in the pre-war years, continues to be a well-balanced staff and we are fortunate that many of the local married nurses continue to work full time at the Hospital.

Each year it has been mentioned in this report that the people of this community and the surrounding communities do not fully appreciate the real service which is rendered by the Ishpeming Hospital. The Hospital is without a doubt the greatest asset from a community standpoint in the whole area. The Hospital, while owned, operated and

j. HOSPITAL AND MEDICAL SERVICE (Continued)

maintained entirely by the Cleveland-Cliffs Iron Company with the assistance of the cooperating and coordinating companies in the district, is being called upon more each year because of the fact that people are becoming more hospital conscious year by year. The community does not in any way contribute to the hospital. That is, there are no special funds coming from any groups or any individuals in the support of the hospital. The lack of appreciation of the hospital on the part of people in this area is not a conscious thought at all but over the years, the people of the community have come to think of the Cleveland-Cliffs Iron Company as providing hospital facilities somewhat in the nature of a contribution to the general welfare and health of the entire community. There is no question but the hospital does bring much goodwill to the company although this goodwill is not very often expressed by local people who take the hospital too much for granted.

During the year there was discussion again of the possibility of reorganization of the administration of the hospital. Various plans have been studied and some definite conclusions have been reached. The Superintendent of the Welfare Department, as Administrator of the hospital, feels very definitely that control of the hospital should be kept by the company. It has often been pointed out that the services which are rendered in connection with compensation and injury cases are of such importance to the company that it should always be in position to guide and control these particular important phases of the company's work. The hospital could be reorganized as a non-profit institution which would dissolve the necessity for paying the Michigan State Sales Tax. The medical staff should be completely disengaged from the company payroll and they should no longer be in any way direct employees of the company. The program which has been established on the Mesaba Range would undoubtedly work very well in this district. During 1951 several conferences regarding the future of the Ishpeming Hospital were held. A survey was made by Mr. D. E. Sadler, Comptroller, pointing out many of the figures involved in the administration of a hospital. The brief conclusions reached as a result of this survey are as follows: (1) Our hospital facilities are inadequate because of the growing hospital consciousness by the public. (2) It is generally agreed that the present medical plan wherein the doctors are direct employees of the Cleveland-Cliffs Iron Company should be abolished and another plan set up.

It is felt that the meetings of the Ishpeming Hospital Advisory Administrative Committee has served a good purpose since several of the executives of our company and coordinating companies have come to know something of the problems which arise in the operating of a hospital business. This committee has been interested and very loayl to the needs of the hospital. We express here our sincere appreciation for their continued loyalty and support in the problems which we meet in operating a hospital. The hospital has really become a big business.

WELFARE DEPARTMENT

23.

j. HOSPITALS AND MEDICAL SERVICE (Continued)

The staff of the Ishpeming Hospital during the year 1951 was made up of the following:

Dr. A. W. Erickson, Chief of Staff
Dr. R. G. Williams
Dr. R. G. Jaedecke

The staff at the Negaunee Dispensary is made up of the following:

Dr. W. A. Mudge
Dr. R. L. Paine

In the Gwinn District, Dr. S. J. Green continues to serve.

Dr. R. A. Burke who conducted his own hospital in Negaunee served our Cambria-Jackson employees by agreement. Dr. Burke was paid $1.50 per man per month for each of the Cambria-Jackson employees for medical care and we also supplement this with $1.00 per man per month to assist Dr. Burke in caring for accidents and injuries and in the maintenance of his own hospital.

We feel that our first obligation is to our own employees and we provide for the care of our employees by reserving two beds at all times for accidents and injuries regardless of what other conditions may be. At present we list our hospital as having a capacity of 52 beds and 24 bassinets. We have, of course, a closed medical staff, a complete nursing staff and we engage only graduate nurses. We also have a trained and experienced anesthetist, a surgical nurse with special training, two laboratory technicians and one x-ray technician as well as a well-organized business staff. The business staff has been increased due to the fact that so many people now carry group hospitalization, and since we have a group hospitalization program now for our own employees, this phase alone requires almost the full time services of one clerk.

The hospital is very well equipped for a hospital of its size. I think it can be safely said that the equipment at the Ishpeming Hospital, including such equipment as x-ray apparatus, laboratory facilities, surgical equipment, operating room equipment, laundry and dietitian department equipment, compares very favorably with any hospital of our size. We are, also, well equipped in our maternity wards and obstetrical department.

The emergency room on the first floor probably has greater use than any other department of the hospital. Heremost of the minor injuries, slight injuries and treatments are cared for. It is estimated that at least 35 to 40 people are taken care of in this department every day.

WELFARE DEPARTMENT

j. HOSPITALS AND MEDICAL SERVICE (Continued)

The Welfare Department, as a department of the Company, and the Administrator of the Hospital, wish to record here their appreciation to the participating companies in the district, to the Hospital Advisory Committee, and to the employees at the Hospital for their continued loyalty and cooperation.

A special report is attached to this general report, giving considerable information regarding the operation of the Ishpeming Hospital for the year 1951.

NEGAUNEE DISPENSARY

The building formerly known as the Negaunee Hospital and in recent years known as the Negaunee Dispensary continues to serve as the medical center for our employees in Negaunee and environs. Dr. W. A. Mudge and Dr. R. L. Paine maintain their offices in the Negaunee Dispensary, as does Miss Atkin, the industrial nurse for the Negaunee District. There are over 1500 employees in the Negaunee area and most of them have their medical needs taken care of through the Negaunee Dispensary. We have maintained through the year two regular registered nurses as part of the staff at the Negaunee Dispensary. During the year we have also had Mr. Leo Syrjanen, a registered pharmacist, on duty at the Negaunee Dispensary pharmacy and upon his resignation, we hired Mr. W. J. Hebbard, a registered pharmacist.

The Negaunee Dispensary serves as an emergency hospital or clinic in the Negaunee District. Many of the emergency cases, particularly injuries, are not brought to the hospital in Ishpeming but are taken care of at the Negaunee Dispensary. We do not hospitalize anyone, however, in the Negaunee Dispensary.

Dr. Burke who was associated with us for many years as a member of our medical staff, passed away in the fall of the year. The Cambria-Jackson employees for the remainder of the year and up to the change in the policy were carried on the medical plan and were cared for by Dr. G. O. Knudsen.

GWINN DISTRICT

Dr. S. J. Green continues to serve our employees in the Gwinn area. He occupies the home which the doctor has always had and in which he has his office and a small dispensary. We do not maintain an industrial nurse in the Gwinn District.

WELFARE DEPARTMENT

23.

j. HOSPITALS AND MEDICAL SERVICE (Continued)

GOVERNING BOARD

A. C. Brown, President
E. B. Greene, Chairman, Board of Directors
C. W. Allen, General Manager
F. J. Haller, Manager of Michigan Mines

ADVISORY COMMITTEE

F. J. Haller
J. S. McNabb
W. F. Gries, Secretary and Chairman
J. C. Cameron
R. D. Satterley
R. W. Braund

ACTIVE MEDICAL STAFF

A. W. Erickson, M.D., President
W. A. Mudge, M.D.
R. G. Jaedecke, M.D.
R. L. Paine, M. D.
George McL. Waldie, M. D.
R. G. Williams, M. D.
S. J. Green, M. D.
Bert Moore, M.D.

COURTESY STAFF

P. Van Riper, M.D.
I. Sicotte, M.D.
F. O. Paull, M.D.

DEPARTMENTS

Laboratory and Roentgenology
A. W. Erickson, M.D.

Gwinn Dispensary
S. J. Green, M.D.

Negaunee Dispensary
W. A. Mudge, M.D.
R. L. Paine, M.D.

Anesthesia
A. W. Erickson, M.D.

Histories
A. W. Erickson, M.D.

Industrial Hygiene
Geo. McL. Waldie, M.D.
Bert Moore, M.D.

Walter F. Gries, Administrator

23.

j. HOSPITALS AND MEDICAL SERVICE (Continued)

REPUBLIC HOSPITAL

Each year we have mentioned the Republic Hospital. If at any time information is desired regarding the Republic Hospital, it is suggested that the Annual Report 1949 be reviewed.

IRON RIVER HOSPITAL

During the year several calls were made at the General Hospital of the Iron River District at Stambaugh. The Superintendent of the Welfare Department attended the annual meeting. The General Hospital of the Iron River District provided for the medical and hospital needs of our employees at the Spies-Virgil Mine at Iron River. This hospital is managed by a board of trustees representing the different stock-holding mining companies and it is administered and operated in a very business-like manner. The Superintendent of the Welfare Department represents our company on the Board of Trustees of the Iron River General Hospital.

Dr. L. E. Irvine continues to provide the necessary medical attention for our Spies-Virgil employees. He also gives the physical examinations, both pre-employment and periodical. Dr. Addison at Crystal Falls, who is associated with the hospital there, provides medical care for a small group of our employees who particularly request his services.

PAYMENTS TO PHYSICIANS

For reference purposes the following statement is made in each annual report:

On August 1, 1927, the rate of payment for the Cleveland-Cliffs Iron Company went into effect. The employees paid $1.25 for medical services for themselves and the dependent members of their families, and the Company paid 50¢ per man per month to cover medical and hospital services for cases coming under the Compensation Act.

From time to time the rates for membership in the Company's medical plan have been changed. On January 1, 1944 the monthly rate was raised from $1.25 to $1.50. The Company increased its contribution at that time from 50¢ to 75¢ per man per month. The contributions made by employees in the Iron River District are as follows: $1.25 per single man and $1.75 per married man.

PHYSICAL EXAMINATION OF EMPLOYEES

The Industrial Hygiene Department, under the direction of Dr. George McL. Waldie, continues to give the physical examinations to employees and to counsel with them regarding physical deficiencies and whose cases require consideration and study.

WELFARE DEPARTMENT

23.

j. HOSPITALS AND MEDICAL SERVICE (Continued)

INDUSTRIAL HYGIENE DEPARTMENT

Our Industrial Hygiene Department was organized on April 1, 1939. Dr. George McL. Waldie continues to have charge of this department. The department continues the usual physical examination program, as well as the follow-up program in cases where employees have been found to have some difficiency. Considerable valuable information has been gathered by this department during the past several years and we feel that we have excellent records on all employees from the standpoint of their physical condition.

The work of the Department of Industrial Hygiene has increased since we did not renew our Saranac contract in the fall of 1945. All films which formerly were sent to Saranac for reading and interpretation are being read and interpreted locally by Dr. Waldie. This work covers also the Inland Steel Company and the North Range Mining Company's employees on the Marquette and Menominee Ranges, as well as the employees of the Hercules Powder Company and Jones & Laughlin Ore Company. Dr. Waldie submits monthly reports, as well as periodical reports, covering the work of his department.

In cases where it seems necessary for an employee to have medical attention of some kind, Dr. Waldie refers him to a regular member of our medical staff. The department makes an effort to correct any defect or some type of illness, a follow-up program is instituted and a check-up is made from time to time to determine what the employee's condition is.

The expansion of operations on the part of our Company has made it necessary to employ additional manpower. This has given the Department of Industrial Hygiene additional responsibility and we engaged Dr. Bert Moore in the fall of this year as Assistant to Dr. Waldie.

The following is the total of examinations made to December, 1951:

The Cleveland-Cliffs Iron Co.	17759
Negaunee Mine	3894
Mather A Shaft	2848
Mather B Shaft	675
Athens Mine	3816
C.P. & L. Co.	819
Land Department	44
Inland Steel Co.	4619
Other Cos. Misc.	3118
Pickands Mather	149
Jones & Laughlin Ore Co.	89
Oliver Iron Mining Co.	725
Marq. Co. Rd. Comm.	10
Hercules Powder Co.	386
TOTAL	38951

WELFARE DEPARTMENT

23.

k. COMMUNITY HEALTH

Each year we include in this report a statement concerning the general health conditions in Marquette County. It is pleasing to again report that the general health conditions in the county were very good and there were no serious epidemics or loss of time at the mines because of illness.

There continues to be an increase in the use of the Ishpeming Hospital, so much so that very often the hospital has to arrange a schedule for admittances of people due to the fact that there is a great demand for hospitalization. Presently, there is a waiting list in the community of persons who are waiting to be hospitalized.

The three cities in Marquette County each have a health officer and a full time school nurse. The City of Marquette also employes a full-time nurse whose services are made available for the most part to the township districts. The townships also have health officers.

The city health officers in Marquette County are:

Ishpeming	- Dr. W. A. Corcoran
Negaunee	- Dr. R. L. Paine
Marquette	- Dr. C. P. Drury

The Northern Michigan Children's Clinic at Marquette, operated in connection with St. Luke's Hospital and supported largely by funds from the Michigan Children's Fund, has continued to serve children throughout the entire Northern Peninsula. The counties of the Northern Peninsula are very fortunate in having available such a fine clinic.

The Bay Cliff Health Camp at Big Bay was in session again during the summer of 1951, completing sixteen years of service. There were about 150 children in the camp from the counties in the Northern Peninsula. These children are cared for for about six or seven weeks and special services are rendered for various groups, such as services for poliomyelitis convalescent children, cardiac cases, rheumatic hearts, speech and hearing defects, diabetics and under-hourished children. The Superintendent of the Welfare Department has continued to serve as Chairman of the Board of Directors of Bay Cliff Health Camp.

WELFARE DEPARTMENT

23.

m. RELIEF WORK

During the year 1951 we carried on our usual program of extending assistance to certain special cases.

The following is a statement of assistance, not including cash assistance, rendered in 1951:

	Ishpeming	Negaunee	Total
January	$	$ 20.89	$20.89
February	12.36	20.74	33.10
March		21.36	21.36
April		21.15	21.15
May	12.36	60.89	73.25
June		20.70	20.70
July		21.07	21.07
August	12.36	21.07	33.43
September		20.87	20.87
October	15.00	21.07	36.07
November		61.00	61.00
December	12.36	21.20	33.56
TOTAL	$ 64.44	$ 332.01	$ 396.45

n. EMPLOYMENT

The Welfare Department keeps in almost daily touch with the Employment Office in charge of Mr. H. W. Sundberg. In cases where there may be some question regarding the employment of a certain individual the case is reviewed. Every effort is made to protect the best interests of the Company in connection with the employment of people.

WELFARE DEPARTMENT

WELFARE DEPT. ANNUAL REPORT YEAR 1951

23.

q. IMPROVEMENT WORK

Mr. Julian Payen, who for many years served as the Company's landscape gardener, has retired from that position and is employed full time at the cottage. Mr. Payen has been succeeded by Mr. Peter Derocher. Mr. Derocher has had the advantage of training under Mr. Payen and he is doing a very good job in his capacity as landscape gardener on our Company properties.

s. COMMUNITY SERVICE WORK

The American Legion Building, which for many years has been the center for the majority of the community activities, has been transferred to the local Legion Post by our Company and the Oliver Iron Mining Company.

The American Legion Building in Negaunee is leased from our Company and recommendations for transfer to the local Legion Post in Negaunee have been made and are underway. We continue to keep the building in condition and regular inspections are made. Considerable of the community activities centers around the Negaunee Legion Clubhouse.

The number of fraternal organizations in the district is rather large for a community of this size. Many of the fraternal orders maintain their own club rooms and considerable of the social life of the community centers around these organizations.

u. OUTDOOR ACTIVITIES

The interest in outdoor activities in the community has increased considerably in recent years. The Winter Sports Club, which maintains a clubhouse north of the city, is a very popular organization and there is greater activity there each winter. This area is also made available during the summer months for various types of outdoor meetings.

The Ishpeming Ski Club conducted its 64th Annual Ski Tournament on February 20, 1952. These tournaments seem to interest more people every year. Several of the employees of our Company participate in the ski jumping.

v. THE MATHER INN

The Mather Inn continues to be the most popular hotel in the Northern Peninsula. It is serving the public in a very fine manner. Many of the civic and community meetings are held here.

WELFARE DEPARTMENT

23.

w. VARIOUS DEPARTMENTS AND ACTIVITIES

The Superintendent of the Welfare Department serves as first vice-president of the Michigan Society for Crippled Children and Adults, and vice-President of the Michigan Tuberculosis Association. He also continues to serve as a member of the Michigan Welfare League and as director of District XI for the University of Michigan Memorial-Phoenix Project.

The Superintendent of the Welfare Department continues to serve as Chairman of the Board of Directors of Bay Cliff Health Camp at Big Bay. He also serves as a member of the Advisory Consultant Staff to the State Department of Public Instruction on community planning and programming.

On December 21, the employees of the Central Office held their annual Christmas Party.

x. POLICE DEPARTMENT

The Police Department is under the supervision of the Superintendent of the Welfare Department and is in direct charge of Mr. R. J. Veale, Chief. Almost daily conferences are held with Mr. Veale, dealing with police work and plant protection. Mr. Veale submits a monthly report. Our police have been uniformed for several years and we have felt that we get excellent service from them. Now men for the department are selected with care and we no longer follow the old policy of using older men in their declining years as members of the police force.

y. DEFERMENTS

The number of employees being inducted into the Armed Forces has gradually increased through 1951. This is true despite the fact the recall of employee reservists has nearly stopped. This is primarily due to the draft board procedure of moving through the draft-eligibles in reverse order, that is, from older to younger. At the beginning of 1951, the local board was working generally in the group from 20-23 years of age. Many of our employees in this age group who might have been called had attained a higher working status and, therefore, we were able to obtain deferments for them. Most of the men now being called are in the 18-19 year group and have not yet progressed to occupations qualifying them for deferment.

