CHAPTER III.
ORE DEPOSITS AND MINES.

About $100,000 has been expended in Douglas county, in working mines and making explorations for metallic copper. The most of this sum has been expended in the interests of those who hoped to speculate on the mining stock, or who had a very strong desire to "get up a company." In consequence of the funds mostly being used by those who had not the greatest pecuniary interest in the successful development of the mines, and, also, owing to the fact that most of the work was undertaken before the occurrence of the metal, and the proper system of mining, were well understood by anybody, a large proportion of the $100,000 was not judiciously expended. Although none of the mining enterprises have proven successful, they do not demonstrate, by any means, that valuable deposits of native copper do not exist in the district, or even that one or two of the partially developed mines may not yet economically produce considerable quantities of copper. It usually requires but a very inconsiderable outlay of money or labor to demonstrate the general character of a deposit. After this has been accomplished, in any future attempt at mining, I would most strongly recommend that some extensively known, and universally recognized, thorough mining expert, one who has had experience with the copper deposits of Michigan, be employed to examine, and report upon the proposed mine. Better pay a few hundred dollars, and have your mine properly condemned, if need be, at the outset, than to expend many thousands and finally condemn it yourself.

Character of the Metalliferous Deposits. Metallic copper occurs under the following conditions in Douglas county:

1. Indiscriminately scattered through belts of epidotic and calcareous rock of various thickness, and lying usually with the bedding of the formation, as at the Percival mine.

2. Irregularly disseminated fine particles of native copper in the layers or beds of diabase, as at the Fond du Lac mine.

3. In true fissure veins, as at the Wisconsin mine.

I have noticed indistinct indications of contact deposits at Black river falls, and on Middle river, between the eruptive rocks and
breccia or sandstone. As these deposits are of great importance in Michigan, I would suggest to explorers to hereafter carefully search for them. Another locality in which to search for contact deposits is along Moose river, and to the west of that stream, at the junction of the crystalline rocks and overlying and interstratified conglomerates.

One consideration which will probably be found somewhat unfavorable to mining enterprises in Douglas county, especially upon fissure veins, may be mentioned in this connection. The layers or beds of uniform rock, apparently, have no very great thickness, but differ considerably in lithological characters. A vein, therefore, in passing from one to another, will doubtless be found to be somewhat irregular. In this respect, the beds of Douglas county strikingly resemble those of Isle Royale.

**History and Descriptions of the Douglas County Copper Mines.** Through the kindness of several of the old settlers of Superior City, Mr. James Barden in particular, and of some of the officers of the various mines, I have been able to collect many interesting and important facts in regard to the history of each location. These will be included and blended with my own observations from a recent personal examination of each location.

**Pre-Historic Mines.** Although from present indications, I assume that their work was very limited, there is, nevertheless, but little doubt that this district was "prospected" by that strange pre-historic people, whose greatest efforts at mining were apparently upon Isle Royale. Mr. Stuntz, of Superior, has informed me that some years ago several small pits were found near the upper falls of Black river, and lying on top of one of the heaps of gravel and earth thrown out, was a rude and broken stone hammer. He also states that long ago he saw indications of pre-historic mining two or three miles east of Copper creek. Almost directly across the stream from the junction of the eruptive rocks and sandstones on Copper creek, I found a tolerably well defined pit three or four feet deep, and six or eight feet long. In the center of the depression was standing a dead spruce, about a foot in diameter, and under the roots were remains of charred wood. In the bottom of the pit, and under a slight covering of soil, were many small boulders, two of which, although very rude, had apparently been used as mauls. In this connection, it may be interesting to state that a fine copper knife, eight inches long, was found a few years ago on Presque Isle, one of the Apostle islands. Mrs. Heyward, of Bayfield, has it with her fine collection of minerals and antiquities.

