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LETTER FROM PROFESSOR R. H. THURSTON.

Lake Superior.—Its wonderful mineral shores.—The Portage Lake.—The discovery of copper.—The Calumet and Hecla mines.—Interesting particulars concerning the process of mining copper.

MARQUETTE, Mich., July 20th, 1872.

Lake Superior, the largest of the great inland seas, has an area estimated at nearly 32,000 square miles and a length of shore line certainly not less than 1 200 miles.

This great body of water is becoming well known to tourists, who are attracted here by the magnificent scenery of its shores and its islands, by the wholesome climate, and by the excellent fishing to be found in the hundred rivers and creeks that feed it and in the lake itself.

LAKE SUPERIOR MINERAL RESOURCES.

To the geologist and to the engineer, it is no less interesting, as one of the most extensive and remarkable known mineral regions of the world. All along the north shore are deposits of copper and silver, some of which are opened and productive. One of these silver mines is at Silver Islet, a little rock lying near the Canadian shore and just opposite Isle Royale; and so small and low is it that it became necessary to partially enclose it by coffer dams and "crib work" before much work could be done on the wave-washed veins. It is stated that the first 22 days' work on the island produced $100,000 worth of native silver, and the amount mined from the 1st September, 1870, to date was recently stated (*Duluth Herald*) as of such value as to give this little rock an estimated present value of $100,000,000. Silver has also been found and mines opened at several points on the main land.

Copper has been found at Pigeon river, the boundary between the United States and Canada at its junction with the lake,—on Isle Royale and Michipicoten Island, and on the main at the eastern end of the lake.

Houghton, the little town from which my last letter was written, lies near the middle of Keweenan Point, and is the principal town in the copper range on the south shore of Lake Superior. Keweenan Point extends some 60 miles out into the lake, and is traversed by a range of high hills, which yield, at many points, large quantities of native copper. At the Ontonagon mines, which are situated a few miles from the coast and behind the point, the copper is found in masses, which are frequently of great size, imbedded in the solid vein rock and almost absolutely pure; the "impurities" are, generally, merely a small percentage of iron and silver, alloyed with the copper. Occasionally a beautifully crystallized mass of silver is found attached to the copper and cemented to it by a slight film of alloy at the surfaces of contact, and instances have occurred in which masses of silver of considerable size and great value have been thus found.

As the Keweenan deposits are followed out toward the extremity of the Point, fewer large masses are found and the copper is more uniformly and finely diffused through the vein rock, until at some places it occurs in such extremely minute particles that they are quite invisible to the unaided eye, although they may form a very considerable percentage of the total weight of the mineral.

PORTAGE LAKE.

Portage Lake is situated near the middle of Keweenan Point, and, extending from the eastern to within about three miles of the western side, nearly makes an island of the outer portion. It thus happens that Houghton and its opposite neighbor, the village of Hancock, form excellent shipping ports for a large portion of this copper district. Several mines, the Quincy, the Pewabic, the Franklin and the Huron, among others, are within gunshot, almost, of the two villages. All vessels loading there pass out on the eastern side of the Point, but the Portage and Lake Superior Ship Canal Company is expected to cut a ship canal from Portage Lake to Lake Superior at the western side of the Point, and thus allow shipments to be made toward that end of Lake Superior; and also, by enabling vessels to cross through Portage Lake, instead of rounding Keweenan Point, to lessen the distance between ports on either side by at least 150 miles.

THE DISCOVERY OF COPPER.

The discovery of copper here, and probably at all other points where it exists in considerable quantity, was made years before the white man came across the Atlantic from the Eastern world. The Indians were familiar with the principal deposits of native copper and often picked up surface masses and slabs. Xavier, who explored a portion of North America in 1720 or 1721, states that they regarded them as divinities or as gifts from the water gods, and preserved them with the utmost care. These masses weighed from a few pounds up to several tuns. At several places, ancient mines have been discovered by modern explorers, and the stone tools—hammers and chisels—of the aboriginal miners are interesting specimens of primitive art.

At Hancock, we visited the works of the Detroit and Lake Superior Copper Company, where four reverberatory furnaces are at work melting down the mass copper and the copper from the stamps of the mines of the neighborhood. Very little refining is required, and after a little stirring of the melted metal with the rabble, it is poured into the ingot molds and is ready for the market. All of the copper shipped here is from deposits of native metal. No deposits of sulphurets are worked and but few are known in the Lake Superior districts, and it rarely happens that the copper here smelted is even slightly contaminated by sulphur.

