

LAKE SUPERIOR COPPER MINING INDUSTRY.

The copper mines of Lake Superior are of comparatively recent origin, yet they are rapidly attaining a world-wide reputation, not only in respect to the large yield of mineral, but for the peculiar excellence of the refined copper which they offer to consumers in home and foreign markets. These mines are a source of wealth and power to the State, and are deserving of the fostering care of the government. They, in connection with the celebrated iron mines of Marquette county, give prominence and chief value to that vast integral portion of the State of Michigan known as the Upper Peninsula. They have been the means, above all others, of redeeming the north-land from a savage state, and extending the blessings of civilization to our most remotest borders. Such a country, of so great and varied resources requiring development, and with such a brilliant future, may safely be commended to the intelligent consideration of the legislature, and of every patriotic citizen of our great State. The Centennial Exposition drew to our shores many gentlemen of rank, learned and distinguished as geologists, mineralogists, and mining engineers. Before departing from the United States they visited the mines of Lake Superior, and, after a careful examination, they gave expression to the most flattering comments in regard to the mineral resources of the country, and of the skill and energy displayed, as well as the wonderful progress made in the art of mining. It is not possible that our own people are less appreciative of this inheritance than foreigners.

The remoteness of Lake Superior from the older and more populous sections of the State; the vast wilderness in both

the peninsulas intervening without connecting roads and the natural channels of inter-communication—the lakes and rivers being closed by ice for one half of each year—are serious obstacles which have operated to separate the people of the two sections, preventing familiar intercourse and perfect unity. Indeed, these natural barriers have given rise to some sectional feeling, and good and patriotic men have entertained the belief that the Upper Peninsula should be set off, and the new territory of Superior created. But it is hoped that a just and equitable spirit may govern the counsels of the *majority*, and the speedy construction of the contemplated Marquette and Mackinaw railway may remove any irritation that may possibly exist. The railroad just mentioned, completed, would be truly a *union road*; it would bring the two sections into close daily communication, and would be materially advantageous. It is the iron link now indispensable to a more perfect union of interest and sentiment.

The object of this paper is to sketch the early history of the copper mines, portray pioneer efforts in that section, note the progress made in settlement and civilization, give some account of the mines, including their present condition and future prospects; trace outlines of topography and geology, present a statement as to climate, soil, agriculture, internal improvements, population, general business and resources—in short all such information as may be of interest. Of course, a paper of this kind must necessarily be brief and incomplete, for, to describe in adequate terms this wonderful region, would require a large volume and a pen more able than that held by the present writer. *He* will find reward for labor bestowed should he succeed in attracting a more earnest attention to the merits of the Upper Peninsula, in which beloved portion of our State many years of his active life were passed.

Prior to the discovery of copper on the south shore of Lake Superior, the chief sources of supply of this valuable metal were the mines of Cornwall, England, those of Continental Europe, and Chili, in South America. There were

workers in brass in the days of Tubal Cain, before the Flood; brass implies copper, hence it is inferred that copper mines were worked at an early day in the history of man. We know that the Lake Superior copper fields were wrought by a people of whom we have no history, termed the “ancient miners.” It is supposed by Mr. Jacob Houghton that these “ancient miners” lived in the stone age of the race; may we not gravely surmise that they were the progenitors of the Tubal Cains of the bronze age, and that the copper used in the formation of brazen images was imported from America, via the fabled island of Atlantia, which for the time being, like so many other islands and continents, is hidden under the sea?

In the year 1841, Dr. Douglass Houghton, the eminent and lamented state geologist of Michigan, after ten years of hard labor in the wilderness, presented his report to the Legislature, and the eyes of the people were opened. It was ascertained definitely and certainly that copper and iron *in situ* existed in the Upper Peninsula; that veins of these minerals could be worked with profit and success, and that the region would eventually become the theatre of prosperous mining.

The existence of copper upon the shores of Lake Superior has been known for more than two hundred years. Marquette, Mesnard, Allouez and other eminent Frenchmen wrote about it; Carver, Henry, Cass, Schoolcraft, and others that might be mentioned, observed copper “float” on the shores of the Lake, and pieces of the metal in the hands of the Indians. But these discoveries led to no practical results; the narratives and records of these daring and accomplished explorers and geographers were interesting and instructive; they were printed and mapped, read by the few, and then put away in the library. Mr. Alexander Henry, an Englishman, in the years 1770–72 did, however, undertake regular mining on the Ontonagon river, a stream flowing into Lake Superior from the south shore. He was deluded by a large mass of float copper lying on the clay banks of the river. He sank a shaft through the clay and came to

sandstone, but found no vein. He was not on the Trap or copper bearing range; he was unsuccessful in his venture, and after losing time and money he left the country.

It would seem as though the time was not yet ripe; that the rich copper field that had lain fallow for so many ages, (since the day of the ancient miners), must still continue to be hidden by the "drift" and the dense forests of the region. The Indian, with superstitious awe, must still remain in dread of the evil Sawabic; wave after wave of immigration must advance westward in steady progression before the rocky hills of Lake Superior shall receive intelligent examination, and awake to the clinking of the miner's hammer and drill and to the booming of explosives.

But Dr. Houghton's report, above mentioned, was the tocsin that called the hardy pioneer to conquests on new and inviting fields in the far-off Lake Superior region. The business of exploring and mining is new to him, but he enters into it with the same zeal and indomitable energy as that displayed by his brother who builded his log cabin in the oak openings of southern Michigan, or set his plow in the fat soil of the prairies of Illinois.

It is worthy of mention that the opening of the copper mines was an event which preceded only by a few years the discovery of gold in California and Australia—a discovery that set the whole world in motion—and then was there witnessed a gigantic movement of peoples which in magnitude and beneficial results surpassed the Crusades. The wealth of the world was greatly augmented; there was a new distribution of the inhabitants of the earth, and vast territories, hitherto remote and almost unknown, speedily became populous states with sovereign influence.

Only about thirty-six years ago the vast territory washed by the waters of Lakes Huron, Michigan and Superior, in the northern division of Michigan, was an almost unbroken wilderness. The missionary and fur-trading village of Sault Ste. Marie had existed since 1668; the founder of the mission was the noble father Marquette. There was an humble mission at L'Anse, situated midway between the east and west

end of the lake on the south shore, and a mission at La Pointe on one of the Apostle Islands, founded by Allouez in the year 1665. At Fort William, on the north shore, there was a trading post belonging to the Huron Bay Fur company. In the year 1844, a small stockade was completed at Copper Harbor, and named Fort Wilkins; one company of U. S. infantry was posted there. About the same time, perhaps a year or two earlier, an United States land office or agency was established on Porter's island, on the north side of the harbor. These establishments formed a nucleus of settlement—the stars and stripes waved a welcome from the tall flag-staff to all comers. The writer well remembers, after a lapse of thirty-one years, the thrill that ran through his breast as he beheld the good old flag floating above the trees on his approach to Copper Harbor, after tedious coasting along shores that were well termed "a howling wilderness." Copper Harbor was a safe and convenient port, and copper was found right on its shores. It immediately became an objective point—a depot of supplies, and the busy centre of field operations. During the season of 1845 and '46, the rocky, wooded shores of the Harbor were gleaming with white tents and teeming with life; it was a grand encampment of eager adventurers. In 1846, a sub-land agency was established at the mouth of Ontonagon river. This river afforded a good harbor for small coasting boats, and speedily became a lively camp—after Copper Harbor it became a second *point d'appui* for copper or mineral explorers. From these two harbors the large fleet of canoes, Mackinaw boats, whale boats, *batteaux* and small sloops sailed and paddled all around the mighty lake, visiting every cove, bay, creek and river. There were no roads in the wilderness, hence exploring parties clung to the water ways as long as possible, and when it became necessary to take to the land their boat was hauled ashore and, with surplus provisions, *cached* or covered with brush. The explorer, then shouldering his pack, his pick and shovel and compass, struck out boldly into the forest. If the U. S. surveyors engaged in making the linear surveys had preceded him, he followed a "blazed" line; but