As previously reported the Marquette County Board continues to cooperate in every case where deferment is requested. However, success with out-of-county boards is spotty at best.

As the call for reservists seems to be lessening, our success in obtaining deferments for those few who are called seems to increase. It all points to a slackening of the manpower needs of the armed forces for previously trained men.

y. DEFERMENTS (Continued)

EMPLOYEES IN SERVICE	DRAFTED	ENLISTMENTS	RESERVISTS RECALLED	TOTAL
Hourly rate				
Underground	31	41	13	85
Surface	9	8	4	21
TOTAL	40	49	17	106
General Roll	7	2	2	11
GRAND TOTAL	47	51	19	117

APPRECIATION

It is a privilege to again record in this report my appreciation for the cooperation, the guidance and the understanding which have always been given this department by Mr. C. W. Allen, General Manager, and Mr. F. J. Haller, Manager of Michigan Mines. I wish also to express my appreciation for the cooperation which has always been received from Mr. A. J. Stromquist, Safety Director, and from Capt. H. F. Rogers, his assistant. We shall strive to coordinate and cooperate with the work of this department at all times. It should also be mentioned here that the Superintendent of the Welfare Department, who acts as Administrator of the Ishpeming Hospital, appreciates the splendid cooperation and help of Mr. F. J. Haller, Manager, Mr. J. S. McNabb, Chief Clerk, Mr. Joseph Cameron, Superintendent of the Hercules Powder Company, Mr. Ray Satterley, Superintendent of the Inland Steel Company, and Mr. R. W. Braund, Superintendent of the Jones & Laughlin Ore Company, who have been serving as members of the Ishpeming Hospital Advisory Administrative Committee.

I wish to conclude my annual report by expressing appreciation for the splendid help and assistance of Mr. W. E. Johnson, Compensation Agent; for the fine service rendered by by Mr. L. C. Holmgren, Mr. J. S. Bowen, Miss Marilyn Holmgren and Miss Shirley Holmgren.

WELFARE DEPARTMENT

Ishpeming Hospital
Ishpeming, Michigan

THIRTY-THIRD ANNUAL REPORT

OF

THE ISHPEMING HOSPITAL

INCORPORATED 1917

Unit of the Cleveland-Cliffs Iron Company
Opened for the Reception of Patients - 1918

Reports close with the Calendar Year, December 31, 1951

ISHPEMING HOSPITAL
Ishpeming, Michigan

GOVERNING BOARD

E. B. Greene, President
C. W. Allen, General Manager
F. J. Haller, Manager, Michigan Mines

ADVISORY COMMITTEE

J. S. McNabb
F. J. Haller
W. F. Gries, Secretary and Chairman
J. C. Cameron
R. D. Satterley
H. S. Peterson

ACTIVE MEDICAL STAFF

A. W. Erickson, M. D., Chief of Staff
W. A. Mudge, M. D.
R. G. Williams, M. D.
Geo. McL. Waldie, M. D.
R. G. Jaedecke, M. D.
R. L. Paine, M. D.
S. J. Green, M. D.

COURTESY STAFF

E. R. Elzinga, M. D.
F. Van Riper, M. D.
I. Sicotte, M. D.
F. O. Paull, M. D.
Local Dentists

CONSULTING STAFF

A. W. Erickson, M. D.
T. B. Bolitho, M. D.,
roentgenologist

DEPARTMENTS

Ishpeming Hospital
A. W. Erickson, M. D., Chief of Staff

Negaunee Dispensary
W. A. Mudge, M. D., Senior Doctor

Gwinn Dispensary
S. J. Green, M. D.

Industrial Hygiene
Geo. McL. Waldie, M. D.

ISHPEMING HOSPITAL
Ishpeming, Michigan

PERSONNEL AS OF DECEMBER 31, 1951

A. W. Erickson, M. D.	Chief of Staff
R. G. Williams, M. D.	
R. G. Jaedecke, M. D.	
George McL. Waldie, M. D.	Industrial Hygiene Department
Bert E. Moore, M. D.	Industrial Hygiene Department
Mrs. Miriam M. Thomas, R. N.	Superintendent
Mrs. Helen Romeli, R. N.	Assistant with Practical Nurse Program
Edgar Holmgren	Pharmacist
Edmund C. Holmgren	Bookkeeper
E. Anna Ruhl	Dietician (ill)
Myrtle Welander, R. N.	Visiting Nurse
Ruth Pasander, R. N.	Anesthetist and Operating Room Supervisor
Mrs. Florence Dawe, R. N.	Surgical Nurse
Marilyn Arsenault, R. N.	Anesthetist and Surgical Nurse
Mrs. Martha Palo, R. N.	Anesthetist and Surgical Nurse
Mrs. Marion Silas, R. N.	Physiotherapist
Mrs. Germaine Myllymaki, R. N.	Emergency Room and Out-patient Department
Mrs. Lydia Carlson, R. N.	Emergency Room and Out-patient Department
Mrs. Doreen Gyles, R. N.	Emergency Room and Out-patient Department
Mrs. Marion Lindberg, R. N.	Third Floor Supervisor
Mrs. Marie Wassberg, R. N.	Second Floor Supervisor
Mrs. Mathilda Strand, R. N.	General Duty
Frances Harrington, R. N.	General Duty
Mrs. Queenie LaFave, R. N.	General Duty
Patricia Regan, R. N.	General Duty
Mrs. Martha Bennett, R. N.	General Duty
Anna Koski, R. N.	General Duty
Mrs. L. Mary Payne, R. N.	General Duty
Mrs. Lillian Larson, R. N.	General Duty
Jeanne Ill	General Duty
Marion Fladeland	General Duty
Helen Frantti, R. N.	General Duty
Mrs. Joan Anderson, R. N.	General Duty
Mrs. Florence Johnson, R. N.	Relief, General Duty
Mrs. Isabel Vercellino, R. N.	Relief, General Duty
Mrs. Mary St. Andre, R. N.	Relief, General Duty
Mrs. Shirley Hoiem, R. N.	Relief, General Duty
Laila Niemela, R. N.	Relief, General Duty
Mrs. Lucy Beard, R. N.	Relief, General Duty
Mrs. Syma Poobus, R. N.	Relief, General Duty
Theresa Grondine	Practical Nurse
Irene Moraski	Practical Nurse
Marjorie Smith	Practical Nurse
Mrs. Myrtle Wilkins	Practical Nurse
Mrs. Elvi Dorffi	Practical Nurse
Fritz Ring	Chief Orderly
Harry Gall	Orderly
Arvo Lyyski	Orderly
George Clark	Orderly
James Johnson	Orderly
Matt Heikkinen	Garage
John Williams	Janitor and Fireman (ill)
Mrs. Anita Holmgren	Switchboard Operator
Ann Quayle	Switchboard Operator
Mrs. Mina Tippett	Relief Switchboard Operator
Eileen Cahill	Assistant to Bookkeeper
Irene Klippel	Stenographer
Mrs. Helen Frederickson	Stenographer

Ann Sundblad	Charge, Record Department
Mrs. Taini Mais	Secretary, Record Department
Betty Tippett	Secretary, Record Department
Nancy Matson	Secretary, Record Department
Ruby Hooper	Secretary, Industrial Hygiene Department
Rita Coron	Secretary, Industrial Hygiene Department
Clayton Quinn	X-ray Technician - Industrial Hygiene Dept
Paul Peterson	Charge, Laboratory
Carolyn Pries	Laboratory Technician
Mrs. Barbara Perrault	X-ray Technician
Mrs. Tillie Wallenstein	Cook

ISHPEMING HOSPITAL
Ishpeming, Michigan

NEGAUNEE DISPENSARY

W. A. Mudge, M. D.	
R. L. Paine, M. D.	
Mrs. Elizabeth Cain, R. N.	Visiting Nurse
Edward Girard	Caretaker
Mrs. Nona Hares, R. N.	Nurse
Miss Ada Lehtonen, R. N.	Nurse
William Hebbard	Pharmacist

GWINN DISPENSARY

S. J. Green, M. D.

ISHPEMING HOSPITAL
Ishpeming, Michigan

DAY WORKERS, DECEMBER 1951

Regular Kitchen

Tillie Wallenstein	Full Time
Elizabeth Ayotte	Full Time
Ethel Oie	Full Time
Aino Kuisti	Full Time
Mildred DeRoche	Full Time
Dagney Rock	Part Time
Emily Chomenko	Part Time

Housekeeper

Florence Hanna	Full Time

Diet Kitchen Supervisor

Emma Argall	Full Time

Receptionist

Elna Elson	Full Time

Diet Kitchen, Second Floor

Helen McQuiggin	Full Time
Edith Wheeler	Full Time
Marilyn Rock	Part Time
Jane Dawe	Part Time

Diet Kitchen, Third Floor

Albina George	Full Time
Clara Solomon	Full Time
Jennie Urich	Full Time

Cleaning

Lilyan Olson	Full Time
Jennie Sirtola	Full Time
Chrissie Keskey	Full Time
Rosemary Brown	Full Time

Nurses' Aids

Blanche Moyle	Full Time
Bertha Hill	Full Time
Lempi Haavisto	Full Time
Hazel Tyynismaa	Full Time
Viola Moffatt	Full Time

ISHPEMING HOSPITAL
Ishpeming, Michigan

DAY WORKERS, DECEMBER 1951

(Continued)

Nurses' Aid Relief

Georgianna Anderson	Part Time
Gertrude Maki	Part Time
Ruth Mattson	Part Time
Lempi Peterson	Part Time
Delyte Heikkinen	Part Time

Laundry

Beatrice Pryor	Full Time
Loretta Brown	Full Time
Dorothy Oliver	Full Time
Columbia Johnson	Full Time
Bertha Nault	Full Time
Leona Rule	Full Time
Marie Eckloff	Full Time
Ruth Trebilcock	Full Time
Alice Backlund	Full Time

Temporary Employees

Elsie Lundin	Part Time
Gladys Maddern	Part Time
Mae Johnson	Part Time

Maintenance

Incher Steve	Full Time

ISHPEMING HOSPITAL
Ishpeming, Michigan

DAY WORKERS WHO RETIRED IN 1951

Laundry

Lyda Turgeon	August 1, 1951

Maintenance

John M. Johnson	May 31, 1951

ISHPEMING HOSPITAL
Ishpeming, Michigan

DAY WORKERS WHO RESIGNED IN 1951

Diet Kitchen, Second Floor

Agnes Kangas	July 31, 1951
Nannie Maki	August 25, 1951

ISHPEMING HOSPITAL
Ishpeming, Michigan

CHANGES IN PERSONNEL

Mrs. Barbara Perrault	X-ray Technician, beginning January 15
Mrs. Joan DeHart	X-ray Technician, Resigned January 31
William Hebbard	Pharmacist, January 1
Mrs. Martha Palo, R. N.	Relief General Duty, February; Anaesthetist, General Duty May 15
Mrs. Donna Cowpland, R. N.	Relief General Duty, February, Resigned June 1
Miss Marjorie Smith	Graduate Practical Nurse, March 1
Mrs. Mina Tippett	Relief Switchboard Operator, March 8
Miss Betty Tippett	Secretary, March 2
Mrs. Syma Poobus, R. N.	Relief General Duty, April
Miss Marilyn Arsenault, R. N.	Anaesthetist, General Duty, May 15
Mrs. Myrtle Wilkins	Graduate Practical Nurse, June 1
Mrs. Muriel Nault	Secretary Industial Hygiene Department, Resigned June 4
Mrs. Emily Torma, R. N.	Relief General Duty, May
Mrs. Gloria Quaal, R. N.	Vacation Relief, General Duty
Mrs. Ann Marie Hammar, R. N.	Vacation Relief, General Duty
Mrs. Laila Marietti, R. N.	Vacation Relief, General Duty
Miss Rita Coron	Secretary Industrial Hygiene Department, June 11
Mrs. Aile B. Johnson	Relief Dietician during Miss Ruhl's absence
Charles Larson	Orderly, expired July 18
James Johnson	Orderly, August 5
Miss Ina Atkin, R. N.	Negaunee Dispensary, Retired July 1
Mrs. Elizabeth Brown Cain, R. N.	Negaunee Dispensary, Visiting Nurse, June 18
Mrs. Margaret Berg, R. N.	General Duty, Resigned August 31
Mrs. Frances Nowell, R. N.	Relief General Duty, Resigned August
Mrs. Florence Johnson, R. N.	Relief General Duty, began August
Mrs. Agnes Person, R. N.	Relief General Duty, began August
Miss Jeanne Ill	Started General Duty, September 5
Miss Marion Fladeland	Started General Duty, September 5
Mrs. Joan Anderson	Started General Duty, September 23
Miss Helen Frantti, R. N.	Started General Duty, September 23
Mrs. Evelyn Laksonen	Laboratory Technician, Resigned September 30
Miss Carolyn Pries	Laboratory Technician, October 3
Miss Nancy Matson	Secretary, October 15
Mrs. Helen Frederickson	Stenographer, October 18
Miss Patricia Regan, R. N.	General Duty, Resigned December 31

ISHPEMING HOSPITAL
Ishpeming,Michigan

RELIEF NURSES

Mrs. Shirley Hoiem, R. N.
Mrs. Frances Nowell, R. N.
Mrs. Lucy Beard, R. N.
Mrs. Isabelle Vercellino, R. N.
Mrs. Mary St.Andre, R. N.
Miss Laila Niemela, R. N.
Mrs. Dorothy Maloney, R. N.
Mrs. Helvi Jennings, R. N.
Mrs. Martha Palo, R. N.
Mrs. Donna Cowpland, R. N.
Mrs. Syma Poobus, R. N.
Mrs. Emily Torma, R. N.
Mrs. Gloria Quaal, R. N.
Mrs. Lillian Hoff, R. N.
Mrs. Ann M. Hammar, R. N.
Mrs. Laila Marietti, R. N.
Mrs. Frances Oja, R. N.
Mrs. Florence Johnson, R. N.
Mrs. Agnes Person, R. N.

ISHPEMING HOSPITAL
Ishpeming, Michigan

NURSES - 1951

Ishpeming Hospital Nurses Month	Operating Room	Emergency Room & Physiotherapist	Supervisors	Assistant with Practical Nurse Education	General Duty	Visiting	Days of Relief	Practical Nurse Education	Graduate Practicals	Nurses Aides	
January	3	4	2	1	10	1	105	10	2	9	
February	3	4	2	1	10 1 ill	1	104	10	2	7	
Ma[illegible]	3	4	2	1	10 1 ill	1	101	10	3	7	
April	3	4	2	1	9 1 ill	1	117	10	3	6½	2 R.N. at Chicago Anaesthesia school
May	4	4	2	1	8 3 ill	1	130½	10	3	6 ≠ 2	3 R.N. off ill 2 Aides part time
June	3	4	2	1	8 2 ill	1	146	8	4	5 ≠ 2	2 R.N. ill 2 Aides part time
July	3	4	2	1	6 3 ill	1	157	5	4	5 ≠ 3	3 R.N. ill 3 Nurses Aides relief
August	3	4	2	1	5 3 ill	1	160½	5	4 ≠ 1	5 ≠ 3	1 Relief P.N. 3 Relief Aides
September	4	4 ≠ 1	2	1	12	1	124	9	4 ≠ 1	5 ≠ 1	1 Emergency Room relief nurse 4 new General Duty, 2 on Sept. 5 and 2 on Sept. 23
October	4	4 ≠ 1	2	1	12	1	87	4 ≠ 2	5 ≠ 1	6 ≠ 1	1 Emergency Room relief nurse, Nurses Aide 1 relief, 2 P.N.S. part of month, 1 Graduate practical relief
November	4 ≠ 1	4 ≠ 1	2	1	12	1	90	3	5	4 ≠ 3	1 Operating room nurse ill, 1 relief 1 Emergency Room relief nurse, 3 relief Nurses Aides
December	4	4	2	1	12	1	91	3	5	6 ≠ 3	

ISHPEMING HOSPITAL
Ishpeming, Michigan

HOSPITAL REPORT FOR THE YEAR 1951

Number of patients remaining in the hospital at the beginning of the year		41
Number of adult patients admitted	1549	
Number of child patients admitted	167	
Number of births	413	
Total new patients for year		2129
Total of all patients during year		2170
Number of deaths	82	
Number discharged during year	2026	
Total number leaving hospital		2108
Number of patients remaining at the end of the year		62

CLASSIFICATION OF NEW CASES:

New born	413	
Surgical	704	
Medical	554	
Obstetrical	458	
Total		2129

NUMBER OF PATIENTS OPERATED ON:

Major	288	
Minor	626	
Circumcisions	181	
Total		1095
Emergency Room Operations	319	
Physiotherapy Treatments	2669	

NUMBER OF PATIENT DAYS:

Newborn	2684	
Other	18832	
Total		21516
Average number of patients per day	58.9	
Number of meals for patients	56496	
Number of meals for nurses, superintendent and dietitian	12905	
Number of meals for physicians and guests	260	
Number of meals for help	10691	
Total meals		80352

Average stay per patient	Newborn	6.5
	Other	11

ISHPEMING HOSPITAL
Ishpeming, Michigan

DEATHS FOR 1951 CLASSIFIED BY DISEASE

Adenocarcinoma, urinary bladder	1
Arterio Embolus, right leg	1
Arteriosclerosis	2
Arteriosclerotic Heart Disease	2
Arteriosclerotic Nephropathy	1
Asthma	1
Atelectasis of the lungs	1
Bowel obstruction	1
Brain concussion	1
Carcinoma of the large bowel	1
Carcinoma of the cecum	1
Carcinoma, intra-abdominal	1
Carcinoma of the penis	1
Cardiac Decompensation	1
Cardiovascular Collapse	1
Cardiovascular Renal Disease	2
Cerebrovascular Accident	3
Coronary Occlusion	8
Coronary Thrombosis	1
Encephalitis lethargica	1
Fractures:	
Cervical vertebrae, 5th & 6th	1
Hip, right	1
Shoulder	1
Skull	2
Gunshot wounds:	
Chest, left	1
Body, lower part	1
Heart block	1
Hemorrhages:	
Bowel	1
Cerebral	6
Cerebrovascular	1

ISHPEMING HOSPITAL
Ishpeming, Michigan

DEATHS FOR 1951 CLASSIFIED BY DISEASE
continued

Hepatorenal syndrome	1
Hypertension	1
Influenza	1
Mesenteric thrombosis	1
Myocarditis	3
Peptic Ulcer	1
Pneumonia:	
Broncho	5
Hypostatic	2
Pneumonitis	3
Premature	1
Pulmonary Edema	2
Pulmonary Embolus	2
Pulmonary Tuberculosis	1
Stillborn	6
Tumor, brain	1
Undetermined Cause	1
Uremia	2
	82

ISHPEMING HOSPITAL
Ishpeming, Michigan

DEATHS DURING YEAR - 1951

Surgical	2
Medical	62
Gynecological	0
Traumatic	10
Newborn	2
Stillborn	6
Total	82

Deaths under 48 hours	26
Deaths over 48 hours	50
Stillborn	6

TRAUMATIC DEATHS

Month	No.	Case No.	Name	Age	Diagnosis
January	0				
February	2	35976	Ellsworth LaBeau	27	Multiple skull fractures and severe brain injury. Severe chest injury and damage to both lungs.
		36000	Urho Salo	27	Gunshot wound, left chest.
March	2	35719	Mrs. Mary Kontio	79	Fracture, right hip.
		36114	Henry Cowling	82	Arteriosclerosis. Terminal respiratory infection. History of a fall with injury to the chest wall.
April	0				
May	1	36422	Clifford Ninnis	31	Broken shoulder. Concussion and chest injuries.
June	0				
July	0				
August	2	36986	Leo Raisanen	39	Fracture, 5th and 6th cervical vertebrae with cord injury.
		36999	Tobias Dahl	74	Brain concussion. Brain injuries.
September	1	37301	Dominic Coluccio	46	Skull fracture. Fracture, legs and left arm.
October	1	37456	Mrs. Mary Carney	81	Fracture of the right hip.
November	1	37584	A. Louis Bonetti	63	Gunshot wound of the lower part of the body destroying the superior ramus of the right pubic bone and the inferior ramus of the ischium.
December	0				

ISHPEMING HOSPITAL
Ishpeming, Michigan

CLASSIFICATION OF PATIENTS ON ADMISSION

Medical	554
Surgical	309
Obstetrical	458
Newborn	413
Gynecological	95
E. E. N. T.	57
Traumatic	243
TOTAL	2129

Women	998
Men	551
Children	167
Newborn	413
TOTAL	2129

CLASSIFICATION OF PATIENTS ON DISCHARGE

Medical	484
Surgical	308
Obstetrical	404
Not Delivered	48
Newborn	401
Gynecological	101
E. E. N. T.	58
Traumatic	222
DISCHARGED	2026
Deaths	82
TOTAL DISCHARGED	2108

Recovered	1556
Improved	378
Not Improved	41
Not Treated (Inc. Undelivered OB)	49
For Diagnosis Only	2
TOTAL	2026

DEATHS

Under 48 hours	26
Over 48 hours	50
Stillborn	6
TOTAL	2108

Medical deaths	61
Surgical deaths	2
Obstetrical deaths	1
Newborn deaths	3
Stillborn	5
Traumatic	10
TOTAL	82

ISHPEMING HOSPITAL
ISHPEMING MICHIGAN

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DIETARY REPORT - YEAR 1951

Patient Meals	56496
Doctors, Nurses, Employees, Visitors	23856
Total Meals for the Year	80352
Formulas	413

SPECIAL DIET PATIENT DAYS

Diabetic	1292
Selective	652
Salt Free	813
Fat Free	257
Low Salt	412
Salt Poor	208
Sodium Free	15
Low Sodium	70
Modified Sippy	133
Initial Ulcer	226
High Caloric	225
Ground Meat	184
1200 Calorie	51
Sippy	85
Salt Free, Diabetic	61
Sodium Free, 1200 Calorie	23
Low Salt, High Vitamin, High Caloric	14
High Vitamin, High Caloric	64
Bland	93
Salt Free, 800 Calorie	5
1000 Calorie	11
Low Residue	154
Neutral	50
Salt Free, 1000 Calorie	14
High Vitamin, High Carbohydrate	121
Bland, Low Residue	23
Salt Poor, Bland, Low Residue	48
Low Fat	34
Rice	14
800 Calorie	9
Low Cholesterol	12
Ulcer	9
Final Ulcer	71
Salt Free, Fat Free, Diabetic	23
Low Salt, Bland	5
Low Fat, High Carbohydrate	48
High Carbohydrate, Soft Fluids	7
Low Purin	23
Fat Free, 1000 Calorie	9
Low Carbohydrate	23
1400 Calorie, Neutral	3
Salt Free, Low Residue	11
Low Fat, Bland	11
Salt Free, Ulcer	17
Low Fat, High Vitamin, High Caloric	8
Salt Free, Low Ash	1
Total Special Diet Patient Days	5768
Total Special Diet Meals	17304

ISHPEMING HOSPITAL
Ishpeming, Michigan

X-RAY REPORT FOR THE YEAR 1952

Extremities	1325
Shoulders	102
Spine	262
Ribs	125
Skull	32
I. V. Pyelogram	21
Kidney	21
Pelvis	51
Stomach	285
Colon	125
Fluoroscope	408
Foreign Bodies	29
Abdomen	21
Chest	426
Jaw	18
Sinuses	2
E. K. G.	180
Fetus	149
Gallbladder	89
Nasal Bones	12
Sternum	12
Hip Fixation	2
Total	3696

No. of In-patients	496
No. of Out-patients	3201
Total	3696

ISHPEMING HOSPITAL
Ishpeming,Michigan

LABORATORY REPORT FOR 1951

Blood Chemistry	834
Blood Type or Match	264
Bleeding Time	133
Cultures	27
Coagulation Time	132
Differential Count	4724
Feces	74
Gastric Analysis	2
Glucose Tolerance	7
Hemoglobin	4891
Icteric Index	70
Miscellaneous Examinations	107
Red Cell Count	4932
Sedimentation	1575
Smears	95
Special Blood Exams	1
Spinal Fluid	5
Sputum	34
Urinalysis	6347
Vena Punctures	4007
White Blood Count	4998
Hematocrit	103
Transfusions	102
Platelet	4
Prothrombin	9
RH Factor	223
Thymol Turbidity	1
Fermentation Test	5
Bromsulfthalien	2
Van den Bergh	1
Blood Thiocyanate	2
Total	33711

Department of Industrial Hygiene

Blood Chemistry	3
Blood Type or Match	395
Bleeding Time	1
Coagulation Time	1
Differential Count	33
Glucose Tolerance	1
Hemoglobin	2276
Icteric Index	1
Miscellaneous Examinations	1
Red Cell Count	49
Sedimentation	2277
Sputum	6
Urinalysis	2265
Vena Punctures	2263
White Blood Count	2265
Blood Screen	5
Transfusions	2
RH Factor	262
Glucose Tolerance	1
Total	12107

ISHPEMING HOSPITAL
Ishpeming, Michigan

EMERGENCY ROOM ANNUAL REPORT

	Co. Cases	Mine Acc. Cases	Outside Cases	Total Cases
January	192	34	113	339
February	196	48	107	351
March	126	46	143	315
April	198	58	121	377
May	177	57	122	356
June	203	47	117	367
July	201	31	134	366
August	232	44	143	419
September	213	61	134	408
October	241	70	141	452
November	223	38	115	376
December	164	47	94	305
Total	2366	581	1484	4431

	Co. Visits	Mine Acc. Visits	Outside Visits	Total Visits
January	640	114	439	1193
February	730	97	328	1155
March	787	139	462	1388
April	742	174	469	1385
May	860	148	570	1578
June	782	128	402	1312
July	972	81	477	1530
August	861	110	640	1611
September	936	168	563	1667
October	932	139	584	1655
November	658	149	430	1237
December	741	113	477	1331
Total	9641	1560	5841	17042

	Operations	C.C.I.	Outside	Fractures Inland Steel	Hercules	J & L
January	12	5	3			
February	26	8	6		2	
March	26	5	5		1	
April	19	7	1	2		
May	31	8	8	2	1	
June	33	7	6	1		
July	29	5	4			
August	39	5	5	1		
September	32	4	4	1	1	
October	24	12	4	1		1
November	24	7	5	1		
December	24	8	1	1		
Total	319	81	52	10	5	1

ISHPEMING HOSPITAL
Ishpeming, Michigan

TREATMENTS FOR THE YEAR OF 1951

Total number of treatments	2669
Total number of patients	433

BASAL METABOLISM

Total number taken	73
Total number of patients	71
Company Cases, Outside	38
Company Cases, Hospital	5
Private Cases, Outside	25
Private Cases, Hospital	3

ULTRA-VIOLET RAY

Total number of treatments	193
Total number of patients	18
Company Cases, Outside	16
Private Cases, Outside	2

INFRA-RED

Total number of treatments	116
Total number of patients	10
Company Cases, Outside	2
Company Cases, Hospital	1
Private Cases, Outside	3
Private Cases, Hospital	4

DIATHERMY

Total number of treatments given	1674
Total number of patients	232
Total number of mine accident treatments	374
Total number of new mine accident patients	28
Company Cases, Outside	151
Company Cases, Hospital	9
Private Cases, Outside	57
Private Cases, Hospital	15

CAUTERY

Total number of treatments	93
Total number of patients	90
Company Cases, Outside	50
Company Cases, Hospital	5
Private Cases, Outside	23
Private Cases, Hospital	12

MASSAGE AND MANIPULATION

Total number of treatments	327
Total number of patients, not included in diathermy or infra-red	12
Company Cases, Outside (Mine Accidents)	5
Company Cases, Hospital (1 Mine Accident)	3
Private Cases, Outside	4
Private Cases, Hospital	0
INTRAMUSCULAR INJECTIONS	143
DRESSINGS	20

ISHPEMING HOSPITAL
Ishpeming, Michigan

SURGERY, 1951
CLASSIFIED BY OPERATION

Abortion, Therapeutic	3	Hemorrhoidectomy	15
Adenoidectomy	3	Herniorrhaphy	42
Adhesions, Freeing	3	Hydrocelectomy	4
Amputation	12	Hysterectomy	11
Amputation, Cervix	1	Incision and Drainage	25
Appendectomy	113	Insertion, Intra-medullary nail	2
Aspiration	1	Insertion, Steinmann Pin	11
Biopsy	27	Ligation, Fallopian Tubes	35
Bowel Obstruction	3	Ligation, Vas Deferens	3
Bursectomy	4	Mastectomy	2
Caesarean Section	30	Orchiectomy	4
Casts	104	Oophorectomy	17
Cauterization	25	Open Reduction	14
Circumcision	194	Packing, Hemostatic	2
Cholecystectomy	8	Paracentesis	1
Closed Reduction	31	Proctoscopy	19
Coccygectomy	1	Prostatectomy	1
Colostomy	1	Removal	10
Colostomy closure	1	Removal, foreign body	9
Colporrhaphy, Anterior	6	Repair, abdominal viscera	8
Colporrhaphy, Posterior	9	Repair	4
Conization--Cervix	2	Repair, traumatic injuries	40
Cystotomy	1	Resection	1
Cystoscopy	5	Salpingectomy	16
Debridement	10	Saphenous Ligation	10
Dilatation	15	Skin Graft	2
Dilatation and Currettage	94	Smith-Peterson nailing	1
Dorsal Slit	1	Spinal Tap	6
Exam. under Anesthesia	4	Tendon repair	6
Excision	23	Thoracentesis	14
Excision, cysts, moles, etc.	107	Thyroidectomy	9
Excision, cervical polyp	7	Tonsillectomy	3
Excision, ingrown toenail	5	Tonsillectomy, Adenoidectomy	48
Excision, Pilonidal Sinus	2	Tooth Extraction	16
Exploratory Laparotomy	7	Trachelorrhaphy	1
Gastro-enterostomy	1	Uterine Suspension	14
		Total	1,385

MAJORS	288
MINORS	626
CIRCUMCISIONS	181
Total Patients	1,095
Total Operations	1,385
Pathology Reports	392

1951

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Patients admitted	182	149	182	180	176	163	194	198	194	178	171	162	2129
Patients discharged	173	140	180	176	190	164	184	189	193	195	158	166	2108
Number of adults	133	108	132	132	133	117	142	145	145	126	127	109	1549
Number of children	16	19	7	8	12	18	19	15	10	14	11	18	167
Newborn	33	22	43	40	31	28	33	38	39	38	33	35	413
Classified as:													
Newborn	33	22	43	40	31	28	33	38	39	38	33	35	413
Obstetrical	33	24	46	43	34	32	35	46	45	45	40	35	458
Medical	59	44	50	48	46	38	51	36	53	46	44	39	554
Surgical	57	59	43	49	65	65	75	78	57	49	54	53	704
Daily Average	56.4	59.89	64.4	63.3	58.1	54.0	55.3	58.7	61.4	61.9	55.9	57.6	58.9
Newborn Days	231	145	262	219	210	192	243	270	263	282	198	169	2684
Patient Days	1520	1532	1736	1681	1592	1430	1472	1550	1580	1639	1481	1619	18832
Total Days	1751	1677	1998	1900	1802	1622	1715	1820	1843	1921	1679	1788	21516
Operations:													
Emergency Room	12	26	26	19	31	33	29	39	32	24	24	24	319
Major	22	19	12	26	33	21	23	27	34	30	26	15	288
Minor	50	48	59	50	67	55	67	48	44	40	43	55	626
Circumcisions	13	8	19	16	11	8	18	14	24	20	12	18	181

82 deaths included in discharges

ELECTRICAL DEPARTMENT
ANNUAL REPORT
YEAR 1951

ATHENS MINE:

The hoisting equipment at this mine has served during the year with several short delays due to some armature and bearing difficulties with the skip hoist motor-generator set. Several broken risers in the armature of the skip hoist generator occurred, but hoisting operations continued with repairs being made over week end shutdown periods. Commutator irregularities and field coil failures of the skip hoist motor were repaired during week end stops in October. Some difficulties occurred with contactor parts for the cage hoist control panels due to obsolete equipment with no parts available. Some of these parts were made or rebuilt in our shops.

The air compressor equipment has been in good condition during the year with routine maintenance.

Installation of the 1500 HP, D.C. generator with the 450 HP synchronous motor and control panels to increase the D.C. haulage and scraper machine power supply was completed in the month of August.

Installation of larger cables in the shaft from the 10th level to the 6th level for D.C. power distribution was also completed. After the installation of larger cables in the shaft and into the 8th level drift, the D.C. load increased to a point which caused some overloading and heating of cables and distribution panels in the pump station. A new 500 MCM, twin conductor cable was put in from the generator bus to a new distribution center and the smaller circuit breakers and panels discontinued.

The pumping equipment has had routine repairs during the year with the exception of the Breitung Shaft pump which was partly destroyed when the headframe was cut down. A changeover of cables and pole line with a spare setup of transformers and control switches was necessary to get away from the falling headframe. This was completed July 10. On July 17, the structure was cut down and dropped in a direction which resulted in so much destruction of the lines and equipment that the shaft was filled with water before another setup for a 20 HP pump could be built. The two 20 HP pumps used for this shaft pumping job are stored at the mine and the pumping is now being done by a 10 HP Layne & Bowler pump borrowed from the Maas Mine.

The light and power job for the new dry house was completed in October. Wiring and service for a 110/220 volt lighting and heater circuit and a 220 volt, 3 phase power circuit were put in with transformers in the headframe. Two 3-conductor, #4 cables were buried in the ground from the dry house to the headframe. One 10 KVA transformer, No. 5090821, was taken from Negaunee Shaft to the Athens Mine for the required increase in capacity.

