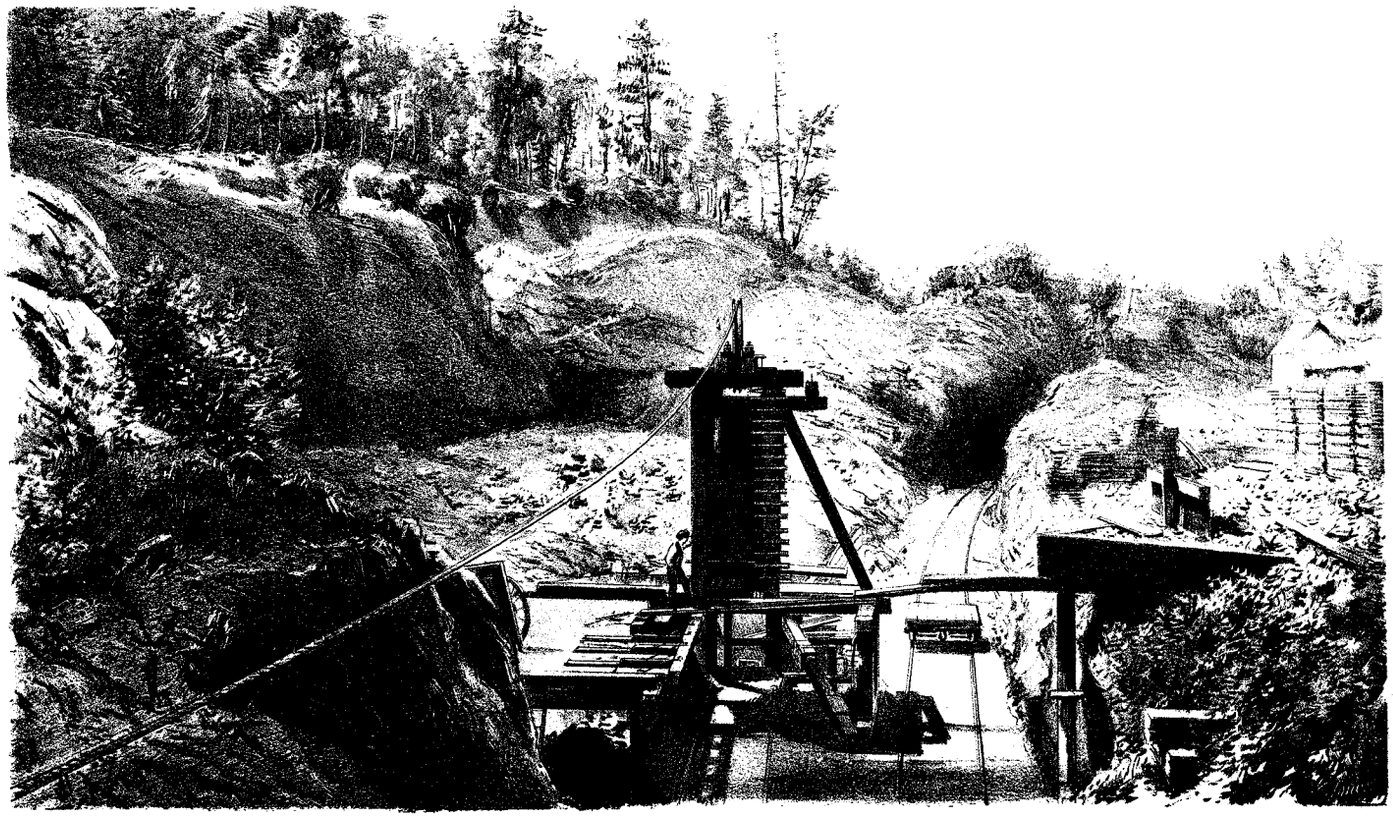
GEOLOGICAL SURVEY

OF

MICHIGAN

1873.



J. Bien, lith.

Photo. by Childs.

JACKSON MINE

Looking West in Nº1 Pit.

PART I.

IRON-BEARING ROCKS
(ECONOMIC).

BY

T. B. BROOKS.

MEMORANDUM.—It has been deemed advisable that the Appendices, referred to in this Part, should be issued separately as Vol. II.

ATLAS PLATES

REFERRED TO IN PART I.

1. Map of the Upper Peninsula.*
2. Map of the Central Portion of the Upper Peninsula.
3. Map of the Marquette Iron Region.
4. Map of the Menominee Iron Region.
5. Map of Iron Mines at Negaunee.
6. Map of Republic Mountain and vicinity.
7. Map of the Champion Mine.
8. Map of the Washington and Edwards Mines.
9. Map of the Lake Superior and Barnum Mines.
10. Map of the New York Mine.
11. Magneto-geologic Chart of Republic Mountain.
12. Statistical Tables of the Iron Ore Trade and Iron Mines of the Upper Peninsula.
13. Statistical Tables of Furnaces consuming Lake Superior Ores, with composition and character of the Ores.

* This map refers also to Parts II. and III.

GEOLOGICAL SURVEY OF MICHIGAN.

UPPER PENINSULA

1869-1873

ACCOMPANIED BY AN

ATLAS OF MAPS.

VOL. I.

PART I. IRON-BEARING ROCKS (ECONOMIC). *T. B. Brooks.*
PART II. COPPER-BEARING ROCKS. *Raphael Pumpelly.*
PART III. PALÆOZOIC ROCKS. *Dr. C. Rominger.*

PUBLISHED BY AUTHORITY OF THE LEGISLATURE
OF MICHIGAN.

UNDER THE DIRECTION OF THE

BOARD OF GEOLOGICAL SURVEY.

NEW YORK
JULIUS BIEN
1873.

Governor J. J. BAGLEY,
Hon. W. J. BAXTER,
Hon. DANL. B. BRIGGS,
} *Board of Geological Survey of the State of Michigan.*

GENTLEMEN,

Herewith I transmit a Report, with maps and illustrations, containing in part the results of my economic survey of the Iron Regions of the Upper Peninsula, made in accordance with a plan approved by your predecessors, under the chairmanship of ex-Governor H. P. Baldwin. I have labored diligently to produce "as complete a manual as possible of information relating to the finding, extracting, transporting, and smelting of the iron ores of the Lake Superior Region;" a book that should possess interest and value to the practical man and capitalist interested in our mines, which have for several years produced nearly one-fourth the ore raised in the United States.

Absence in Europe, on account of ill-health, prevents my giving the book that supervision, in passing through the press, which is essential to accuracy and finish in a work of this kind, especially when, as in this case, the author is not accustomed to bookmaking. Your publisher, Mr. Julius Bien, has promised to perform this duty, which is a guarantee that it will be well done.

I hope that the iron trade of the West will find in this a useful, although incomplete, manual, and that the people of Michigan will approve of the manner in which I have expended the money entrusted to me.

Very respectfully and obediently yours,

T. B. BROOKS.

London, May 1st, 1873.

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INTRODUCTION.

It is customary to preface Geological Reports with a history of the surveys on which they are based; in this case, however, it will be impossible to give more than a brief sketch, without omitting some part of the report itself, the limits of the book, for the publication of which funds were provided, having already been considerably exceeded.

The first survey of the State by Dr. Houghton, which was discontinued on account of his death by drowning in Lake Superior in 1845, is noticed in the first chapter in connection with the discovery of iron ore. The present survey was inaugurated by act of the Legislature in 1869, which appropriated $8,000 per year for the work, one-half of which went to the Upper Peninsula. This amount was again divided equally between the Iron and Copper Regions, which gave $2,000 per year for each to cover all expenses, including salaries, supplies, instruments, travelling, etc. To the $8,000 aggregate for four years from this source, the Geological Board added $1,000 for chemical work, making $9,000 in all received by me from the State for the survey of the Iron Region. In addition to this sum I have expended about $2,000 of my own means, and have not received any compensation for my services.

This small sum would have been inadequate to have accomplished anything worthy of the importance of the work undertaken, had not several corporations and individuals generously come to my relief: indeed on this source of help I counted largely in undertaking the work, and made it an express condition in the arrangement that I should be permitted to avail myself of all the assistance of this kind I could obtain, and also that during the progress of the work I should be free to continue the practice of a profession from which I was sure to obtain further facts bearing on the objects of the survey.

The companies which have contributed valuable data in their

possession, or have instituted special surveys at my suggestions, with the view of furthering the object of the survey, are :—The Marquette, Houghton & Ontonagon Railway, The Portage Lake & Lake Superior Ship Canal Co., The Republic, Washington, Lake Superior, Champion, New York, Spurr Mountain, Iron Cliff, Cannon and Magnetic Iron Companies. E. Breitung bore a part of the expense of making Map No. V., and John Fritz, A. Pardee, and Daniel J. Morrell, of Pennsylvania, S. P. Ely, of Marquette, and A. B. Mecker, of Chicago, contributed generously to the chemical fund, the results of the analyses being given in Chapter X.

The law of 1869 established a Board of Survey, consisting of H. P. Baldwin, Governor; W. J. Baxter, President of the Board of Education, O. Hosford, Superintendent of Public Instruction, with power to select the Geologists, disburse the money appropriated, and perform other necessary duties. Prof. A. Winchell was made Director, who approved the plan for the survey of the Iron Region which I submitted to him, and which is contained in the following letter:

LETTER OF INSTRUCTIONS,

Referred to in Agreement with T. B. BROOKS, *dated Negaunee, Mich., June 5th*, 1869.

"*To Major* T. B. BROOKS, *Assistant of the Geological Survey of Michigan.*

"SIR:—You are hereby authorized and requested to make a Survey of the Marquette Iron District, and to draw up a report on the same, substantially in accordance with the following suggestions:

"1. By the Marquette Iron District is meant the region embracing all the deposits of iron ore extending from the shore of Lake Superior on the east, through Townships 46, 47, and 48 north, as far as Range 31 west, inclusive, being the region which for the present finds its outlet by railroads through Marquette and Escanaba.

"Your report on this district would appropriately furnish—

"2. A historical sketch of discovery in the Iron Region of Lake Superior.

"3. A physiographical sketch of the Marquette Iron District; general topography, hydrography, timber, soil, climate, etc.

"4. The general geological structure of the district (not entering into details, nor theoretical discussions); identification of iron range stratification; outline description of the rocks; general description of the ores of iron occurring in the district.

"5. The mines in general; their distribution and grouping.

"6. Special notices of the mines and mining locations of the District; local structural geology, topography, mineralogical specialties of the ores.

"7. Discovery of ores; geological principles applicable; the use of instruments.

"8. The working of Iron Mines; methods in use here and elsewhere in analogous regions; advantages of each; machinery.

"9. The manufacture of iron and steel; special adaptations of the different varieties of ore in the District; the use of charcoal and mineral coal; resources of charcoal in Michigan; manufacture of charcoal; fluxes; location of furnaces; construction and operation of furnaces.

"10. Transportation of iron ores, and of iron; market; prices.

"11. Commercial statistics of iron ores, and of iron.

"In the discussion of the above topics, it is intended that you make such reference to other iron regions as may be necessary to thorough treatment and illustration of the general subject.

"It is not intended to lay down any stringent rules for your procedure, but only to furnish a general conception of the ground to be worked over. It is desired to produce as complete a manual as possible of information relating to the finding, extracting, transporting, and smelting of the iron ores of the Lake Superior Region, and it is believed that your own experience and the suggestions which may occur to you in the progress of the work will render it proper to deviate from the letter of the foregoing programme, according to the dictates of your own judgment. Specimens are to be collected according to the requirements and provisions of the law of 1869.

"In the prosecution of your field work, it is obvious that you cannot with the money at your disposal enter into detailed and complete examinations of individual properties, but it will promote the interests of the general work, if proprietors can be induced to defray the expenses of such detailed surveys beyond the limits to which you may be able officially to prosecute them; and it is evident that the interests of proprietors, no less than those of the State, will be promoted by committing such detailed surveys to your direction.

"The report, with the requisite maps, plans, and other illustrations, is to be ready for publication by the 31st day of December, 1870.

"(Signed) A. WINCHELL,
"Director Geological Survey,
"Ann Arbor, Mich."

On the completion of this survey of the Marquette Region, the Board decided to extend the work over the Menominee Region as well as further West before publishing, thus embracing all the known iron-fields of the Upper Peninsula. Professor Winchell having resigned in 1871, this part of the work was done under the direction of the Board.

Prof. R. Pumpelly has been engaged, with interruptions, in the Copper Region during the same period I have been at work in the Iron (see his Report, Part II.), and in the spring of 1871 Dr. C. Rominger commenced work on the Palæozoic rocks; his Report on the Silurian rocks of the Upper Peninsula is contained in Part III. of this volume.

The sum appropriated ($20,000) for publishing 2,000 copies of the three reports, with Atlas of maps, enabled the Board to contract for no more than a 500 octavo-page volume, which at the time was deemed sufficient space. I have been generously allowed more than one-half this space, but find that it was not sufficient to contain the material which I had accumulated, and which it seemed to me could be advantageously embodied in the proposed report. It was for some time a question with me, whether I should attempt to consider all the points named in the above scheme (giving each its relative space), which plan would have excluded a large amount of valuable material, or whether I should only attempt to treat each subject in order, as fully as my material would admit and its importance seemed to demand, without attempting at this time to cover the whole ground.

I choose the latter plan, and have in consequence been obliged to entirely omit all consideration of the important subjects of the location, construction and operation of furnaces; of fuels, fluxes, and ore mixtures; of the resources and manufacture of charcoal in Michigan,* as well as the consideration of the question of steel manufacture. The question of the transportation of ore and iron, of markets and prices, was also forced out for want of space. A proper treatment of these subjects would fill a volume.

I trust those gentlemen, who have favored me with lengthy and carefully prepared replies to my numerous inquiries on these excluded subjects, will feel that no injustice has been done them in withholding their papers, until they can be properly presented.

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* The subject of the resources of Michigan in Charcoal and the location of charcoal furnaces both on the Upper and Lower Peninsulas has been carefully worked up and illustrated by Timber Maps, but there is unfortunately no means provided for their publication.

The following named gentlemen are well acquainted with their respective localities on the Lower Peninsula, and are prepared to give information regarding the timber, etc., which is in many instances unsurpassed:

JOSEPH DAME, North Port.
E. E. BENEDICT, Manistee.
E. B. MILLS, Mayville.
GEO. N. SMITH, Bear river.
W. H. C. MITCHELL, East Traverse bay.
LEROY WARREN, Pentwater.
J. S. DIXON, Charlevoix.
O. W. HART, Torch lake.
A. G. BUTLER, Frankfort.
JAMES LEE, Bingham.
W. H. HURLBURT, South Haven.
DENNIS T. DOWNING, Little Traverse.
DELOS L. FILER, Ludington.
WILLIAM H. FREY, West Olive.

