

Ishpeming, Michigan
September 17, 1951

REPORT OF GEOLOGICAL DEPARTMENT FOR YEAR ENDING, DECEMBER 31, 1950

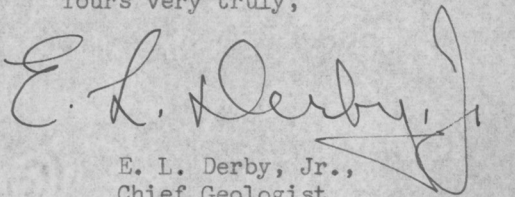
Mr. C. W. Allen,
General Manager,
Building.

Dear Sir:

I am handing you, herewith, the usual two copies of the report of the Geological Department for the year ending, December 31, 1950, which has been prepared by Mr. Boyum. There is nothing of importance that I can add to this report because I worked closely with Mr. Boyum in its preparation and, therefore, the report incorporates our combined efforts.

This is the first Annual report that we have been able to prepare since that for the period ending, December 31, 1946. Because of that gap, during which period the Department was expanded considerably, both in personnel and its field of activities, we thought it best, perhaps, to go into the item of personnel and the duties of the individual members of the current permanent staff a little more fully than may be necessary in the future.

Yours very truly,



E. L. Derby, Jr.,
Chief Geologist

ELD:JJ

Encls.

REPORT OF GEOLOGICAL DEPARTMENT FOR YEAR
ENDING DECEMBER 31, 1950

The following is the report of the Geological Department for the year 1950:

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I. DEPARTMENT ACTIVITIES SUMMARY

The prime function of the Geological Department is to find iron ore effectively, efficiently and economically. This scope embraces finding extensions of known ore bodies, finding new ore bodies in known districts and finding new districts containing iron ore. By the term ore, both direct shipping and treating materials are included as well as the profit aspect.

The principal methods employed are geologic mapping, geophysical prospecting and drilling with infrequent use of test pitting on surface and dog-drifting underground. The goal of the work is the ore estimate itself.

The Department is concerned with establishing and maintaining uniform standards of rock names and mapping conventions. As the Exploration Division of the Company, it maintains the permanent records of the exploration and development work. All exploration samples are processed through the Department. Uniform control is exercised over sampling technique and drilling operations. A greater part of the Company drilling equipment is owned and operated by the Geological Department through its Exploration Drilling Division, the balance is provided by contractors.

In many cases, prior to a drilling campaign, geologic studies and geophysical prospecting are carried on. These phases, together with the preparation of maps, sections and ore estimates are all part of the integrated exploration program of the Company.

The Department also investigates mineral Land Offers, mine subsidence and ground water control. It collaborates with the Engineering Department on matters of taxation and Aerial Photography.

II. STAFF

Ishpeming continued to be the headquarters of the Geological Department. The greater part of the staff has been based here.

The Departmental Staff is comprised as follows:

TABLE I

Edwin L. Derby, Jr., Chief Geologist
Burton H. Boyum, Assistant Chief Geologist

Exploration Drilling Division

H. Walter Rembold, Ass't. Supt. (A)
 Edwin R. Jacka, Foreman
 Swante Merrila, Foreman

Geologists

Robert M. Becker (B)
 Layton C. Binon
 Gilbert A. Dawe
 Eric J. Rex (C)
 Robert W. Riedel (B)
 John S. Sumner (D)

Prof. Wm. A. Longacre, Consulting Geophysicist
 Prof. F. C. Kruger, Consulting Geologist

George M. Olson, Technician
 Robert W. Ryan, Technician
 Mrs. Belle F. Bloch, Secretary
 Donald W. Carlson, Secretary (E)
 Mrs. Esther Fandrem, Secretary (E)

Archie Minnear, Draftsman
 Pat S. Johnson, Draftsman

Field Assistants, temporary

Eugene A. Enyart, Geologist
 John A. Halpin, Geologist
 Walter H. Sermon, Jr., Geologist
 Paul Chidwick, Notekeeper

Darwin C. Cedarleaf, Compassman
 Carl A. Corneliuson, Compassman
 John L. Preston, Compassman
 Terence T. Quirke, Jr., Compassman

- (A) Joined Department, April 1, 1950 (transferred from Eng'g. Dept.)
- (B) Joined Department, June 12, 1950
- (C) Joined Department, October 16, 1950
- (D) Called to Active Duty, U. S. Marine Corps, August 1, 1950
- (E) Shared with Engineering Department

Thus the staff consisted of 16 permanent members who worked 26,202 hours and 10 temporary employees who worked 5,144 hours. This makes a total of 26 employees and 31,346 hours worked. To this may be added the 37 drill runners and helpers.