if the country had not been thus marked, the compass, or *instinct*, was his only guide. Days and weeks were passed in toilsome march through the "deep tangled wood," trap out-crops and ranges were carefully searched for veins, rapid topographical sketches were made and mineral locations selected for entry at the land office, or as a basis for a "permit," which being granted by the government would enable him to mine for copper and other ores. After a day of toil and hardship, he made his camp fire by some stream; a cup of tea, some hard-bread and pork constituted his simple diet, unless he was fortunate enough to garnish his feast with a brook trout captured from the stream at his feet, by no means a rare occurrence. Every rivulet and brook in this well watered country swarmed with these gamey "speckled beauties." The spruce and fir groves were well supplied with ruffed grouse and porcupines, both so tame that they could be knocked over with a stick, or spitted on a Jacob staff. The woods swarmed with mosquitoes, black flies and gnats, and while there was a certain harmony in the droning of these insects, their direct attacks did not tend to "soothe the savage breast" of the irritable homo. Sweet-smelling evergreen boughs—pine, spruce, cedar or hemlock,—spread upon the leaves, with a log for a pillow, a pair of blankets wrapped around him, formed an inviting couch. Other covering there was none, save the solemn trees and the vaulted arch of heaven. Exposure to storm and rain could not be avoided, but the sublime reverberations among the hills of a Lake Superior thunder storm reconciled the drenched explorer to a wet jacket. The grand and noble views often granted to him as he attained some superior eminence, a Mt. Pisgah of the wilderness, fully compensated for all his toil in the low grounds and pestilent cedar swamps. The bright sunlight alone, after days spent in the gloomy forest, is most cheering. He seats himself on the edge of a cliff, lights his home-made pipe, fashioned out of the knot of a maple, and slowly puffing, looks. Far below him and stretching away to the south as far as the eye can reach, lays a vast unbroken forest, the variegated foliage, softened by

distance, resembles a beautiful natural carpet, which the looms of Persia or Turkey could not copy. In another direction sharp, conical peaks, towering aloft, are clearly defined against the blue sky, and awaken hopes in the breast of the ever practical explorer, or copper hunter, of new and rich finds in their hidden recesses. The great solemn lake bounding the northern horizon, so distant that the rippling of a summer breeze on its face is not seen, looks like the "deep, dark blue ocean." But the copper hunter has other joys; when he is so fortunate as to find a rich vein of mineral his excitement and delight is such as not to be described. The result of such a discovery is generally a sudden rush for the lake shore, a launching of the boat, and a hasty descent upon the first land office, in order to record "location."

After this hard campaign, look at our explorer as he lounges about the agency—his apparel is coarse and tattered, his face bronzed and bearded, but his health is perfect, and he comes from the woods robust and iron-nerved as an Indian returning from a long successful hunt. He is a perfect picture of our northern pioneer—brave, alert, sagacious and enterprising; sometimes stormy and belligerent.

In the earlier days of settlement, indeed, until quite recently, Lake Superior could be practically reached only by the way of the lakes. Embarking at Detroit, the chief commercial city of Michigan, the voyage carried us through Lake St. Clair and the beautiful river of the same name; across Lake Huron and up the picturesque St. Mary's river to the falls. The Sault Ste. Marie was the head of navigation in that direction. Passengers and freight destined for the upper country had to be transferred across a portage one mile long. Subsequently, a tram road was built across the divide, later still, so rapidly does the business of the mines increase, the United States government made a large land grant to aid in the construction of a ship canal. This canal, with two stone locks, was opened for navigation in 1855. Since the completion of this important work steamers and vessels of the largest class, have passed through it into Lake Superior. Prior to its completion Lake Superior

was navigated by a small fleet of inferior steam and sail vessels, most of which had their origin in the lower lakes and were hauled across the portage. At this date, 1878, the canal is being enlarged, the water deepened to 16 feet, and one immense lock 515 feet long, and 80 feet wide constructing. The lower reaches of the river, in shoal places, are being dredged to 18 feet. The United States treasury is supplying funds for the work, and it is under the supervision of U. S. engineers. Daily lines of large, safe and neat steamers now sail from Buffalo, N. Y., Cleveland, O. Detroit, from Chicago, Ill., and Milwaukee, Wisconsin, to all important points on Lake Superior. There is likewise a large fleet of sail vessels engaged in the same trade.

The Superior country is now approached by four railroad lines, namely: by the Chicago and Northwestern, at Marquette, the Wisconsin Central at Ashland, the Northern Pacific and the St. Paul and Duluth, at Duluth. There are also local railways of importance in the Upper Peninsula, namely: the Marquette, Houghton and Ontonagon R. R. and the Mineral Range Railroad.

The copper mines under consideration are situated on the south shore of Lake Superior and on Isle Royale, in the Upper Peninsula of the state of Michigan, United States of America. Active mining is prosecuted in the counties of Keweenaw, Isle Royale, Houghton and Ontonagon. Copper ore has been found in Marquette and Baraga counties. About Lat. 47° W. Long. 88° West Greenwich.

The copper or Trap range, reaching from the extremity of Keweenaw point to the Porcupine mountains, is about 150 miles long, having a variable width of from four to seven miles. There is another district in Michigan known as Isle Royale, the Minong of early travelers. These travelers viewed this island with peculiar favor, regarding it as the most promising ground for the production of copper; for these reasons, doubtless. On the rocky shores of the island the belts of trap were denuded—cleaned of earth or drift—so that the small veins with copper glistening in the gangue can be seen by the most casual observer. The

shingle beaches also contained much float and pebbles of copper metal which could not fail to attract the notice of the *voyageurs* as they, wind-bound, paced up and down the beach or loitered around the camp fire. Isle Royale is 40 miles long by 5 miles in width.

If we take a map of Michigan and look for Lake Superior, our attention will be fixed by a long narrow point, which, starting from the south shore, projects in a northeasterly direction nearly half-way across the lake. If, as some of the old writers described it, the configuration of Lake Superior is a bent bow, then this point is the shaft, with the feather end held in the Porcupine mountains. This shaft is the famous Keweenaw point, the chief *localité* of the copper mines. In strictness and in accordance with local acceptance, the term Keweenaw point only applies to the land lying northeast of Portage Lake. But, since the completion of the ship canal across the portage, the term must be changed; for, in fact, Keweenaw point is an island. So, for convenience, we shall assume that Keweenaw point is an extension with the Trap range. This trap range forms the back bone of this particular section; its average elevation above the lake is, say 600 feet; some peaks or ranges, as for example, mount Houghton, Wheal Kate and the Porcupines, attain a height of from 800 to 1,200 feet. The trap range is flanked by comparatively low, level country, underlaid by the red sandstone formation. On the coast line, at various points, picturesque cliffs of red and variegated sandstone tower above the lake, with deep water at the base. For reaches of several miles, these cliffs present a bold front to the lake and, in stormy weather, the mighty waves beat and surge up against them with sullen, impotent rage. In winter, when these rocks are covered with ice, formed by spray freezing as it fell, or by a crystallized water fall, they present a very prized yet rare appearance. In the earlier days, when small boats were used in coasting, these frowning, iron bound shores were the terror of navigators. At numerous points along the trap range, owing to the tilting of the formation, at an angle of say 55° from the horizon, occur

picturesque knobs and cliffs from one to two hundred feet in height. These cliffs face to the southeast, have rough, weather-worn, broken outlines, and very much resemble battlements. On the northwest side they slope gradually down to the lake level, or conforming sandstone. Small lakes and beaver ponds are common features of the landscape. Streams springing from them meander at first slowly through the tangled copse, but coming to the junction of the sandstone and trap on the southeast they leap down in foaming cascades, a sheer descent of one hundred feet, or more, and then hurry away to mingle with the flood of the great lake. There are no large streams having their source in the trap range, owing to the narrowness of the water shed. There are some noticable breaks in the trap range, the greatest of which is the great gorge or trough of Portage Lake. This trough strongly resembles and suggests the work of a glacier. The Ontonagon river also crosses the range at the bottom of a deep gorge, which must have been formed by a dynamic agent greater than the present river. Originally the country was densely wooded, but in the vicinity of the mines the land is being rapidly cleared for economic purposes.