CAMBRIA-JACKSON MINE:

The hoisting equipment at this mine has given little trouble in 1951. All operations have been quite satisfactory since the installation of the 700 HP motor.

The spot welding of the rotor bars on the 250 HP Allis-Chalmers synchronous motor of the Laidlaw-Dunn-Gordon air compressor was completed in March. These bars were riveted several times but failed to hold proper contact, so spot welding was tried with good results. The field coils of the rotor were also tested, cleaned and repainted.

ELECTRICAL DEPARTMENT
ANNUAL REPORT
YEAR 1951

CAMBRIA-JACKSON MINE: (continued)

The 200 HP, G. E. wound rotor motor for #1 Prescott pump on the 4th level was taken to the shops for a bearing and winding repair job. The motor foundation was also broken out and a completely new sole plate set up and concrete base made. The change made a great improvement in the gear and motor operation.

The 15 HP, 1750 RPM Louis Allis D.C. compound wound motor for the feeder conveyor at the winze was replaced with a 15 HP, 1150 RPM Westinghouse Type SK, D.C. motor for a more suitable speed range for loading the belt conveyor.

Several changes were made in the 250 volt D.C. haulage and U.G. power system. Another 500 MCM feeder cable was put into the winze from the 7th level to the 8th level and the 4/0 trolley cable extended into the 8th level drift 1000 feet.

Some minor repairs were made to the Crocker-Wheeler haulage generator windings and bearings. The two 150 KW, D.C. haulage generators in the engine house are in parallel operation continuously.

CLIFFS SHAFT MINE:

The 750 HP wound rotor motor for the "A" Shaft hoist was taken apart for inspection of band wires and coils in April and September, 1951, and they were found to be in good condition. Similar inspections were made of the "B" Shaft 750 HP hoist motor and it was also found to be in good condition. New worm gears and shafting repairs were made on both hoist controllers.

The 100 KW rotary converter and the 100 KW generator of the 250 volt D.C. haulage equipment in the engine house were overhauled during the year.

After several rotor bar failures on the synchronous motor of #1 compressor due to poor contact and burning connections, the riveting of these bars to the outer rings was discontinued in favor of the welding job which has proved a more permanent remedy for this difficulty.

Bearing renewals and winding repairs to the 200 HP motors of #1 and #2 Prescott pumps were made during the year.

The failure of one of the 2300 volt pump cables and a circuit breaker on surface at "A" Shaft occurred in June. The flashover also destroyed the "A" Shaft 2300 volt feeder cable for the scraper machine power circuit. Temporary cables were connected to restore the pumping. New cables were then laid in the ground from the circuit breaker near the blacksmith shop to the switches in the headframe, and a new 2/0, 2300 volt, 3-conductor cable installation made from the pole line to the oil circuit breaker and shaft cable connections in the headframe.

Changes requiring the removal of transformers, pole lines and cables for relocation of the distribution center and substation for surface power, "A" and "B" Shaft cables for underground 2300 volt power supply, and the main feeders for the engine house were completed. This work was done to clear the way for

ELECTRICAL DEPARTMENT
ANNUAL REPORT
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CLIFFS SHAFT MINE: (continued)

test holes near the engine house and to eliminate as much overhead wiring as possible. Transformers to make this change without power interruptions were borrowed from The Cliffs Power & Light Company and one new 10 KVA transformer was bought for the laboratory and sample crusher building power supply. The relocation of signal and haulage cables were also made at this time.

One new substation on the 5th level for 440 volt, 3 phase power distribution in the "B" Shaft area was completed in December. This is a 150 KVA substation with a setup of three 50 KVA transformers.

The 15 HP slip ring motor and controller with grid resistors formerly used with the screen and crusher equipment in the crusher house were set up with a small hoist for handling material in the air shaft. A cable for this 220 volt, 3 phase job was run in the ground from the transformer bank at the pellet plant to the shaft location.

One of the 50 HP wound rotor motors for the ore tram failed and was temporarily repaired during the stocking season. A complete set of coils was ordered and the stator winding rebuilt during the summer. The old rock tram motor is not in use and is stored at the mine. This is a duplicate of the ore tram motor and can be used in an emergency.

LLOYD MINE:

Several failures of the 500 HP skip hoist motor were the cause of some short delays due to open connections in the stator winding. Temporary repairs were made until October when the motor was taken apart and all the stator coils rewedged in the slots and a new tie ring put in and the coils tied and painted. A spare rebuilt bearing for the slip ring end of the motor was also put in at this time. Contact failures on the secondary control panel of the skip hoist also caused some stoppages. This control equipment is obsolete and parts are not readily obtainable from the manufacturer. It was, therefore, necessary to make connecting parts from spares used for Athens Mine cage hoist.

The haulage generators and equipment were kept in operating condition during the year with routine repairs.

Minor repairs were also made to the compressor equipment.

Bearing failures caused the burnout of several coils in the stator of the 50 HP Allis-Chalmers motor on the 2nd level water supply pump for the North Lake Location. The coils were cut out and the winding temporarily repaired in the shops. A complete set of coils was ordered and the stator rewound.

The 250 HP motor and line starter from the Mather Mine "A" Shaft 1000 ft. level were taken to the Lloyd Mine 5th level and installed with the 500 GPM, 3500 RPM centrifugal pump to be used in an emergency and while repairs are made to the Aldrich pump.

ELECTRICAL DEPARTMENT
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MAAS MINE:

Several week end repair jobs were made on the skip hoist equipment during the year. The commutator of the motor developed irregularities from overheating and stalling due to overloads. Some repairs and changes were made to the lubricating system for the motor-generator set. Two bearing failures on the 1500 HP Allis-Chalmers generator occurred during the year. Some improvements were also made in the Ward Leonard control setup for this hoist.

Limit switches and signal lights were installed on the 5th level winze hoist for the travel limits of both cages.

Compressor motor repairs became costly the latter part of the year. The stator winding of No. 2, 438 HP motor failed and was repaired in October. This motor failed again November 2, due to a high voltage surge caused by a cross-up of a grounded Negaunee City arc lighting circuit with the primary or 2300 volt line. While a partial rewind was being made on the No. 2 compressor motor, the stator winding of No. 1 failed and burned beyond repair possibilities without a complete new set of coils. The coils were ordered from General Electric Company. While the pipe lines between the Maas Mine and Negaunee Shaft were being rebuilt, the air for both mines was supplied by one compressor at each end.

The D.C. haulage and scraper load had increased early in the year to a point beyond the capacity of the 830 ampere Allis-Chalmers motor-generator set. It was, therefore, necessary to arrange equalizer cables and connections for running this generator and one of the 400 ampere General Electric machines in parallel to carry the load until the installation of the larger motor-generator set on the 5th level could be completed.

Work on making room and concreting the base for the new 450 HP synchronous motor and the 2290 ampere D.C. generator on the 5th level near the winze was commenced in February. The installation of the motor-generator set with control and distribution panels was completed in September. Some difficulties occurred with falling ground due to heat from the machine. A shutdown was necessary to repair the timber and steel sets. The motor-generator set was started again and has been in operation since the first week of October. The D.C. voltage and general operating conditions were greatly improved with this installation which supplies all the necessary D.C. power without the aid of the machines in the engine house.

Bearing and winding failures were the cause of a tie-up of the 5th level 125 HP Westinghouse motor on the Prescott pump during the month of February. A broken end bracket occurred on this motor in April due to a bad line-up. The pump bearings were rebuilt and a new flexible coupling was built into the drive setup between the motor and pinion shaft and motor end bracket welded for temporary operation until a new one was made. This 2300 volt squirrel cage motor was bought from the Hill-Trumbull Mine in 1947.

A new 3-conductor, #2, 2300 volt, steel tape armored cable for power supply to the new haulage motor-generator set, winze hoist and the 6th and 7th level pumps was put in the 5th level drift from the pump station near the main shaft to the winze location. All connections for parallel operation of the new cable with the former cable setup from the shaft to the winze were completed.

ELECTRICAL DEPARTMENT
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YEAR 1951

MATHER MINE "A" SHAFT:

Riser failures in the armature of the 1250 HP, D.C. skip hoist motor occurred and were repaired in October. A broken riser also occurred in the armature of the south generator of the skip hoist motor-generator set. These repairs were made during week end stops.

The 75 HP, 2300 volt, 3 phase motor for the underground sinking hoist failed June 21, and was brought to the General Shops for repairs. While in the shops, four coils were cut out of the stator winding and tests indicated that the motor would be all right until a new set of coils could be made. The motor was again taken underground but failed on a few trips. It was then decided to send the stator to the Industrial Engineering & Sales, Marquette, for a re-insulating job of the same coils and a complete rewind. The stator was sent to their shops in Marquette on June 26, and the job was completed July 10.

No costly changes or repairs were made to the motors or line starters of the compressors during the year.

Failure of the automatic line starters for the 300 HP synchronous motors of No. 1 and No. 2 Worthington pumps occurred in August. The difficulty was caused by a breakdown of selenium rectifiers in the control circuit. That part of the control equipment was replaced with A.C. magnetic contactors until re-newal parts can be procured.

The installation of a new 500 MCM, twin conductor, 600 volt D.C. haulage cable in the shaft was completed from the shaft collar to the 5th level ignitron room. This cable, when completed to the D.C. panels in the engine house, will complete the tie between the ignitron and the haulage generator of the M-G set on surface.

The electrical equipment for the 7th level crusher and conveyor system, including a 150 HP wound rotor motor and control for the belt conveyor, a 20 HP, A.C. variable speed motor and control for the feeder conveyor, is on the job with installation about completed. The 100 HP, 2300 volt induction motor formerly used with the crusher in the headframe was set up for the underground crusher.

Installation of new transformers or substations for 440 volt power distri-bution underground were made with one 150 KVA, 3 phase station on the 5th level, one 150 KVA, 3 phase setup on the 6th level and two of the same size and type on the 7th level.

Some changes were made in the 2300 volt power distribution on surface for the shovel connections near the stockpiles. A metal enclosure for housing an oil circuit breaker with ground detectors and protection was set up with cables run along the trestle to three connecting stations.

MATHER MINE "B" SHAFT:

The new, improved type Westinghouse controllers were installed for the skip and cage hoists during the year to replace the controllers installed with the equipment.

MATHER MINE "B" SHAFT: (continued)

That part of the Negaunee Shaft D.C. haulage equipment known as the No. 2 motor-generator set was taken to the Mather Mine "B" Shaft and installed in the 7th level. This consists of one General Electric 200 KW, 275 volt compound wound D.C. generator, one 300 HP, General Electric, 2300 volt synchronous motor with its line starting equipment and D.C. panels, switches and circuit breakers. While the D.C. voltage was built up on the generator, a failure occurred in one of the field coils due to an insulation breakdown between the shunt and series windings. The coil was sent to the General Electric shops for repairs while the motor-generator set was tied up for several weeks. A similar failure occurred again after a short run and repairs were made at the mine. Twin conductor, 4/0, concentric type, 600 volt cables for 275 volt D.C. distribution were extended from the 7th to the 8th level and from the 7th to the 10th level.

Installation of a 75 HP, 2300 volt Allis-Chalmers motor and Westinghouse starting compensator for a 600 gallon pump was made on the 7th level.

The setup of motors and controls for the stocking equipment on surface was made with one 30 HP, A.C., one 20 HP, D.C. for the pan feeders, one 7½ HP, A.C. motor for the small belt conveyor, and a 50 HP, 440 volt, A.C. motor on the long belt conveyor.

The following substations were added for underground 440 volt, A.C. power distribution:

2 - 150 KVA on the 6th level.
1 - 150 KVA on the 7th level.
1 - 150 KVA on the 8th level.
1 - 75 KVA consisting of 3 - 25 KVA transformers on the 10th level.

NEGAUNEE SHAFT:

Many difficulties arose in the shaft sinking operations due to high rope speed of the hoist with the 800 HP, A.C. motor and liquid rheostat control. The locked-in speed of the motor could seldom be used in that type of operation with the result that intermediate control points were used with the primary contacts opening under heavy loads which destroyed the contacts much too often. The flashing over at the liquid rheostat contacts plus the overheated, boiling solution also made trouble and consequent delays. The constant use of the brakes made necessary by these control difficulties was also destructive. After working under these conditions until May 1, it was decided to complete the D.C. motor and generator equipment and make the change to D.C. Ward-Leonard control as soon as possible. This was a difficult and costly installation on account of the A.C. equipment being in place and the building under construction. The change was made from May 26 to May 29. Some of the control and feeder panels and the exciter motor-generator set are temporarily set up while the hoist motor and large motor-generator set are permanently installed. Two bearing failures occurred on the motor-generator set but delays in operation were short and the control equipment is working very well.

ELECTRICAL DEPARTMENT
ANNUAL REPORT
YEAR 1951

NEGAUNEE SHAFT: (continued)

The 438 HP synchronous motor of the Ingersoll-Rand compressor failed again on September 25. An insulation failure occurred in the stator coils near the motor connections and set fire to the winding. A complete set of coils was ordered from the General Electric Company and the stator rewind job was completed November 17.

SPIES MINE:

Several short delays occurred on account of power failures which did not affect the operations other than the pumping. A transformer failure occurred in the power bank which supplied the mine with 2300 volt, A.C. power. The power company replaced the old bank of 6 - 125 KVA single phase transformers with a newly built General Electric substation including a 1000 KVA, 3 phase transformer with circuit breakers and a two circuit feeder setup. The mine feeders were renewed with 250 MCM cables in two circuits placed in underground conduits from the engine house to the substation.

The installation of a 600 ampere oil circuit breaker and 500 ampere current transformers in the engine house on the 2300 volt shaft cable circuit was completed.

The new General Electric skip hoist controller on order since October, 1950, arrived and was set up and in operation during the month of July.

The stator winding of the synchronous motor on No. 1 haulage motor-generator set failed during a lightning storm September 26. One coil was cut out of the winding and operations continued with no difficulty until October 1 when another coil in the same slot failed. The second failure was probably due to burned insulation from the first break. The machine has been in continuous operation since October with no further coil difficulties.

The D.C. generator for field excitation of the synchronous motor of the Ingersoll-Rand compressor was repaired in the General Shops. Excitation current for the job was supplied by one of the haulage generators while this work was done.

Three 15 KVA transformers were moved into the 4th level drift about 1500 ft. and supplied with 2300 volt, 3 phase power by a #2, 3-conductor cable to supply A.C. power for the pumps near the air shaft while the stripping job in the shaft was done. This work also required 3000 ft. of #4, 3-conductor cable for 440 volt transmission from the transformers to the pumps. The feeders through the air shaft will be restored after the stripping job is completed.

Ishpeming, Michigan
November 5, 1952

Mr. C. W. Allen
General Manager
Building

Dear Sir:

I am handing you, herewith, two copies of the report of the Geological Department for the year ending December 31, 1951.

The activities of the Department expanded materially over those of previous years. This required a corresponding expansion in personnel which stands out quite prominently by comparing this report with that of 1950. In spite of this increase, however, we were unable to accomplish all of our objectives in accordance with the most desirable time schedule. The expansion, both in activities and personnel, has continued during the current year, much of it in areas outside of the Marquette Range.

The report, in my judgment, is quite complete and, since it incorporates the combined efforts of the geological "Family" group, I can add nothing of material importance at this time.

Very truly yours,

E. L. Derby, Jr.

E. L. Derby, Jr.
Chief Geologist

ELD:des
encs.

REPORT OF GEOLOGICAL DEPARTMENT FOR YEAR ENDING DECEMBER 31, 1951

The following is the report of the Geological Department for the year 1951:

CONTENTS

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 E. L. Derby, Jr., H. W. Rembold, J. L. Patrick, Mrs. Belle Bloch, Mrs. Esther Fandrem and Burton H. Boyum.

I. STAFF

A. Distribution

During the year 1951, Ishpeming continued to be the headquarters and base from which the Geological Department operated. The staff increased in keeping with the accelerated rate of Company exploration. Tables I, II and III show the distribution of staff members.