Directly behind this village and at the top of the bank, 500 or 600 feet above the water, are the entrances to several mines, and at a similar altitude on the Houghton side are others. These mines are employing a large number of men and are producing large quantities of copper, but, to the stranger, the most interesting of all the mines of this section are, probably, the "Calumet" and the "Hecla," two mines situated side by side, formerly independent but now united under a single management. This is claimed to be the richest copper mine in the world, and an examination of the mine, as well as the market price of its stock, affords pretty strong evidence of the truth of the assertion. The Calumet and Hecla mine is about 14 miles distant from Houghton and Hancock, and we travelled over the road on a pleasant afternoon in a lumbering "stage," making the journey in two hours and a half.

At several points, we passed the deserted buildings and unused shafts of mines that were opened a few years ago, when the high price of copper stimulated production so wonderfully, but which have since—in consequence of the reduction in price at the close of our civil war, and partly perhaps in consequence of the "leanness" of the rock or of ignorance or recklessness in management—been deserted. In some of these mines, hundreds of thousands of dollars have been thrown away. Fine buildings and the best of machinery are immensely expensive, but yet cannot make a success of a mine which must compete with neighbors having richer ores or better management. There is, probably, little doubt that some of these mines, if now reopened, might be made to pay handsomely if properly worked, but good superintendents and skillful captains are not always readily obtained for even well established and long worked mines.

HOW THE COPPER IS MINED.

Arriving at the mine, we spent the evening with the superintendent, from whom we obtained a considerable amount of most valuable and interesting information, and whose fine cabinet of specimens from his own and other mines excited our vein of covetousness very seriously. Next morning we had an early breakfast and prepared to enter the mine.

At seven o'clock, we met the "Captains of the Mine" at the "Change House" and exchanged our travelling suits for the miner's uniform—a round crowned, narrow brimmed hat, a flannel shirt "converted" from a heavy blanket, a stiff canvas coat, strong linen trowsers, and clumsy cowhide boots; a candle enveloped in clay and stuck on the hat, and two others hung from the upper button, were to supply us with light during our underground journey. Thus equipped, we started down the ladders and were soon beyond the reach of daylight.

The Calumet and Hecla Mine extends, in the direction of the vein, nearly two miles, and has penetrated nearly 900 feet into the earth. The vein rock is a peculiar red "conglomerate," as the miners call it, penetrated in every direction, permeated by metallic copper. The "walls" of the mine are of hard trap rock, separated by the vein rock to a distance of, sometimes, fifteen feet or more. The mine is worked in a series of "levels," horizontal galleries or "drifts" being driven at intervals of about ninety feet, as the shafts are carried downward, and the "stopes" are opened out until all of the ore is worked out except a portion a few feet in thickness, which forms the floor of one level and the roof of the next level below. The rock is extremely hard and is all worked out by blasting. The drilling is principally done by hand, but two Burleigh drills, driven by compressed air, are on trial. We were much interested in their operations, and were pleased with their performance and by the ingenuity of their construction. They were said to be doing excellent work.

After the miner has done his work, under the careful supervision and direction of the captains of the mine, he is followed, if he has not been accompanied, by the "timbering party." The timbering of a mine is one of the most important branches of mining work, and is always directed by an experienced miner of unusually sound judgment. It is his duty to examine the walls of the mine with the captains, and, sometimes—consulting the superintendent—to support them, wherever necessary, by heavy timbers. At the Calumet and Hecla, we were particularly impressed with the care and the skill displayed in timbering, although, as a rule, the walls, both foot and hanging, are remarkably good. In a neighboring mine, but a few days since, the walls came together, crushing the timbering, and several miners, caught in the trap, perished at their work, victims of insufficient timbering, It seems remarkable, however, that the miners, who are more exposed to such dangers than other employees of the mine, are usually the most reckless in working under unsupported walls.

We spent a number of hours in the mine, exploring its several levels, sliding down "winzes," clambering over rocks and ore, climbing long ladders, and, now and then, warned by the cry of the miners, dodging into a cavity or behind a battery of timbers to escape the danger of being struck by flying masses of rock detached by a blast. In many places, the particles of copper were too minute to be detected by inexperienced explorers; at other places they glistened in the candle light and their sharp points tore the hand that was incautiously passed across them, while here and there, but very rarely, the metal in solid masses filled large chinks in the rock. After being dislodged by the blast, the ore is wheeled, on low cars, to the shaft, dumped into the iron "skip," and is hoisted rapidly up to the surface where it is thrown into cars and taken off to the stamps. At this mine, steam stamps are used, powerful steam hammers in fact, and under their tremendous blows the rock rapidly crumbles into dust; the copper is then readily washed clean and is next sent to the furnaces to be melted into ingots for the market. After exploring the mine to our satisfaction, watching the several methods employed in opening "shafts," "winzes," "stopes," etc., in securing the walls and in transporting material, a straight climb of 630 feet took us up to daylight once more, and we staggered to the nearest seat, decidedly "weak in the knees," but with an excellent appetite for the dinner which we found waiting for us at the house on our arrival there. This great mine employs about 600 people underground in its fifteen or eighteen miles of gallery and produces about 10,000 tuns of marketable copper per year.