**At Black River Falls,** the North American Fur Company sunk a shaft a few feet, and prospected about the falls considerably during the years 1846-7. Since then there appears to have been little or no work done at the locality. A short distance along the northeast wall of the canon from the foot of the great fall, a fine-grained reddish brown diabase comes in, which is frequently amygdaloidal. The dip is 46° about S. 20° E. In this rock there is a band of amygdaloidal diabase, one or two feet thick. The cavities of the amygdaloid are chiefly studded with small acicular crystals of epidote, and the rock is quite highly charged with the green and blue carbonates of copper. A small amount of galena was also noticed in the vein matter, which induced me to make an assay for silver. A distinct trace was found. A trace of silver was also found in a sample of the debris piled up upon the bank near the head of the falls. Galena was also noticed in this.
Copper Creek Mine. This mine is located on the west half of the S. W. qr. of Sec. 14, and the east half of the S. E. qr. of Sec. 15, T. 47, R. 14 W., comprising 160 acres. The North American Fur Company, in the years 1846-7, sunk four shafts on this location, which appear from soundings to be 28 ft., 28 ft., 46 ft., and 35 ft. deep, respectively. So far as I was able to determine, they do not appear to be on a vein, or even a metaliferous bed. This tract of land, immediately after the government survey in 1853, was secured, after a litigation with the Fur company, by J. H. C. McKinney. From him it passed with one intervening title, to Gen. Geo. B. Sargent, of Davenport, Iowa, and Jas. O. Sargent, of Boston, Mass. Explorations were made by the latter gentleman in the fall of 1863, with such encouraging results that a company was organized to mine for copper on an extensive scale. During the years 1864-5, a large force of men was employed, and about $30,000 expended on the location. Considerable surface exploration was carried on, three shafts were sunk, and drifts were run in various directions, generally from the bottoms of the shafts. The aggregate depth of shafts sunk was about 200 feet, and the length of drifting about 260 feet. The surface indications were considered good, but, as there is no true vein, the deposits, of course, were found very irregular. It was supposed that there were three distinct veins. A perpendicular shaft was sunk at the junction of the forks of the creek, to strike one of the hypothetical veins, which was supposed to be exposed on the surface to the west of the shaft, and to apparently dip towards it. As the hole (?) was not struck at a depth of 60 feet, a drift was run towards it at a distance of about 40 feet, and then to the north 15 feet. It is needless to state that no "vein" was found. A drift was also run from the bottom of the shaft 15 feet to the east, but without striking a "vein." The rock which came out of the shaft is very amygdaloidal, soft and earthy, and decomposes with exceeding rapidity. A large amount of very epidotic rock, quartz and calcite, carrying more or less fine shot copper, were also taken from the shaft and drifts. The other shafts, tunnels, and drifts, afforded no more encouraging results than those first described. One of the shafts is located about 100 feet south from the junction of the forks. A large amount of quartz, carrying small flakes of native copper, came from this shaft, which would seem to indicate the presence of a quartz vein. However, I saw no surface indications to warrant such a supposition. The third shaft is located about 400 feet northeast from the forks of the creek. It was sunk upon a bedded "epidote vein," which is two feet wide on the surface, where it appears at the mouth of a tunnel, 50 feet long, run to intersect the shaft. The dip is at 50° S. E. In the shaft, above the water, a clay-like material, somewhat reddish, probably derived from haematite, composes the "vein," about four inches wide. Epidote is found in the walls about a foot either side of the vein, and grades into amygdaloidal diabase. These shafts are all filled with water to very near the surface. The buildings belonging to the location are now so thoroughly decayed as to be entirely worthless. The wagon road, which was constructed to Superior City, thirteen and one half miles, since the abandonment of the mine, has become impassable for teams.

Fond du Lac Mine. This location comprises the N. E. qr. of Sec. 8, T. 47, R. 13 W.—160 acres. The land was purchased from the government by A. A. Parker and C. Kimball, both mineral explorers from Ontonagon, Michigan. In 1855 a company was organized under the general laws of Wisconsin, with local officers residing at Superior, and with a subscribed capital of $50,000. W. S. Crowell, from Michigan, was appointed superintendent, and a regular force of miners was employed during 1856-7. During this period there was expended about $12,000 in sinking two shafts upon what the company supposed to be a "well-defined vein." The depth reached was 40 feet in one shaft, and 60 feet in the other. The operations at this location were suspended "on account of the financial crisis in 1857," and have not been resumed. The shafts are nearly one-fourth mile apart. The one near the road leading from Copper creek to
the Wisconsin mine, has an inclination of about 40°, S. 30° E. The debris consists largely of a pinkish, dark-gray diabase, often containing minute flakes of native copper, which, I conclude from the indications about the shaft, came from the foot wall of an epidotic belt. The hanging wall is mainly gray amygdaloidal diabase, containing no copper. The vein stuff is very epidotic, but contains no copper. A determination of copper from a selected specimen of the foot wall, gives me less than one-fourth of one per cent. The rock from the second shaft is chiefly amygdaloidal. A small quantity of epidotic rock, and small pieces of coarsely crystallized calcite were noticed with the debris. Copper was only found in diabase from the foot wall, and in quantities nothing like sufficient to induce a re-opening of the mine. This mine was opened with the idea of finding mass copper. It was supposed that it was only necessary to open a mine almost anywhere in the crystalline eruptive rocks, in order to develop a lode which would produce large masses of pure copper. The shafts at this location are nearly full of water, which renders their interior exploration impossible. The buildings have decayed and tumbled down.

