Description of the Calumet mine

The mine is situated in the Calumet settlement in the Copper region of Lake Superior, it is about 12 miles North East of Houghton and about 15 miles South West of Eagle River, both of which places are celebrated for their copper mines, All these places are situated upon Keweenaw Point.

The copper deposit belonging to the Calumet mine consists of a red coarse conglomerate, mainly composed of pebbles of red trap, containing also crystallized red felspar, quartz and carbonate of lime, with small specks of brown hematite; the copper is in small leaves and pellets. The hanging wall is composed of a strong slate coloured trap with occasional small amygdules of copper, (S. G. = 2.9). Next below the Hanging wall there is an occasional belt of amygdaloidal trap of the same colour as the Hanging, but thickly sprinkled with amygdules of Carbonate of lime;

its specific gravity is 2.8; it also contains some red felspar. The vein Rock is of specific grabity 2.6; it somtimes contains, besides the minerals alluded to, a horse, so called, of sandstone, which is a block of that materiel entirely separated from rock of its kind. Below the vein rock there is a layer of very friable red clay slate, called the Flucan, which ranges from 2.7 to 2.8 in specific gravity. below this there is a layer of ~~conglomero~~ amygdaloid, like the one under the Hanging, excepts that it has less red felspar and is more constant and continued. The thickness of the vein rock is 10 to 12 feet, that of the flucan is from 6 in to 1 foot, the amygdaloids are never over 6 feet thick, and very often dissappear altogether. the Hanging is from 6 to 10 feet thick. The foot wall is very much the same as the hanging. Massls of copper in leaves and crystals are somltimes found in the amygdaloid; this is like the copper found at the Huron and some of the other amygdaloid mines of Houghton.

The Calumet vein dips 43° North west, the strike is North East. These Parallel layess of Trap, which compose the copper bearing rocks of Keweenaw Point, at the three different points Houghton, Calumet & Eagle River, have a dip respectively of 70° 43° and about 25°, showing a gradual flattening out of the formation towards the End of the point. At Houghton the conglomerate disappears. the copper is entirely in amygdaloid. At Eagle River the conglomerate also dissappears, but there the principle part of the copper is found in true fissure veins in large masses weighing many tons, containing also prehnites datholite analcimes, all very finely crystallized. None of the mines on Lake Superior grow warm as the diggings decend as in most other places. The Cliff mine of Eagle River is down at a depth of 1400 feet, but is very cold at the bottom of it.

The Calumet mine is worked by the method called overhand stoping. The Shafts are excavated in the first place along the formation to the depth of 90 feet, which is the distance between the levels, when at the above depth two drifts are put out along the vein. a winze is now put down from the Surface 90 feet deep, and a drift started to meet the shaft. Winzes are like small shafts, except that they never run more than the distance between two levels, or from the surface to the first level. their use is that the ground by means of them may be opened much faster, giving more room for the men to work. They are generally about 40 feet from a shaft. When there is sufficient drifting ground opened, parties are employed to widen the drifts into levels. The drift is a hole about 6 feet high and 6 ft broad. The level is of the full thickness of the vein, and has a row of stull timbers above it, to Support the roof and prevent the falling Rock from occupying it. A complete level always has a railroad for the Cars to run on.

The parties which enlarge a drift, at the sametime stope out the rock for 20 feet above the bottom of the level. The stope extends from one shaft to another generally. Occasionally the miners leave what are termed arches; they consist of solid pillars of rock, in its natural position, left for the support of the roof, generally about 20 ft up the slope by 15 along the vein. When one stope is far enough advanced another one is started up twenty feet farther and then again another, until they have arrived as near, as prudence will permit, to the ~~app~~ level above. The grade of all the levels is about 1 foot down in 50 ft towards the No 2 shaft, this is to carry all the water to the pumping shaft.

Shafts are sunk and drifts run entirely by parties of 3 men; one holds the drill while two alternately strike it with heavy sledges; these parties shift every 12 hours, hence they always have 6 men, or 3 on a shift, working at a drift or a stope.

Blasting is done entirely with powder, although nitro-glycerine has superseded it in one of the mines at Eagle river.

The ventilation of the Calumet mine is entirely natural, the fresh air goes down No 2 shaft and up No 3, or the reverse according to the direction of the wind. No 1 shaft is not in working order, it is filled with water at present, but every effort is being made to reach it by stoping & drifting since the richest portion of the mine is in that vicinity.

The pumping of the mine is done by an engine at No 2 shaft. At each level there is a reservoir. The pump rod at the surface connects with a lift pump at each of these reservoirs, hence the water is only lifted up one level at a time. This water when at the surface is saved for the use of the engine.

One engine does both the pumping and the hoisting. The Rock from the stopes and drifts is loaded in cars by men employed directly by the Company, the Stoping and drifting being done entirely by contract, The cars are then pushed to the Shaft and dumped into what is called a Skip, which is a car built to be hoisted on an inclined or vertical shaft. There are two men stationed at the head of the shaft to receive the skip and one man at the hoisting engine, The moment the car is dumped into the skip at the bottom of the shaft, a signal is given by means of a wire and bell to the man at the top of the Shaft, who at once passes word by a similar Contrivance to the Engine driver, who at once hoists the car. The man at the Shaft signals the Engineer when to stop hoisting, the skip at this moment dumps itself into a car and immediately is allowed to return slowly down the Shaft by its own weight. The car which was filled by the skip at the top of the shaft is then pushed by two men to the Rock house and dumped there; it then returns and awaits another skip. When in lowering, the skip is required to be brought to rest at any level below the lower one, two beams with rails on them and with proper supports are placed in a horizontal position in the same vertical plane with the inclined rails and in connection with them, so that the Skip easily comes to rest on them. Thus the Skip may be stopped on any level.