As a rule, the drift on the range is deep; vegetable mould on top, sand, gravel, clay, hard pan and boulders down to the bed rock. But at many points the conglomerates and trappean rocks are denuded; at other points immense deposits of erratic boulders, the talus of ice-bergs are spread over the surface. Yet the range is by no means so rugged as might be inferred; there is much level country, and the engineer experiences no serious difficulty in making common roads and railroads. It is true, steep gradients must be overcome in ascending from the lake level to the summit of the range, but after that is accomplished the rest is easy.

Such were the physical features of the copper country when the pioneer entered into possession of the land. It was not a land flowing with milk and honey; far otherwise. It was a hard, forbidding wilderness to grapple with; it

called for the exercise of the most exalted courage, the most enduring soul-strength. It was a land of isolation, of snow and frost, of almost desert barrenness in regard to a supply of the simplest food necessary to support life.

GEOLOGY.

As mining was to be his chief business, a knowledge of the rocks and vein phenomena had to be acquired. As a rule, this man was not familiar with the science of geology and mineralogy, or with the arts of mining and exploring; of these he scarcely understood the first principles. But this tyro, who was in time to become the skillful explorer and successful manager of mine affairs, was a bold man and full of expedients. Everything was to be learned by practical experiment, by diligent application, and at the expense of toil, hardships and sufferings untold.

The geology of the country was not well understood even by men of science; many novel features were presented that would have puzzled a Dana or a Lyell. What wonder then that our pioneer miner, under these adverse circumstances, did often at first blunder and stumble, fail, and lose his time and money. In view of his final, splendid achievements, a mantle of charity should be permitted to cover his early mistakes.

As a preliminary step to mining, veins and lodes of value had to be discovered. The explorer after some dear-bought experience learned that in the trap range only he must look for metalliferous veins of character. He had been wandering far and near, indefinitely, in search of cupriferous and argentiferous deposits, in regions as likely to contain what he wanted as the limestones of Niagara or the sandstones and shale of lower Michigan. His efforts must be concentrated; the trap range, described on a former page, is his stage. The trap range, or "mineral range" consists of beds of trappean rocks, or melaphyr of varying thickness, with belts of conglomerate intercalated. The conglomerates vary in width from a mere line to several hundred feet. The trappean rocks of the series also vary in thickness from twenty to more than one hundred feet, and are often highly

amygdaloidal in character. These beds have a general northeasterly or southwesterly course, following the general sweep or curvature of Keweenaw point; they dip to the northwest, at varying angles, in different localities, from 45° to 55° . At Portage Lake the course, or trend, of the belts is N. 35° east.

In this formation copper and associated silver are found in either fissure veins, contact veins, or in amygdaloid and conglomerate lodes or belts.

The true, or fissure veins of working value, are confined to that sub-division of the copper region known as the Keweenaw district, in Keweenaw county. These veins cut across the formation with a course north, a few degrees west, with a slight dip to the east. Mines based upon these fissure veins, as for example, the "old Cliff" and Central, have proven of great value and persistence in depth. The famous *mass copper*, which has astonished the world, is produced by these mines.

Workable contact veins are rare; but the Minnesota mine, once so famous as a producer of mass copper, and situated in the Ontonagon district, Ontonagon county, was in a contact vein, as are also its neighbors, the National and Rockland mines.

The amygdaloid and conglomerate beds, belts or lodes of the Portage Lake district, third in order of cupriferous deposits, and latest known, are very productive and persistent in depth. In the language of the country the amygdaloidal and epidotic beds containing copper are called "lodes," while the conglomerates are termed "belts." These belts and lodes have the same course and dip as the "country," or associated rocks, and are a part and parcel of the formation. They are unlike true veins, having no regular well defined walls. These lodes and belts that are so rich in copper, do not, in character of "vein rock," to a casual observer, seem to differ one particle from neighboring belts which contain no copper. Why copper, in ample quantity, should seek a home in *this* belt and not in *that*, is a mystery. Who will please solve it? These belts and lodes, contain-

ing small mass and stamp copper, have been worked, thus far, most extensively and profitably in the Portage Lake district, but they are found of value in Ontonagon county, as well as in Keweenaw. They are also found, both conglomerates and amygdaloid, in the district of Isle Royale; small fissure veins have been wrought on that island.

In the Poreupine mountain district, beds of grayish sandstone have been found, containing from three to four per cent. of copper. The grains of copper are exceedingly comminuted, and evenly blended with the indurated sand. The Nonesuch mine rock affords an example.

In the Iron River section veins of silver ore have been discovered, quite recently, in beds of sandstone and slate. Their value is prospective.

In the early days, the fissure vein was the one exclusively sought for; it was considered *the one thing needful*. In fact, nobody knew anything about metalliferous beds of copper, and as a matter of course they did not trouble themselves about the unknown. The discovery of fissure veins was a comparatively easy task. The south side of the range presented many bold escarpments—tall ranges of cliffs formed by the tilting of the formation—veins crossing the formation and dividing the cliff would be detected in exposed places; or the deep "breaks" filled with earth, would point out the probable line of the fissure. The "Cliff vein" was found in the face of the cliff, on the property of the Pittsburgh and Boston Mining Company, four miles southwest of the port of Eagle river. In 1846 the mine was a success, although only recently discovered, and its vein became an exemplar for the explorer. To its honor, be it said en passant, the Cliff mine was for many years a beacon light that encouraged mining pursuits in other places on the peninsula, and prevented, in times of doubt, uncertainty and financial difficulty, and entire abandonment of the country.

But had our early explorer possessed more light—known about belts and lodes of a cupriferous character, stupendous blunders, in following after the *ignis fatuus*—fissure veins—would have been avoided, and millions of dollars

saved; and the country would have been a decade ahead of what it now is, in progress and population.

Owing to the dense underbrush, and the deep drift—from 4 to 20 feet—covering the country, the finding of underlying beds of rock, with metalliferous lodes, was a costly and difficult and doubtful operation, necessitating expensive trenching, heavy pit work and handling of water. Skillful engineering is also in demand; and the only guide or clue that the explorer often has, is a piece of float rock or stone picked up on the surface, showing traces of copper, to the lode he is searching for.

"Float copper" is found all along the range for one hundred and fifty miles, in size from a pigeon's egg up to a "mass" of 18 tons. Old gold hunters have remarked, in view of this phenomenon, that if, instead of copper, this "float" were gold, the whole country would be torn up and washed with the hydraulic apparatus of California. Fortunately for those owning farms on the range, nature is not so prodigal of her chief treasures. Yet the gross value of the float copper, hidden in the drift and under the waters of the great lake, must be very considerable.

The explorer of to day is a man quite accomplished in wood-craft, has a practical knowledge of the surface of the country and of the underlying rocks, of the working mines and the veins and the beds in which mining is being carried on. He can use a theodolite and make a map, and unless controlled by some absurd theory, or visions, such as dreams are made of, he is trustworthy—of course the explorer of to day has the light of all past experience in the mining region to guide him.