TABLE I

E. L. Derby, Jr., Chief Geologist
Burton H. Boyum, Ass't. Chief Geologist

EXPLORATION DRILLING DIVISION

H. Walter Rembold, Sup't.
Edwin Jacka, Foreman
Swante Merrila, Foreman
Carl Ostlund, Foreman (C)

GEOLOGISTS

Gerald J. Anderson (D)
Robert M. Becker
David M. Bennett (E)
Layton C. Binon (F)
Rolland L. Blake (G)
Gilbert A. Dawe (H)
Kenneth H. Johnson (I)
Joseph L. Patrick (J)
Eric J. Rex
Robert W. Riedel

SECRETARIAL

Mrs. Belle Bloch, Office Secretary
Mrs. Esther Fandrem (L)
Donald M. Carlson (M)
Miss Jean Jensen (N)

CONSULTANTS

Prof. William A. Longacre, Geophysics
Dr. Melville W. Bartley, Geology, Canada (A)
Dr. James M. Neilson, Geology, Canada (B)

TECHNICIANS

George M. Olson
Robert W. Ryan
Bruce G. Cain (K)

DRAFTSMEN

Archie Minnear
Pat S. Johnson

FIELD ASSISTANTS, TEMPORARY

David M. Bennett, Geologist (E)
Malcolm Conrad, "
William P. Cromwell, Notekeeper
Fred Paulus, Geologist
Leslie Price, "
Terence T. Quirke, Jr., Geologist

(A) Feb. 1, 1951 - Engaged as part time Chief Consultant
(B) June 18, 1951 - Engaged as part time Consultant
(C) Aug. 1, 1951 - Became Foreman
(D) June 18, 1951 - Joined permanent staff
(E) June 18, 1951 - Joined temporary staff
Sep't. 15, 1951 - Joined permanent staff
(F) Dec. 1, 1951 - Transferred to Mather Mine "B" Shaft as Operating Engineer
(G) Nov. 15, 1951 - Joined permanent staff
(H) Nov. 1, 1951 - Transferred to Mather Mine "A" Shaft as Operating Engineer
(I) June 25, 1951 - Joined permanent staff
(J) April 2, 1951 - Joined permanent staff
(K) April 11, 1951 - Joined permanent staff
(L) June 1, 1951 - Transferred from shared basis with Engineering Department to permanent staff
(M) Sep't. 1, 1951 - Transferred from shared basis with Engineering Department to the Recording Division
(N) July 16, 1951 - Joined Company and shared with Engineering Department

B. Figure 1.

Figure 1 is the photograph of the 1951 staff of the Geological Department, including both permanent and temporary personnel. This photo shows, in addition to the Geological Department members, those members of our field crews who were employed as compassmen under the Engineering Department.

V. Man-hour Summary

During the year 1951, the Geological Department employed, for at least a portion of the year, 25 people on a permanent basis. In addition to the permanent staff, we had a total of 9 temporary employees. The latter includes our 3 consultants and 6 geologists or notekeepers employed for the summer. The permanent employees worked a total of 37,659 man-hours and the temporary employees worked a total of 4,520 man-hours. This makes a total of 34 staff members and a total of 42,179 man-hours.

TABLE II

DISPOSITION OF HOURLY RATE PERSONNEL
GENERAL STOREHOUSE PAYROLL

Total Days Worked	- 292
Sundays	- 52
Holidays	- 6
Days Lost to Strike, etc.	- 15

	Total Men Jan. 1, 1951	New Hire (Helpers only)	Separations	Total Hrs. Worked	Total Shifts (Statistical)	Total Men Dec. 31 1951
Runners	22	0	4	48,290-1/2	248-3/4	22
Helpers	22	18	9	57,216-3/4	294-3/4	27
Total	44	18	13	105,507-1/4	- - -	49

The Department employed a total of 12 professional geologists including Messrs. Derby and Boyum. Prior to June, the staff consisted of 7 permanent geologists. In June, 3 additional members were added. In the fall, 2 additional geologists became permanent staff members. By December, 2 of the staff members, Messrs. Dawe and Binon were transferred to the Mather Mine property as operating engineers. This left a net of 10 permanent staff members, an increase of 3 over June. It is interesting to note that at the end of the year, our most experienced geologists had been with us a year and a half.

GEOLOGICAL DEPARTMENT - SUMMER 1951

Back Row: P. S. Johnson, M. A. Conrad, F. J. Paulus, J. P. Meyers, D. M. Bennett, H. E. Clickner, A. Minnear, L. F. Taccolini, E. J. Rex, D. W. Carlson, J. L. Patrick, C. Ostlund, E. R. Jacka

Middle Row: R. W. Riedel, R. M. Becker, B. H. Boyum, Mrs. E. Fandrem, Mr. E. L. Derby, Jr., Mrs. B. Bloch, H. W. Rembold, G. A. Dawe, L. C. Binon, S. Merrila

Front Row: J. F. McAleer, G. J. Anderson, G. M. Olson, L. E. Price, W. W. Sternitzky, K. H. Johnson, T. T. Quirke, Jr., W. N. Tidd, B. G. Cain

Figure 1

The following tabulation, Table III, shows the distribution of the professional members of the Geological Department by projects, as of the end of the year.

DISTRIBUTION OF PROFESSIONAL GEOLOGICAL STAFF

AS OF DECEMBER 31, 1951

MICHIGAN

Operating Mines

Athens----------Kenneth H. Johnson
Cambria-Jackson----------Kenneth H. Johnson
Cliffs Shaft----------Robert M. Becker
Lloyd----------Rolland L. Blake
Maas----------Kenneth H. Johnson
Mather Mine "A" Shaft-----David M. Bennett
Mather Mine "B" Shaft-----Gerald J. Anderson
Negaunee----------Kenneth H. Johnson
Ohio----------Robert W. Riedel
Spies----------Robert W. Riedel
Tilden----------Kenneth H. Johnson

Exploration Projects

Bunker Hill----------Kenneth H. Johnson
Cascade----------Kenneth H. Johnson
Empire----------Kenneth H. Johnson
Fitch-Saginaw----------Rolland L. Blake
Gwinn----------Rolland L. Blake
Hilltop----------Robert W. Riedel
Humboldt----------Rolland L. Blake
Menominee Range, General--Robert W. Riedel
Michigamme Mine----------Rolland L. Blake
Michigamme River----------Robert W. Riedel
North Champion----------Rolland L. Blake
Smyth Oval----------Robert W. Riedel
Teal Lake----------Kenneth H. Johnson
Sec. 4, 47-27 (Deep)------Joseph L. Patrick
Sec. 4, 5, 6, 47-27-------Joseph L. Patrick
Sec. 8-9, 47-27----------Robert M. Becker
Sec. 11-12, 47-27---------Joseph L. Patrick
Sec. 13, 43-35----------Robert W, Riedel
Sec. 25, 43-35----------Robert W. Riedel

MINNESOTA - GENERAL

E. L. Derby, Jr.
B. H. Boyum

CANADA - GENERAL

E. L. Derby, Jr.
B. H. Boyum
R. W. Riedel

VENEZUELA - GENERAL

Eric J. Rex

II. GEOLOGICAL FIELD WORK

For the most part, our geologic field work consisted of two-man reconnaissance parties. One member acted as geologist and the other as a compassman. Their work consisted of running sun-dial compass survey lines, mapping outcrops, dumps and pits, sampling iron-formation and collecting representative hand specimens of all rock types encountered.

A. Michigan

We employed 5 two-man field parties in Michigan during the summer of 1951.

1. Cascade District - A total of 29½ miles of line were brushed in Sections 19, 20, 21, 22, 29 and 32. The outcrops were mapped and the iron-formation sampled along all but 1½ miles of this line. The lines not completed were in Sec. 22.

A total of 57 samples were sent to the Metallurgical Research Laboratory for testing. Fifty-one of the samples were from outcrops and six were from dumps. Five of the dumps sampled were from old pits south and east of Palmer. The remaining sample was from the Platt mine dump.

2. Michigamme River Area - The 1951 field work consisted of approximately 4500 ft. of reconnaissance mapping at 1" = 132' and about 35 acres of plane tabling at 1" = 50' on the Norman property (Sec. 30, 47-30), about 8300 ft. of reconnaissance mapping at 1" = 132' on the Magnetic Mine property (Sec. 20, 47-30), and on the Michigamme River area proper approximately 794 acres of land was completely mapped in detail at 1" = 132'. The Norman was leased from the fee owners, the Magnetic was part of the state lease, and the Michigamme River Area proper was composed of land owned in fee by us, lands owned in fee by The Ford Motor Co., and lands leased from the state along with the Magnetic. The purpose of the exploration was to prove up any body of iron-formation of minable width that could be beneficiated and thereby become an economic deposit. Samples were taken of all iron-formation outcrops, test pits, dumps, trenches and shafts, and of the 28 samples taken, 16 were amenable to froth flotation and were classified as "concentratable" by the Metallurgical Department.

3. Michigamme District - During the summer field season in 1951 approximately 42,000 ft. of traverse line was run and mapped geologically at 1" = 132' in Sec. 15, 16, 17, 21, 22, 23 and 26 in 48-31. This area lies north of the Ohio Mine and south of the graywacke and quartzite below the Negaunee iron-formation and was explored between Three Lakes and the west line of the Spurr Mine property in Sec. 24, 48-31. The only outcrops of iron-formation which could be sampled were those which one sees along U.S.41 by the Ohio Mine road. This iron-formation was sampled in the hopes that it might respond to some concentration method and if that were the case an attempt would be made to prove up a body of minable width for an operation. Three samples were taken and of the three only one was encouraging and was classified as "favorable"

by the Metallurgical Department; the other two samples were classified as "no good". The material has a high ratio of iron and silica and even at finer grinds than the standard 100 mesh it is doubtful if the results would be much more encouraging.

4. Dead River Basin - During portion III of the 1951 season, one day was spent in the field locating outcrops and taking samples of the iron-formation in the Silver Lake Basin. This geological feature is a synclinorium, the long axis of which extends from the Hoist Dam to Silver Lake,- about 16 miles, and is approximately 5 miles wide from limb to limb. It contains the Negaunee iron-formation which, where known, is relatively thin and was mapped by the eminent E. E. White in 1907. Only one iron-formation outcrop was located and sampled, - this was on the Hoist Dam road and the concentrate results are not available at this time. Although the known iron-formation is relatively thin and fairly lean in iron, the overall area does hold some measure of promise and future work is certainly warranted.

5. Green Creek - After the aerial magnetic work was completed over that area south of the Tilden and between Gwinn and Republic, an attempt was made to correlate the magnetic pattern with known geology to form regional control for further interpretation. One area around Green's Creek south of Palmer was known to contain ferruginous sediments and these were mapped in the field. The sediments consisted of a ferruginous quartzite under, and a graphitic argillite over a thin, well oxidized iron-formation all enclosed in the granite. An attempt was made to correlate this material with the magnetic pattern, but could not be done. The long thru-going lows on the magnetic maps are caused by basic dikes - this was the only positive fact borne out by the field work before the snow became excessive.

6. Miscellaneous Reconnaissance

a. Michigamme Mountain, O.E. 1014 - One day was devoted to the sampling of exposures of iron-formation in the area known as Michigamme Mountain located in the NE¼ of Sec. 4, T 43, R 31, Iron County.

A composite sample was made of the gathered material and submitted to the Metallurgical Laboratory for testing. The results obtained were as follows:

Crude	Magnetic Concentrate				
% Fe	% Wt.	% Fe	% SiO2	Tail. % Fe	% Fe Rec.
31.80	30.64	61.90	10.48	18.50	59.65

b. The Shouldeis, O. E. 1013 - The outcrop areas of the Shouldeis, O. E. 1013, E½ of NE¼, Sec. 21, 43-35, were sampled. The sample was submitted to the Metallurgical Laboratory for testing. The results were not too satisfactory as the material does not lend itself to magnetic concentration:

Crude	Magnetic Concentrate			
% Fe	% Wt.	% Fe	% SiO2	Tail. % Fe
34.52	3.75	66.00	0.98	33.30

c. St. Lawrence Mine - Two samples were submitted to the Research Laboratory from material gathered from the St. Lawrence open pit mine located in the NW¼ of Sec. 5, 47-27.

Only a small proportion of the material was reported as magnetic. Flotation tests indicate that some concentration was effected; however, the low crude iron content definitely limited the recoveries obtainable.

d. Cliffs Shaft Area, Sec. 8, 47-27 - Two dump samples were obtained from an outcrop and dump located in the City Park, Sec. 8, 47-27. The material is of the hard ore type.

The crude and concentration results are as follows:

Sample No.	Crude	Magnetic Concentrate				
	Fe	% Wt.	Fe	SiO2	Fe Rec.	% Mag. Fe
MX 1032	43.7	14.33	67.5	3.14	22.38	9.67
MX 1033	49.2	15.88	65.7	4.79	20.91	10.43

	Froth Flotation			
	% Wt.	% Fe	% SiO2	% Fe Rec.
MX 1032	50.33	65.2	5.03	74.76
MX 1033	42.38	63.8	5.67	54.41

The future plans for the area include drilling of at least one angle hole to test the extent and position of the iron-formation.

B. Minnesota

During the year 1951, no geological field work was carried out in Minnesota either by the permanent personnel or by temporary summer staff.

C. Canada

During the year 1951 the Company initiated an expanded exploration program in Canada. Dr. M. W. Bartley was engaged as chief consultant and Dr. J. M. Neilson was employed as a geologist for the summer.

The year 1951 is notable in Canadian exploration also as it marks the beginning of an aggressive policy concerning exploration and acquisition. Dr. Neilson devoted the greater part of his time to a review of the available information in the various governmental and educational institutions in Canada. It is interesting to note the great increase in land offers and outside explorations investigated during the year. (See Part VII of this report).

1. Ontario

Nemegos - Two days were spent in the field with Dr. M. W. Bartley, our Canadian consultant, investigating Land Offers 2701 and 2639, near Nemogos station on the C. P. R., 160 miles northwest of Sudbury. The deposits were of titaniferous magnetite and the available trenches and pits were sampled. The twelve samples taken were tested by the Metallurgical Department and although a good iron product could be made, the TiO2 was excessive and the offers were both declined and referred to National Lead who is interested in titanium prospects assaying 10%+ in TiO2.

D. Venezuela

In May, 1951, the preliminary reconnaissance of the iron ore occurrences of Venezuela was conducted by Messrs. Stanley W. Sundeen and Robert E. Cannon. Additional field work was carried out in November and December by Messrs. Eric J. Rex and Burton H. Boyum. The latter work was principally in conjunction with Land Offer 2644, El Trueno, and Outside Explorations 1018 and 1019, El Pao and Cerro Bolivar, respectively.

III. GEOPHYSICAL FIELD WORK

Geophysical field work in 1951 was confined to magnetic prospecting. Both the Ruska Magnetometer and Hotchkiss Superdip were employed. Generally, stations were occupied every 50' along the traverse lines. Data were reduced and plotted in both plan and profile.

A. Michigan

1. Cascade District

It was planned to conduct geophysical prospecting of the magnetic type in the Cascade District during 1951. The summer field work was concluded before the program got underway and hence the work was deferred until 1952.

2. Michigamme River Area

The outcrops as mapped in this area were not sufficient to intelligently locate the hanging wall contact of the iron-formation and so some geophysical method was to be employed. The one outstanding physical property of the iron-formation and its neighboring rocks is the magnetic susceptibility. This was high in the iron-formation and low in the other rocks and for this reason magnetic profiles would be very helpful in delineating the iron-formation and locating diamond drill holes.

The instrument used was the Hotchkiss superdip on loan from the U. S. G. S. office in Iron River and was adjusted to compare with the M. C. M. & T. instrument for which W. A. Longacre had prepared conversion curves. The instrument was oriented perpendicular to the magnetic meridian at each of the 50 ft. stations and thus the relative vertical intensities of these stations were obtained and tied in to our Marquette Range magnetic system by occupying either magnetic prime #22, 31 or 31-A.

On the Norman property, about 4500 ft. of line was run, on the Magnetic Mine land about 8300 ft. of traverse was run, and on the Michigamme River area proper a little over 35,500 ft. of line was run. These geophysical traverses were made on the traverse lines already cut for the geological mapping and in all about 970 observations were made.

Magnetic profiles are relatively cheap and easy to produce and are invaluable in making a geological interpretation.

3. Michigamme District

The same system was followed in this district as on the Michigamme River area for the geophysical prospecting which was entirely magnetics with the Hotchkiss superdip. In this district we used the Ohio Mine magnetic prime #16 for a base and completed approximately 42,000 ft. of traverse with 840 separate observations.

Here again the data was good and in addition to delineating the Negaunee iron-formation along the highway (U.S. 41) they disclosed a moderate magnetic high between the Negaunee and the Bijiki iron-formation which is quite probably the Greenwood iron-formation.

An attempt to extend the reserve of the Ohio Mine thru the Beaufort property led to about 2000 ft. of north-south traverse with the Ruska magnetometer. The reduced data was used to locate drill holes.

4. Green Creek

The Aero Service Corp. of Pittsburgh flew an aerial magnetometer survey of an area composed of all of T. 45 N, R. 26 W., 45-27, 45-28, 45-29, 46-26, 46-27, 46-28, 46-29, and south half of Townships 47-26, 47-27, 47-28, and 47-29. This is roughly the entire area from Gwinn to Republic and 15 miles south of the Tilden Mine. The flight was made using standard procedure andequipment. The flight lines were north-south, ¼ miles apart and flown at approximately 500 ft. above the land surface. A special instrument was in use on the flight and was called a gradiometer. It made a separate record from the magnetic record and recorded the variance in the rate of change on the slope of any anomaly. With this it is possible to accurately map any minor anomalies which are superimposed on a large one.

The finished contoured maps of the 360 sq. mi. (10 townships) were submitted and are to be interpreted now. We are particularly looking for an anomaly which may be caused by a large basin of sediments and included ore in the granites. The anomaly could be a high or a low and our work at Green's Creek was inconclusive mainly because the area was so small and shallow that at 500 ft. the anomaly was marked by the regional gradient. No significant anomaly was found to indicate another sedimentary basin and thus rules out this possibility, based upon present interpretation.