It may be questioned, whether with the purely practical object I have had in view in preparing this report, and the limited space, that so large a place should be given to the subject of Lithology, so ably treated by Mr. Julien, in App. A, Vol. II. The reasons which led to this were my own inability to properly treat this subject, its great relative importance in the study of rocks devoid of fossils, but above all I had collected and catalogued during seven years a more complete suite of specimens from the Azoic of the Upper Peninsula, than had before been got together, which collection I believed worthy the study and paper referred to, and which I saw no better way of utilizing to the public, than as has been done It is open to question whether Mr. Julien's paper should not have been published through some scientific channel, rather than in an industrial report, where it will stand nearly alone as a contribution to science.

Grouping Iron Deposits.—It has been found convenient in this report to disregard such political divisions as counties and towns in designating localities, and to employ instead, either the precise and simple method of U. S. linear surveyors, which can be readily understood by an inspection of Maps II., III. and IV. of Atlas; or, by the use of what may be termed the mineral or industrial geography of the Upper Peninsula, by which it is conveniently divided into regions, districts, groups, etc., which, although not sharply defined, may be considered at present to have the following boundaries: The *Marquette Iron Region* (see Map III., Table XIII., and Chap. IV.) embraces all the developed iron mines of the Upper Peninsula, the ores of which now find their outlets via Marquette, L'Anse and Escanaba by the Marquette, Houghton and Ontonagon and Chicago and Northwestern railroads. This again is subdivided into the (1) Negaunee, (2) Michigamme, (3) Escanaba, and (4) L'Anse districts. These divisions may be conveniently carried still further by a subdivision of the Negaunee District into the Cascade Range, Negaunee Hematite Mines, Ishpeming Group, New England and Saginaw Range; and of the Michigamme District into the Washington, Champion, Spurr and Magnetic Ranges, and Republic Mountain Basin. The S. C. Smith is the only worked mine in the Escanaba District, and no ore has yet been shipped from the L'Anse District or Range. The *Menominee Iron Region* (see Map IV. and Chap. IV.), which as yet has sent no ore to market,

is divided into (1) The North Belt in south part of T. 42, (2) The South Belt in Ts. 39 and 40, and (3) The Paint River District. The *Lake Gogebic and Montreal River Region or Range* (Chap. VI.) is so little known that it may be questionable whether it should have a place in this economic grouping; it embraces the country between Lake Gogebic and the west boundary of Michigan, and is 100 miles west of the Marquette Region.

It but remains for me to express my obligations and gratitude to the many gentlemen who have contributed in various ways to the objects of this survey, to officially acknowledge their services and to thank them cordially for myself and on behalf of the Board for what they have done.

To S. P. Ely, of Marquette, the survey is more deeply indebted than to any other person; indeed, I would not have undertaken the work except from assurance of his support, which has been constant and generous from the beginning. To Messrs. H. B. and F. L. Tuttle, of Cleveland, Ohio, I am indebted for a considerable amount of the material embodied on Statistical Tables XII. and XIII. of Atlas, much of which I believe it would have been impossible for me to have procured, except through them; App. J, Vol. II., contains a letter from H. B. Tuttle, who has always, with great promptness and care, answered my various inquiries. To Major Fayette Brown, Cleveland, the survey is indebted for a most valuable paper on the amount of air required by charcoal furnaces and the mode of applying it, based on his experience with the Jackson Co.'s furnaces at Fayette, the almost unparalleled success of which gives his statements great value. S. L. Smith, on the part of the Marquette, Houghton & Ontonagon railroad, placed all the results of that company's explorations, made under my direction, at the disposal of the survey. J. J. Hagerman, Milwaukee, furnished a statement regarding the working of Lake Superior and Iron Ridge, Wisconsin, ores with anthracite and coke, and the successful use of the metal in making rails. John L. Agnew has furnished drawings of the new charcoal furnace, superintended by him at Escanaba, 50 feet high and 12 feet bosh, the largest, so far as I know, in the world. M. R. Hunt, Depere, Wis., has given full details of a remarkable long and successful blast of the First National Iron Co.'s furnaces.

The Historical chapter has been made far more complete and reliable than would otherwise have been possible through the contribution of facts and documents by Messrs. William and John Burt, Messrs. Everett, White, Harlow, Hewitt, and Ely, of Marquette; also by Messrs. Jacob Houghton and Charles T. Harvey. This chapter was rewritten by Charles D. Lawton.

I am indebted to so many persons for the facts embodied in the chapter on Mining, that I can only mention W. E. Dickinson, J. C. Morse, William Sedgwick, A. Kidder, Peter Pascoe, George and Eugene St. Clair, and D. H. Merritt, of Marquette county, and Prof. R. Akerman, of Stockholm, Sweden.

C. H. V. Cavis, S. H. Selden, and George P. Cummings, civil engineers, have greatly aided in the work by their personal efforts in procuring information which is embodied in the maps. The valuable explorations of C. E. and Frank Brotherton, and of A. M. Brotherton, deceased, made for the C. & N. W. and M. H. & O. roads, has been to a large extent placed at my disposal by the officers of these companies.

The nature of the valuable scientific aid given to this work by Alexis A. Julien, Prof. R. Pumpelly, Dr. T. S. Hunt, Prof. George J. Brush, Dr. H. Credner, and Charles E. Wright, are explained in the text of chapters III., V., VI., and in Appendices A, B, and C, Vol. II.

Edwin Harrison, of St. Louis, has given me full and detailed statements regarding the working of his Irondale furnace, which has one of the best records ever made by a charcoal furnace. Robert Wood has prepared most of the manuscript for the press, and, with Mr. Bien, will take care of the publication and indexing.

The survey is indebted to the University of Michigan, Ann Arbor, for the use of rooms without charge, and for the same courtesy (most cordially extended) to the School of Mines, Columbia College, New York, on which institution the survey had no claim.

The Marquette, Houghton & Ontonagon, Chicago & Northwestern, Michigan Central, the Great Western, and Grand Trunk railways have in every instance, when requested, granted passes to persons connected with the survey.

To the gentlemen and companies above named, as well as to Messrs. J. N. Armstrong, American Iron & Steel Association, S. C. Baldwin, William H. Barnum, J. B. Britton, C. M. Boss, J. R. Case, Mr. Childs, Girard Iron Company, C. H. Hall, A. Heberlein, Alexander L. Holley, E. C. Hungerford, Prof. Hayden, Gilbert D.

Johnson, F. B. Jenny, Prof. J. P. Leslie, J. S. Lane, A. W. Maitland, David Morgan, Capt. H. Merry, F. W. Noble, Charles H. Pease, New York Mine, J. R. Orthey, Freiburg Royal School of Mines, James M. Safford, Samuel Thomas, J. M. Wilkinson, H. N. Walker, Walter Williams, Capt. R. D. Weston (deceased), Washington Mine, Dr. White, and Charles R. Westbrook, who have in various ways promoted my work, I am under great obligations. Without their aid this report could not have been prepared. I have forwarded to the Board of Survey a full list of their names and addresses, with the request to furnish each with a copy of this Report and accompanying Atlas.

CHAPTER I.

HISTORICAL SKETCH OF DISCOVERY AND DEVELOPMENT.*

NOTE.—Statistical Tables XII. and XIII. of Atlas contain many facts relevant to this subject, which could not well be incorporated in the text.

MINERAL explorations along the south shore of Lake Superior began at a very early period, and the existence of copper was made known to the world as long ago as 1636, by La Garde, in a book published in Paris. During the subsequent portion of the 17th century frequent mention is made in the "Relations" of the Jesuit Fathers of the finding of this metal.

These Relations† extend from 1632 to 1672, and are made up of the reports or simple narratives of these humble but zealous missionaries, scattered as they were all over the region of the great Lakes, then controlled by the French Government, and are necessarily of inestimable value to the historian and archæologist; and also contain much that is highly interesting to the geologist, as indicating the early discoveries of minerals and the knowledge of their localities and uses, possessed by the natives. In illustration of the allusions to copper found in these reports, we quote simply from one, Claude Allouez, who seems to have been a man of intelligence, as well as one of the most persevering and deserving of these early missionaries. He first visited Lake Superior in 1666, and makes mention of a large mass of copper to be seen near the shore of the lake, with its top rising above the water, giving an opportunity for those who passed that way to cut pieces from it. The writer says, this "rock" has disappeared, having become buried, as he opines, beneath the sands, through the action of the waves. He also states that pieces of copper weighing from 10 to 20 lbs. are frequently found among the savages, who esteem them

* C. D. Lawton, Esq., rendered much assistance in the preparation of this chapter.

† These valuable documents have been republished by the Canadian Government.

as domestic gods, and hold them in superstitious awe, preserving them, in some instances, time out of mind, among their most precious articles.

In 1672, a map was published in Paris of this region, which was made by these early Jesuits, and on which is represented 1,600 miles of coast and many islands, with what may be considered remarkable accuracy.*

In 1689, Baron La Houtan, in a book relating to travels in Canada, mentions that "upon Lake Superior we find copper mines, the metal of which is fine and plentiful; there being not a seventh part base from the ore."

In 1721, P. De Charlevoix described the native copper deposits, and the superstitions which the Indians had in regard to them, in considerable detail. The occurrence of native copper being so frequent, the wonder of the early voyageurs was naturally excited, being increased also by vague rumors (gathered from the savages) of the existence of gold, silver, and diamonds.

In 1765, Captain Jonathan Carver visited Lake Superior, and in his account dwelt so largely on the abundance of native copper, that a copper company was formed in England in 1771, which actually began mining operations on the Ontonagon river, under the direction of Mr. Alexander Henry, who seems to have been a better historian than miner; for he gives a detailed account of the winding-up of his operations in 1772 and concludes, as the result of his unsuccessful experiment in mining, that the country must be cultivated and peopled before the copper can be profitably mined.

In 18.9, Mr. H. R. Schoolcraft accompanied as mineralogist and geologist a government exploring expedition along the south shore of Lake Superior, having for its object the investigation of the copper mines.

In 1823 another government expedition, under charge of Major Long, passed along the north shore of the Lake, having come from the northwest; and mention is made of their having observed copper boulders in the region of the headwaters of the Mississippi.

Steps had been taken with a view to an exploration of this region

* A fac-simile of this map, and much other interesting matter relating to the early history of the copper region, may be found in Foster and Whitney's Report, Exec. Doc., 1850, Part I.

during the Presidency of John Adams, but nothing was ever effected. The work of systematic, scientific exploration of the Upper Peninsula of Michigan was first undertaken by Dr. Douglas Houghton, the earliest State Geologist. Dr. Houghton had commenced his examination of this region in 1831, and in his first annual report to the Legislature in 1841 presented the results of his labors up to that period in so able a manner, that the attention of the world became directed to the Northern Peninsula with greatly increased interest. In 1840, Dr. Houghton wrote to the Hon. A. S. Porter, under date December 26th, regarding the mineral wealth of the south shore of Lake Superior: "Ores of zinc, iron and manganese occur in the vicinity of the shore, but I doubt whether either of these, unless it be zinc and iron, is in sufficient abundance to prove of much importance. Ores of copper are much more abundant than either of those before mentioned, and a sufficient examination of them has been made to satisfy me that they may be made to yield an abundant supply of the metal."

In his Geological Report of 1841 Dr. Houghton says: "Although hematite ore is abundantly disseminated through all the rocks of the metamorphic group, it does not appear in sufficient quantity at any one point that has been examined to be of practical importance." At this date Dr. Houghton had traversed the south shore of Lake Superior five times, in a small-boat or canoe, on geological investigations. It is therefore probable that up to 1841 no Indian traditions worthy of credence, in regard to large deposits of iron ore, had come to his knowledge. As there are, so far as known, no considerable outcrops of iron ore, which come nearer than seven miles to the shore of the Lake, it is plain that investigations, based on observations taken along the shore only, could have determined no more than its probable existence, which is plainly indicated in the extracts given. Dr. Houghton was not aware of the existence of iron ore in quantity, until the return of Mr. Burt's party of surveyors to Detroit in the fall of 1844, his examinations in the interior of the country having been confined to the Copper Region. Attention at that early period was entirely directed to searching for ores of more value than iron, and it is worthy of remark, that the Jackson and Cleveland Iron Companies, which were the first two organized, were formed to mine copper, silver, and gold.

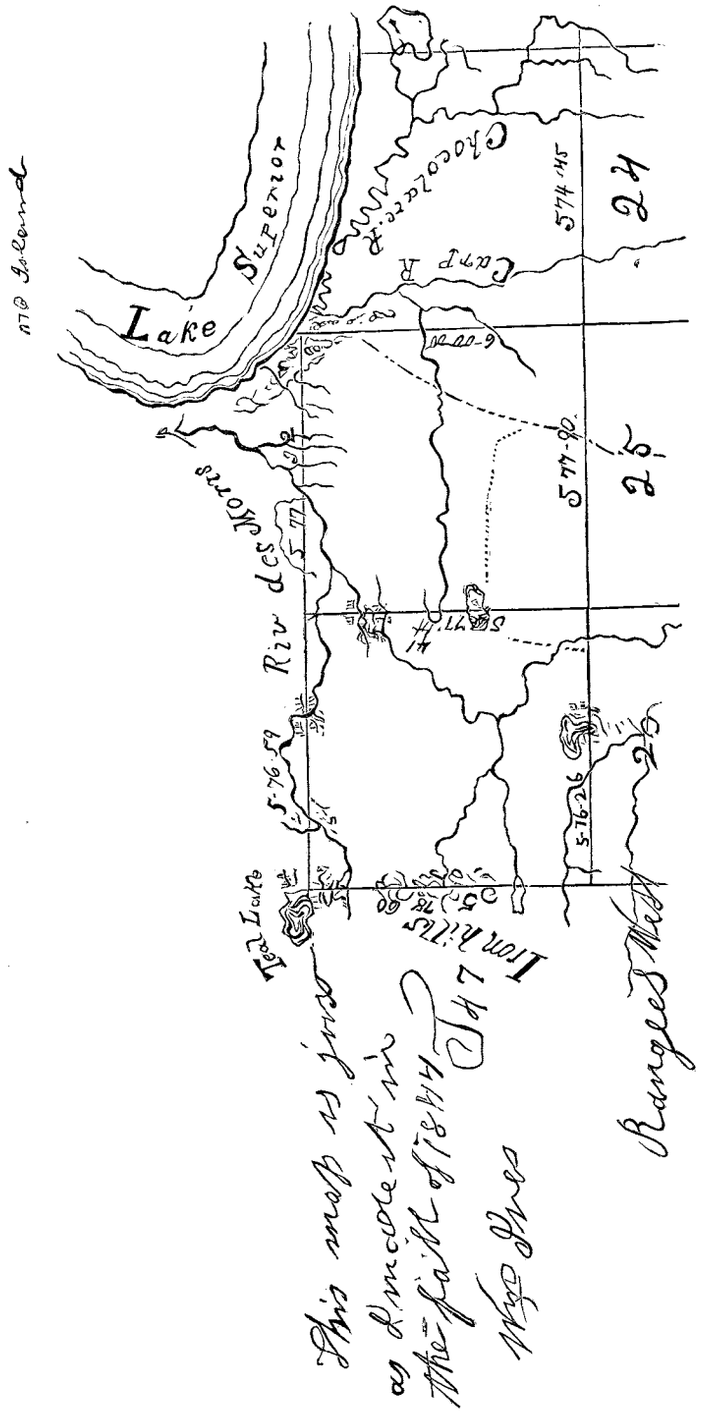
The remarkably rapid development of the mineral resources of

the Upper Peninsula is largely due, among other causes, to the fact that the United States Linear Surveyors were required to combine geological and topographical observations with their surveys. The use of Burt's solar compass, which permits of rapid and precise observations of local variations (so important in the economic survey of a primitive iron region), served greatly to enhance the value of the results, by making known the position of rocks containing magnetic ore.