Upon entering a field for discovery, if there are no outcroppings to afford a clue to a vein or belt, the explorer scours the woods for specimens of "float" copper with vein rock adhering. The track of the glacial drift in this region is from the east, northeast. This track is plainly to be seen, in favorable situations, by the beautiful grooves scored in the surface of solid rock, and in spots where the course of the heaped up boulders of trap and conglomerate have

been arrested. A favorable specimen found—and the more angular and less rounded the specimen is, the better—the explorer turns his steps in the direction whence the drift came; if, as he advances, the float evidences of a vein accumulate, are less rounded or worn, he is pretty sure that the object of his search is near. He now proceeds with greater care, noting every "sign" like an Indian on a trail, till he comes to a line beyond which there is no "float" of the kind he has been following. He pauses, for this is an indication that he has passed over the lode he is in quest of. Retracing his steps, he, in accordance with his best judgment as to depth of drift, sticks an initial stake, and directs his men to sink a pit there down to the solid rock and drift therefrom towards the vein.

The vein, or lode, found, the next step is to sink pits on the longitudinal course of the vein, at as many points on the property as may be desirable to prove the lode superficially.

Should the several pits encourage the beginning of mining, the next process in that vein is the clearing of the forest and undergrowth; the building a wagon road out to the nearest settlement; the erection of a few log huts or cabins for the workmen, and the sinking of two shafts, say four hundred feet apart on the lode, and one hundred feet deep from the surface, or "grass;" connecting the same, at that depth, by means of a drift, and not neglecting some stoping, in order the more thoroughly to prove the value of the lode before venturing upon more extensive mining, costly surface improvements and mine plant.

Quite recently, the diamond steam drill has been used successfully, as an instrument in explorations. The dip needle has never been much used in the discovery of copper lodes. Yet the rocks cause a marked deflection of the magnetic needle, which deflection is greatest near some well-known working mines. The common compass is not trustworthy as a surveying instrument on the trap range. Burt's solar compass and the theodolite are the instruments relied upon in geodetic work. All the land has been sub-

divided and marked in accordance with the United States system of linear surveys. The section and town lines are of great assistance to the explorer, and those lines, as a rule, form the demarkation or boundary lines of the several mining "locations."

The copper produced by the mines of Lake Superior, is virgin or native copper, almost chemically pure as it lies in the vein. Stamping, washing and smelting are processes only necessary to free the copper from its rocky matrix and put it into a merchantable shape. The copper of commerce is turned out of the smelting works in the form of ingots, bars, bolts and cakes.

Experience has pretty well settled the fact that if a lode does not show on the surface or back copper in quantity or percentage large enough to justify regular and profitable mining, it would be a waste of time and means to sink deeper in the vain hope of finding richer ground. Much money has been squandered in our copper districts by mining in lodes that were poor to start with. The error ought to be avoided in future. It is true, instances are known when the surface show, by careful analytical trial and a practical treatment of a quantity of the vein rock, has proved to be all that was desirable; yet it was further shown that after one or two levels had been opened in the mine, and the rock stoped out and sent to the stamp mill in considerable quantities, the percentage of copper was found to be so low as not to cover the cost of mining. Of course, such a result was disastrous; the fair inference is that the trial experiments were faulty.

It sometimes happens—we hope rarely—that mines of no intrinsic value are kept alive for the purpose of speculation in stock, or for the support of impecunious employes. It is pretty well settled that really good veins, lodes and belts, as, for example, the Central, the Cliff, the Calumet & Hecla, the Pewabic, and others that might be mentioned, all rich on the surface, do not fail as depth is attained, but on the contrary are, if anything, richer at the greatest depths. This is a noteworthy feature of our good mines, but there are some exceptions.

It is not to be denied that there is always risk, more or less, in mining ventures; but the gains are often enormous—and the net gain is far in excess of legitimate losses, so far as the copper mines are concerned. Has mining on Lake Superior been more hazardous than others of our great industries? Has it not done much to encourage settlement, and hasten the march of civilization? And is it not as respectable a business as any other, when prudently and honestly followed for legitimate ends? Certainly the production of gold, silver, iron, copper, and other useful metals, is of great benefit to the world at large.

In the preceding pages of this paper allusion has been made to the so-called ancient miner. A brief notice of this man who, no doubt, was respectable in his day and generation, may not be improper in this place. This man who wrought in the copper mines probably belonged to the Stone Age of the race. If born at a later period he was—although very sagacious in the matter of finding copper bearing lodes—a rude miner, using rounded stones or boulders for hammers, and mining by means of fire and water, calcining the vein rock with a fire made of wood, and rending the vein by throwing water upon the heated rock. He managed to mine from 10 to 20 feet in depth, or down to the water line. Further he did not go on account, probably, of the difficulty he had in keeping his pits and trenches clear of water. He had no means of cutting up or removing any considerable masses of copper. There have been found in ancient pits masses of copper from one to three tons in weight, which show evidences of his work. The stone hammer marks can be distinctly seen; the angular pieces of the mass have been removed; in some cases the mass has been partly raised, and the blocking which shored it up remains; broken hammers, rude copper tools and plenty of charcoal are found in the pits. What a grief to the enterprising, yet unskillful miners, to be obliged to abandon so fair a treasure! These ancient pits are found by our explorers by observing on the surface of the ground circular, or trench-like depressions, in line for a distance of several hundred

feet. They are filled with sand, debris of rocks and vegetable mould. Large trees have been found growing in these pits. These works are common all along the Trap Range. The most recent discovery, in this line, was made by the Hon. Samuel W. Hill, at the Minong mine, on the north side of Isle Royale, near McCargo's cove. "Here," according to Mr. Jacob Houghton, "for a distance of one and three-fourths of a mile, and for an average width of four hundred feet, the succession of pits indicate the mining out of the belt, (solid rock,) to an average depth of not less than twenty feet. Scattered over this ground are battered stone hammers, numberless, but running into the millions. This work was carried on by vast numbers of people, and extended through centuries of time." The present writer will indulge in no theories as to who these ancient miners were, whence they came, and whither they departed, but content himself with a statement of the fact of their once having occupied the Lake Superior country, together with the few evidences out of many adduced above, in confirmation of that fact; our Indians had no knowledge of the existence of copper in veins or belts; their knowledge was confined to float pieces in the soil.

It is a curious fact that all successful working copper mines on the Lake had been previously wrought by the ancient miner. In this instance do we again see how history repeats itself. The modern explorer has been benefited by these ancient workings which, in many instances have been sure indications of valuable lodes beneath, but not always. Proof exists that the ancient miners often sank pits on poor veins, being no wiser, in these instances, than we are to-day.

When the Lake Superior country was first opened to settlement, no titles in fee simple were given to settlers or mining corporations, nor was pre-emption allowed. The public lands were not, as usual, controlled by the Land Office, but by the War Department. As before stated, an agent of the War Department, and a corps of surveyors and draughtsmen, were stationed at the U. S. agency. *Permits*, as they

were called, were issued in Washington; these permits at first covered nine square miles, but afterwards were reduced to one square mile. So great was the demand for permits, it was soon found that the whole south shore of Lake Superior would not (if the issuing of nine mile permits were continued) be big enough to give each one of the numerous and importunate applicants a slice. These permits were authority for taking possession of any lands not otherwise claimed. The holder of a permit was allowed one year for exploration, and three years more to mine, with the privilege of two renewals of three years each, making the whole term of occupancy ten years. The Department required returns to be made to the Mineral Agency giving an account of the work performed and mineral raised, and a payment to the mineral collector, at the rate of twenty per cent. mineral value. The term of the grant, or lease, was presumed to be ample to enable the fortunate holder thereof to realize immense gain—such wealth as would enable him to leave his mine, plant and improvements without regret, free to the next comer. Afterwards commissioners were sent out to appraise the mineral lands and fix a money value on them. Five dollars per acre was the valuation. Later, all lands were open to pre-emption except mineral lands. Finally, all lands, without exception, remaining unsold, (save school and canal lands,) were thrown open to pre-emption and sale, and could be purchased for one dollar and a quarter the acre. Lands held under permits required personal occupancy. After so many changes of policy it will be seen the Government settled upon this—the wisest plan of all. The fixing the minimum price of one and a quarter of a dollar per acre gave all an equal chance to obtain land, the poor man as well as the rich; it promoted settlement, and was not so encouraging to mere speculators in lands who, as a rule, are a drawback to the country. The same wise system extends over all the territories wherever the government owns land; gold and silver lands are held at the same price as agricultural lands; aliens as well as citizens may purchase. By the laws of the State of Michigan no corpo-

ration could hold more than ten thousand acres of land; but a recent amendment to the law permits mining and manufacturing companies, who use charcoal largely in the reduction of ores, to hold fifty thousand acres.