5. Ishpeming-Negaunee Seismic

In June, four companies on the Marquette Range joined in a cooperative geophysical research program with the staff of the M. C. M. & T. This consisted of the investigation by refraction seismic prospecting of two areas. These areas were adjacent to the Morris Mine and Maas Mine. The goal of the project was to compare the depth determinations by refraction seismic prospecting with known depths from drill holes. The four companies involved were the Inland Steel, Jones and Laughlin, North Range and The Cleveland-Cliffs. In general, the depth determinations checked within 10% of the known values.

B. Minnesota

The distribution of field work was as follows:

Type of Survey	Days	Length of Traverse
Road traverse, magnetometer	11.5	121 miles
Profile traverse, magnetometer	4.5	25,900 feet
Profile traverse, superdip	5	26,400 feet
Scouting, superdip	1	4,000 feet

The road traverse averaged about 10.5 miles per day. The magnetometer profile traverse averaged about 5750 feet per day. The superdip traverse averaged nearly 5100 feet per day. The station interval in the road traverse was 1/10 mile, 2/10 mile, or 1/4 mile, depending on the gradient of the magnetic field. About half of the magnetometer profile was run at 50-ft. station interval, and the remainder at 100-ft. station interval. Almost all of the superdip work was done at 50-ft. station interval.

1. Mesabi Range

a. Mahtowa Township Magnetometer Survey (Land Offer 2663)- The magnetic measurements in this area did not disclose any pattern of anomalies that could be considered favorable for further exploration. One broad anomaly of moderate amplitude was discovered in the northwest corner of the township. No outcrops were found along the roads in this part of the surveyed area, and the cause of the anomaly is unknown. One possibility is the presence of iron-formation. In the rest of the surveyed area, the uniformity of the magnetic field, and the presence of occasional outcrops of slate, would indicate that extensive magnetic mineralization is unlikely.

Some casual magnetic observations in the Kettle River area disclosed an elevation in the level of the magnetic field. This area appeared more interesting magnetically, but inquiry revealed that most of the surrounding land had been placed under option. One small drill-rig was seen in the vicinity. Presumably, this was the location of the iron ore discovery as reported in the newspapers later in the summer.

b. Eveleth Anticlinal Axis and Vicinity Magnetometer Survey, (Land Offer 2680) - This survey was undertaken to check, to complement, and to extend the survey made by G. M. Schwartz in 1942. The original survey had been made at the suggestion of M. P. Walle.

The new survey confirmed in general the anomalous magnetic pattern as published by Dr. Schwartz except in a few scattered areas; one notable lack of correlation being along the west line of T. 56 N., R. 18 W., where the earlier survey had indicated a greater extension of the "zone of magnetic attraction" than could be found in the recent survey.

In some areas not covered by Schwartz, additional anomalies were found. Those in T. 58 N., R. 18 W. seem especially interesting and perhaps warrant further investigation.

It would appear that the principal zone of magnetic highs is clearly related to the Eveleth anticline. The magnetically low area southwesterly of the axis of magnetic highs, and in the Peary area, is also very likely related to the anticlinal structure. It was concluded that the first drilling should investigate these anomalies.

c. Supplementary Magnetometer Survey, Forbes-Peary Area, (Land Offer 2680) - Following the acquisition of State lands in the Forbes area, additional magnetic work was done to establish drill-hole locations in relation to the magnetics, and to investigate the easterly extent of the magnetically low zone which exists in the Peary area. It was found that the low anomaly extends less than three miles to the east of U. S. Highway 53. The magnetic traverse for accurate determination of optimum drill-hole location on the Forbes anomaly was run along the approximate diagonal of Section 36, T. 57 N., R. 18 W. through the northwest corner, and extended from this corner along the approximate diagonal of the south 1/2 of Section 26, T. 57 N., R. 18 W. From the magnetic profile along this line, two drill-hole locations were chosen; One in the magnetic low and near the southeast corner of Section 36, and one in the magnetic high and 1000 feet northwesterly from the northwest corner of Section 36.

d. Magnetometer Survey, Summerfield Property (Land Offer 2678) - This survey was made principally in two forty-acre tracts about four miles northeast of Hibbing and just south of the Douglass mine. The objective was to determine from the magnetics the best location for a drill-hole.

The north forty, the SE-SE of Section 34, 58-20, appears more likely to contain iron-formation than the south forty, the NE-NE of Section 3, 57-20. In the latter area, the magnetic field has a gentle gradient to the northeast. In the north forty the general gradient is to the north, but is distributed considerably by alternate highs and lows, especially in the eastern half of the tract.

The center of the SE-SE of Section 34, 58-20 is in a relative magnetic low, partly surrounded by magnetic highs. This point is considered the best location for possible drilling. This estimate is based on the magnetic map only, since no specific geological information could be obtained.

e. Magnetometer Survey, Wanless Mine Area - This survey was made over an area near the Wanless Mine which had been proposed as a dump site. The magnetometer survey indicated that the underlying material is very magnetic, and presumably taconite. A nearby drill-hole, C-8, is in taconite and magnetic readings taken at and near this location show an elevated level of magnetic field with considerable variation from station to station. The traverse lines over the surveyed area were 400 ft. apart and the station interval was 50 ft. Large and erratic variations in a distance of 50 ft. along the lines made contouring of the isodynamic lines an almost impossible task with the large separation of the lines. However, since no indications of non-magnetic material were encountered on any of the lines, it is believed that the entire area is underlain with magnetic taconite.

2. Vermilion Range

Superdip Survey, Thompson Property, Tower-Soudan Area (Land Offer 2611) - In the scouting trip on July 17, 1951, random superdip traverses revealed the presence of very large magnetic anomalies. It was decided to run a reasonably detailed superdip survey over the area, and to this end, a 3/4 mile base line was established along the north property line, from which north-south lines were run to approximately the south boundary of the 120-acre tract. These lines were 200 feet apart. Superdip readings were taken at 50-ft. station interval along these lines, and in addition the western 1/4 mile of the base line was surveyed magnetically at 100-ft. station interval. The superdip readings were converted to gammas and plotted both in plan and profile.

The resulting magnetic picture for the area is highly interesting, and would provide an excellent text-book example of magnetic exploration. The strike of the formations is indicated quite clearly; the dips are not quite so clear, but evidently are generally very steep. The magnitude of the magnetic highs is such that the presence of underlying iron-formation containing considerable magnetite is virtually a certainty. Whether this material is ore, or concentratable iron-formation, or worthless at present, can only be determined by drilling. In addition, the drilling would provide more exact information on the structure, since the integrating nature of magnetic variations tends to mask some detail.

One interesting by-product of the survey was the opportunity to compare ground magnetics with aeromagnetics over the same small area. The aerial survey showed isodynamic contours over the Thompson Property which followed the strike of the formations quite closely, but did not show the maxima, minima, and other important details as brought out clearly by the ground survey. The explanation of these differences involve many factors. The aerial magnetometer measures changes in the total magnetic intensity while the ground instrument measures changes in the vertical component of the total intensity. At higher elevation, diffraction effects become more evident, that is, a number of separated anomalies on the ground may become a single broad anomaly at 500 or 1000 ft. elevation. In airborne work, shift of anomaly patterns may occur due to the dip of the earth's magnetic field, and also due to errors in mapping where landmarks are widely scattered. In addition, sharp anomalies on the ground are sometimes damped out partially in aeromagnetic surveying due to inertia in the plotting system.

It is believed that aeromagnetics and ground magnetics are complementary and that each has its function in magnetic exploration. Large scale reconnaissance of big areas is the apparent function of the air-borne magnetometer while detailed magnetic studies of smaller areas is the function of ground magnetics. For example, the large scale magnetic pattern to the south-east of Tower, Minnesota, as shown by the aeromagnetic survey, could be shown by ground work only at the cost of excessive amounts of time, labor, and money. On the other hand, the detail as brought out by the ground magnetic survey over the Thompson Property could not be obtained by aeromagnetic surveying at its present state of development.

C. Canada

A limited amount of magnetic prospecting was conducted at the St. Adele property, Outside Exploration #999. This was done by Mr. T. T. Quirke, Jr., employing a Sharpe Superdip. This work was of little value because of the instrumental difficulties encountered.

TABLE IV

The following tabulation, Table IV, shows the summary of the geophysical activity for 1951:

	Man-months	Cost
MICHIGAN		
Ground Magnetic	4.0	$ 1,243.57
Aeromagnetic	11.0	18,551.25
Seismic	1.0	500.00
	16.0	$ 20,294.82
MINNESOTA		
Ground Magnetics	4.8	$ 4,224.77
TOTAL	20.8	$ 24,519.59

IV. EXPLORATION DRILLING DIVISION

The newly formed Exploratory Drilling Division is the result of the efforts made by the Chief Geologist to streamline the Departmental Responsibilities. The prime function of the Exploratory Drilling Division is to expedite the drilling phase of the exploration once the drilling campaign has been laid out by the Geologist. The prime responsibility of the Exploratory Drilling Division is the drilling equipment, drilling personnel and contractual arrangement for any drilling that is to be performed.

The principal drilling method employed is that of diamond core drilling. Variations from the normal drilling methods include standpiping, churn drilling, rotary mud drilling, structure drilling, and combinations thereof.

The Geologists assigned to the various explorations, be it surface or underground, afford the direct tie between the geological requirements and the drilling operations.

1. Diamond Cost

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

TABLE V

PER FOOT COST OF DIAMOND BITS USED IN 1951

CONTRACT	EX			AX			BX			NX		
Sec. Hole	Ft.	Amt.	Per Ft.	Ft.	Amt.	Per Ft.	Ft.	Amt.	Per Ft.	Ft.	Amt.	Per Ft.
4 - 42							166	$ 1177.39	$ 7.09	2729	$ 12238.66	$ 4.48
4 - 43										3301	10096.26	3.06
9 - 58							2156	6002.13	2.78			
11 - 12										2975	13226.14	4.45
11 - 13										3463	12727.77	3.68
11 - 20										1134	3776.88	3.33
29 - 2							1671	4339.68	2.60			
29 - 3							926	2751.20	2.97			
Athens				1221	$ 5394.96	$ 4.42	561	2195.23	3.91			
Mather "A"	58	$ 262.74	$ 4.53	4445	7324.97	1.65	6743	12004.37	1.78	216	660.10	3.06
Mather "B"	237	875.47	3.69	4219	9294.75	2.20	4932	12413.42	2.52			
Cliffs Shaft	9186	10226.87	1.11	147	381.19	2.59						
Lloyd				509	1701.61	3.34	3333	10349.53	3.11	328	991.14	3.02
Spies				1301	1543.17	1.19	1064	942.80	.89	10	47.08	4.71
19 - 7A				455	291.22	.64						
19 - 8				403	1293.70	3.21						
20 - 2				413	277.41	.67						
27 - 22				440	969.67	2.20						
27 - 23				363	825.85	2.28						
27 - 23A				541	3176.61	5.87						
29 - 1A				95	634.81	6.68						
TOTAL	9481	$11365.08	$1.20	14552	$33109.92	$2.28	21552	$52175.75	$2.42	14156	$53764.03	$3.80

$2.52 Cost Per Foot for All Bits Used in 1951

2. Diamond Inventory - Hand Setting

The following Table VI shows the distribution of carbon and ballas bortz for the year 1951.

TABLE VI

DIAMOND INVENTORY (Hand Setting), December 31, 1951

	CARBON (Hand Setting)			BALLAS BORTZ (Hand Setting)		
	Kts.	Amount	Per Kt.	Kts.	Amount	Per Kt.
On Hand 1/1/51	808.24	$63,629.89	$78.72	40.89	$4,077.47	$99.72
Purchased 1951	--	None	--	--	--	--
TOTAL	808.24	$63,629.89	$78.72	40.89	$4,077.47	$99.72
Used 1951 (Loss)	--	--	--	--	--	--
On Hand 12/31/51	808.24	$63,629.89	$78.72	40.89	$4,077.47	$99.72

DISTRIBUTION OF INVENTORY: Loose Carbon, Carbon set in bits, loose Ballas (C. C. I. Co.)

3. Diamond Inventory - Mechanical Setting

The following tabulation shows the overall distribution of all types of diamonds used and on hand during the year 1951.

TABLE VII

DIAMOND INVENTORY (Mechanical Setting), December 31, 1951

	SCRAP CARBON		CONGO		LONGYEAR		"R" GRADE		"G" GRADE		TOTAL BORTZ (Mechanical Setting)	
	Kts.	Amount	Kts.	Amount	Kts.	Amount	Kts.	Amount	Kts.	Amount	Kts.	Amount
On Hand 1/1/51	306.71	$4,569.91	330.82	$1,984.92	---	--	11,920.86	$91,144.98	3,939.75	$34,625.42	16,191.47	$289,320.38
Purchased 1951	---	---	60.14	360.84	373.81	$4,111.91	28,351.21	239,662.34	4,284.98	45,185.29	33,070.14	127,755.32
TOTAL	306.71	$4,569.91	390.96	$2,345.76	373.81	$4,111.91	40,272.07	$330,807.32	8,224.73	$79,810.71	49,261.61	$417,075.70
Used 1951 (loss)	4.51	79.54	44.30	265.80	65.17	716.87	10,765.71	91,623.44	1,148.38	11,673.96	12,023.56	104,280.07
On hand 12/31/51	302.20	$4,490.37	346.66	$2,079.96	308.64	$3,395.04	29,506.36	$239,183.88	7,076.35	$68,136.75	37,238.01	$312,795.63

DISTRIBUTION OF INVENTORY IN CARATS

	SCRAP CARBON	CONGO	LONGYEAR	NEW	"R" GRADE Used	TOTAL	NEW	"G" GRADE Used	TOTAL
Loose Bortz (Manufacturers)	69.83	173.82	---	8,933.54	953.45	9,886.99	2,259.59	1,044.89	3,304.48
Loose Bortz (C. C. I. Co.)	18.97	---	---	200.00	102.85	302.85	200.00	100.00	300.00
Salvage Reports Pending	31.54	---	134.46			6,817.76			462.14
Bits in Stock or Issued to Contracts	181.86	172.84	174.18			12,498.76			3,009.73

4. Plant Account

Table VIII is merely an excerpt from the 1951 Financial Statement.

TABLE VIII

	Account "A"	Account "B"	Account "C"	Total
End 1950	$ 17,971.64	$ 115,779.92	$ 114,830.10	$ 248,581.66
End 1951	23,338.39	129,354.12	159,906.60	312,599.11

Group "A" - Life not exceeding 2 years.
Group "B" - Life not exceeding 10 years.
Group "C" - Rods & Casing - Depreciated on footage basis.

Rental charges (Per shift and per foot charges to cover depreciation and maintenance cost) amounted to $ 26,835.47.

V. SURFACE EXPLORATION

A. Michigan

1. Introduction - The term "exploration" as we use it, includes, where necessary, geological mapping, geophysical prospecting, and drilling. The details of the geological mapping and the geophysical prospecting are covered in Sections II and III of this report. The principal part of this section is devoted to drilling and to the combined techniques.

Our surface exploration may be divided into two general types, - the shallow exploration for beneficiating ores and the deep exploration for direct shipping ores. During the year, we employed 1 Company rig and 3 Longyear contract rigs in the beneficiating ore exploration. In the exploration for the direct shipping ore we employed 7 Company rigs and 5 contract rigs for a total of 12 drill rigs during the year.