The honesty, skill and enthusiasm with which the field-work was executed resulted in the collection of a large amount of geological data, which at the completion of the survey would have left little to be done save the final report, in which the master-mind should classify, group, and harmonize the facts, and thereby develop nature's law from the mass of material collected. Dr. Houghton's untimely death by drowning in Lake Superior, while in the midst of his labors, prevented him from performing the crowning work. Any one familiar with the geology of the Upper Peninsula, who will peruse the manuscript notes * left by Dr. Houghton, will be convinced that his views regarding the geology of the older rocks were far in advance of his time, and such only as geologists years afterward arrived at, and those which are but now, thirty years after he recorded them, universally accepted (see Appendix E, Vol. II.). A brief statement of the origin of a work from which such important results have accrued will be given. In 1843 the financial troubles of the State of Michigan arising out of the "Five Million Loan," as it was called, were of such a character as to cause the Legislature to withhold the annual appropriation for the Geological Survey, which then had been for several years in successful operation under the direction of Dr. Houghton. Thoroughly interested in his scientific work, and believing that the best interests of the State and the cause of science demanded the continuance of the survey, Dr. Houghton asked from the General Government the aid which his own State felt unable to grant, and succeeded in obtaining, in the appropriation for the Public Surveys of

* These manuscript notes are now in the University Library at Ann Arbor, having been presented to that Institution by Dr. Houghton's widow. Dr. Houghton, it will be remembered, was at the time of his death a Professor in the University of Michigan as well as State Geologist.

IVES' MAP, SHOWING IRON HILLS, 1844.



the Upper Peninsula of Michigan, an additional allowance per mile to cover the cost of the geological work. In order to expedite the work and insure the best scientific results from the adoption of his plan, Dr. Houghton himself took the contract from the Government for completing the surveys on the Upper Peninsula, which had been previously begun in 1840 under the direction of the Hon. William A. Burt, United States Deputy Surveyor. In the spring of 1844 Dr. Houghton commenced operations under his contract, the field-work being in charge of Mr. Burt, who received in compensation therefor the allowance granted by the Government. It is proper to add that Mr. Burt entered with deep interest into Dr. Houghton's plans and had, during his survey in the Lower Peninsula, collected for him many specimens and important geological information not required by his instructions.

In 1844 Mr. Burt, with a party consisting of William Ives, compassman, Jacob Houghton, barometer man, H. Mellen, R. S. Mellen, James King, and two Indians named John Taylor and Bonney * was engaged in establishing Township lines and making geological observations, as previously described.

On the 19th September, while running the east line of Town. 47 north, Range 27 west (the great iron Township), they observed by means of the solar compass remarkable variations in the direction of the needle, amounting to 87° from the normal. (See Appendix D, Vol. II.) Ascribing this phenomenon to iron ore, they sought for and found it in the ledges or outcrops at several points. Specimens † were collected and named by Mr. Burt and Dr. Houghton (See Appendix D, Vol. II.), and were described by them in their official returns; the fact of the great variation and large amount of ore being also especially commented upon. (See Appendix and official notes in Land Office, Washington, Lansing and Marquette.) A map made by Mr. Ives at the time, a fac-simile of which is given in Pl. I., has written along this line the words "Iron Hills." As the Jackson range is not magnetic at this locality, and does not outcrop on the line in question, it is not probable it was seen, but instead one or more of the ranges of flag or soft hematite ore further south.

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* Bonney's real name was Michael Doner; himself and Taylor are now dead.

† Mr. R. S. Mellen has still in his possession a piece of the ore found that day, which he brought away with him.

In the month of June following, Dr. Houghton and Mr. Burt, with their party, were engaged in subdividing the Township above mentioned (Town. 47 north, Range 26 west), when the former made a personal examination in reference to iron ore, especially at the corners of Sections 29, 30, 31, 32 (see Appendix D, Vol. II.), now known as the Cascade mines, and remarked to Jacob Houghton and others, who were members of the party, that it would some day be very valuable and the basis of an active industry.

It thus appears that the U. S. surveyors, in the fall of 1844, officially established the fact, that iron ore in considerable quantities existed in the Upper Peninsula of Michigan. It is also undoubtedly true, that Indians had previously observed the ore and were acquainted with locations of it, without, however, being able to identify it.

The Jackson Co.—The manner in which this, the earliest developed, and one of the most important of the iron properties on Lake Superior, was discovered (although the enterprise was not mainly undertaken with a view of finding iron), is reliably set forth in the following letter, written by P. M. Everett, now of Marquette, to Captain G. D. Johnson, now of the Lake Superior mine. The letter is dated at Jackson, Mich., Nov. 10th, 1845, and is as follows :—

"I left here on the 23d of July last and was gone until the 24th of October. . . . . I had considerable difficulty in getting any one to join me in the enterprise, but I at last succeeded in forming a company of thirteen. I was appointed treasurer and agent to explore and make locations, for which last purpose we had secured seven permits from the Secretary of War. I took four men with me from Jackson and hired a guide at the Sault, where I bought a boat and coasted up the lake to Copper Harbor, which is over 300 miles from Sault Ste. Marie. . . . . We made several locations, one of which we called iron at the time. It is a mountain of solid iron ore, 150 feet high. The ore looks as bright as a bar of iron just broken. Since coming home we have had some of it smelted, and find that it produces iron and something resembling gold—some say it is gold and copper. Our location is one mile square, and we shall send a company of men up in the Spring to begin operations; our company is called the 'Jackson Mining Co.'"

The actual discovery of the Jackson location was made by S. T. Carr and E. S. Rockwell, members of Everett's party, who were guided to the locality by an Indian chief, named Manjekijik.*

The superstition of the savage not allowing him to approach the spot, Mr. Carr continued the search alone, resulting in the discovery of the outcrop, which he describes as indicated in Mr. Everett's letter. Previous to the discovery he was led to suppose from the Indians' description, that he would find silver, lead, copper or some other metal more precious than iron, as it was represented and found to be "bright and shiny."

July 23d, 1845, articles of association of the Jackson Iron Company were executed at Jackson, Mich., and by these articles Abram V. Berry was appointed the first *President*, Frederick W. Kirtland, *Secretary*, Philo M. Everett, *Treasurer*, and George W. Carr and William A. Ernst, *Trustees*.

Mr. Berry gives the following account of the early history of his company, in a letter dated at Jackson, Mich., Oct. 21st, 1870 :—

"In the summer of 1845, an association was formed in this city, then a village, for the purpose of exploring the mineral region on the south shore of Lake Superior. The company consisted of P. M. Everett, James Ganson, S. T. Carr, G. W. Carr, F. W. Carr, E. W. Rockwell, F. W. Kirtland, W. H. Munroe, A. W. Ernst, F. Farrand, of Jackson, and S. A. Hastings, of Detroit (John Watkins, of Detroit, was interested with Hastings). Eleven individuals of the association procured permits from the War Department to locate one square mile each of mineral land on the south shore of Lake Superior. John Western, of Jackson, was then added to the

* In reward for the service of the Indian on this occasion, the officers of the Jackson Company subsequently gave him a written stipulation, of which the following is a copy :—

"RIVER DU MORT, LAKE SUPERIOR,
May 30, 1846.

This may certify that, in consideration of the services rendered by Manjekijik, a Chippeway Indian, in hunting ores of Location No. 593 of the Jackson Mining Company, that he is entitled to twelve undivided twenty one-hundredths part of the interest of said mining company in said location No. 593.

A. V. BERRY, *Superintendent.*
F. W. KIRTLAND, *Secratary.*"

This agreement on the part of the company was never fulfilled, and Manjekijik finally died in poverty; his relatives, now living in Marquette, are in the same miserable condition, without ever having received, as is averred by those who are cognizant of the facts, any compensation for the services mentioned.

company, making thirteen in all. In the fall of 1845 a company of explorers, consisting of S. T. Carr, P. M. Everett, W. H. Munroe, and E. S. Rockwell, visited Lake Superior, when what is now known as the Jackson location was secured by the permit granted to James Ganson, in the unsurveyed district, the section lines not having been run. The location was described by metes and bounds, commencing at a certain large pine-tree, the position of which was fixed by its course and distance from the corner of Teal lake. When the land was surveyed it was bought at $2.50 per acre. * * *

"In the spring of 1846, another expedition was fitted out, consisting of F. W. Kirtland, E. S. Rockwell, W. H. Munroe and myself, members of the company and several other adventurers; the object being to make further examinations of the iron and to use the remaining permits, by entering other mineral land. * * * * * I found our location much beyond what I had anticipated. After spending twelve days in the woods, exploring the surrounding country, including what was afterwards known as the Cleveland location and building what we called a house, we returned to the mouth of the Carp with 300 pounds of ore on our backs. We then divided; one party was left to keep possession of the location, another went farther up the Lake to use the remaining permits, while I returned to the Sault with the ore. It was my intention at this time to use another permit on the Cleveland location, but on arriving at the Sault I met Dr. Cassels, of Cleveland, agent of a Cleveland company, and having arranged with him that his company should pay a portion of the expense of keeping possession, making roads, etc., I discovered to him the whereabouts of the Cleveland location. He took my canoe, visited the location, and secured it by a permit. On arriving at Jackson we endeavored on two occasions to smelt the ore which I had brought down, in our common cupola furnaces, but failed entirely. In August of the same year, Mr. Olds, of Cucush Prairie, who owned a forge (in which he was making iron from bog ore), then undergoing repairs, succeeded in making a fine bar of iron from our ore in a blacksmith's fire, the first iron ever made from Lake Superior ore. In the winter of 1846–47 we began to get up at Jackson a bellows and other machinery for constructing a forge on the "Carp;" and in the summer of 1847 a company of men commenced building the same, and continued until March, 1848, when a freshet carried away the dam. * *

"—The association was then (1848) merged into an incorporated company, and by some means the pioneers in the enterprise are now all out."

In a book* on the mineral region of Lake Superior, with map by Jacob Houghton, Jr. and T. W. Bristol, published in 1846, only one iron company is mentioned—The Jackson. The description of the company's property is as follows:

Permit No. 593—somewhere in T. 46, N.-R. 27 or 28 W., while on Section 1 of T. 47, R. 27, Permit No. 158 is marked, which was granted to D. Hamilton, of Watervliet, New York. Section 3, same Township, embracing the New York mine, is covered by Permit No. 160, granted to T. Williams, of Newburg, N. Y. Section 10, same Township, embracing parts of the Cleveland and Lake Superior mines, was covered by Permit No. 177, granted to T. Ricket, of Copper Harbor.

In 1846 Fairchild Farrand explored the Jackson location and mined some ore. The company, under the superintendency of Wm. McNair, began, in 1847, the construction of a forge on the Carp river, three miles east of the mine, the first iron being made Feb. 10th, 1848, by forgeman, now Judge, A. N. Barney. Work was stopped in a few days by a freshet which carried away the dam. Mr. Everett came up in the summer of 1848, had the dam repaired and resumed the manufacture of blooms. The first iron made was sold to E. B. Ward, who employed it in the construction of the steamboat "Ocean." This forge was afterwards carried on under leases by B. F. Eaton, and later by the Clinton Iron Co., subsequently by Peter White and lastly by J. P. Pendill; it made but little iron and no money. The quality varied from the highest (as shown by the experiments of Major Wade, of the U. S. army) to indifferent, the trouble being a lack of uniformity in the blooms. The power was supplied by the Carp river, a dam 18 feet high having been constructed across the stream for this purpose. There were upon either side of the stone arch, and arranged opposite each other, four fires, from each of which a lump was taken every six hours, which was placed under the hammer and forged into blooms

* This little volume, (afterwards revised by Mr. Houghton,) thus early issued, contains much interesting and valuable matter relating to the early discoveries and mining operations of Lake Superior, especially regarding the copper region.

four inches square and two feet in length; the daily product being about three tons, requiring two teams of six horses each to convey them over the intervening ten miles of horrible road to Marquette. These teams, when so fortunate as not to break down, on returning brought back supplies for the men and animals. The same difficulties attended the procuring of the supply of ore and charcoal. The power was also found to be insufficient, owing to a scant supply of water occurring at certain seasons of the year. These difficulties were too numerous and serious for the maintenance of the existence of the concern, and resulted in its abandonment in 1856.

On the 6th of June, 1848, a meeting was called to act on the question of the acceptance of an act of incorporation passed at the preceding session of the Legislature, and it was decided to incorporate the company under the act referred to. The organization was completed under the title of the Jackson Mining Co., of Jackson, Michigan—Fairchild Farrand, *President*, W. A. Ernst, *Secretary*, George Foot, *Treasurer*, F. W. Carr, F. W. Kirtland, Lewis Bascom, and John Western, *Directors*. The capital stock of the company, as also that of the New England Mining Co., organized at this time, was fixed at $300,000, in shares of $100 each; the purpose of each being the mining of copper as well as iron. April 2d, 1849, an amendment to the charter of the Jackson Mining Co., of Jackson, was obtained, when the title was changed to its present form—**Jackson Iron Co.** The first officers under this organization were Ezra Jones, *President*, Wm. A. Ernst, *Secretary*, John Watson, *Treasurer*, S. H. Kimball, James A. Dyer, and James Day, *Directors*.

In 1850, Mr. A. L. Crawford, proprietor of the iron works at Newcastle, Pa., took with him from Lake Superior about five tons of the Jackson ore, and there worked it up. Part of the ore having been made into blooms and rolled into bar-iron, was used for special purposes, and part used for lining in the puddling furnaces. The iron was found to be excellent. About the same time, General Curtis, of Sharon, Pa., proprietor of extensive iron-works at that place, came to Lake Superior to inspect the Jackson and Cleveland locations; his object being to secure an interest, with a view to a future supply of ore for his works, of a better quality than he then possessed. Failing to make an arrangement for the Cleveland, he bought up sufficient stock in the Jackson Co. to give

him a controlling interest in the management of its affairs; so that for some years the location was known as "Sharon."