III. GEOLOGIC 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 to running sun-dial compass survey lines, mapping outcrops, dumps and pits, sampling and collecting hand specimens.

A. Michigan

We employed three, two-man field parties in Michigan during the summer of 1950.

Party 1 conducted prospecting in the Cascade District and in the Fitch-Saginaw Area. Favorable treating material was found in both vicinities.

Parties 2 and 3 conducted prospecting in the Michigamme River Area. This work covered both sides of the Michigamme River from the Republic Mine to the Magnetic Mine. Favorable treating material was found on our lands, on Lease No. 90 (State Lease No. 42) and the Ford Motor Company lands. The work on the latter was done for Ford account and paid for by it.

Additional field work was carried on in the Michigamme, Pumphelly, Floodwood and Conrad Area by Messrs. Becker, Boyum, Rex, Riedel, Sumner, Olson and Johnson.

B. Minnesota

One field party conducted prospecting a geological reconnaissance on the Vermilion Range, Minnesota. The geologist was Dr. Frederick C. Kruger, Geological Consultant to the Company, and Professor of Geology at the University of Tennessee. The field work was directed to determine the nature and extent of treatable iron formation. Test results of field sampling was termed "favorable" by the Metallurgical Department. No large tonnage, however, was found on lands of open ownership. The Oliver Iron Mining Company owns the major part of the favorable areas.

IV. GEOPHYSICAL FIELD WORK (MICHIGAN)

A. Geophysical field work in 1950 was confined largely 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.

Party 1 conducted magnetic prospecting with a two-man party. Professor William A. Longacre, Consultant, of the Michigan College of Mining & Technology, was the instrument man and also worked on interpretation. Areas in which traversing was conducted were the Cascade, Fitch, Michigamme, Michigamme River and Pumphelly.

Additional magnetic work also was done by Messrs. Sumner and Riedel, of our Staff, especially in the Michigamme and Michigamme River Areas.

B. A limited gravimetric survey was made in the Lloyd Mine in cooperation with Professor Lloyal Bacon, Geophysicist, Michigan College of Mining and Technology. This survey was made on the 1350 W. meridian along the 8th level exploration cross-cut to the South.

C. No geophysical work was conducted in Minnesota.

V. SURFACE DRILLING

A. Michigan

1. During the year 1950, the Exploration Drilling Division of the Department was augmented with the services of Mr. H. W. Rembold as Operating Engineer, and later, Assistant Superintendent. Mr. Rembold took over the supervision of the drilling personnel and equipment formerly handled by Mr. Boyum.

During the year a total of 7 drill rigs of the Department were engaged in surface drilling. Four of these were in deep exploration and three in shallow exploration. Five contract drill rigs were employed, also. The distribution of holes is shown as follows:

TABLE II

<u>LOCATION</u>	<u>HOLES</u>	<u>RIGS</u>	<u>TOTAL FOOTAGE</u>
<u>Cascade</u>			
Sec. 29, 47-26	1, 1-A, 2	Geol. Dept.	2181
<u>Ishpeming</u>			
Sec. 4, 47-27	37B, 42, 43	Geol. Dept.	1206
Sec. 9, 47-27	58	Geol. Dept.	224
Sec. 10, 47-27	23, 24	Geol. Dept.	118
Sec. 11, 47-27	9D, 11, 12, 13	Geol. Dept.	4291
Sec. 11, 47-27	14	Longyear	867
			<u>5158</u>
<u>Tilden Area</u>			
Sec. 23, 47-27	1, 2, 3	Geol. Dept.	1170
Sec. 24, 47-27	1, 2	Geol. Dept.	984
Sec. 25, 47-27	1, 2	Geol. Dept.	1432
Sec. 27, 47-27	21, 22, 23	Geol. Dept.	1646
<u>Michigamme Mine</u>			
Sec. 19, 48-30	1, 2, 3, 4, 5, 6, 7, 7A, 8	Geol. Dept.	2706
Sec. 20, 48-30	1, 2	Geol. Dept.	965
<u>Ohio Mine, et al</u>			
Sec. 22, 48-31	1, 2, 3, 4, 5, 6, 7, 8	Longyear	1477
Sec. 23, 48-31	1, 2	Longyear	215
Sec. 26, 48-31	10, 11, 12 13, 14	Longyear	408
<u>Boyington</u>			
Sec. 13, 43-35	1, 2, 3, 4	Joy (Sullivan)	3868
<u>Hilltop</u>			
Sec. 26, 43-35	1, 2, 2A, 3	Longyear	3502
Sec. 27, 43-35	1, 2	Longyear	2140