In the days when permits were issued *they* were much sought for. The holder of one of these pieces of paper considered himself a rich man. So valuable was the whole copper district considered to be that it mattered little where one plastered his permit. People were simply wild—hence, after an examination, many a rich location was found to be entirely worthless, was not on the Trap Range, or was covered fathoms deep under Lake Superior; money was made by sale and transfer of these permits, but the last holder had the grim satisfaction often of knowing *himself* "sold."

The first pre-emption of mineral land was made by Captain Rickard, in February, 1851.

The linear surveys were extended over the Range, and completed in the autumn of 1848. Dr. Douglass Houghton, the state geologist and contractor to make the surveys, perished by drowning October 13, 1845, but the surveys were completed by his able assistant, Mr. Bela Hubbard, of Detroit.

The season of 1848 was, perhaps, the most active of any in the work of exploring lands; it was the culmination of the first grand rush to the copper mines. On the approach of winter all that could do so, departed from the country. The government troops stationed at Fort Wilkins had, about mid-summer, been ordered to Mexico to assist in the war then waged against that country. The government agent also left, never to return permanently, for in the next year the agency was removed to Sault Ste. Marie. Even the only press on the lake, the *Lake Superior News and Mining Journal*, was removed to the same place.

The first working companies organized for the mining of silver, copper and iron were managed by boards of trustees; were incorporated under the laws of different states, and issued such number of stock certificates as suited the corporators. One company, for example, had 1,200 shares, par

value one hundred dollars; another 3,000 shares, the par value of which was ten dollars. It was not until several years later that the State of Michigan enacted the wise and salutary mining laws now on the statute book, fixing the number of shares of each organization at 20,000, with par value fixed at \$25 per share. These laws have been amended so as to permit actual working companies to consolidate, and thereby virtually increase the number of shares; a later amendment also authorizes the organization of mining companies upon a basis of \$2,500,000, divided into shares of the par value of \$25 each.

In the fall of 1848 we find in the copper region only three small villages—namely, Copper Harbor, Eagle Harbor and Eagle River—all lake ports. From that day to this Copper Harbor has made but little progress—the harbor is the best on that stormy, iron-bound coast, and is much esteemed as a port of refuge. Other settlements there were none, except where a mine was being worked. There were no continuous roads from one village to another, or between the mines—an Indian trail, or bridle path winding through the woods, was the only path open. There were few horses or oxen; provisions and mine supplies were packed on men's backs. The old bush rangers found steady employment. Travelers were obliged to go on foot; all pedestrians, in winter, were compelled to use snow-shoes. Dog trains were used in the transportation of the mails, and for other purposes. The dwelling houses and offices in the mine locations were generally few in number, and of the most primitive character, being constructed of logs. The dense forests were cleared a little space, giving just room enough for the little cluster of cabins. The food of the officers and miners was of the simplest kind—pork, bread, beans, coffee, tea and sugar—all imported. The lake and streams furnished a good supply of fish—trout and whitefish. Potatoes were rare, and fresh meats were out of the question with most people during the long winters of that region.

There was a semi-weekly mail; it was hauled three hun-

dred miles, through a wilderness, on a dog train. Travelers "for below" or civilized lands in the south, were obliged to "snow-shoe it" the same distance. To reach the land office at the Sault, the same conveyance was resorted to, and a month was sometimes consumed in accomplishing a journey that now, by rail, would be made in twelve hours. The isolation of our pioneer miners was somewhat oppressive; the deep snows and fierce storms of winter did not tend to soften the feeling. Yet the people were hospitable to a fault, and were always more than glad to receive a visitor.

It is not deemed necessary for the purposes of this paper to give a detailed description of what we term the pioneer mining companies, operating in the year 1847. A brief running notice must suffice.

THE PITTSBURGH AND BOSTON MINING COMPANY

Had worked a vein of black oxide of copper at Copper Harbor, just east of Fort Wilkins. A few tons of this ore had been raised, when not proving profitable, the company transferred its men and supplies to another location, afterwards known as the Cliff mine.

THE ISLE ROYALE MINE

Was in the immediate vicinity of Copper Harbor, but it was soon abandoned. In the next decade a mine of the same name attained prominence on the south side of Portage Lake.

THE LAC LA BELLE AND BOHEMIAN MINES

Were situate on the south side of the range, in the conglomerate and syenitic rocks, on the high lands overlooking that charming inland sheet of water, called Lac La Belle. These mines were in fissure veins, and the copper was in the form of yellow sulphuret and grey ores. Although work in these mines has been discontinued and resumed more than once, thus far they have not reached a paying point. A small smelting furnace was erected there about eleven years ago, and quite a village built, but nothing is doing there at the present time. The government voted 100,000 acres of land to improve the outlet of Lac La Belle, and piers were built and the rim dredged so that

large steamers entered the lake. Between Copper Harbor and Eagle Harbor several veins were worked at different points, but they never reached the dignity of mines.

THE NEW YORK AND LAKE SUPERIOR COMPANY

Was operating at Agate Harbor; the mine is not known to-day.

THE NORTH-WEST COMPANY

Was mining in a bluff back of Grand Marais harbor; in an open cut quite a handsome show of copper was to be seen. This mine has been idle for many years.

THE EAGLE HARBOR COMPANY,

At Eagle Harbor, was working quite a large force, and their property bid fair to be one of the great mines of the country. The harbor proper is a good haven, though small. The village was handsomely situated at the west end of the bay. Mining was being conducted near the lake shore, in a fissure vein, with considerable mass copper showing. But as a mine, this vein was not a success. The Eagle Harbor property covers nine square miles, and is considered valuable. Being favorably situated on the Trap Range, the chances are that good paying mines will yet be developed on this great property. Eagle Harbor is the shipping port for the Central, Copper Falls, Amygdaloid and other mines.

COPPER FALLS MINE

Is situated on the high lands overlooking Lake Superior, a few miles west of Eagle Harbor. This mine has been worked since its organization down to the present time with varied success. The works are in a fissure vein and in the ash bed. Ball's steam stamps are used on the mine; at this point they were first introduced on the Lake. Although at times the show of copper in the mine has been rich, yet the company has never been fortunate in receiving many dividends from profits—\$100,000.

NORTH-WESTERN COMPANY,

Working a location a few miles southeast of Eagle River; vein or fissure, carrying heavy mass copper. The enterprise did not prove a success, although in the opinion of

good mining men it ought to have succeeded. It may in the future, if work upon the vein is ever resumed.

LAKE SUPERIOR COMPANY.