It is proper to remark that General Curtis believed, as did also John Western before him, that, as soon as practicable, the best policy for Lake Superior iron mines to follow would be to sell their ore to the furnaces of Ohio, Pennsylvania, and elsewhere; and in 1852 about 70 tons of the company's ore were taken to Sharon, Pa., and there made into pig-iron in the "old Clay Furnace." There were frequent changes of officers and directors in the Jackson Co. up to 1860, and the history of the company was one of disappointment and financial embarrassment. Between 1860 and 1862 the gentlemen who now compose the Board of Directors came into office, and in 1862 the first dividend was made. The great demand for iron occasioned by the war caused the iron interests of Lake Superior, for the first time, to assume a very successful aspect. The first regular shipments of ore from the Jackson mine were made in 1856, which amounted to about 5,000 tons. Up to this time the different forges in the district had consumed about 25,000 tons of ore. (See Table, Pl. XII. of Atlas.) The Jackson mine, earliest discovered, and first opened and tested, became widely known from the outset, and has ever continued to remain the leading mine in the district. The important village of Negaunee, within whose corporate limits the Jackson mine is situated, dates its origin with the commencement of the company's o erations. As the Chicago and Northwestern and the Marquette, Houghton and Ontonagon railroads form a junction in Negaunee, facilities are thus afforded for shipments over either road—that is, by the way of Escanaba or Marquette. The "openings," or pits, are irregular and numerous, and extend from the west edge of the village of Negaunee west for three-quarters of a mile. The greater portion of the product finds its outlet through a tunnel, which enters the mines from the north side of the hill and is of sufficient size to admit railroad cars and small locomotive engines. From the main tunnel radiate several branches, which extend to, or are being extended to, the different stopes and shafts. The main shafts are supplied with ample steam-power for pumping and hoisting purposes. For details of workings, geological structure, etc., see accompanying maps, tables, and text.

The New England Mining Co. was, like the Jackson, *incorporated* by a special act of the Michigan Legislature passed in 1848. The purpose for which the organization was effected is stated as being the mining and smelting and manufacturing of ores and minerals in the State of Michigan, the language stating the company's objects being identical with that of the Jackson Company; the capital stock was placed at 300,000. It does not appear that anything noticeable was accomplished by this company, thus early organized. The charter came in 1855 into the possession of Capt. E. B. Ward, by whom it is now held.

The Marquette Iron Co.—In the summer of 1848, Mr. Edward Clark, of Worcester, Mass., was sent to Lake Superior by Boston parties, to look for copper, but at the Sault he fell in with Robert J. Graveraet, who induced him to stop at the Carp river and see the iron mines. The Jackson Company's forge was at work and had made a little iron. Clark, on his return to Worcester, carried with him a bloom and some ore from the Jackson Iron mountain, which, on being drawn into wire at a factory, proved excellent. Clark at once proceeded to form an association for the purpose of building a forge on the far-off shore of Lake Superior, assisted by Graveraet, who also appeared in Worcester at this time (having travelled from Marquette to Saginaw on snow-shoes); he succeeded in organizing a company, March 4th, 1849, consisting of E. B. Clark, W. A. Fisher, A. R. Harlow, of Worcester, Mass., and R. J. Graveraet, of Mackinaw; Clark and Graveraet putting in against the capital of the others leases of iron lands of which they claimed to have possession. These iron lands constitute what subsequently became known as the Lake Superior and Cleveland mines, and over which a long controversy arose as to which party should possess the land, and which was finally decided by the Interior Department at Washington in favor of what was known as the Cleveland Company. Mr. Harlow constructed and purchased the necessary machinery to the value of $8,000, and in the spring of 1849 shipped it to Marquette, starting himself with his family on the 11th of June, and arriving in Marquette on the 6th of July thereafter. Graveraet had reached there on the 17th of May previous, taking with him a small party of men, among whom was Peter White, then a lad, but subsequently largely identified with numerous interests in the Iron

Region, and now President of the First National Bank of Marquette. The forge was completed, making the first bloom in just one year from the date of Mr. Harlow's arrival.

The Marquette Iron Co.'s works started with 10 fires, and used Cleveland and Lake Superior ores, mostly the former, making blooms exclusively, which were sold in Pittsburg at prices ranging from $35 to $50. The works were in operation somewhat irregularly until 1853, when the Marquette Company was merged into the Cleveland Company, under the auspices of which the forge continued in operation for a few months longer, and was finally destroyed by fire in 1854. Like all bloomeries started in Marquette County, it was from the first, financially, a failure. The cost of the plant was great, transportation difficult and expensive, and the price of iron during the entire period disproportionately low. There was no dock at Marquette, no canal at the Sault, scarcely a road in the country, no shop for repairs, no skilled labor but what was, together with all supplies, imported "from below," and no regular communication. During the summer of 1849 only three sailing vessels and five propellers arrived at Marquette. The stock of the Marquette Company was bought up by the Cleveland Company, and its property passed to the ownership of the latter.

In 1852 John Downey, Samuel Barney and others began the construction of a forge on the "Little Carp," but after having built some houses, constructed a wheel, etc., permanently abandoned the enterprise.

In 1849 and 1850 a *whetstone quarry* was opened in a bed of novaculite, near the outlet of Teal lake, and Messrs. Smith and Pratt established a factory, for the purpose of sawing these blocks, at the mouth of a small stream near the Marquette landing, and carried on a "thrifty business."

The Iron Mountain Railroad.—The question of transporting the rich ores of Marquette county to the coal of Ohio and Pennsylvania, being one that came to be seriously considered, it naturally suggested the necessity of *a railroad* from the mines (those near the present villages of Negaunee and Ishpeming) to Marquette bay. In 1851 Messrs. Heman B. Ely and John Burt strongly advocated the enterprise, and in the following year Mr. Ely caused a survey to be made; at that period the entire population of Marquette county was

less than 150 persons. There being no general railroad law in the State at that time, the construction of the railroad was undertaken by Mr. Ely, assisted by his brothers George H. and Samuel P. Ely, of Rochester, New York, as an individual enterprise, he having previously made a contract with the Jackson and Cleveland Iron Mining Companies and Mr. John Burt, as the representative of other companies, for the transportation of their ores. This contract the two first-named iron companies subsequently attempted to break, and sought to defeat the railroad by constructing a plank-road in opposition to it, thus instituting a serious and embarrassing controversy, which continued until 1855, when all matter of dispute then pending between the Railroad Company, under charge of Mr. Ely, and the Plank-road Company, under charge of Mr. S. H. Kimball, were submitted to arbitration and settled to the satisfaction of both parties—Messrs. C. T. Harvey and Austin Burt being arbitrators. Immediately after the passage of the General Railroad Law of this State in 1855, the Messrs. Ely incorporated the railroad under the title of the Iron Mountain Railroad, and John Burt was first President. A year later the company was strengthened by the addition of Jos. S. Fay, Edwin Parsons, Lewis H. Morgan, and other capitalists; and in 1857 the road was completed and put in operation. Mr. H. B. Ely, to whose foresight and energy the origin and success of the enterprise was largely due, and to whom the interests of Lake Superior became otherwise greatly indebted, died in Marquette, in 1856, before the work upon which he had labored so intently was completed.

The death of his brother, and his own connection with the road, was the occasion of bringing to Marquette Mr. S. P. Ely, who is now more largely identified with the business management of many of the leading enterprises in the Iron Region than any person resident on "Lake Superior." The Iron Mountain Railroad became subsequently a part of the Bay de Noquette and Marquette Railroad, this becoming afterwards, by consolidation, the Marquette and Ontonagon Road, and still later, by further consolidation, a part of the through line of the Marquette, Houghton, and Ontonagon Railroad. The plank-road to which reference is here made was built by the Jackson and Cleveland Companies jointly, but was never used as a plank-road; longitudinal sleepers were laid down and covered with strap-rail, on which horse cars were run. The road was used for two seasons, and cost $120,000, which

amount was practically sunk. The cost of transportation was nominally one dollar per ton; each team would make the round trip in a day, bringing four tons of ore. It is proper to add that the rates of transportation fixed by these H. B. Ely contracts, although afterward deemed by the iron companies much too liberal, were lower than any at which ore has ever been carried over the road; the present rates being more than double those agreed upon with Mr. Ely.

Among the most important enterprises early connected with the development of the Lake Superior iron interests was the construction of the **Sault Ste. Marie Ship Canal.** In the St. Mary's river or strait, connecting the waters of Lakes Superior and Huron, occurs, nearly opposite the village of Sault Ste. Marie, a rapid of about one mile in length, and about seventeen feet fall, forming a complete barrier to the communication between the lakes. Some years previous to the construction of the canal this barrier had been overcome partially, by the construction and use of a portage flat-bar railroad, over which all articles of commerce between the lower lakes and Lake Superior were transported and reshipped in both directions. The important and growing interests of Lake Superior demanded more easy and effective means of commercial communication with the lower lakes. The matter being brought before the National Legislature, Congress granted to the State of Michigan, by Act approved Aug. 26th, 1852, 750,000 acres of land for the purpose of aiding in the construction and completion of a ship canal around the falls of Ste. Marie. On the 5th of February following, the State of Michigan, by an Act of its Legislature, accepted the grant of land above mentioned; and to further the objects thereof, authorized the Governor of the State to appoint Commissioners to let the contract for the construction of the canal, and to enter the lands authorized under the grant.

The Commissioners appointed under this legislative act entered into contract with Joseph P. Fairbanks, Erastus Corning and others for building the canal within two years from date thereof; the consideration being the U. S. Government grant of lands. This contract was soon after duly assigned to the Ste. Marie's Falls Ship Canal Co., which company had been organized in the city of New York on the 14th of May, 1853, under an Act of the Legisla-

ture of the State of New York, passed April 12th, immediately preceding. At the organization of the company, the following persons were chosen officers and directors of the company: Erastus Corning, *President*, J. W. Brooks, *Vice-President*, J. V. L. Pruyn, *Treasurer* and *Secretary*. *Directors:* Erastus Corning, J. W. Brooks, J. V. L. Pruyn, Jos. P. Fairbanks, John M. Forbes, John F. Seymour, and James F. Joy.

Subsequent to the passage of the grant by Congress, but previous to the acceptance thereof by the State of Michigan, Mr. Charles T. Harvey was authorized by Messrs. Fairbanks and Corning to cause a survey to be made, which he proceeded to do during the month of November, 1852, having secured the services of an experienced engineer from the Erie Canal, Mr. L. L. N. Davis. After the organization of the company, Mr. Harvey was appointed its general agent, and the supervision of the construction placed under his control.

Early in the season of 1853 Mr. Harvey, with 400 men, proceeded to the Sault, and on the 4th of June broke ground for the canal. The remoteness of the locality, and many other unfavorable circumstances, rendered the construction of a work of such magnitude exceedingly difficult, and necessitated at every step of the operations unusual care and energy in the management as well as heavy pecuniary expenditures. Mr. Harvey remained in control of the construction for one year, when he was relieved and placed in charge of the finance, and also appointed agent for the State to select lands under the grant in the Upper Peninsula. Mr. Harvey selected about 200,000 acres of land, 39,000 of which were taken in Marquette county, and were subsequently sold for $500,000 cash, to the Iron Cliff Co. Among the copper land selected was the quarter section on which the Calumet and Hecla Company's mine is situated, and which was sold by the canal company for $60,000, now worth, on the basis of late sales of stock, $13,000,000. The 750,000 acres granted by the General Government were entered by the company as follows: on the Upper Peninsula, 262,283 acres of iron, copper, and timber land, and 487,717 acres of pine land in the Lower Peninsula. A land agency was established at Detroit for the purpose of locating the lands obtained through the grant.

During the summer of 1854 the difficulties necessarily attendant upon building the canal were very much enhanced by disease among

the workmen; some 200 of whom died of the cholera, and among them was Mr. Ward, who had charge of the construction. Mr. Harvey was again placed in charge of the work, which, owing to the panic among the workmen, had become nearly suspended; but by the exercise of much skill and energy he succeeded in reorganizing the force, and pushing the work vigorously forward to final completion. On the 19th of April, 1855, the water was let into the canal, and in the following June the work was opened for public use, under the superintendency of Mr. John Burt.

The total cost of the construction of the canal, which includes also the expense attendant upon the selection of lands, as contained in the report of the company under date of January 1st, 1858, was $999,802.46.

The State of New York, by act passed April 15th, 1858, granted a charter incorporating the **"St. Mary's Canal Mineral Land Co."** Under this act of incorporation, a company was duly organized, and to it was transferred the canal company's lands of the Upper Peninsula. It was soon found that the canal failed to meet the growing wants of the commerce of Lake Superior, owing to the variation in the general level of the Lake Superior becoming somewhat lower than when the canal was completed, thus making a variable difference in the depth of the canal of from one to one and one-half feet; and also that the General Government, by successive appropriations, has caused the channels through Lake George and the St. Clair Flats to be so widened and deepened, that vessels of far heavier tonnage than was originally anticipated could be employed. The Michigan State Legislature adopted a resolution in the session of 1869, offering to cede the canal to the U. S. Government; although Congress has not as yet formally accepted the offer made by the State, nevertheless, under its system of internal improvement, the General Government is now engaged in the enlargement of the canal. The width of the canal is to be increased to 300 feet, and its depth to 16 feet the locks are to be double, 80 feet in width and 450 feet long. The amount of the government appropriations under which this improvement is being effected is in the aggregate $800,000; and the work, when completed, will be fully adequate to the wants of commerce.