Wisconsin Mine. This mine, locally known as the Edwards Mine, is in the N. E. qr. and the S. E. qr. of Sec. 2, T. 47, R. 13 W., comprising 329 acres. A company, composed of James Edwards, J. Mallory, J. V. Platte, J. W. Cary, J. A. Noonan and A. Finch, was organized in the spring of 1863, under chapter 331 of the general laws of Wisconsin for that year, having the name of the "Wisconsin Copper Mining and Smelting Company," with a capital stock of 20,000 shares, of $100 each. A regular and well-defined fissure vein, from four to six feet wide, was found in this location, and the shafts were sunk on it between 300 and 400 feet apart. Work was commenced in June, 1863, under the direction of Capt. Jas. Edwards, and continued for nearly a year. About $14,000 was expended, when the work ceased on account of lack of funds. The owners of the location are confident that it is rich in copper, and that it only requires skill and capital to develop it. The vein is composed of an epidotic rock, carrying a considerable amount of crystalline and dusty quartz, with prehnite and granular calcite. It carries a considerable quantity of shot and nugget copper. Nuggets weighing from one to fifteen pounds are frequently found. In sinking one of the shafts to a depth of fifteen feet below the surface, a half ton of copper was taken out. One of the shafts was sunk to a depth of 59 feet, and the other 72 feet. The vein trends nearly N. E. and S. W., and dips about 75° N. W. The country rock is amygdaloidal, and is very uniform over an area of several acres. The base of the rock is rather soft, dark brownish and granular to compact. The amygdaloids are prehnite, calcite, and an altered prehnite. Often the cavities are studded with quartz or epidote crystals. The shafts, now nearly filled with water, are very large, being seven feet wide, and ten long. The wagon road to Superior, eight and one-half miles distant, is in very good condition, but the buildings at the mine have been destroyed.

This location, being upon a true vein, as is known from the polished and striated condition of the walls, and the well marked selvages, I regard as the most desirable piece of mining property in Douglas county. It ought to be prospected still farther. At least, levels ought to be run on the vein from the shafts. A small expenditure would do this much.

In this connection it may be interesting to note the cost of sinking the shafts, or running the levels or tunnels. The average cost per foot of sinking the shafts and running the drifts at Copper creek in 1864-5, was $36. At the Fond du Lac mine in 1856-7, the cost per foot in sinking the shafts was $120, and it cost to sink the shafts on the Wisconsin location in 1863, $107 per foot. It may be observed that these figures are extraordinarily high. At the present time (1877), numerous contracts are taken in various mining districts of Colorado, some of which are vastly more inaccessible than was the Copper Range of Douglas county, for sinking shafts and running tunnels, in
much harder rock than the diabases of Wisconsin, and at a price a good deal less than half the sum it cost the Wisconsin companies.

The Percival Mine. This location, named in honor of J. G. Percival, the eminent scholar and geologist, comprises the north half of Sec. 27, T. 48, R. 10 W. — 320 acres. It was owned principally by the late Gen. Geo. B. Sargent, of Duluth, Minnesota, who was also the owner of over 11,000 acres of mineral lands upon the Copper Range of Douglas county. Work was commenced on this location in September, 1873. The mine was visited September 30th, by the geological party, at which date a force of eight men were employed in tracing the "veins." Mr. E. McNair, who was largely interested in the location, was upon the ground and greatly assisted the geological party. Owing in part to the bad condition of the roads, and the consequent difficulty of obtaining supplies, but very little work has been done on the mine, not enough, in fact, to warrant me in drawing definite conclusions in regard to the character of the deposits. The owners claimed to have four parallel "veins," separated from each other by 50 or 100 feet, and trending nearly east and west. There are very few natural exposures in the vicinity of the mine, nearly the whole range in this locality being covered with a slight coating of drift. The country rock in proximity to the "veins," is a dark gray granular diabase, often having a pinkish tinge, and occasionally contains amygdules of prehnite.

"Vein" No. 1 is the most southern of the series of metalliferous deposits, and consists mainly of a calcareous and lamontitic gneiss, containing small quantities of the carbonates of copper, derived from the native metal, and occasional nuggets of metallic copper weighing from one to seven pounds. From the indications about several shallow test pits sunk along the line of this so-called vein, it is probable that a number of surface impregnations were struck instead of a vein being followed.