This is the Pioneer company, par-excellence; situate $1\frac{1}{2}$ miles south of Eagle River. There were twenty buildings on the property; seventy men employed; two shafts sunk, 125 and 150 feet respectively; ore raised from the mine was considered very valuable, as follows: Silver \$568, Copper \$200, per ton of rock. This mine had a small stamp mill and a saw mill, the first of the kind in the region. Mr. C. C. Douglass, one of Dr. Houghton's assistants in the geological survey, was the superintendent. But this mine failed in reaching a permanent position. In later years, farther back in the country, under the greenstone bluff on the same property, a new mine was opened on a handsome fissure vein and called the Phoenix.

THE PITTSBURGH AND BOSTON OR "CLIFF MINE."

This celebrated mine had got fairly started in 1846, and was situated on a nine mile permit tract, four miles southwest of Eagle River village. The mine was upon a true vein, and was just under the greenstone bluffs. It has been a very successful mine; its history is well known. The company has divided among its stockholders \$2,280,000. The mine has attained great depth, and has been worked on a limited scale for the last few years.

NORTH AMERICAN COMPANY.

This concern was operating half a mile west of the Cliff, upon a fissure vein carrying mass copper, but it has never reached a paying point and is now idle.

THE ALBION AND MEDORA,

Working a little further west, under the same greenstone cliffs, upon north and south fissures. Quite a large sum of money was expended at these points but without adequate success. These mines are not active now.

FULTON MINING COMPANY,

Occupying a nine mile tract, and working a small fissure vein, southwest of the Albion. Work was discontinued after two or three years trial; the property to day is considered by good judges to be valuable.

OHIO TRAP ROCK COMPANY,

Working upon a seam of serpentine of no value; a mistaken venture; soon abandoned.

NEW YORK & MICHIGAN COMPANY,

Working at the junction of the sandstone and trap four miles northeast of Torch Lake. Some stamp rock was found, but not enough to meet the cost of mining; location abandoned to be revived, like so many other old concerns, at some future day, under a new name. It subsequently took the name of Washington and is now the St. Louis, but these changes have not brought success.

DOUGLASS HOUGHTON COMPANY,

Mining under a branch of Trap Rock river, at the junction of the sandstone and trap formations. Not successful. Theory of the early geologists was, that at the junction of these rocks copper would be found abundantly; but the theory has not been sustained by facts.

PORTAGE LAKE DISTRICT.

In the winter of 1846 and '47 almost unknown; one or two small parties of men wintered there, one of which, lived in a miserable hovel on Wheel Kate mountain.

SILVER MOUNTAIN,

A knob of diorite found some twelve miles west of the head of Keweenaw bay, not on the copper range, was the scene of mining operations. Silver was looked for, but the expectations of the adventurers were evidently not realized, for the location was found abandoned in the autumn of 1847.

IN ONTONAGON COUNTY,

Much exploring had been done on the head waters of Misery, Flint Steel, Fire Steel and Ontonagon rivers, as well as upon Iron river and in the Porcupine mountains further west, down to the close of the season of 1847.

THE ALGONQUIN COMPANY,

On Flint Steel; working quite a force of miners; mine in an epidote lode, with outcrop in a bluff, and producing stamp copper mainly with small masses, termed barrel work.

DOUGLASS HOUGHTON COMPANY

Near the Algonquin, working on a small fissure. This mine belonged to the same corporation as the one before mentioned, of same name, situate on Torch Lake. In passing I would remark that in those days of "permits" mining corporations managed to claim a large amount of land, and a single corporation had lands, at points, from the northeast end of Keweenaw point to the Porcupines; so that if they failed at any given point, they would remove to another and try again. They proposed not to have all their eggs in one nest; or in other words, they chose to have several strings to their bow. As we have seen in the foregoing pages, the Pittsburgh and Boston company abandoned their first work at Copper Harbor and removed to the Cliff mine, where they attained eminence and wealth. But all were not so fortunate in changing base. Upon the

ONTONAGON RIVER,

Twelve miles from its mouth, much preliminary mining was going on in the epidotic rocks of that section, but no marked success had as yet attended the efforts of the miners. The discovery of the great Minesota mine, at a date a little later, in that vicinity, brought out that section strongly upon the canvas, and was the beginning of a new era in the copper mines.

This closes our summary of the history of what may, not improperly, be termed the pioneer enterprises of Lake Superior.

ONTONAGON DISTRICT.

In the winter of 1847-8 Mr. Samuel O. Knapp discovered the Minesota lode. Evidences of the existence of a valuable lode were numerous. The works of the ancient miners attracted his attention, and an exploration of the old pits and trenches revealed many curious and suggestive remains; the most interesting, because of practical importance, was the uncovering of a considerable mass of almost pure copper which the ancient miner had worked at but finally abandoned. In the spring of 1848, as soon as the snow was gone, he explored for the supposed lode, and his

labors were rewarded by the discovery of the great Minesota lode, which eventually became one of the greatest copper mines in the world, producing for many years enormous products of mass copper and much native free silver. Hitherto in the copper districts of Lake Superior mass copper had been observed only in fissure veins. But here was presented a new feature—and this copper region has, from first to last, always been full of surprises or novelties in chemical geology—a lode running *with* the formation, not a true vein, carrying, as its chief burden, masses of copper of great purity and several hundred tons in weight. The lode lies between conglomerate and trap beds, and has the same strike as the range, with a dip to the northwest.

The Minesota mine was eminently prosperous for fifteen years, or more, and during that time it divided among its shareholders the sum of \$2,000,000; it was the *bonanza* mine of its day. The success of this mine encouraged new hopes in the breasts of mining adventurers, and was a great stimulus to new enterprises all along the range. During the succeeding decade many important discoveries were made, and a better knowledge of the country acquired. Great addition was made to the now long list of mining corporations whose papers are filed in the office of the secretary of State, and whose locations are platted upon the large map of Lake Superior copper mines.

After, as has been observed, enjoying a period of almost unexampled prosperity, the fortunes of this great mine began to wane; the annual product of mineral decreased more and more until finally the old management retired, or in the terse language of the country, "got out of it." It is a mooted question whether the mine was really worked out. It is assumed by some that the mineral portion of the lode was lost in the lower levels, and that a thorough system of cross-cutting, or deeper sinking would again lead to the discovery of the lode. At this date the mine is in the hands of tributors. This mine was organized under the mining laws of Mich., June 5th, 1855.

THE NATIONAL AND ROCKLAND MINES

Are on the same lode, the first just west, and the second

immediately east of the Minesota, and are in pretty much the same condition as the last mentioned concern. Although at one time prominent as good mines, and producing a large amount of copper, yet they could never compare with the mother mine; organized under laws of Michigan in 1854.

During the active existence of these mines, a large number of mines, situated both east and west of the Ontonagon river, were worked with varied success, extensive improvements were made, the country opened up and a large amount of money was expended, often without profit. (A full list of these mines is presented elsewhere; space will not permit a seriatim description of all.)

The most prominent of these mines now, is the

RIDGE MINING COMPANY,

Which has been working regularly and unobtrusively, year after year. The mine is producing, of stamp and mass mineral, about two hundred tons annually at a handsome profit. In the judgment of good miners, this mine should be worked more extensively, in just proportion to its great merits.

On the Evergreen bluff range, and east and west therefrom, we find many good properties—mines that have produced from one to three hundred tons of copper each, namely: the Evergreen Bluff, the Flint Steel, the Mass, the Ogima, the Caledonia, the Bohemian, the Toltec and Knowlton; on the west side of the Ontonagon the Norwich, the Victoria, the Nonesuch, &c.

The one great imperative need of this section is a steam railroad along the range. The mines are situated from 14 to 30 miles from the lake and Keweenaw bay; the streams on the ridge are too small for extensive stamping operations; therefore, for transportation of stamp stuff, supplies, &c, the railroad would be a prime factor to success.