The report of superintendent Guy H. Carleton shows the following to be some of the principal exports and imports through the canal during 1871 and 1872:

	1871.	1872.
Flour, bbls.	25,146	42,141
Pork, bbls.	8,887	10,306
Beef, bbls.	3,054	4,161
Bacon, lbs.	163,763	242,475
Lards, lbs.	283,141	213,394
Butter, lbs.	519,545	559,137
Cheese, lbs.	187,340	200,994
Tallow, lbs.	104,354	106,170
Soap, boxes.	21,799	18,205
Apples, bbls.	18,359	20,025
Sugar, lbs.	4,062,087	5,454,559
Tea, chests.	3,864	7,980
Coffee, bags	5,228	7,815
Salt, bbls.	36,199	42,690
Tobacco, lbs.	258,179	321,836
Nails, kegs.	29,843	34,984
Dried Fruit, lbs.	115,366	73,230
Vegetables, bush.	27,619	35,263
Lime, bbls.	2,338	6,067
Window Glass, boxes.	25,226	7,492
Cattle, head.	2,639	3,608
Horses and Mules.	435	528
Hogs, head.	1,625	1,567
Brick, M.	1,225	9,067
Furniture, pieces.	13,616	44,768
Machinery, tons.	1,595	10,593
Engines.	18	28
Boilers	17	34
Liquor, bbls.	4,366	7,082
Malt, lbs.	653,140	1,545,875
Coarse Grain, bush.	283,503	444,875
Mdse., tons.	23,245	38,215

The following are some of the principal exports from Lake Superior for 1871–72 :—

	1871.	1872.
Mass Copper, tons.	1,091	1,709
Ingot Copper, tons.	7,666	8,547
Stamped Work Copper, tons.	5,705	4,365
Iron Ore, tons.	327,461	383,105
Pig Iron, tons	23,304	29,341
Fish, half bbls.	26,041	14,529
Wheat, bush.	1,376,705	567,134
Tallow, lbs.	59,225	64,567
Flour, bbls.	179,093	94,270
Barley, bush.	25,320	898

	1871.	1872.
Silver Ore.	464	306
Stone, building, tons.	5,528	5,213
Potatoes, bush.	.....	636
Copper, manufactured, tons.	.....	395
Quartz, tons.	.....	591
Wool, tons.	.....	30

In 1853 the **Lake Superior Iron Company**, one of the three oldest companies in the district, was formed; articles of association were filed March 13th, capital stock $300,000, in 12,000 shares of $25 each. The capital stock was subsequently increased to $500,000, which has all been returned to the stockholders in dividends. The incorporators were Heman B. Ely and Anson Gorton, of Marquette, Mich.; Samuel P. Ely, George H. Ely, and Alvah Strong, of Rochester, New York. The company commenced operations in 1857 on 120 acres of land in Sections 9 and 10, T. 47, R. 27, which was purchased of John Burt, being a part of the Briggs and Graveraet claim spoken of above under the Cleveland Company. Subsequent purchases enlarged the company's estate to 2,000 acres, its present dimensions. The company's principal openings are upon the land originally purchased. The first shipment of ore (4,658 tons) was made in 1858; since which the increase has been so great that its shipments now exceed those of any mine in the district, as will be seen by reference to the tables. This company have recently constructed, in Marquette, the Grace Furnace, which went into blast in December, 1872, using anthracite coal in the manufacture of pig-iron. The furnace is located on the shore of the bay, within the limits of the city, and is the first anthracite furnace built on Lake Superior. A map of the Lake Superior and Barnum mines accompanies this report.

The Eureka Iron Company was organized October 29th, 1853, with a capital stock of $500,000 in 20,000 shares. The corporators were Eber B. Ward, Harmon De Graffe, Silas M. Kendrick, M. Tracy Howe, P. Thurber, Elijah Wilson, Thomas W. Lockwood, and Francis Choate, with office in Detroit. The organization was effected with a view of mining ore and of manufacturing charcoal pig-iron from Lake Superior ores; preparations were made to build a furnace in Marquette county, but the location was finally

changed and the furnace erected where now stands the flourishing city of Wyandotte, becoming the nucleus of the extensive iron works which have since grown up in that locality. The Eureka Company was also the first iron enterprise in which Captain E. B. Ward, subsequently so widely known as a successful iron master, became engaged. The company was formed by Philip Thurber, and a quarter section of land purchased near Marquette of Mr. A. R. Harlow, on which a few hundred tons of ore were mined; but it becoming evident that the ore did not exist in quantity, the work was abandoned. This land was subsequently sold back to Mr. Harlow for his shares of the company's stock, and is now known as Harlow's Mill.

The Cleveland Iron Mining Company filed articles of association March 29th, 1853; capital stock, $500,000, in 20,000 shares. The corporators were John Outhwaite, Morgan L. Hewitt, S. Chamberlain, Samuel L. Mather, Isaac L. Hewitt, Henry F. Brayton, and E. M. Clark, with office in Cleveland, Ohio. The early history of this celebrated mine, one of the oldest and most important in the district, is referred to in connection with that of the Jackson Co.

Dr. J. Lang Cassels, of Cleveland, to whom reference is made in Mr. Berry's letter, visited Lake Superior in 1846, and took, as he expresses it, "squatter's possession" of a square mile for the Dead River Silver and Copper Mining Co. of Cleveland; the property here spoken of includes the mines of the present Cleveland Co. The Jackson Co. had previously taken possession of their lands, and Dr. Cassels obtained guidance thereto from an Indian, there being no white men in the region; the doctor went up from and returned to the Sault in a bark canoe. During the succeeding year, Cassels having left the country, the location was taken possession of by Messrs. Samuel Moody, John Mann and Dr. Edward Rogers. The two former claiming what became the Cleveland mine, and the latter what is known as the Lake Superior. When the Marquette Forge Co. was organized in Worcester, as previously described, Clark had authority from Mann and Moody to lease their location, and Graveraet had similar power from Rogers.

In this manner leases of these lands were put into the organization against $20,000 cash capital, to be paid by Messrs. Harlow and

Fisher. Both the Cleveland Co. and Graveraet, representing Messrs. Moody and Mann, claimed priority of right to the land under a "pre-emptor's mining act." These conflicting claims went before the Department at Washington, where a decision was rendered, which gave the right of purchase to the Cleveland Co. The entries which the Cleveland Co. made did not cover the Lake Superior location, Graveraet still claiming it, in behalf of the Marquette Co., on the ground of the Rogers pre-emption. Previously Isaiah Briggs had been on the land, but, leaving it, Rogers had taken possession. Rogers lost his interest, however, by not being present at the Government sale of lands in November, 1850, and establishing his claim, having been detained by a storm on the lake while endeavoring to proceed to the Sault (where the land office was located) for that purpose. The location was purchased by John Burt, on the basis of the Briggs claim, he having agreed to lease an undivided one-half interest to Graveraet, who was also present in behalf of the Rogers claim. This lease to Graveraet was assigned by him to the Marquette Co., passed with the company's other assets into the possession of the Cleveland Co., and was finally sold for $30,000 to the Lake Superior Iron Co., that company having previously purchased the Briggs title.

The Cleveland association, although formed in 1849, did not do any business in Lake Superior until 1853; at that date the Cleveland and Marquette companies became finally merged by the former company purchasing (including 64 acres of land on which the forge was located) the assets of the latter, and the present Cleveland Iron Co. was formed. The Cleveland Co. continued to run the forge for about two years, until it was burned down. The company mined in 1854, 4,000 tons of ore, which was made into blooms at the different forges in the vicinity. In 1855 they shipped 1,449 tons of ore to the furnaces "below," thus preceding the Jackson Co. one year, and becoming the first to send out of the region any considerable amount of ore. The Jackson Co. had sent a few tons to the World's Fair in New York in 1853, and in 1852 some had been sent to Sharon, as before mentioned. The Cleveland Co. has also an ore dock at Marquette, entirely similar to the docks of the M. H. & O. R. R. Co., of which full descriptions and illustration are given.

On Nov. 8th, 1853, the **Collins Iron Co.** filed articles of associa-

tion, with a capital stock of $500,000 in 20,000 shares. The corporators were Edward K. Collins, of New York, Solon Farnsworth, Edwin H. Thomson, Robert J. Graveraet, and Charles A. Trowbridge, with office in Detroit.

The company built a forge in 1854, and began to make blooms late in the fall of 1855; Robert J. Graveraet, Supt., and C. A. Trowbridge, Managing Director. E. K. Collins largely interested himself with a view of obtaining a superior quality of iron for the shafts of his ocean steamers. In 1858, about the time the Pioneer Furnace was completed, Mr. S. R. Gay, who had been engaged on that work, leased the Collins Forge and put up a cupola there in which he made some pig-iron. The company immediately thereafter constructed a blast-furnace under the direction of Mr. Gay. This furnace was completed and put in operation December 13th, 1858, with a single stack; all the necessary power being afforded by the Dead river, upon which the furnace is located.

On August 28th, 1854, **the Peninsula Iron Co.** filed articles of association, with a capital stock of $500,000 in 20,000 shares. The corporators were Wm. A. Burt, Austin Burt, Wells Burt, John Burt, Heman B. Ely, Samuel P. Ely, and Geo. H. Ely; the two latter of Rochester, N. Y., the others of Michigan. Office of the company, Marquette, Mich. The company originally owned 800 acres of iron lands, which it sold in 1862 to the Lake Superior Iron Co., and determined on building a blast-furnace at Hamtramck, Detroit, Mich., which furnace was completed in February, 1863, and is still in successful operation. The company also operated a sawmill for a few years, which they built on the Carp river, a short distance from Marquette.

Oct. 11th, 1854, the articles of association of the **Chicago and Lake Superior Iron Mining and Manufacturing Co.** were filed. Capital stock, $500,000, in 20,000 shares. The corporators were B. S. Morris, Isaac Shelby, Jr., Geo. Staley, Henry Frink, and Samuel S. Baker, all of Chicago, Ill.; and Solomon T. Carr and Fairchild Farrand, of Jackson, Mich. No permanent mining work was ever done by this company.

The Clinton Iron Co. Organized by forgemen from Clinton Co.,

New York, Jan. 20th, 1855. Capital stock, $25,000. *Corporators*, Azel Lathrop, Jr., H. Butler, Chas. Parish, and Daniel Brittol.

The object for which the organization was effected was to lease and operate the Jackson Forge. The company being composed of workmen, who at the time were employed in that concern and were locally styled the "Mudchunk." The market price of blooms being much below the cost of their manufacture, they were enabled to operate the forge but a brief period, and having become hopelessly involved in indebtedness, the company permanently suspended.

The Forest Iron Co. filed articles of association, September 22d, 1855, with a capital stock of $25,000 in 1,000 shares. The corporators were Matthew McConnell, Wm. G. Butler, Wm. G. McComber, M. L. Hewitt, and J. G. Butler. This company was organized for the purpose of putting up a bloom forge on Dead river, and the location became known as Forestville. McConnell, Butler and McComber commenced operations at this point as early as 1852 on their own private account, but becoming financially embarrassed, they sought relief by organizing a company as above indicated, who continued the manufacture of what was called half blooms, the production of which cost them from $180 to $200 a ton. These selling in Pittsburg for $35 to $40, on six months' time, it naturally resulted in the ruin of the company.

To the original projectors of the **Pioneer Iron Co.** belongs the credit of having established the first blast-furnace on Lake Superior; previous to that all the iron manufactured had been made in bloomeries. Mr. C. T. Harvey was the mover of the scheme, and the originator and manager of the company. He induced capitalists (chiefly in New York) to embark in the enterprise, Mr. E. C. Hungerford of Chester, Conn., being chosen Secretary and Resident Treasurer. Although the business was unknown to a single man on Lake Superior, the most sanguine views prevailed from the outset, and a two-stack furnace was constructed near the Jackson mine.

The late S. R. Gay and L. D. Harvey, now Superintendent of the Northern Furnace, were the builders; the work being commenced June, 1857, and completed so as to make the first iron in February of the next year.

Much of the material, including two millions of brick, was brought from Detroit and had to be hauled 13 miles from Marquette by teams; the engines were made at the West Point Foundry. The original stock was $125,000, in 5,000 shares; the articles were filed July 20th, 1857, the corporators being Moses A. Hoppock, Wm. Pearsall and Chas. T. Harvey. Most of the parties interested in the concern were totally ignorant of iron-making and as an instance illustrating the fact, it is related that one of the directors, during the period of construction, inquired when the furnace would be completed so that it might be sent up to Lake Superior; he supposing it was being made in Detroit. These unfavorable circumstances, combined with the financial depression of 1857, at which time the company were obliged to sell their iron for $22, while the cost of its production was $24 per ton, gave no return save anxiety and disappointment.

In the spring of 1860, the furnace was leased for four years to Mr. I. B. B. Case, he agreeing to deliver the pig-iron on board the vessels at Marquette for $17.50 per ton, and paying all the expenses of its manufacture; the company furnishing the timber, standing, for the charcoal, and giving him the advantage of a contract with the Jackson Company for the ore, the royalty for which ($1.00 per ton of iron) he paid. This price proved to be less than the iron could be made for. The furnace was burnt down August 9th, 1864; number two stack was at once rebuilt and put in operation in January following, by Mr. Case.

In 1865, Dr. J. C. McKenzie, then President of the Pioneer Iron Company, entered into negotiations with the Iron Cliff Company, which subsequently resulted, largely through the instrumentality of Major T. B. Brooks, Vice-President of the latter company, in an arrangement (ratified by the stockholders of both companies, March 10th, 1866) by which the Iron Cliff Company came into possession of the furnace, on consideration that it pay to its former proprietors one-third of the profits of the business. Soon after the two companies became practically one, through the purchase of the stock of the Pioneer by the Iron Cliff Company.

The Detroit Iron Mining Company filed articles 15th August, 1857. Capital, $500,000, in 20,000 shares at $25 each, with office in Detroit. Corporators were Patrick Tregent, Guy Foot, Joseph

P. Whittemore, John H. Harmon, John W. Strong, Oville B. Dibble, Nelson P. Stewart, Andrew T. McReynolds, Thornton T. Brodhead, Henry T. Stringham, Henry J. Buckley, Joseph L. Langley, of Detroit, and Edwin H. Thomson, of Flint. The company having ascertained, as they believed, that their lands did not contain sufficient ore for mining purposes, sold them to Mr. J. P. Pendill, and upon them is now built a portion of the village of Negaunee. The McComber mine, which lies at a short distance south of that village, is on this land.

The Excelsior Iron Company filed articles October 6th, 1857. Capital stock, $100,000; 4,000 shares, at $25 each. Corporators were: C. T. Harvey, Sarah V. E. Harvey, E. C. Hungerford, George P. Cummings, and Joseph Harvey, all of Marquette. This company did little but organize. It originated with Mr. C. T. Harvey, and some of the land which it owned has since proved to be valuable mining property, as it embraces the Barnum mine, now owned by the Iron Cliff Company; upon it is also situated a portion of the village of Ishpeming.

The Lake Superior Foundry Company filed articles of association July 14th, 1858. Capital stock (paid in), $10,000; 400 shares, at $25 each. *Corporators:* John Thorn, Isaac Maynard, Thomas Maynard, Nathan E. Platt, of Utica, N. Y., and Charles T. Harvey, of Marquette, Mich. This establishment, which was started in 1858, is now running on a much enlarged scale, under the name of the **Iron Bay Foundry,** D. H. Merritt, proprietor. The location is near the bay, within the city of Marquette.