TABLE III

RECAP - SURFACE DRILLING

<u>ORGANIZATION</u>	<u>RIGS</u>	<u>FOOTAGE</u>	<u>PROPORTION</u>
Geological Department	7	16,923	57.6%
Longyear	4	8,609	29.3%
Joy (Sullivan)	1	3,868	13.1%
	<u>12</u>	<u>29,400</u>	<u>100.0%</u>

2. Summary of Results

Cascade. The initial exploration was for direct shipping material in the structure North of the Isabella dike and South of the Volunteer dike. We did not reach the target area because of excessive drill-hole deviation.

Ishpeming

Section 4, 47-27. Hole #37-B had to be abandoned without reaching the footwall contact due to extremely adverse drilling conditions. Holes #42 and #43 continued the exploration to the Northwest of hole #37.

Section 9, 47-27. Exploration was resumed for the Cliffs-Shaft Mine extension to the Southwest of present workings and West of surface hole #57.

Section 11, 47-27. Hole #9-D cut first class ore from 3842' to 4227' at which point drilling was abandoned, still in ore, due to adverse drilling conditions. This is a new depth record for the Lake Superior area. Hole #11 was bottomed without encountering high grade ore. Holes #12, #13 and #14 were started to explore South, East and West, of hole #9-D respectively.

Tilden Area. Relatively shallow core drilling was conducted in Sections 23, 24, 25, and 27, all in 47-27, in the Tilden Area, to determine the treating characteristics of this type of iron formation. This was a joint exploration with the Bethlehem Steel Company. The core was tested at its metallurgical laboratory at Lebanon, Pennsylvania.

Michigamme Mine. Core drilling was employed in determining the grade and tonnage of treating type of iron formation on Sections 19 and 20, 48-30. The principal zone explored was adjacent to the upper contact of the iron formation although one hole (#7-A) was drilled in the iron formation lying geologically under the intrusive sill. In general, the results by flotation concentration were encouraging.

Ohio Mine, et al. A Longyear contract drill, using standard Mesabi structure drilling practice combined with core drilling, explored from the Webster Mine thru the Portland, Steward, Ohio and Norwood properties for treating type of iron-formation. Sufficient material of favorable concentration characteristics was found to warrant an operation.

Boyington Area. The Company obtained an option on the Boyington Area comprising the SE $\frac{1}{4}$ of Section 13, 43-35. Holes #1, #2 and #4, each encountered significant runs of iron-formation. None of the iron-formation was oxidized, however, and the exploration was discontinued.

Hilltop Area. This area comprises 160 acre tracts in each of Sections 26 and 27, 43-35. Drilling in Section 27, in 1950, found only unoxidized iron-formation. The exploration was shifted to Section 26 on the east limb of the syncline. Holes #2-A and #3 found oxidized iron-formation and enough ore to warrant a continuation of this drilling.

B. Minnesota

The Minnesota exploration drilling is covered in the Annual Report of Mr. Grover J. Holt, Manager for Minnesota.

VI. UNDERGROUND EXPLORATION (MICHIGAN)

A. During the year 1950, the trend toward parallel staffing of underground mines continued with numerous properties each having a separate mine engineer and a mine geologist. The mine or "operating" geologist mapped the geology of all main level developments and the critical sub-levels, maintained the mine cross-sections, made structure studies, directed the mine exploration program (generally, as the immediate supervisor of the drilling crews), and collaborated with the mine engineer in the preparation of the ore estimates.

The following shows the distribution of the staff:

TABLE IV

<u>OPERATING GEOLOGIST</u>	<u>PROPERTY</u>
1. Robert M. Becker	Cliffs-Shaft Mine
2. Layton C. Binon	Mather Mine "A" Shaft
3. Gilbert A. Dawe	Mather Mine "B" Shaft
4. Eric J. Rex	Athens, Cambria-Jackson, Maas
5. Robert W. Riedel	Lloyd, Spies

B. The following table shows the exploration drilling by properties:

TABLE V

UNDERGROUND DRILLING

<u>PROPERTY</u>	<u>HOLES (inclusive)</u>	<u>RIGS</u>	<u>FOOTAGE</u>	<u>PERCENT OF FIRST CLASS ORE CUT</u>
Athens	41-44	Geol. Dept. (1)	386	33.7%
Cliffs-Shaft	629-667	Mine (2)	6118	14.7%
Lloyd	180-184	Geol. Dept. (1)	1892	2.3%
Mather Mine "A" Shaft	35,65-69	Mine (1)	2118	13.2%
Mather Mine "B" Shaft	8-18	(Mine (2) (Geol. Dept. (1))	5094	34.4%
Spies	44-53	Odgers	4378	14.6%

C. As mentioned previously (page 1) much of the drilling equipment is owned by the Department. The trend has been for the properties having extensive drilling in sight to purchase their own drills and accessories and to employ the runners on the mine payroll. In these cases, the supervision still remains with the mine geologist.