The above mentioned mines are mostly founded upon amygdaloidal-epidote beds, which often present rich shows of stamp copper, together with small masses. No doubt, many of these mines are valuable; but the veinstone,

charged, mainly, with stamp copper, requires for its extraction adequate stamping and washing machinery. The stamp mills employed at these mines, it is believed, have been insufficient to build up prosperous concerns. The stamp lodes of the Portage Lake district, many of them, are no richer in mineral than certain belts in Ontonagon district, but the Portage mines have succeeded admirably, solely by reason of their great mills most of which reduce four hundred tons of stamp rock per day for each mill. The example of Portage Lake mines is worthy of imitation, especially as it is believed, that if followed, the result would be beneficial to those most concerned. It is not asserted that *all* of the mines that have a "local habitation and a name" in the Ontonagon district, will ultimately, under improved circumstances, be remunerative but it is candidly believed that at some future time, perhaps not distant, a fair proportion of them will prove to be profitable undertakings.

It is a melancholy fact that at the present time, in this once renowned district, mining, except on a limited scale, is at a stand still. The low price at which copper has ruled for several years past, *and the want of railroad facilities*, has greatly discouraged mining enterprises therein.

In Ontonagon county there is a large area of mineral land that has been only partially explored, or not at all; and new discoveries of great value are within the range of probability, at any time.

The once flourishing villages of Ontonagon and Rockland are suffering from the general stoppage of mining; their population has dwindled, and business is almost extinct.

Aside from its mineral resources, Ontonagon county is a good agricultural section, and the people of the county have turned their attention to farming—a pursuit not commonly popular in mining regions. The plow seems to be bringing to them that measure of content and modest prosperity which the miners' pick and hammer have failed to insure. Wheat, oats, grass, potatoes, garden vegetables, small fruits,

apples and flowers all do well, and some of them remarkably well.

PORTAGE LAKE DISTRICT.

This district is of more recent origin than either Keweenaw or Ontonagon. When the Cliff and Minesota mines and their cotemporaries were flourishing, the Portage Lake mines were nearly unknown. To day this district is the busiest centre of mining, as well as the most wealthy and populous. It occupies a happy geographical position, about mid-way between the extremity of Keweenaw point and the Porcupine mountains. Portage Lake, an inland sheet of water from which the district takes its name, is one of the most spacious, deep and accessible harbors on the lakes. Its basin cuts across the trap range at Houghton and Hancock, and at the head of Torch Lake, 16 miles distant from Houghton, in a northeasterly direction, the waters come very near to the range. Thus is a deep waterway formed in close connection with the mines, a natural advantage which has been of inestimable value in the development of the country. At the south end of the lake, by means of artificial canals, Portage river has been made navigable; at the north end, twenty-four miles from the south end, the old Grand Portage has been changed to a ship canal over two miles in length, one hundred feet wide, and 15 feet deep, with heavy breakwaters projecting from the shore into Lake Superior 800 feet. The river connecting Portage and Torch lakes, has also been dredged and enlarged. So that with these extensive and costly internal improvements, Portage Lake is accessible at the two extremes, and the largest sail vessels and steamers navigating the great lakes pass through it and touch at the mine docks, warehouses and smelting works, to discharge mine supplies and take on copper. These advantages have rendered Portage Lake a commercial centre, and the trade of the other districts is gradually converging thither.

The villages of Houghton and Hancock, the first named situated on the south side of the lake, and the last named on the north side, less than one mile apart, and connected

by a draw-bridge sixteen hundred feet long, are flourishing, well built mining towns, containing (both places and including the mills and furnaces, foundries, machine shops, saw mills, rolling mills and other manufactories located in the suburbs,) about 8,000 inhabitants. The shore of the lake, on the south side, is abrupt and rocky, and at a point one mile back attains an elevation of four hundred feet; on the north side the slope is steeper, and at a distance of one-half mile the brow of the hill is nearly six hundred feet above the level of the lake. The lake at this point, scarcely one-half mile wide, resembles a river, and the steep declivities, rough in outline, by shortening the view, tend to confirm the impression; the whole scenery is picturesque. The steepness of these declivities are rendered subservient to mine economies. Those mines which lie back of the lake on the plains above, send their stamp rock to their stamp mills, which are located on the immediate shore of the lake, by means of inclined tram-roads; the gravity of the loaded descending cars drawing the empty ones up. At the head of the incline planes, the cars are moved to the mines either by horses, or small locomotives. A large quantity of water, from 1,500 to 3,000 gallons per minute, is used in the stamp mills; hence these establishments are always placed within reach of water. Mines that are situated from four to eight miles from an adequate stream or lake, are compelled to build railroads to connect mine and mill.

Nearly all of the copper mineral produced in the district, about 20,000 tons per annum, is smelted at the Detroit and Portage Lake smelting works, situated on the lake, opposite Houghton. These works are quite extensive and complete, and maintain an enviable reputation both in home and foreign markets—a branch of these works is located at Detroit.

On the south side of the lake there is a good copper rolling mill. There are five large, first-class stamp mills located near Houghton and Hancock, which stamp and

wash daily at least 1,500 tons of rock. A stamp mill costs from \$100,000 to \$200,000. The foundry and machine shops are able to supply the mines with a large proportion of the machinery required; the saw mills also supply the mines with pine and hard wood lumber and timber sufficient for their need. There is a fleet of small steam tugs and scows which bring from a distance to the mills wood for fuel, and timber and lagging for the mines.

At the head of Torch Lake there are two large stamp mills with 800 tons daily capacity, and quite a village called Lake Linden has grown up around them; they belong to the celebrated Calumet and Hecla consolidated mining company. Across the lake, near these mills, Mr. Gregory has erected a large steam saw mill, a planing mill, and door and sash factory. Bituminous coal, imported from Cleveland, Ohio, or Erie, Pa., is largely used at the stamp mills, and is laid down on the mill docks and at the smelting works at a cost of from three to four dollars per ton. Good building stone—sandstone and trap rock—are easily procured; a good quality of red brick is made at L'Anse, distant by water thirty miles, and at the same point the best kind of slate for roofing and marbling can be had in unlimited quantity. The forests of maple covering the range furnish excellent fuel, while the pine, hemlock and cedar, growing alike on the trap range and the low lands of the Silurian rocks, have yielded thus far an ample supply of timber and lumber.

Thus it will be seen that all these necessary adjuncts to successful mining are possessed in pretty full measure by the people of Portage Lake. Ingot copper is transported via the lakes, to Buffalo at cost of \$4.00 per ton.

Between the years 1852 and 1857 considerable exploring was done in the vicinity of Portage Lake, and mining was inaugurated on rather a limited, parsimonious scale. Perhaps it was advisable to proceed slowly. At first mining was most active on the south side of the lake, and was confined to the Isle Royale lode. This lode is an amygdaloidal epidote; its strike is north 32° east; it dips to the northwest at an

angle of 55° from the horizon. Its width varies from 4 to 40 feet; the copper found in it is in the form of rather coarse stamp work, barrel work, (mineral not sent to the stamps, but dressed with a hammer and, when the product was shipped to distant smelting houses, was packed in barrels,) and irregular masses often three to four tons in weight. The vein rock is composed of a variety of minerals, such as quartz, calc-spar, prehnite, green earth, epidote, etc. Much native silver occurs in the lode; the copper deposits have a tendency to make in bunches from 50 to 200 feet in length; at such points the lode widens enormously, and the yield of copper is very fine. But the objection to the lode is that these bunches are not more persistent in length, and that there is too much poor, unproductive ground between them. The cost of passing through these poor "bars" in regular mine work, and hoisting such a quantity of rock to the surface, which has to be thrown into the waste piles, militates against the success of the mine, eating up the profits accruing from the mineral raised from the rich bunches. It is believed that by a consolidation of two or more of the present mining companies whose separate mining territory is rather limited, and by confining the work underground to the rich shutes, or bunches, the mines could be made to pay a good profit. The situation of these mines in a settled country, with good roads, and in close proximity to navigable waters, smelting works, &c., is very advantageous. The following mines are located on the Isle Royale lode, namely: The **SHELDEN AND COLUMBIAN, CONSOLIDATED**, (formerly the Shelden and Albion,) the **GRAND PORTAGE**, (formerly the Portage,) the **ISLE ROYALE** and the **HOUGHTON**, (formerly the Huron,) the **DODGE** and **FRUE**.