The Grand Island Iron Company filed articles May 3d, 1859. Capital, $400,000; 16,000 shares, at $25 each; paid in, $110,000. *Corporators:* Thomas Sparks, Henry W. Andrews, William Lippincott, John L. Newbold, John D. Taylor, John R. Wilmer, Samuel Pleasants, William M. Baird, Samuel J. Christian, L. de la Cuesta, William A. Rhodes, Charles Lennig, James C. Fisher, Samuel T. Fisher, Lewis Seal, Coleman Fisher, Henry Maule, William Gaul, J. T. Linnard, Howard Spencer, Caleb Jones, Charles W. Carrigan, of Philadelphia, and Devere Burr, of Washington, D. C., with office in Philadelphia. The property belonging to

this company, consisting of 3,000 acres of land, situated on Grand Island harbor, in Munising Township, was sold in 1867 to the Schoolcraft Iron Company, and their operations were confined to some minor improvements in the way of wharves, etc.

The Northern Iron Company filed articles May 16th, 1859. Capital stock, $125,000, in 5,000 shares of $25 each. *Corporators:* John C. Tucker, Moses A. Hoppock, of N. Y., and Charles T. Harvey, of Marquette, with office in Marquette. This company was formed through the efforts of C. T. Harvey, and constructed a blast-furnace at the mouth of the Chocolate river, 5 miles south of Marquette, with a view of making pig-iron with bituminous coal, being the first enterprise of this kind inaugurated in this region. After making about 1,000 tons of iron, the furnace was changed into and run as a charcoal furnace up to June, 1867; since which time it has not been working, and it is now being changed back into a bituminous coal furnace. This is the first charcoal furnace on the Upper Peninsula that has been permanently blown out.

1863.—The great financial prostration of 1857, combined with numerous causes which readily suggest themselves, naturally embarrassed and, in instances, extinguished the new and struggling enterprises of Lake Superior to the extent, that comparatively little was done in the manufacture of iron or the mining of ore up to the opening of 1863. During this interval of time no companies of importance filed articles of association in this region. Very early in the war, however, the greatly increased demand for iron which it occasioned, began to be felt over the country and finally extended its influence to Lake Superior, causing the revival of the languishing enterprises already started and the organization of many new ones. The abundance of ore, together with its surpassing richness in iron and freedom from deleterious substances, the facility with which it could be mined and the greatly improved means of transportation, were becoming generally known, and the strength and exceeding tenacity of the iron manufactured therefrom universally acknowledged. Thus altogether there was opened to the Marquette region an outlook of prosperity, which it had not heretofore experienced, enabling its mining and iron manufacturing companies to assume a basis of more successful operation, and confidently to push forward their improvements.

The articles of association of the **Teal Lake Co.** were filed on the 7th of June, 1863, with a capital stock of $500,000, in 20,000 shares, and an amount paid in of $100,000. The corporators were George A. Fellows, John W. Wheelwright and Charles L. Wright, of New York, with office in New York. Beyond some explorations this company never did any work on Lake Superior, confining its operations chiefly to stock speculations, it being the only iron mining company organized in this region, whose stock was sold at the Brokers' Board in New York.

The articles of association of the **Morgan Iron Co.** were filed on the 1st of July, 1863, with a capital stock of $50,000, in 2,000 shares, and $26,000 paid in. Corporators were Joseph S. Fay, of Boston, Lewis H. Morgan, of New York, Harriet H. Ely, Samuel P. Ely, Ellen S. White and Cornelius Donkersley, of Marquette, with office in Marquette. The capital stock was subsequently increased to $250,000, in 10,000 shares fully paid. The company own 20,000 acres of timber land. In 1863 they constructed the Morgan Furnace, eight miles west of Marquette on the M. H. and O. R. R., and the location has since become known as "Morgan." The furnace was put up under the supervision of Mr. C. Donkersley and has been successful. It went into blast Nov. 27th, 1863, making that year 337 tons of iron, and was the first furnace company in the region to pay a dividend to its stockholders. The extreme high price of iron, created by the war, enabled the company to realize, during the first ten months of the operation of the furnace, a dividend of 100 per cent. over and above the total outlay in its construction. Having exhausted the fuel in the vicinity, the company constructed charcoal kilns upon their lands at a distance of nine miles north from the furnace, and provided for the transportation of the coal by building a wooden railway thereto. The kilns and railway were made in 1869, and most of the coal now used is prepared at these kilns.

In 1867 the Morgan Company built the **Champion Furnace,** which went into blast Dec. 4th of that year. This furnace is located at what is now Champion village, on the line of the M. H. and O. R. R., 31 miles west from Marquette. The ore used is mainly magnetic from the Champion mine, and the record of the furnace is one of gratifying success.

The articles of association of the **Marquette Iron Co.** were filed April 9th, 1864, with a capital of $500,000, in 20,000 shares of $25 each. *Corporators:* George Worthington, Truman P. Handy, Samuel L. Mather, N. B. Hurlbut, Richard C. Parsons, G. D. McMillen, John Outhwaite, of Cleveland, Ohio, and Charles I. Walker, of Detroit, Mich. This company was organized for the purpose of mining iron ore and owns 400 acres of land, lying contiguous to, and south of, the Cleveland mines, 240 acres of which was originally held by the latter company. Its stock is held by stockholders of the Cleveland Company. The year of its organization it shipped 3,922 tons of ore, and has been somewhat regularly in operation since that period.

The Magnetic Iron Co. was organized in 1864; the articles of the company were filed May the 6th of that year, with a capital stock of $500,000 in 20,000 shares. *Corporators:* John C. McKenzie, Alex. Campbell, of Marquette, and Edwin Parsons, of New York. Office in Marquette, but now in Philadelphia, Pa. The property owned by this company consists of 520 acres of land on Section 20, T. 47, R. 30. A shaft 60 feet in depth has been sunk, and other explorations made to test the ore-deposit and the company expect to take out ore, as soon as a branch road is built to the mine.

The Chippewa mining property comprises Section 22, T. 47, R. 30, W., owned by J. S. Waterman, of Philadelphia, and S. S. Burt, of Marquette; considerable exploring has been done on the property and some fair ore found, but no mining done. This property lies on the east side of Michigamme river and opposite the Magnetic and Cannon properties.

The Phœnix Iron Co. filed its articles of association June 7th, 1864. Capital, $500,000, in 20,000 shares, of which $20,000 was paid in. The Corporators were Wm. C. Duncan, Henry J. Buckley and Simon Mandlebaum, of Detroit, with office in Detroit. No mining or manufacturing was ever done in the Marquette Region by this company.

Washington Iron Company filed its articles of association July 30th, 1864. Capital stock, $500,000, in 20,000 shares, at $25 per share; amount paid in, $100,000. The Corporators were Edward Breitung, I. B. B. Case and Samuel P. Ely, of Marquette, Joseph S. Fay, of Boston, and Edwin Parsons, of New York.

This company made its first shipments of ore (4,782 tons) in 1865, and has since been in active operation. The land owned by the company comprises 1,000 acres in the northeast part of T. 47, R. 29, which was purchased of Silas C. Smith, J. J. St. Clair, J. C. McKenzie, and Alexander Campbell, who derived their title from the United States Government. The mine is on the M. H. and O. railroad, at a distance by rail from Marquette of 27 miles. All the company's surplus earnings have been expended in making extensive improvements, of which an adit or tunnel, now over 1,100 feet long, constitutes the chief. Their plans and expenditures have been on an extensive scale, and contemplate operations for a long period to come. The details of the mine, shafts, adit and underground workings, together with the geological structure, are fully shown by the map of the Washington mine, accompanying this report.

The Bancroft Iron Co. filed its articles of association September 12th, 1864; capital stock being $250,000 in 10,000 shares, of which $100,000 was paid in. The Corporators were Wm. E. Dodge, of New York, Samuel L. Mather, John Outhwaite and Wm. L. Cutter, of Cleveland, Peter White and Samuel P. Ely, of Marquette, and Henry L. Fisher and L. S. McKnight, of Detroit, with office in Marquette.

The location of this company is the same as that of the Forest Iron Co., heretofore described; the property of the latter having been purchased by Mr. S. R. Gay, in 1860, he erected on the water-power employed by the old forge a blast-furnace, this being the second furnace he had built on Dead river, the one at Collinsville having been constructed by him the winter before.

Mr. Gay * having died in 1863, his furnace at Forestville passed to the ownership of the Bancroft Iron Co., who have since continued

* It is a fact worthy of note, in connection with the services rendered by Mr. Gay, that he was the first among the iron men who visited Lake Superior to recognize the value of the hematite ores; while engaged in the construction of the Pioneer Furnace, he observed that the Jackson Co. were wasting their soft hematite in large quantities, they supposing it to be worthless. He at once called their attention to its value.

to operate it. The furnace is worked by Mr. L. Huillier on contract, the company paying him a certain price per ton for the iron delivered on the dock in Marquette.

The articles of **The Iron Cliff Co.** were filed September 15th, 1864, with a capital stock of $1,000,000, in 40,000 shares at $25 each. *Corporators:* William B. Ogden and John W. Foster, of Chicago, and Samuel J. Tilden, of New York. Office at Negaunee, Mich. This company in 1864 purchased of the St. Mary's Ship Canal and Mineral Land Co. the 38,000 acres of land which that company owned in Marquette county. Subsequently, as heretofore mentioned, the Iron Cliff Co. came into possession of the Pioneer Co.'s property, thus increasing its estate to over 40,000 acres. The company soon began the construction of a furnace near the Foster mine, which has never been completed. They own and are working the *Barnum* and the *Foster mines*, the latter of which was opened in the spring of 1865. The product is a soft hematite, which forms a good mixture with hard ores. This mine is situated on Secs. 22 and 23, T. 47, R. 27. The first shipment of ore therefrom was made in 1866, and the mine has since been continually worked.

The **Barnum mine** is situated on Sec. 9, T. 47, R. 27, connecting with the Lake Superior Co.'s principal opening. The first shipments of ore were made during 1868, the ore being specular and of excellent quality. The C. and N. W. R. R. has a branch running into the mine, over which shipments are made. The mine is supplied with pumping and hoisting machinery. The map of the Lake Superior mine, which will be found in the accompanying Atlas, embraces the Barnum mine.

On that portion of the estate purchased of the Excelsior Company, in addition to the Barnum, a deposit of specular ore has been found near the corner of Secs. 5, 6, 7, and 8, T. 47, R. 27, which promises well; a branch railroad has been surveyed to it. Besides those already mentioned the company have several other openings. One on Sec. 15, adjoining the Pittsburgh and Lake Angeline Co., opened during the past season, which gives a fine showing of hematite ore. The Cliff-Parsons, also opened during the past season, adjoins the *Old Parsons*, on Sec. 21, T. 47, R. 27.

Another opening is near the quarter-post between Secs. 17 and 18, T. 47, R. 26, from which ore was shipped during the season. A second opening is being made on this same line, at a point farther north, near the section corner. These openings belong to the Negaunee Hematite Group. In addition to their own mines the company are working the Pioneer opening of the Jackson mine on a lease. Near the Foster mine the company have in operation a sawmill, to which is attached shingle and lath mills.

In 1864 the *Ogden* and *Tilden* mines, situated on Secs. 13, 23, and 24, T. 47, R. 27, were extensively opened, and the branch road, which also extends to the Foster, built to them. The ores, however, proved of too low a percentage to sell in the then existing market, and the work was abandoned. The purchasers of the Iron Cliff estate also controlled the Chicago and Northwestern Railroad, and a short time previous to the purchase effected a consolidation with the Peninsula Road of Michigan, with a view to the future development of iron deposits on this extensive property, and the control of the railroad facilities for transporting the product of these and other mines to Lake Michigan.

The Iron Mountain Mining Co. filed its articles of association Nov. 1, 1864, paid in $100,000. *Corporators:* Geo. E. Hall, of Cleveland, O., Richard Hays, Henry A. Laughlin, and Irwin B. Laughlin, of Pittsburgh, and Gilbert D. Johnson, of Ishpeming. The company own 320 acres of land, being the S. ½ of Sec. 14, T. 47, R. 27. The first shipments of ore were made in 1865, a branch of the C. and N. W. R. R. extending into the mine. All work at this mine has been discontinued, owing to the leanness and refractory nature of the ore, its yield being less than 50 per cent. of iron in the furnace. This mine has been recently leased to Messrs. Clark and Colwell, under whose auspices work will be resumed in the spring of 1873, with the view of finding hematite.

The Michigan Iron Co. filed its articles of association Dec. 30th, 1864. Capital stock, $500,000, in 20,000 shares of $25 each. *Corporators:* Henry J. Colwell, Andrew G. Clark and Samuel P. Ely, of Marquette, with office there.

This company own a large amount of woodlands, two furnaces and considerable other manufacturing property. The Michigan

furnace was built by them in 1866, went into blast June, 1867, and has since been in constant operation; it is on the M. H. and O. R. R., 23 miles west of Marquette, and is surrounded by the village of Clarksburgh.

The remaining furnace owned by this company, known as the Greenwood, went into blast in June, 1865, and was purchased by the Michigan Co., together with about 8,000 acres of land of the M. and O. Rd., in 1868. Greenwood is 27 miles from Marquette, on the line of the M. H. and O. R. R., and the furnace has continued in blast since the time of its purchase by the present owners.

In 1864 **The Peninsula Railroad,** from its junction with the Marquette and Ontonagon Railroad at Negaunee to Escanaba (a distance of 62 miles), was completed and put in operation. The project which has resulted in opening this important outlet to the great iron mines was first definitely broached in 1855. In that year meetings were held at Ontonagon, Marquette, and all important points to Milwaukee, with a view to the united action of the people along the route, in the endeavor to obtain governmental aid in the construction of the railroad. These meetings were chiefly initiated by Mr. C. T. Harvey and H. B. Ely. Mr. Harvey, John Burt and others, immediately proceeded to Washington and were instrumental in obtaining from Congress the passage of an act, June, 1856, which donated a large amount of land in aid of railroad enterprises.

Among the projects for which provision was thus made in this grant were the building of a railroad from Marquette to Little Bay de Noquette, and also from thence to Menominee, as well as for the extension of a road from Fond du Lac to this latter point. In 1859, the Chicago, St. Paul and Fond du Lac Railroad Co. (which company had received from Wisconsin the congressional grant), through the agents of its bond-holders, organized under the name of the Chicago and Northwestern Railway Company, and in 1861, under a law of the State of Wisconsin, proceeded to locate a line by the way of Fort Howard to the Menominee river. In 1862 the State of Wisconsin conferred upon the C. and N. W. R. R. Co. all the franchises and rights heretofore granted to the several companies of which it had become the successor; and in the same year

the road was extended to Green bay, a distance of 242 miles from Chicago.

The Iron Mountain road was completed and became consolidated with the Bay de Noquette railroad in 1858. The location of the Marquette and State line grant was changed by act of Congress in 1860, so as to extend from Menominee northward along the shore of Green Bay, and thence to Negaunee; and in 1863 the Marquette and State line grant, with the remainder of the Bay de Noquette grant (being coincident with it from Negaunee to Escanaba) having been suffered to lapse, were, by agreement between the grantees, conferred by the State upon the Peninsula Railroad Co., of Michigan. Surveys were made in 1862 (the enterprise being set on foot by C. T. Harvey, who subsequently transferred it to S. J. Tilden, of New York), and work began in the summer of 1863, and in December of the following year the road was opened to the public. During the preceding October, however, the Peninsula road had consolidated with the Chicago and Northwestern, and the line from Marquette to Menominee became known as the Peninsula division of the C. and N. W. R. R. The lands owned by the Peninsula division embrace in the aggregate 1,200,000 acres.