We returned to Houghton, found the Atlantic in port and ready to sail, and took advantage of the opportunity to continue our journey. We entered the beautiful harbor of Marquette, the principal shipping port of the iron regions of Lake Superior, early next morning. The next letter will give you some account of the neighboring iron mines.

R. H. T.

Chances for Investment.

Many of our most successful business men invest their surplus capital entirely in railroad bonds. Such investments, when the securities are good, pay the best rate of interest with the least trouble to the holder of any class of investments that are made, and it is becoming usual for holders of Government securities which are selling at a high premium to exchange for railroad bonds at par or less, they paying the same or better rate of interest.

In this connection, we would refer to the advertisement of the Chicago and Canada Southern Railroad first mortgage seven per cent gold bonds, in another column. The names of the gentlemen connected with the road are among our best known citizens and capitalists, and the bankers through whom the loan is effected rank among the first in the city. By addressing either firm whose names appear in the advertisement, full information as to the character of the securities offered will be given.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.

1.—STAINS OF LEMON JUICE ON BLACK MARBLE.—The polished black marble case of my mantel clock is badly disfigured by white spots caused by drops of lemon juice. Will some one tell me how to restore the original black polish?—S. M. T.

2.—DEPILATORY.—Is there a compound that will remove the human hair without leaving a scar?—J. R. M.

3.—WORM EATEN BARREL STAVES.—Can you inform me of any sure method of keeping worms out of barrel staves? Sometimes, after having been long in use, when the danger is thought to be past, we suddenly find their depredations.—J. H. R.

4.—ICE HOUSE.—Will some one who knows give me the best plan in use for a family ice house?—C. C.

5.—PRUSSIATE OF POTASH PAPER.—How can this be prepared for use in Bain's telegraph instrument, and in the electric copying press recently illustrated in your journal?—F. H. H.

6.—FLEAS.—How can these pests be induced to entirely quit a house which they have succeeded in entering?—T. J. W.

7.—DESIGNS ON STEEL.—Will some one inform me how to make impressions on small steel articles? How long should the acid remain on? What acid should be used, and should it be diluted, or not?—J. K.

8.—GRATES FOR BURNING SAWDUST.—Can N. J., of N. Y., or any one else, inform me what kind of grates I need to burn sawdust in a common firebox?—B. W.

9.—NITRO-GLYCERIN.—Can nitro-glycerin be ignited by a common safety fuse?—O. J. K.

10.—BAITING FISH.—Will some of your readers inform me what is better than oil of aniseed to use on fish baits to cause the fish to bite?—W. H. O.

11.—MONKEY WRENCH.—Can you inform me, through your columns, the reason why a slide or screw wrench is called a "monkey wrench?"—H.

12.—THIN RUBBER GOODS.—I would like to know the manner in which thin rubber goods, such as hollow balls, shoes, etc., are formed.—G. C. D.

13.—POWER OF ENGINE.—What power should a double engine give, the cylinders being 2½ inches by 5 inches, working under 50 pounds to the square inch, and the engine at 150 revolutions a minute?—W. H. P.

14.—BISULPHIDE OF CARBON.—Can bisulphide of carbon be used with safety in the place of water for running a small engine, the exhaust vapor to be condensed? Where can it be obtained, or how can it be made?—W. H. P.

15.—SPECIFIC GRAVITY.—Is the attraction greater at the poles than at the equator? If so, please give the reasons. Will a body weigh less at the equator than at the poles?—J. P.

16.—BLACK SURFACE ON BRASS.—How can the brass work around the lock of a Winchester repeating rifle be made black without heating or removing from the rifle? If it be necessary to remove the black stain, what should be used?—C. W. L.

17.—GUNPOWDER IN CARTRIDGES.—Does gunpowder deteriorate by being kept any length of time in paper cartridges?—C. W. L.

18.—CUTTING GLASS.—Will some one of your readers give me plain directions for cutting glass with a common glazier's diamond? I can cut in a straight line very well; how can I cut a round or oval glass? Is it necessary to cut on both sides? If an imperfect cut is made, can I cut in the same place again, or must I move the straightedge and take another cut?—J. W. A.

20.—CUTTING THE COGS OF MORTISE WHEELS.—Can any of your readers give me any information about cutting the above by machinery? What sort of cutters are used? At what speed should they run? How do they stand? And what kind of wood was used?—J. W