On the Shelden and Columbian, near the shore of the lake, there is a fissure vein; course N. 12° W., and dipping to the northeast. This vein is four to eight feet wide; veinstone, quartz carrying native copper, whitneyite and domeykite. The vein is a strong one, but has not been worked sufficiently to test its value. There is another

small fissure, crossing the Isle Royale lode in a northeasterly direction, but of no apparent value.

On the north, or opposite side of the lake, on the supposed extension of the Isle Royale lode, in the year 1863-4 several mining companies were organized, and began work in a small way. These are the HIGHLAND, (formerly the Ripley,) the DOUGLASS, the CONCORD, the ARCADIAN and the EDWARDS. The characteristics of the lode are similar to the Isle Royale. Rich bunches, or shutes, of copper were found, but owing to many causes, of these mines only the Concord is at work, and that in a small way. These mines have not been thoroughly proved up, but the indications are sufficient, in the matter of copper, to justify a larger expenditure of money in testing them. At the Arcadian the ancient miner has left extensive remains of workings. The vein, or lode, carries much heavy copper and first-rate stamp rock. There is a small fissure crossing the lode on the Douglass, out of which a mass weighing one ton was taken. On the Concord, in the soft brown amygdaloid, very numerous deep and perfect glacial grooves were observed. The rock was polished, and the grooves were as perfect as if they had been cut with a chisel. The score marks were from one inch to four inches deep, and from a line, or scratch, to six inches wide.

In the year 1853 on the north side of Portage Lake regular mining had been begun, and in the year 1857 on the great Pewabic lode were found several mining organizations namely, the QUINCY, PEWABIC and FRANKLIN. The Pewabic lode has the same strike and dip, nearly, as the Isle Royale lode, and lies a little more than one mile to the west of the Isle Royale. For a mile or so in length, on the territory owned by the Quincy, Pewabic and Franklin, the lode has been and is very rich in metallic copper; the yield since 1860 has been large, and the profits handsome. The lowest levels in the Quincy and Pewabic are 2,000 feet in depth on the dip of the lode; the lode is from ten to forty feet in width, and the veinstone is chocolate colored, quite soft, and is associated with calcite or tabular spar, and many

other minerals; some of the crystallizations are very perfect and beautiful. The copper has often taken the place of crystals, and retains the form of the extinct mineral. Much silver is found associated with the copper, sufficiently so to make it an object to be looked after by the silver pickers in the stamp mills. The copper mined occurs in the forms of mass, barrel and stamp work. Masses and barrel work constitute perhaps 33 per cent. of the mineral raised. That part of the lode worked, or the veinstone manipulated, yields about 2 per cent. ingot copper. There is considerable waste rock taken from these mines, as from all amygdaloid belts of this character, and the stamp rock must be assorted before sending to the stamps.

In the year 1860 these mines had reached an assured position, and within a year or two thereafter they began to pay dividends to the shareholders. Each of the above mentioned mines have a first class stamp mill, situated on the lake shore, tram-roads leading thereto, excellent mine plant, extensive ranges of offices, shops, good macadamized roads, comfortable dwellings and tenement houses, supply stores, hospitals, dispensaries, and are, in brief, model industries.

The example and success of these mines gave character to, and confidence in, the Portage Lake District. In the early days of mining in this country this district was not much esteemed by the copper magnates of Keweenaw and Ontonagon counties, and, for a time, there was but one man in the country to do it reverence, and that was Mr. Ransom Shelden. He was laughed at as an enthusiast, and little heed was given to his word as he expatiated on the riches of his beloved district.

The Quincy is the leading mine on the Pewabic lode, and it is still maintaining its high character for regular products and handsome dividends. It was never a great burden to its stockholders, the amount of money called in being comparatively small—\$200,000—the mine from the first yielding much copper, which was used in developing the mine, in

lieu of assessments. This company, thus far, from legitimate profits of mining, has divided with its stockholders \$2,200,000. The Quincy company has been working under an old special charter, but this year, 1878, has organized under the General Mining Laws of Michigan; capital stock, 40,000 shares—\$1,000,000. The Pewabic has divided \$400,000; assessments, \$240,000; the Franklin, \$240,000; assessments, \$380,000. The copper ground in the Pewabic mine is short, and is now worked out on the company's property, but the shute of copper, always so rich, extends to other property on the west.

The following interesting figures are taken from Quincy Mining Company's report for the year 1877, copied from the *Mining Gazette*. The Quincy is a *characteristic* mine, working on amygdaloid lodes of Portage Lake District; therefore these figures afford a fair exhibit of the cost of mining these lodes:

GENERAL SUMMARY OF RECEIPTS AND EXPENDITURES OF THE
QUINCY MINING COMPANY, FROM ITS ORGANIZATION TO DECEMBER 31, 1877:

EXPENDITURES.

For expenditures on location previous to 1856.....	\$ 42,097.98
For expenditures on Quincy vein in 1858, not now worked.....	55,000.00
For openings and explorations on 3,800 feet "east" or Pewabic vein, extending to Portage Lake, preparatory to future work.....	11,500.00
For real estate and permanent improvements on same, including dwelling houses, stamp mill, machinery, steam engines, tram-road, dock, warehouses and other buildings, and roads.....	670,641.63
For mining and surface labor, expense of smelting and marketing copper, and all incidental expenses.....	7,953,183.66
Balance carried down.....	2,594,685.85
	<u>\$11,327,109.12</u>

DIVIDENDS DECLARED.

No. 1 payable July 31, 1862.....	\$ 60,000
No. 2 payable February 2, 1863.....	80,000
No. 3 payable August 5, 1863.....	120,000
No. 4 payable February 5, 1864.....	120,000

No. 5 payable August 15, 1864.....	160,000
No. 6 payable February 27, 1865.....	160,000
No. 7 payable February 7, 1868.....	60,000
No. 8 payable March 20, 1869.....	40,000
No. 9 payable March 10, 1870.....	120,000
No. 10 payable February 6, 1871... ..	80,000
No. 11 payable August 1, 1871.....	60,000
No. 12 payable February 15, 1872.....	200,000
No. 13 payable August 1, 1872.....	150,000
No. 14 payable February 24, 1873.....	100,000
No. 15 payable February 20, 1874.....	160,000
No. 16 payable February 15, 1875.....	160,000
No. 17 payable August 1, 1875.....	60,000
No. 18 payable February 15, 1876.....	100,000
No. 19 payable August 28, 1876.....	60,000
No. 20 payable February 15, 1877.....	80,000—\$2,130,000.00

Balance.....	464,685.85
	<u>\$2,594,685.85</u>

RECEIPTS.

From capital stock, full paid.....	\$ 200,000.00
From proceeds copper and silver (43,126,038 lbs. copper).....	11,022,517.12
From interest received (less amount charged off on government bonds).....	50,953.66
From sales of real estate, Hancock, Mich.....	46,508.34
From profit on sale P. L. & R. Improvement Co. stock.....	7,130.00
	<u>\$11,327,109.12</u>
Balance brought down, being receipts over expenditures.....	<u>\$2,594,685.85</u>
Balance brought down, being amount undivided, as per statement of assets and liabilities.....	\$464,685.85