An extensive ore dock was constructed at Escanaba, upwards of 1,300 feet in length, 32 feet in height, and 37 feet in width, capable of receiving in the pockets 20,000 tons of ore at a time, and of shuting it thence into the holds of vessels. This dock was built at an expense of about $200,000. Communication to this excellent and accessible harbor being thus opened, and such ample facilities afforded for the transmission and shipment, large and increasing amounts of ore have since been carried yearly over this route.

Corning Iron Co. filed articles of association March 23d, 1865. Capital stock, $200,000—8,000 shares of $25. *Corporators:* G. C. Davidson, S. Churchill and Chas. T. Harvey, with office in Marquette. This company did nothing worthy of note.

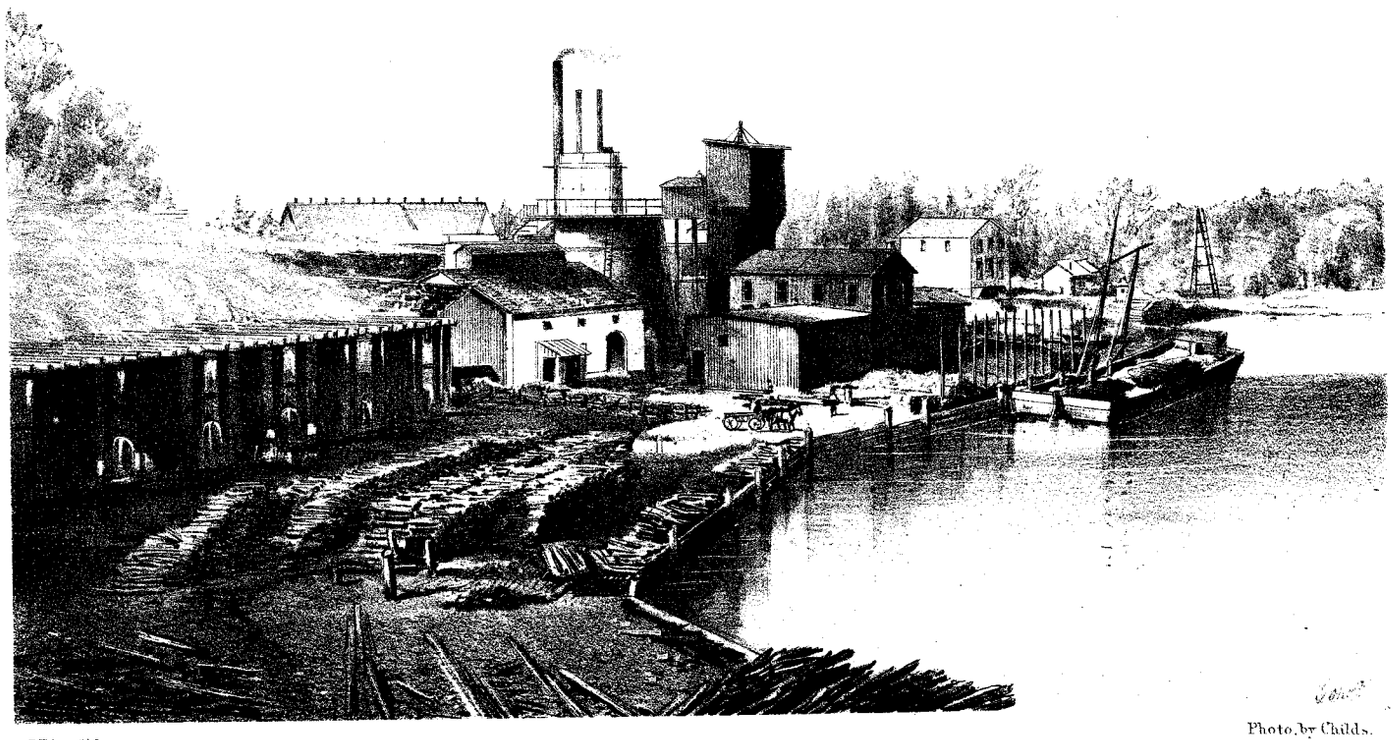
The New York Iron Mining Co. Incorporated April 8th, 1865. Capital stock, $250,000, in 10,000 shares of $25 each. *Corporators:* Samuel J. Tilden, J. P. Sinnett and J. Rankin, of New York.

The mining operations of this company are conducted in the southeast ¼ of southeast ¼, Sect. 3, T. 47, R. 27, being 16 miles west from Marquette and adjoining the Cleveland. The mine is worked under a lease from Mr. A. R. Harlow and the stock is all held by Mr. S. J. Tilden and Messrs. W. L. and F. W. Wetmore. Operations were commenced in the mine in 1864, during which year 8,000 tons of ore were shipped. The statement of its yearly product and other details will be found by reference to the tables in this work; the workings and geological structure are shown by a map. This company is identical with the New York and Boston Iron Mining Co., and also with the New York iron mine, incorporated March 31st, 1865; it soon after changed to the New York Iron Mining Co., as above described.

The Pittsburgh and Lake Angeline Iron Co. was incorporated Nov. 11th, 1865. Capital stock, $500,000, in 20,000 shares of $25 each. James Laughlin, *President*, T. Dwight Eels, *Secretary* and *Treasurer*. The company own 1,376 acres of land, situated in T. 47 and 48, R. 27 and 28, of the former Town., and R. 31 of the latter. They also hold a lease of about 300 acres, on which is located the Edwards mine. The company's mines consist of the Lake Angeline and Edwards; the *Lake Angeline* mine is situated on the south shore of Lake Angeline and on the line of the M. H. and O. and C. and N. W. R. Rs., 17 miles from Marquette and 66 miles from Escanaba, and produces both specular and hematite ore, the latter of first quality.

The **Edwards mine** lying contiguous to the Washington, is also on the line of the M. H. and O. R. R., distant from Marquette 28 miles, and produces only magnetic ore. Work was commenced in 1865, the first shipments being made in the following year. The mining is all conducted underground, the ore being raised to the surface through shafts and is the only mine in the Iron Region which has been exclusively worked in this way. The results of this company's operations are shown in the accompanying tables and the mine workings by maps and illustrations.

The Schoolcraft Iron Co. filed articles of association April 8th, 1866. Capital stock, $500,000, in 20,000 shares of $25 each. Paid in, $250,000; the remaining 10,000 shares being held by the com-



J. Bien, lith.

Photo. by Childs.

JACKSON IRON CO'S. FURNACES AND COAL KILNS

Fayette, Big Bay de Noquette, Mich.

pany. *Corporators:* Hiram A. Burt, Peter White and H. R. Mather, of Marquette; office at Marquette, Michigan.

A furnace was constructed by this company at Munising, Schoolcraft county, on Grand Island bay, which went into blast in June, 1868, and was blown out in about six months thereafter. The furnace continued "in and out" of blast somewhat irregularly, until the company went into bankruptcy. In 1871 the furnace and other property, including 40,000 acres of hard wood land, which had belonged to them, passed into the hands of Peter White, Esq., by whom it was transferred to the Munising Iron Co., an organization effected for the purpose of owning and operating this estate, which is now being successfully done. Mr. Peter White, of Marquette, is managing director.

The Marquette and Pacific Rolling-Mill Co. filed its articles of association Oct. 1st, 1866. Capital stock, $500,000, in 20,000 shares of $25 each. The corporators were John Burt, Samuel P. Ely, Wm. Burt, Edward Breitung, Timothy T. Hurley, Cornelius Donkersley, W. L. Wetmore, Peter White and Alvin C. Burt, of Marquette. Office in Marquette, Mich.

The company has constructed at Marquette a bituminous blast-furnace, with rolling-mill connected therewith. The works are located near the lake shore, at a short distance south from the city, went into operation in the summer of 1871, and are connected with the M. H. and O. R. R. by a branch track. Upon their land at Negaunee, the company have opened a mine of manganiferous hematite ore, to which a side track has been extended, connecting it with both railroads; from this mine the company's furnace at Marquette is in part supplied. This rolling mill is the first erected on Lake Superior, and the furnace the first which has continually used bituminous coal. H. A. Burt is superintendent.

The *Fayette Furnace* was constructed and put in operation in December, 1867, the enterprise originating with Major Fayette Brown, general agent of **The Jackson Iron Co.** It is located at "Snail Shell Harbor," in Big Bay de Noquette, 20 miles east of Escanaba, and about it has grown up the beautiful village of Fayette. It is owned by the Jackson Iron Co., with general office in Cleveland, Ohio. The company own 16,000 acres of land, excellently well timbered with hard wood, and generally adapted to

agricultural purposes, the soil being of limestone formation. From the ledges of limestone, which exist in the immediate neighborhood, material for the necessary flux is obtained, as well as for the manufacture of all the lime used by the company. They possess a full complement of charcoal kilns, and a large portion of the necessary wood is purchased, the company preferring to save their own timber as long as possible. This wood is delivered by the parties of whom it is bought at the furnace, or along the line of the company's railroad, of which they have constructed for this purpose six miles, laid with T-rail, and operated with two small locomotive engines, it being the only furnace on the Upper Peninsula that operates a locomotive railway for the exclusive purpose of transporting fuel. The company have also a saw-mill, machine-shop, etc. The furnace, as originally started, consisted of a single stack, which is shown in the accompanying illustration. A second one was subsequently erected, and both stacks have since been in operation with results more favorable, than any other charcoal furnaces using Lake Superior ore. The extraordinary favorable working of these furnaces will be fully realized from the following statements, furnished from the company's reports: During the 73 days immediately preceding April 13th, 1872, there were made in the No. 1 stack an average of $27\frac{6}{10}$ tons per day, using 94 bushels of charcoal and 125 lbs. of limestone per ton, the ore being from the Jackson mine and yielding from 62½ to 64½ %. On August 4th following, the same stack again went into blast, making, during the first quarter, a period of 91 days, 2,258 tons of iron, an average of 27 ^{8} tons per day, using by measure 92 bushels of charcoal per ton. No. 2 was also in blast during a portion of the same period with corresponding results. On December 14th No. 2 stack had produced, during the previous four weeks, an average of $26\frac{39}{100}$ tons per day, and on January 18th, 1873, had produced, during the previous five weeks, an average of $29\frac{34}{100}$ tons per day; the charge used during this time was 26½ (called 30) bushels of charcoal, 1,000 lbs. of ore (⅓ soft and ⅔ hard specular Jackson), 35 lbs. of limestone and 10 lbs. of clay.

These results require no comment relative to the efficiency of the management. The coal is of the best quality, kept dry under shelter, as is also the ore, which is crushed finer than is customary. The stacks are each 42 feet high inside and 9 feet 6 inches bosh;

4 feet 8 inches, and 5 feet 8 inches diameter, 3 feet below the top, and 4 feet and 5 feet at the top respectively. The hearths are 4 feet diameter battering from the bottom; the tuyeres, three in number, with 3½ inch nozzle, are placed 40 inches above the bottom of the hearth. Two blowing engines are used, the cylinders respectively 36 and 48 inches in length, with diameter of 50 and 44 inches. The engines make from 24 to 28 revolutions per minute, and both of them are only run when the two stacks are in operation. The temperature of the hot blast averages in one about 600° and in the other 750°. Originally No. 2 stack had a five-foot cone, but did not make as much iron, nor as cheaply, as the other, until the cone was reduced in height to 4 feet 4 inches, since which time it has worked equally well with the other. The total product of these furnaces during 1871 and '72 was 19,117 tons, which were used as follows:

For Bessemer Steel.....	17,465	tons.
" Malleable Iron	88	"
" Wheels.....	787	"
" Foundry, etc.....	400	"
" Forge purposes.....	377	"

Genl. Agt., Major Fayette Brown, Cleveland, Ohio. Local Agt., C. L. Rhodes, Fayette, Mich. Founder, Jos. Harris, Fayette, Mich.

The Deer Lake Iron Company.—Articles of association were filed July 9th, 1868. Capital, $75,000—3,000 shares at $25 each. *Corporators:* George P. Cummings, of Marquette, Edward C. Hungerford, of Chester, Conn., Gardner Green, Caleb B. Rogers, Moses Pierce, Samuel B. Case, Theodore T. McCurdy, John E. Ward, James Lloyd Greene, James C. Colby (Ex'r), Daniel T. Gulliver, William R. Potter and Enoch F. Chapman, of Norwich, Conn.; Giles Blague, Jr., New York, Geo. Smith, New York, G. F. Ward, E. R. Ward, Old Saybrook, Conn., and James H. Mainwaring, of Montville, Conn., with office at Marquette, Mich.

This company organized for the purpose of smelting iron ore, and immediately constructed a furnace, which went into operation in Sept., 1868. This furnace, the smallest in the district, is located at Deer lake on the Carp river, two miles north from the village of Ishpeming on the M. H. and O. R. R., with which place it is

connected by a tram railway. The stack is 33 feet high and 7 feet 8 inches bosh, thus making it perhaps the smallest furnace which has been built in the United States during the past 7 years. Another peculiarity of this furnace is the comparatively enormous size of its hot-blast oven, to which is doubtless due in part the favorable results, which, considering its small size and peculiar management, the furnace has accomplished. The oven, on the Pleyer plan, contains 45 tons of metal, which is 50 per cent. more than that contained in the ovens of our largest charcoal furnaces; having twice the capacity of the Deer lake stack. The furnace is driven by water, employing an 18-inch turbine wheel under 35 feet head, thus leaving all the gas available for heating the blast, which is brought to an extremely high temperature. It runs but six days in the week, "banking up" Saturday night and starting again on Sunday night. Notwithstanding an arrangement necessarily disadvantageous to the greatest production, the furnace has averaged during several consecutive weeks 11 tons of pig-iron per day, using 110 bushels of charcoal to the ton, one-half of which is made from pine slabs,—the ore used being hard ore from the New York mine, averaging 66 per cent. The origin of this enterprise is due to Mr. E. C. Hungerford, who also determined its unusual size and the peculiar policy under which the furnace has been managed. Near the present one the company are now building a new iron shell furnace, 9 feet bosh.

The Cannon Iron Company.—Articles filed July, 1869. Capital, $500,000; 20,000 shares, $25 each. *Corporators:* Bernard A. Hoppes and Wm. H. Berry, of Philadelphia, and Samuel S. Burt, of Marquette, with office in Philadelphia. This company organized for the purpose of mining iron ore, but beyond making explorations on their lands with this view, nothing has as yet been done.