2. Summary of Drilling

The following tabulation shows the Summary of Drilling:

TABLE IX

SUMMARY OF SURFACE DRILLING - COST ANALYSIS

LOCATION	HOLES	RIGS	OVER-BURDEN	DIAMOND DRILLING	TOTAL	1st CLASS ORE FOOTAGE	1st CLASS ORE %	TOTAL COST "A"	COST/FT. "A"	TOTAL COST "B"	COST/FT "B"
Sec. 29, 47-26	2 & 3	C. C. I.	34	3221	3255	10	.307	$34,026.22	$10.45	$41,812.51	$12.85
Sec. 2, 47-27	66 & 67	E. J. L.	74	1231	1305			13,041.30	9.99	13,222.06	10.13
Sec. 4, 47-27	42 & 43	C. C. I.	2	7021	7023	82	1.168	93,440.60	13.44	109,782.96	15.79
Sec. 9, 47-27	58	C. C. I.		2359	2359			19,572.78	8.30	23,745.73	10.07
" " "	59,60, 61	E. J. L.	339	1300	1611	34	2.110	17,510.77	10.87	17,737.25	11.01
Total Drilling Sec, 9	58,59,60,61	C.C.I. & E.L.J.	339	3659	3970	34	.856	$37,083.55	$9.34	$41,482.98	$10.45
Sec. 10, 47-27	25 & 26	C. C. I.	120.5		120.5			300.00		300.00	
Sec. 11, 47-27	11, 12, 13, 20	C. C. I.	21.	7196	7217	5	.069	85,120.23	11.79	99,712.28	13.82
" " "	(14, 14A, 15 (16, 17, 18, (19 & 21	E. J. L.	120	12604	12724	86	.676	151,124.36	11.86	155,535.85	12.22
Total Drilling Sec. 11	(11,12,13,14) (15,16,17,18 19,20,21)	C. C. I.& E. J. L.	141	19800	19941	91	.456	$236,244.59	$11.85	$255,248.13	$12.80
Sec. 27, 47-27	23	C. C. I.		331	331			9,611.16	29.04	10,866.84	32.83
Sec. 2, 46-30	1	E. J. L.	40	377	417			2,810.24	6.74	3,028.69	7.26
Sec. 20, 47-30	1, 2, 3, 4, & 5	E. J. L.	415	1780	2195						
Sec. 30, 47-30	1, 2, 3, 4, & 5	E. J. L.	258	3003	3261						
Sec. 34, 47-30	1, 2, 3, 4	E. J. L.	90	1512	1602						
Total Drilling Secs. 20, 30 & 34, 47-30			763	6295	7058			37,757.38	5.35	41,296.28	5.85

TABLE IX - (Continued)

LOCATION	HOLES	RIGS	OVER-BURDEN	DIAMOND DRILLING	TOTAL	1st CLASS ORE FOOTAGE	%	TOTAL COST "A"	COST/FT. "A"	TOTAL COST "B"	COST/FT.
Sec. 19, 48-30 (Michigamme Mine)	8	C. C. I.		294	294			$5,283.82	$17.97	$5,962.47	$20.28
Sec. 22, 48-31	9, 10, 11, & 12	E. J. L.	159	246	405			4,805.53	11.87	5,583.79	13.79
Sec. 26, 43-35			3505	6867	10372						
Sec. 27, 43-35			478	2617	3095						
Total Sec. 26 & 27, 43-35			3983	9484	13467			104,408.14	7.75	107,360.75	7.97
TOTAL SURFACE DRILLING					57,586.5						

3. Recap by Organization

The following tabulation shows the Recap by Organization:

TABLE X

	NO. RIGS	FOOTAGE	% OF TOTAL
DEEP HOLE DIRECT SHIPPING			
C. C. I.	6	19,854	66.3
Contract	1	10,072	33.7
TOTAL		29,926	100.0
SHALLOW HOLE DIRECT SHIPPING			
C. C. I.		---	
Contract	3	19,035	100.0
TOTAL		19,035	
METALLURGICAL DRILLING			
C. C. I.	1	331	3.9
Contract	4	8,174	96.1
TOTAL		8,505	100.0

	FOOTAGE	% OF TOTAL
C.C.I. Cliffs Shaft Mine Shaft Testing	120.5	100.
GRAND TOTAL SURFACE	57,586.5	

4. Summary of Results

a. Cascade - The exploration for direct shipping ore in the structure between the Isabella and Volunteer dikes has not been successful as yet. Excessive drill hole deviation, coupled with the negative nature of the iron-formation which makes compass tests unreliable, necessitated the drilling of hole #3 before the nature of the intrusive encountered in holes #1 and #2 could be determined.

b. Section 2, 47-27 - The program of surface exploration in Sec. 2, 47-27, was designed to test for ore above the intrusive directly south of the "A" Shaft of the Mather Mine. Two holes were drilled. Hole #66, a vertical hole, was testing the area above the intrusive and was drilled to 1249'. No ore was encountered. Hole #67 was drilled as an angle hole for structural control. These two holes completed the campaign of exploration from the surface. The area will be explored at greater depth from proposed underground workings at some future date.

c. Section 4, 47-27 - Two deep hole rigs were conducting the exploration for ore in Sec. 4, 47-27. Hole #42 was completed at a depth of 3695'. Eighty-two (82) feet of first class ore was cut in this hole. The ore was found at a considerable distance above the footwall and the full significance of its position is not known at the present time.

Hole #43 had reached a total depth of 4221' by the end of the year. Deviation, southward, occurred in the quartzite and as a result the hole did not test the area for which it was planned.

The deep hole drilling in Sec. 4, 47-27 is contributing structural information which is of great value in our search for deep ores.

d. Section 9, 47-27 - The surface drilling of Sec. 9, 47-27 is discussed in the Cliffs Shaft report under Part VI, Sub-section (d), 3rd paragraph.

e. Section 10, 47-27 - Two holes were drilled in conjunction with the proposed shaft for the Cliffs Shaft mine. These holes were testing the thickness and type of overburden through which the shaft would be sunk.

f. Section 11, 47-27 - The drilling exploration in Sec. 11, 47-27, was carried on by shallow and deep hole rigs.

The deep holes were 12, 13, 14, 14A, 19, 20 and 21 and the shallow holes were 15, 16, 17 and 18.

The first phase of exploration was concentrated in the northeast quarter of the section. The purpose was to search for structure and possible extension of the ore which was discovered in hole #9. Drilling has shown that the ore in hole #9 is confined to the northeastern part of the section. No deep ore of any significance was discovered in any of the holes.

Shallow ore was discovered in hole #14 and further exploration was conducted by holes #15, 16, 17, and 18. It appears that the ore is confined to the area drilled by holes 14, 15, and 16, and holes 17 and 18 were in different structure.

The second phase of drilling in Sec. 11, 47-27, was initiated by Holes #20 and 21 located in the northwest quarter and the southwest quarter. These holes had not reached significant depth at the end of the year.

g. Tilden - The western portion of the Tilden Area surface exploration for treating ore was completed in the early part of 1951. The metallurgical results indicated need of more research in the future.

h. North Michigamme Area - The last hole in the drilling campaign for the Michigamme Mine was completed during 1951. This was hole #8 in Sec. 19, 48-30. The sections and plan map were posted and after receiving the Metallurgical Department test work on the core, an ore and stripping estimate was made.

i. Ohio Mine - During 1951, an attempt was made to extend the reserves of the mine to the northwest through the Beaufort property. The magnetic profiles were taken on 600 ft. centers and an interpretation made. On the basis of this data, we drilled four holes totaling 375 ft. of drilling which extended the west end of the west pit 550 ft. This added material increased the reserves of concentrates by 24.9%. The stripping ratio was increased from 3.30 to 3.74.

j. Michigamme River Area

1'. Norman Mine - The iron-formation is composed of interbedded magnetite, iron-silicate, and chert and was explored for 4500 ft. along the strike by five drill holes totaling 3261 ft. of drilling in addition to the surface geological and geophysical work. The formation strikes N 15° E, dips 80° to the west, and the 425 ft. from foot to hanging contains four diorite sills which total twice as much rock as iron-formation. The Metallurgical Laboratory does not classify any of the iron-formation core as concentratable. These facts indicate that the area does not contain an economic deposit of beneficiating iron-formation at this time.

2'. Magnetic Mine - The iron-formation on the Magnetic anticline was explored by diamond core drilling and from the magnetic profiles an iron-formation was outlined in the northern part of Sec. 20 which would be stratigraphically higher than the Negaunee near the center of the section. Five holes totaling 2177 ft. of drilling explored both of these horizons below surface and only 39 ft. of all the holes was classed as favorable by the Metallurgical Laboratory. The iron-formation was thin (120 ft. including 28 ft. of sill material) and not long (3000 ft.) There is not an economic deposit of beneficiating iron-formation on the Magnetic Mine area.

3'. Standard Mine - To the end of the year, three holes had been drilled on this area and had disclosed an iron-formation of minable width (180 ft. max.) but which did not respond to any of the metallurgical tests thus far to produce a high grade concentrate.

4'. Metropolis Mine - Only one hole had been drilled by the end of the year and the iron-formation, tho thin, looked fairly good. On the Metropolis it was a specular hematite - quartzite rock. No test work has been done on this material.

In general, the drilling correlated very nicely with the surface geology and as was mentioned before, the magnetic profiles were invaluable in making a geologic interpretation and planning intelligent drill holes. In a few cases, the holes cut too much hanging wall material but this was because of either the unusual, variable high susceptibilities in the hanging sills or the depth of overburden which spread the magnetic high of the iron-formation out considerably.

k. Hilltop Exploration

During 1951, 17 holes were drilled on this exploration totaling 13,467 ft. of drilling. The ore encountered in D.D.H. #3, Sec. 26, was cut in #4, but it was deeper and much thinner. Hole # 13 cut a short run of ore but this did not persist along the strike so amounted to nothing. We have a fair idea of the ledge geology now and are following the formation to the south boundary. As of the end of 1951, no minable body of first class ore has been found on the Hilltop. The iron-formation trends roughly northeast-southwest, dips from -70° to -90° to the northwest and varies from 60 to 200 ft. in width.

B. Minnesota

The Minnesota Exploration program discussed in this report covers the work done outside of the operating properties. This drilling was not successful in finding new reserves. The work may be tabulated as follows:

TABLE XI

MINNESOTA EXPLORATION DRILLING

LAND OFFER	NAME	HOLES	FOOTAGE	COST
2680	Eveleth	3	1487	$ 19,556.37
2662	Wagner	3	707	7,659.53
2660	Gross-Wolvin	5	750	10,386.34
	TOTAL	11	2944	$ 37,602.24

VI. UNDERGROUND EXPLORATION

A. Michigan

1. Summary of Drilling

The following tabulation is the summary of drilling:

TABLE XII

LOCATION	HOLES	RIGS	DIAMOND DRILLING	1st CLASS ORE FOOTAGE	%	TOTAL COST "A"	COST/FT. "A"	TOTAL COST "B"	COST/FT. "B"
Athens	33, 45, 46	C. C. I.	547	57	10.4				
Bunker Hill	5, 6, 7, 8	C. C. I.	889	185	20.8	$7,040.04	$7.92	$7,579.04	$8.52
Lloyd	185-190, Incl.		3056	356	11.6				
Mather Mine, "A" Shaft	71 - 89 "		5580	979	17.5	33,174.77	5.94	36,791.83	6.59
Mather Mine, "B" Shaft	2, 11, 17 & 19 to 72 Incl.	C.C.I.	14453	3442	23.8	94,114.00	6.51	101,787.00	7.04
Cliffs-Shaft		C. C. I.	7247	1293	17.8	33,098.23	4.57	36,177.60	4.99
Spies	48, 54, 55A, 56	Odgers Co.	2753					5,906.39	2.14
		E.U.L.	1324					10,872.04	8.21

2. Recap by Organization

The following tabulation is the recap by organization:

TABLE XIII

ORGANIZATION	NO. of RIGS	FOOTAGE	PER CENT
a. C.C.I.Co.			
1. Geol. Dept.	3	4,492'	12.5 %
2. Mine	6	27,280'	76.1 %
b. Contract	1	4,077	11.4 %
TOTAL	10	35,849'	100.0 %

3. Summary by Properties

a. Athens Mine - Drilling from the -780 sub and 8th level disclosed first class ore north of the main north ore body. It is necessary to prove more tonnage by drifting and diamond drilling from 10th level before it would warrant the 600 ft. of rock drifting necessary to mine it.

b. Bunker Hill - The significant exploration consisted of diamond drilling from the -990 sub level. It was disclosed that the ore goes at least to a depth of -1245 ft. sea level elevation in the north ore body on the 2100 W. coordinate.

Ore was found to occur above 10th level elevation on the 1900 W. coordinate in the south ore body as far south as the 3580 S. coordinate where it is cut off by a diorite intrusive.

C. Cambria-Jackson Mine - Geological work consisted in routine mapping in the mining subs and in mapping the winze and 8th level development.

d. Cliffs Shaft Mine - Underground drilling during the year has been confined to "A" and "B" shafts above 5th level, the Section 10 and Bancroft leases and the "A" East area. The most significant tonnage additions have been in the Bancroft and "A" East areas. From the workings available at the present time, drilling can be considered largely complete above 5th level "A" and "B" shafts and in the Section 10 lease.

Limits of the Cliffs Shaft hard ore horizon have been established to the north and south with greater precision. Nearly E-W faults bordering the Bancroft and Section 10 leases on the north and south respectively and bounding the "B" Shaft workings on the north and south have removed the ore horizon above the surface of erosion.

The ore horizon, dipping south, rolls back and intersects ledge about 800' south of the south limiting fault mentioned above. It is in this area, where the ore horizon is back below ledge, that a short range surface drilling program was initiated to explore for ore which could be expected above present workings. At the end of the year the three holes that had been drilled in this area, near the Robbins Flooring Mill, had proven up largely lean and 2nd class conglomerate ore.

e. Lloyd Mine - Drilling in depth from the 8th level exploration drift did not disclose any ore body of minable size. The final two holes were drilled during 1951 and consisted of 1971 ft. of drilling in two holes.

The high sulfur ore body south of the main east-west dike was explored below 9th level by four holes which totaled 1085 ft. of drilling and an interpretation on this data reveals some 202,125 tons to the -120 ft. elevation analyzing 59.57 Fe, 0.137 phos., and 0.704 sulfur. This body together with a probable body north of the dike gives a total of 267,937 tons analyzing 59.37 Fe, 0.151 phos., and 0.546 sulfur.

f. Maas Mine - Geological work for the Maas Mine consisted of mapping in the mining subs and in seventh level development. The mapping in 7th level indicates that the anticipated ore outlines are essentially correct.

g. Mather Mine "A" Shaft - Diamond drilling on seventh level was confined to west of the Mather fault, and proved up scattered ore bodies mainly. On sixth level, holes were drilled on both "A" Shaft and "B" Shaft property, and resulted in proving some ore for 7th level. Fifth level drilling enabled the further exploration of an ore pipe between 5th and 6th levels, while a number of holes

were drilled to investigate for possible ore adjacent to #4 dike.

Other exploration included some dog drifting north on the -160 sub which showed a sizable ore body. Exploration openings on -675 sub and the -700 sub will enable future drilling which should indicate more reserves.

7400 X-Cut was important in establishing important contacts which should facilitate working out the structure with more assurance.

h. Mather Mine "B" Shaft - An extensive diamond drilling campaign was conducted during the year. The holes were planned to cover three major objectives: these were: (1) the outlining of ore available to a 5th level, (2) detailing the ore outlines for 6th level mining, (3) outlining the 7th level ore bodies. Just prior to the end of the year, one diamond drill hole was started to explore for 8th level.

5th Level - Twelve holes were drilled to test for extensions of ore up the dip for a 5th level. Six of these holes encountered sizable runs of high sulphur ore at or above 5th level elevation.

6th Level - Twenty-two holes were drilled from 6th level and the sublevels above to detail the outlines of ore bodies which might be available for 6th level mining. This extensive use of diamond drilling allowed greater use of the limited number of mining crews for development and production work rather than for exploration by small drifts and small raises. This drilling increased slightly the ore reserves indicated in this area.

7th level - The 7th level exploration program included seven holes drilled down from the 6th level, and eight holes from 7th level workings. The results of this drilling indicate (1) large tonnages will be available to 7th level, (2) the ore will be standard grade, (3) the geologic structure is complex and further exploration will be necessary.

8th Level - Hole #72 was started down from the 7000 crosscut to explore for 8th level. Information from the 7000 crosscut and surface D.D.H. #136 indicate only a limited amount of height to the ore body above 8th level.

i. Negaunee Mine - Geological plan maps were made of the Negaunee Mine shaft at about 80 ft. intervals. The sinking was in graywacke, argillite and quartzite with some slate from about the -1100 to -1200 foot elevation.

j. Spies Mine - During 1951, an exploration campaign was conducted to explore that area south of the main level drifts to the Spies East ore body and north of the ore cut in surface holes #56, 59, 79, etc. For ease of exploration, it was decided to drill from underground due south to intercept any upfolding of the strata before the target was reached. Drilling was done from 4th and 6th levels and consisted of four holes which totaled 3362 ft. D.D.H. #56 drilled from 6th level, went 1050 ft. south on the 3200 E. Coordinate and as it was completely unoxidized cherty carbonate iron-formation, the upfolding was not oxidized and the iron-formation to

the south (D.D.H. #79 etc.) will be explored by drilling from surface.

Drifting on 8th level disclosed a considerable length of oxidized iron-formation which was unknown on the upper levels and will be explored laterally and in depth by drilling.

VII. LAND OFFERS AND OUTSIDE EXPLORATIONS

A. Land Offers

During the year 1951 the Geological Department continued to process the various Land Offers submitted to the Company. These comprised numbers 2621, 2622, 2625 to 2632, 2634 to 2659, 2661 to 2779, 2786, 2805 and 3002, all inclusive. The offers were divided into five general groups as follows:

	Area	No.	Per Cent
1.	Michigan	94	57.3 %
2.	Minnesota	20	12.2 %
3.	Canada	32	19.5 %
4.	United States, other than Michigan or Minnesota	12	7.3 %
5.	South and Central America	6	3.7 %
	TOTAL	164	100.0 %

Under the long accustomed practice, the land offers include houses, etc., in addition to mineral lands. Thus, 60 of the 94 land offers in Michigan were for houses and lots.

During 1951 a total of $7,841.43 was spent in investigation of all of the land offers. This is more than had been spent in previous years because of the increased number of offers. Figure 2 shows graphically the 1951 distribution compared with the last four years preceeding 1951.