It may be seen from the above tabulation (Table V) that during the year, 3 rigs were used from the Geological Department, 5 rigs were mine owned and 1 rig was contracted from the Odgers Drilling Company. Table VI shows this distribution:

TABLE VI
DISTRIBUTION OF UNDERGROUND DRILLING

<u>ORGANIZATION</u>	<u>RIGS</u>	<u>FOOTAGE</u>	<u>PROPORTION</u>
Geological Department	3	2,705	13.5%
Mines	5	12,903	64.6%
Odgers (Contractor)	<u>1</u>	<u>4,378</u>	<u>21.9%</u>
	9	19,986	100.0%

D. Summary By Properties

Athens Mine. The principal exploration has been the North ore body from seventh level to tenth level. The work confirmed our anticipated outlines.

Cliffs-Shaft Mine. The most significant exploration in 1950 was that done on eighth level (Section 10 Lease) where an entirely new area was opened by development and found to extend to the old Moro Mine. New ore extensions also were added to the "B" Shaft dome above first level and several other areas to a lesser extent.
(R.M.B.)

Lloyd Mine. Exploration was directed to areas below the eighth level with a drilling campaign from the long cross-cut on the 1350 W. meridian. Results were discouraging in that outlined structures were not ore filled. Another highlight of exploration work was the raise development from the long eighth level cross-cut to the +260' sub-level.

Mather Mine "A" Shaft. The drilling on third, fifth and seventh levels indicated no new major reserves. The drilling on the sixth level indicated only minor extensions of known reserves.
(R.M.B.)

Mather Mine "B" Shaft. Problems of immediate concern in 1950 were: first, to find a substantial tonnage of ore that was immediately accessible for mining operations from the sixth level elevation; and secondly, what is the general geologic structure adjacent to the sixth level development and what is its relationship to future mining operations at the Mather Mine "B" Shaft property.

Explorations during the year accomplished the following:

1. Established the ore outlines at the sixth level elevation adjacent to the main sixth level drift.
2. Established that the structure of the footwall Siamo formation and the overlying Negaunee Iron Formation was very complicated due to excessive faulting and folding.
3. Provided openings into the saturated areas in the fault structure to drain these areas for mining operations.

4. Established the need for further exploration, up the dip, to determine the extent of ore reserves above the fifth level elevation.

Exploration was speeded up considerably toward the end of the year with an increase from one to three drills operating underground. (C.A.D.)

Spies Mine. The Spies Mine exploration was devoted to outlining the ore body on and above eighth level.

VII. OTHER DEPARTMENTAL HIGHLIGHTS

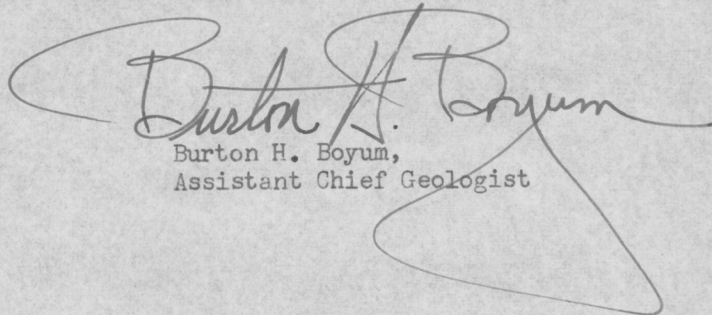
A. During the year 1950, Land Offers numbers 2559 through 2620, 2623, 2624 and 2633, (a total of 64) were processed.

B. Studies continued on the matter of ground water problems of active properties. Close liason has been maintained with Messrs. Stuart, Rhodehamel and Brown of the U. S. Geological Survey, Water Supply Division.

C. Subsidence studies continued on the Marquette and Menominee Ranges. This includes both geological structure studies and microseismic (geophone) observations. This is a joint program with the Applied Physics Division, U. S. Bureau of Mines.

D. During the year the Department collaborated with the Engineering Department on the production of mine models of the Mather Mine.

Respectfully submitted



Burton H. Boyum,
Assistant Chief Geologist

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