Bay Furnace Company.—Articles filed July 19th, 1869. Capital stock, $150,000; 6,000 shares at $25 each. *Corporators:* William Shea, of Munising, Mich., George Wagner, Jay C. Morse, Frank B. Spear and James Pickands, of Marquette, John Outhwaite, of Cleveland, and John P. Outhwaite, of Ishpeming, Mich., with office in Marquette.

This concern organized for the purpose of smelting iron ore, and

immediately proceeded to the construction of a blast-furnace for that purpose. This furnace was completed and went into operation on the 6th of March, 1870. It is located at Onota, in Schoolcraft county, on Grand Island bay, 40 miles from Marquette. But one stack was originally constructed; a second one, however, has since been erected and put in readiness for the blast. The ore used is from the Cleveland and McComber mines, received by the way of Marquette. This company own about 20,000 acres of land, mostly hard wood timber, from which the fuel for the furnace is obtained.

The Whetstone Iron Company.—Organized Aug. 20th, 1869. Capital stock, $150,000, in 6,000 shares of $25 each. Office at Marquette. This company have not commenced operations. Corporators were William Burts, Samuel Peck, A. A. Cole, Thomas O. Hampton, Clark Stratton, A. S. Harvey and A. G. Benedict.

Champion Iron Company.—Organized August 23d, 1869, with a capital stock of $500,000, in 20,000 shares of $25 each. *Corporators:* Joseph S. Fay, of Boston, Edwin Parsons, of New York, Thomas C. Foster, of Cambridge, Mass., and Samuel P. Ely and Peter White, of Marquette. The company own about 1,600 acres of land, but their mining operations are conducted on that portion of their land comprising the south half of Sec. 31, T. 48, R. 29, being 32 miles by railroad from Marquette. The ore is principally magnetic, though a large amount of slate ore is obtained. The Champion mine is upon the south outcrop of the magnetic ore basin, which underlies Lake Michigamme, and near the village of Champion, about half a mile distant from the furnace of that name. The company are now working chiefly underground, as is fully shown in Map VII. of Atlas, where the geological structure and all other important details will also be found.

The Lake Superior Foundry Company filed their articles of association Sept. 2d, 1869, with a capital stock of $50,000—2,000 shares at $25 each. *Corporators:* Daniel H. Merritt, Lotan E. Osborn, Henry J. Colwell, William L. Wetmore, Jay C. Morse, Alfred Kidder, James Pickands and Thomas Fitzgerald, of Marquette, Mich.; Gilbert D. Johnson, Seymour Johnson, Harvey Diamond and Robert Nelson, of Ishpeming. The works (located at

Ishpeming) are quite extensive and adapted to general and particular foundry and machine work. (See Iron Bay Foundry, p. 33.)

Silas C. Smith Iron Company.— Articles of association filed Jan., 1870. Capital, $500,000, in 20,000 shares at $25 each. *Corporators:* Silas C. Smith, of Ashtabula, O., Oliver F. Forsyth and Wm. H. Lyons, of Flint, Mich., with office at Ashtabula, O.

The property of this company consists of 703 acres of land in Sections 18, 20, and 28, T. 45, R. 25, upon which have been made numerous openings, showing soft hematite ore in quantity, the main one being near the E. ¼ post of Sect. 18. A tunnel is being driven into the deposit, of sufficient size for the admission of railway cars from a branch road five miles in length, which connects with the Chicago and Northwestern railroad. The ore at present is loaded into the cars from temporary docks, provided with pockets for that purpose. The principal stockholders are Silas C. Smith, the discoverer, General James Pierce, of Sharpsville, Pa., and Henry Fassett, of Ashtabula, O. The shipments of ore and other details will be seen by reference to the mining tables.

The Pittsburgh and Lake Superior Iron Co. filed articles of association June 28th, 1870. Capital stock, $500,000, in 20,000 shares of $25 each. *Corporators:* James McAuley, C. T. Spang, C. G. Hussy, Thos. M. Howe and James M. Cooper, of Pittsburgh; Sherman J. Bacon, of New York, Joseph G. Hussy, of Cleveland and W. M. Sinclair, of Philadelphia; with office at Pittsburgh, Pa. The company own 2,691 acres of land in Towns. 47 and 48, Ranges 25 and 26, their title to which was derived direct from the United States Government. Work was commenced on their property near the Cascade mines in Sept., 1872, houses, etc., were erected, a railroad side track built and a pit opened on Sec. 32, which is called the Hussy mine, and from which about 2,000 tons have been shipped.

The Republic Iron Co. was organized Oct. 20th, 1870. Capital stock, $500,000, in 20,000 shares. Office in Marquette. *Corporators:* E. Breitung, S. P. Ely and Ed. Parsons. This company own 1,328 acres of land, being in part in Sections 6, 7, and 18, T. 46, R. 29, comprising what was formerly known as Smith mountain, which

is unquestionably one of the largest deposits of pure specular and magnetic ore on the Upper Peninsula, if not in the United States. The great extent and value of this deposit was observed and commented on by the early United States surveyors, when engaged in running the township lines in that locality in 1846. The property was explored and selected by Silas C. Smith, of Marquette, and entered in the name of Dr. James St. Clair, in 1854 and 1855. A branch from the M. H. and O. R. R. has been constructed to the mine, over which the shipments of ore are now being made. See Tables, Plts. XII. and XIII. of Atlas. A complete map of this property, based upon careful surveys, exhibiting the topography, geological structure, magnetism and other important details, will be found in the Atlas accompanying this work, together with full descriptions.

The Cascade Iron Co. is an association of Pittsburgh men, owning 3,120 acres of land in Sections 19, 20, 29, 30, 31, and 25, T. 47, Ranges 26 and 27. These lands were entered by Waterman Palmer and purchased by the present company in 1869. An examination of the iron deposits in this locality was made by Dr. Douglas Houghton, in 1845, while engaged in running the interior section lines. (See Appendix D., Vol. II.)

The company's mines are provided with side tracks, connecting with a branch road of six miles in length to the C. and N. W. R. R. Mining operations commenced in 1871, and the openings (including the leased mines) are seven in number. There are other improvements, such as a saw-mill run by water, a store, sufficient number of dwellings, barns, repair-shop, etc. The expenditure which these improvements (including the branch railroad and side tracks) have necessitated has been very large, and future operations are contemplated upon a scale of considerable magnitude. (See Statistical Tables.)

The Cascade Company, under another organization, to wit, **The Escanaba Iron Co.,** are constructing a blast-furnace at Escanaba, to consist of two stacks, one of which will go into operation in January, 1873; the height of stack, 56 feet; diameter of bosh, 12 feet. The entire structure is built in the most complete and substantial manner, and when finished, will probably not be surpassed, if equalled, in capacity, durability, or beauty, by any similar furnace in the United States. The principal owners are Joseph Kirk-

patrick, William Bagaley, James Lyon, William Smith, Samuel Riddle and Samuel Hartman; Joseph Kirkpatrick, *President*, James Lyon, *Treasurer*, and John L. Agnew, *General Superintendent*.

The Emma Mine, one of the Cascade openings, is on the E. ½ of E. ½ of N. E. ¼, Sec. 31, and is being worked under a lease from the Cascade Company by an association of Pittsburgh gentlemen, who are represented at the mine by Mr. James E. Clark. They commenced shipping ore in 1872.

The Bagaley Mine, likewise one of the Cascade openings, is also worked under a lease from the Cascade Company, by Messrs. Wilcox & Bagaley, and its total product is about 6,000 tons.

The Gribben Iron Co., having a capital stock of $500,000, in 20,000 shares of $25 each, was organized 1872. The mining property comprises a lease on the S. E. ¼, Sec. 28, T. 47, R. 26, being on the Cascade range. Mining and exploring operations during the season have resulted in taking out considerable ore, some of which has been shipped for testing. The company have built a side track, which connects with the Cascade branch of the C. and N. W. R. R. Officers of the company are: W. C. McComber, *President*, C. H. Hopkins, *Secretary*, and James Mathews, *Treasurer;* all of Negaunee, Mich.

The Carr Iron Co. was also organized in the summer of 1872, with a capital stock of $250,000. Its real estate comprises forty acres of land, situated on Sec. 33, T. 47, R. 26, being also in the Cascade range. The officers are Amos Root, *President*, Jackson, Mich.; E.W. Barber, *Secretary*, Jackson, Mich.; and W. H. Maynard, *Managing Director*, Marquette.

Negaunee Hematite Mines. A large number of new companies have recently been organized for the purpose of mining hematite ore in the vicinity of Negaunee. These new locations, which have been and are in process of being developed, are situated in Sections 6, 7, 8, and 18, T. 47, R. 26, and comprise what are known as the McComber, Grand Central, Rolling Mill, Himrod, Ada, Negaunee, Calhoun and Spurr, Green Bay, Allen, the Iron Cliff "Sec. 18," and other mines. The McComber mine, opened by William C. McComber in 1870, is worked on a lease from J. P. Pendill, of Negaunee, at a royalty of fifty cents per ton for ore. The mine has been worked for the past three seasons, and in the spring of 1872 the lease was sold to parties interested in the Cleveland mine, who in July organized a company. The Rolling Mill mine, heretofore spoken of, is worked in part under a lease from A. L. Crawford. The company, however, own the greater portion of the land.

All these workings, except Sec. 18 and the McComber, are worked on leases from Edward Breitung, at 75 cents per ton royalty, he having leased from the owners, Messrs. Harvey and Reynolds, at 50 cents per ton royalty. Some of these pits have been worked during the past season, and nearly all of them are prepared for active operations during the coming year. Railroad side tracks are either completed, or in process of construction, to the several mines; dwellings and other improvements have been made, or are contemplated at each, and several of the locations bid fair to be the scene of active mining operations. The product is for the most part a soft hematite, containing usually from one to five per cent. of manganese, which renders the ore more easily worked in the furnace and is probably beneficial to the iron. The yield of metallic iron of the best of these ores is 50 per cent. and upwards, the average, however, is below that. See Map No. V. and Table Pl. XII. of Atlas.

Among the promising iron properties upon which work has been commenced during the present season, and from which large shipments may be reasonably anticipated, are the Michigamme and Spurr Mountain mines, at both of which work has actively commenced; side tracks are being constructed at both places, connecting with the M. H. and O. R. R. The mines are situated upon the same magnetic range and are about two miles apart.

The property of the **Spurr Mountain Co.** (which company was organized in September last) comprises 160 acres of land, and the point at which mining operations have been commenced is at what is known as Spurr mountain. The preliminary work has uncovered the south side of a very large mass of magnetic ore of a great degree of purity; rising at the highest point to a height of 60 feet above the surface of the ground at the base of the hill. This remarkable outcrop of ore is situated (as will be seen by reference

to the accompanying map) 900 feet east and 700 feet north from the west and south boundaries respectively of the company's property. It was first discovered to the public in 1868. The examinations which have been made, established beyond any reasonable doubt the presence of the ore in a very large quantity and of a uniform purity and quality. The natural facilities afforded at Spurr mountain for commencing mining operations are excellent, and with the exception of Republic mountain there is, so far as known, no other locality in Marquette county where occurs so large an exposure of pure ore, rising at so great an elevation above the general level and at which there is apparently so little preliminary work necessary.

This range has been explored to a considerable extent in either direction; westerly, across the east half of Sec. 23, owned by the M. H. and O. R. R. Co., the examinations show the presence of the ore, but to how great an extent the deposit exists future workings alone can determine; easterly, as is elsewhere more fully related, the range has been traced along the north side of Lake Michigamme for several miles. The officers of the Spurr Mountain Co. are: H. N. Walker, Esq., of Detroit, *Prest.;* Col. Freeman Norvell, *Supt.* and *Sec.* The distances from the mine to the ports of L'Anse and Marquette are respectively, by rail, about 24 and 39 miles.

The Michigamme Co. was organized in the winter of 1870–71, the organization being effected mainly by persons already largely identified with Lake Superior iron interests. The land owned by the company comprises 1,400 acres, situated on the north side of Lake Michigamme. Preliminary work was begun in the spring of 1872, and prosecuted during the summer. The point selected for the commencement of mining operations is near the shore of the lake, and upon each side of the line between Sections 19 and 20, the developments resulting from this work thus far being of the most promising character. Improvements, not previously indicated, consist of a large, substantial steam saw-mill, with other machinery attached thereto, an office, dwellings, etc. At a short distance south and west from this location the company have laid out a village plat, to be called "Michigamme," and which promises to be built up with considerable rapidity. The distance to L'Anse is about 26

miles, and to Marquette 37, by rail. The officers of the company are: William H. Barnum, of Lime Rock, Conn., *Prest.;* James Rood, of Chicago, *Sec.* and *Treas.;* and Jacob Houghton, *Supt.*

The Keystone Iron Co. also organized in the fall of 1872, with capital stock of $500,000, in 20,000 shares of $25 each. The property comprises the southeast ¼ of southwest ¼, Sec. 32, T. 48, R. 29, distant from Marquette, by rail, 29 miles, from Escanaba 77, and from L'Anse 35. The company are at work preparing for mining the ensuing season. A. P. Swineford, Marquette, *General Agent.*

A number of mining enterprises, comprising **The Albion, Saginaw, Lake Superior Company's new openings, The New England, Winthrop, Shenango, and Parsons,** in Secs. 19, 20, 21, 16, T. 47, R. 27, are situated east and west, parallel and contiguous ranges of specular and hematite ore, are all connected by branches with the M. H. and O. R. R., and soon to be with the C. and N. W. Road.

The Albion mine, opened in 1871 by the brothers St. Clair, who hold the property comprising the northeast ¼ of the northwest ¼, Sec. 19, on a lease from Messrs. E. Breitung and S. L. Smith; at a royalty of 75c. per ton; up to the present time but a small amount of ore has been mined. The opening is immediately west of the Saginaw mine and on the same ore belt.

The Saginaw Mine, situated on the northwest ¼ of the northeast ¼ of Sec. 19, T. 47, R. 27, was opened in 1872, and during the same season shipped (via M. H. and O. R. R.) 19,000 tons of specular ore. The mine was worked on a lease by Messrs. Maas, Lonstorf and Mitchell, of Negaunee, on a royalty of 50c. per ton for the ore. During the fall of 1872 the lessees sold out to parties representing the Cleveland Rolling Mill Co. for $300,000, and immediately thereafter the Saginaw Mining Co. was organized with a capital stock of $500,000 in 20,000 shares. A. B. Stone, of Cleveland, *Prest.*, and A. G. Stone, of Cleveland, *Sec.* and *Treas.* A side track has been surveyed, to connect with the Chicago and N. W. Railroad, and the grading finished to the Winthrop mine. The land on which the Saginaw mine is located was purchased of the State of Michigan, with four other contiguous "40's" situated about the