"Vein" No. 2 I regard as merely a vein-like impregnation. Several pits were sunk in tracing it, and a shaft was put down 15 feet, at a point supposed to be the junction of a leader with the main vein. Here the dip is about 45° N., and the impregnation has a width at the surface of only two inches, while at the bottom of the shaft it is indistinctly fifteen inches. Shot, and strings of native copper are found in the "vein-stones," of epidote and quartz, which grade into the walls. A determination of the amount of copper in a carefully selected average sample of the epidotic rock gave me 2.61 per cent.

"Vein" No. 3 is fifty feet north of No. 2. It is a belt of the common epidotic altered amygdaloid, with impregnations of copper in the walls. More work has been done upon it than upon all of the other deposits. It has been followed about 2,000 feet. The gneiss is a quartzose epidotic rock carrying shot and nugget copper. Several nuggets weighing over twenty pounds each have been taken out. An analysis of what was regarded as a fair average sample of a pile of the vein stuff, gave me 3.50 per cent. of copper. Of course I do not intend to assert that the entire vein will average that amount. The country rock is a dull ash colored diabase, very amygdaloidal. The amygdules are chiefly prehnite and calcite. Two shafts have been sunk, 300 feet apart, each to a depth of thirty or forty feet. The bed is from twenty to forty inches wide and dips about 49° to the south. It grades somewhat into the country rocks.

"Vein" No. 4. But very little prospecting has been done upon this. If metallic deposits are found here they will probably be impregnations. Work was discontinued upon this location in December, 1873, and has not been resumed. "Hard times" was the alleged cause for the discontinuance. Several thousand dollars were expended upon this mine, and buildings suitable for the accommodation of forty men were erected. Upon a reexamination of the location in the spring of 1877, the buildings were found to be in good condition, but as the shafts were filled with water, and no additional stripping or test-pitting had been done since my former visit, very little additional information was obtained.
From the present facts accessible to me, it is impossible to condemn or approve the mine. If copper shall hereafter be proven to exist in quantities sufficient to remunerate the expense of mining it, the indications are that it will be found in the vein-stone as "stamp-work." The facilities for conveying the ore from the mine to the Brulé, only one mile distant, and working it with stamps, are particularly noticeable. The descent from the mine to the river is gradual, and about 200 feet. The expense, therefore, of conveying the ore to the river and working it under stamps, which should be run by water power, would be merely nominal. The soil upon the range in the vicinity of the mine is excellent, and the timber, consisting of sugar maple, oak and birch, exists in great abundance.

How and where to search for deposits of copper. It is not at all improbable that much more valuable deposits of copper exist in the cupriferous series of Douglas and Bayfield counties, than have yet been discovered. Exposures of the rock in which these deposits may be expected to occur are rarely met with except in the vicinity of the streams, so universal is the distribution of the drift. In many places, however, upon the range of Douglas county, the drift is light, and might readily be removed, at any point where there are indications of a deposit in the underlying rocks. Of course such indications are difficult to discover. They may sometimes be found by tracing pebbles and fragments of rock, found in the channels of small streams, or in the drift, in their origin. If the indications are found in the channels of streams, or dry runs, the water-courses must evidently be followed up, if in the drift; always remember in tracing them, that the movement of the drift was from the north or northeast.

It is known that deposits of metallic copper usually occur in belts of rock, having an unusually large amount of the magnetic oxide of iron. It is said that explorers in the Michigan copper districts frequently take advantage of this fact, and carefully watch the magnetic needle. At localities where the local attraction or variation is greatest, they make careful and minute examinations. From personal observations, I am unable to state whether or not this can be relied upon.

By referring to the geological map of this portion of the state, it will be observed that all of the mines and all of the reported "veins," except that at the upper falls of Black river, which was a small impregnation, are within one-half mile of the line of junction of the eruptive rocks and the Lake Superior sandstones. The most favorable known belt, then, for the occurrence of metalliferous deposits, is from the sandstones about a half mile to the south, along the northern face, and on the summit of the range. A belt 2,000 feet wide will include nearly all of the known deposits.

I would also suggest that careful search be made very close to the sandstones, in fact, between them and the crystalline rocks. Deposits of metallic copper may be discovered almost anywhere south of the sandstones in Douglas or Bayfield counties. An almost totally unexplored, and very inviting field to the explorer, is along Moose river, and in the townships to the west from it. The drift is not heavy in this region, and many small copper boulders are found to the south of it. Conglomerates and sandstones overlie the eruptive crystalline rocks, which are doubtless the equivalents of the Isle Royale copper-bearing beds, and of the great beds, in the other side of the synclinal, in which the vast deposits of Michigan are found.