B. Outside Explorations

The term "Outside Exploration" has been used for years to cover investigations and reports on exploration and exploitation projects by individuals or companies in areas in which we are interested. It provides a convenient method of referring to them and also for handling expenses incidental to these reports. The system was more or less inactive for a few years and was revived in 1951. Thus, the number processed in 1951 is not a good index to judge by. We did process a total of 46 in 1951. Figure 3 shows the relative distribution of the Outside Explorations. It is interesting to note that several of these became Land Offers during the year. We spent a total of $6,041.72 on all of the Outside Explorations.

Figure 2

GRAPH SHOWING RATE OF LAND OFFERS

1946– 1951, Inclusive

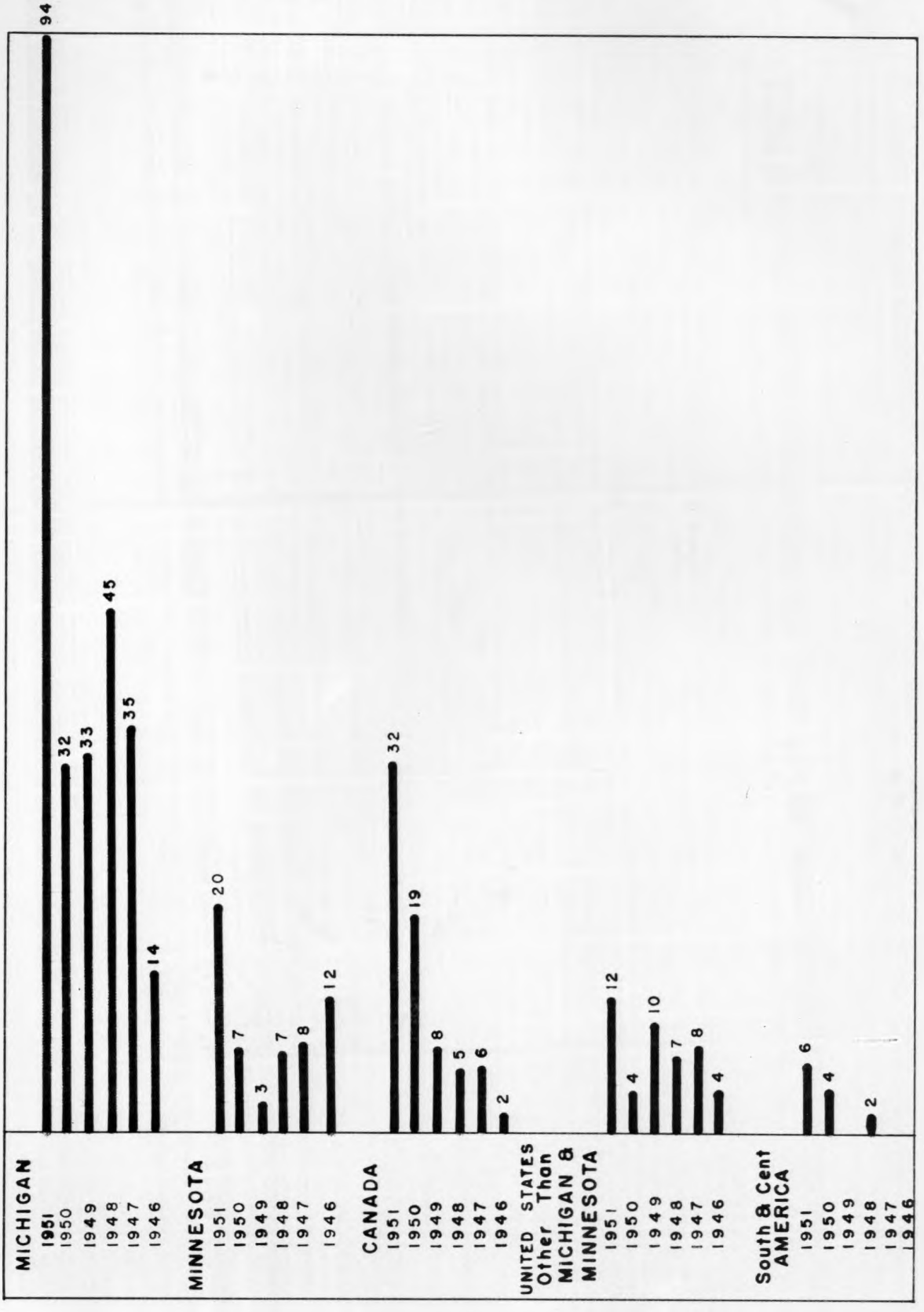

Figure 3

GRAPH SHOWING RATE OF

OUTSIDE EXPLORATIONS

1946–1951, Inclusive

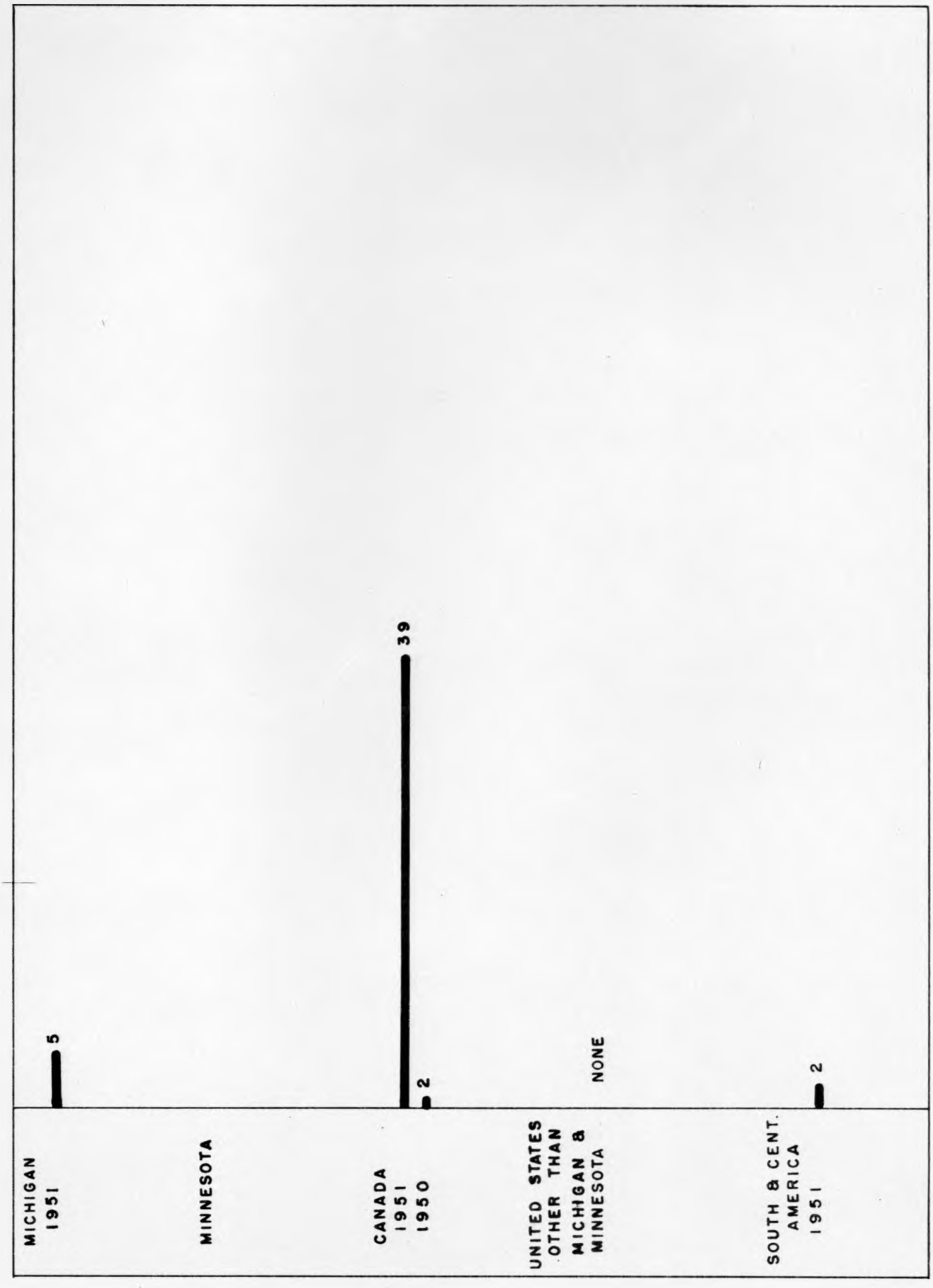

Figure 4

LAND OFFERS and OUTSIDE EXPLORATIONS

1946—1951, Inclusive

LAND OFFERS		OUTSIDE EXPLORATIONS	
MICHIGAN			
1951	94	1951	5
1950	32	1950	NONE
1949	33	1949	"
1948	45	1948	"
1947	35	1947	"
1946	14	1946	"
MINNESOTA			
1951	20	1951	NONE
1950	7	1950	"
1949	3	1949	"
1948	7	1948	"
1947	8	1947	"
1946	12	1946	"
CANADA			
1951	32	1951	39
1950	19	1950	1
1949	8	1949	NONE
1948	5	1948	"
1947	6	1947	"
1946	2	1946	"
UNITED STATES OTHER THAN MICHIGAN & MINNESOTA			
1951	12	1951	NONE
1950	4	1950	"
1949	10	1949	"
1948	7	1948	"
1947	8	1947	"
1946	4	1946	"
SOUTH & CENT. AMERICA			
1951	6	1951	2
1950	4	1950	NONE
1949	NONE	1949	"
1948	2	1948	"
1947	NONE	1947	"
1946	"	1946	"

LAND OFFERS

OUTSIDE EXPLORATIONS

VIII. OTHER DEPARTMENTAL HIGHLIGHTS

This portion of the Annual Report touches on the highlights of new developments, studies and projects not discussed in the preceding pages.

A. The Halliburton Reel

The Halliburton Reel, a wire line diamond drill hole testing unit, was purchased to augment our surveying equipment. The rated capacity of the unit is 6000 feet. However, the greatest amount of success has been realized in testing surface holes less than 2000 feet deep. It is conservatively estimated that the testing time has been reduced by 50%, where the unit can be utilized.

The unit is composed of a Wisconsin air-cooled engine driving a miniature hoist. The wire line passes through a depth-measuring device or odometer. For ease of handling and mobility the unit was enclosed in a trailer. Figure 5 shows the assembly in operation.

B. The Trailer Mounted Drill

For several years the Department has worked with the E. J. Longyear Company of Minneapolis to develop a mobile, self-contined diamond core on a trailer mounting. The completed unit was delivered and placed in service during the year. Figure 6 shows the rig in service. It affords a self-erecting mast capable of drilling an inclined drill hole from -30° to vertical. The unit has its own fluid pump (clear water or mud), shelter and tool house, rod racks and lighting plant. Initially, it has been equipped with a twin hydraulic swivelhead with fully automatic chuck and kelly drive. It is anticipated that the unit will provide another valuable adjunct to our drilling equipment.

C. Experiments in Mud Drilling and Related Sampling

During the summer and early fall of 1951, two series of drilling experiments were made independent of the regular drilling programs. These tests were made with a twofold purpose:

1. To determine the adaptability of the mud drilling procedure toward the more efficient drilling of unconsolidated material encountered in our drilling with a possible application to the drilling of overburden.

2. To experiment with sampling techniques to determine the possibility of using cuttings from a tricone type of bit for analyses of the material drilled.

First Series Tests (With Aquagel)

In the first series of tests, the Department's new trailer-mounted drill rig was used in conjunction with a "Shale Shaker" vibrating screen (See Figure 6). The tests were carried out on the Mather Mine "B" Shaft stockpile, and one hole 26 ½ feet was drilled.

Aquagel was used as the mud body and was passed through a 10 mesh screen at which point the +10 mesh size particles were removed from the fluid and kept as samples. Relative mud viscosity was kept at about 50. Drilling speeds were on the order of one foot per minute.

The hole kept open very well. After lifting the bit 24 feet in the hole, it was possible to lower it again with no difficulty.

Analyses were made of the samples obtained. Results were studied of material that had been washed only once and that which had been subjected to multiple washings. As a basis of checking results of the samples, analyses were compared with analyses of the stockpile made by Mr. Bennett, Chief Sampler.

In checking with Mr. Bennett's results to duplicate his particle size of his sample fraction, the screened -8+20 mesh portion was used. The sample from the mud drilling of that size checked to within 0.22% Fe. of Mr. Bennett's analysis. It also checked to within 0.09% Fe. of his composite analysis of the stockpile.

Although the tests were very limited in number, it showed that the aquagel mud may be expected to hold up the walls of holes in unconsolidated materials, the success of which, of course, will be inversely proportioned to the depth of the hole and friability of the material drilled.

The sampling and treatment of samples has indicated a very satisfactory procedure, and it appears to point toward the necessity of washing the sample only once to remove the aquagel sufficiently to give the required accuracy of analysis.

Second Series of Tests

The second series of tests were conducted to determine the possibility of the application of a starch base mud to a drilling circuit using a tricone bit and shale shaker and to determine the techniques required to obtain accurate analyses of the material drilled using the drill cuttings.

Tests were made on the starch to learn about its physical characteristics applicable to its utilization in our particular problems. A drill machine was set up and used to drill a prepared 10 foot broken ore section in a 16" diameter ventilation pipe.

It was found that to mix the starch in water, the most adaptable method was merely recycling the mixture in the pump circuit. Fermentation tests on the starch mixture were made over a two week period, at which time, the experiment was discontinued. The starch mud could be mixed with commercial preservative, in the proportion of 55 gallons to 1 pound, and at the end of that time was not noticeably broken down chemically. The temperature during the two week period varied between 60 and 80° F.

A Link-Belt shale shaker was used to separate the cuttings from the mud circuit. These cuttings were used to sample the material drilled. The separation was made by a 28 mesh screen.

The analyses of the samples showed that the starch adhering to the particles, produced deviation of not greater than 0.5% Fe. In the report from the Chemistry Laboratory, it is stated that "no large error, due to oxidation of starch by potassium permanganate, would result if the amount of starch was moderate." In the analysis of the cuttings it was found that the starch content, without washing, was about 4%. Mr. Owen Hassett, of the analytical laboratory, feels that the iron analyses, with the 4% pollution with starch, can still be kept within 0.3 to 0.4 % of the actual iron content.

D. Cementing of Surface Drill Holes

Cementing of surface diamond drill holes falls into two major requirements; cementing of hole to condition the hole for safe drilling practices and cementing of diamond drill holes to prevent the flow of surface and underground waters into mining areas.

Deep hole cementing for purposes of good drilling conditons has been very successful by careful observance of volumes and speed of cementing of operation. It is next to impossible to cement a hole successfully where there is fluid motion in the hole.

Cementing of surface drill holes above or near a mining area is limited to paper tube or sectional cementing. In order to attain and be reasonably certain that a solid cement plug is present from bottom of hole to surface, the cement level must be checked regularly by means of drill rods. In a grouting technique it is next to impossible to predict the bottom of the cement plug, and, in many cases, this method may not prevent fluid motion in the hole.

E. Comparison of Drill Hole Deviation

Diamond drill hole deviation has been a very serious problem in the exploration for deep direct shipping ores. The targets, in general, are relatively small and therefore require the maximum accuracy in the directional drilling.

In the face of higher diamond cost and slower rate of drilling the department went to drilling the deep holes NX size (3 inch). In the final analysis, cost sheets disproved the fear of higher drill hole costs.

The following tabulation bears out the statement of less deviation with larger sized diamond drill holes. It is hoped that the problem can be further alleviated through changes in equipment and personnel education.

Hole No.	Location	Horizontal Departure from Vertical BX - Hole	Horizontal Departure from Vertical NX - Hole	Depth of Drilling
9	Sec. 11, 47-27	230	—	3730
10	Sec. 11, 47-27	245	—	3751
11	Sec. 11, 47-27	None	—	3890
37	Sec. 4, 47-27	1145	—	4106
58	Sec. 9, 47-27	275	—	2359
3	Sec. 29, 47-26	1137	—	2037
	Total BX Deflection	3032	Total BX Drilling	19,873
42	Sec. 4, 47-27	—	360	2840
43	Sec. 4, 47-27	—	600	3700
12	Sec. 11, 47-27	—	25	3846
13	Sec. 11, 47-27	—	None	3601
14	Sec. 11, 47-27	—	None	4338
19	Sec. 11, 47-27	—	None	3664
20	Sec. 11, 47-27	—	25	2489
21	Sec. 11, 47-27	—	None	682
		Total NX Deflection	1,010	Total NX Drilling 25,160

F. Subsidence

The Geology Department with the Engineering Department continued their joint program of investigation of Mine Subsidence. The principal activity has been to study the changes on surface and underground together with geophone records in selected areas. The Engineering Department has made regular surveys of key stations. During the year this record was augmented with aerial photographs. Also, during the year, a system of 200 feet to the inch scale vertical cross-sections with full geological interpretations was inaugurated. Principal areas studied were:

1. Athens - Bunker Hill Mines
2. Mather Mine
3. Spies Mine
4. Cambria-Jackson Mine
5. Cliffs-Shaft Mine

View of Halliburton Reel in Operation for Testing Diamond Drill Hole Deviation

Figure 6

View of Trailer Mounted Diamond Drill Showing Drill, Mast, and Vibrating Screen for Collection of Samples