In the Rock House the ore is picked over by men, and that which is rich enough to be sent at once to the smelting works without stamping is barrelled up for that purpose. The poorest such as the Hanging wall and the amygdaloid, which scarcely contain any copper, are wheeled off and piled up in heaps; but by far the larger portion of the vein rock has to be passed thro' the various pulverizers and stamp mill. It first goes to the steam hammer, which is of iron with a steel point below and falls about 8 feet, ~~it is lifted by steam~~ One man stands at the engine ready to let the hammer fall, 5 or 6 men are below tending the hammer and sorting the rock as it comes from the mine; every thing larger than a 7 in cube has to go under the hammer, some of the smaller portion of this class ~~are~~, by way of saving time, are broken by hand sledges. When the rock has been reduced to the above size it is shovelled by hand to Blakes Patent Rock Breaker, which acts like a pair of jaws facing upwards, fed from above. The breaker consists of a lever with one arm vertical, of 2 feet in length, the other arm is horizontal, 8 feet in length; the fulcrum in the form of an axle is at the junction of the two arms and at right angles with their plane. The short arm of the lever acts as the moveable jaw; the long arm is moved by a connecting rod and eccentric wheel worked by a small engine; opposite to the short arm is placed the stationary jaw; at the top, the jaws are about 8 inches apart, below they are about 2½ inches. The motion of the jaw is about 1 inch, which it repeats about 80 times per minute; by means of this incessant opening and shutting the rock, which is shovelled in from above, is crushed down to the size of a man's fist or smaller, and passes out below, where it is allowed to fall into cars ready to take it to the stamp mill. The cars are pushed by hand the first part of the way, the force of gravitation is sufficient to carry them the rest, on account of the steepness of the slope.

The stamp mill contains two of Ball's stamps with a set of Collom's washers. Ball's stamp is by far the most powerful stamp used on L. Superior. It consists of a piston and piston rod, then below is the ~~shaft rod~~ stamping piston and on the foot of that is the shoe, the whole thing weighs about one ton, its stroke is 2 feet, it is lifted by steam and is forced down by its weight with the addition of 60 lbs pr. square in. of steam on its piston which is 10 in. in diameter. The stamp makes 50 strokes per minute. The rock is fed to the stamps from above through hoppers; the two stamps are supplied with 1400 gallons of water per minute, which is pumped from the pond to a height of 34 ft. The water and fine sand are forced by the splash of the stamp to come out through a steel plate perforated with holes 3/16 in. in diameter. Each stamp has two of these gratings one in front and one behind, and each grating supplies a set of washers; hence there are four sets.

The arrangement of the stamp mill may be seen in the plate. above are seen the two stamp boxes with a trough from in front and one from behind, each carrying the sand to four pairs of colloms washers. A washing table consists of an oblong box with a horizontal sieve placed in it, the receiving end of the box is about an inch above the delivering end, the box projects upwards about 2 inches all round the sieve. Underneath there is a funnel to collect all that goes through the sieve and convey it to the outlet. The funnel is kept full of water all the time by a supply from the tank. Each table has a plunger which makes 100 strokes per minute, at each stroke forcing water up through the sieve. The sieves are in pairs one below the other, with a little bridge between them, over which the water has to pass carrying with it the waste sand. The sand which comes from the stamps is carried by troughs to the separator, which is a trough about 14 feet long with four holes at intervals supplying 4 pairs of tables with sand. The first hole, of course, gives coarse

-sand, the second is finer, the third finer still and the fourth is finest. The coarse sand has a coarse sieve to receive it, the fine has a fine sieve. The action is as follows; sand and water come from the separator on to the sieve. The action of the plunger forces water up through the sieve raising the sand mixed with copper. The latter being the heaviest falls first, thus a layer of copper is formed on the sieve then above it is sand, the ~~the~~ sand is scraped off as often as required and the copper secured, the sand is then scraped back again and rewashed. Much copper mixed with a good deal of sand goes through the sieves, this is carried by troughs down to the finishing sieves below. Every thing which passes over a pair of tables is waste, except on the finishers. Every thing which passes over the finishers is called slime and is washed in a slime washer. All the copper taken from above the sieves is called No 1 copper, all which passes through the finishers is called No 2 copper, that derived from the slime washers is No 3 copper.

The slime washer is a trough with the right slope, the ~~co~~ sand and water are fed at the top, a boy is kept there to sweep constantly the sand, thereby washing out the sand and allowing the copper to settle at the ~~top~~ upper end of the trough, then a certain amount of this is saved and called No 3 Copper.

Analyses of the different grades of mineral copper. Each of these numbers is the average of three analyses.

No 1	Copper gave	Copper	91. o/o	oxide of iron	4. o/o
No 2	"	"	88 "	"	6. "
No 3	"	"	38 "	"	38

The waste sand taken from outside the building gave from several analyses 1½ o/o of metallic copper.

During one month the mine has been found to yield 116 tons of mineral copper from 4190 tons of Rock showing that the mills save 2.7 o/o of the copper in the rock adding this to the loss of copper in the waste sand 1.5 o/o we have 4.2 o/o of the Rock which comes from the mine is copper. From these data we may calculate the following

The mill saves 64.0/0 of the whole copper which comes from the mine and looses 36.0/0.

The principle expenses of the mine may be thus summed up for June 1868

Mining Expenses	$16446.27
Rock breaking	2559.68
Tramming rock	604.49
Stamp mill	5902.17
Barrels &c for Mineral copper	1160.87
Repairs to buildings	31.78
Repairs to tools and Machinery	131.38
General Expenses	1241.57
Total Expenses	28078.21

116 tons copper at 400.$ per ton	$46400.
Expence	28078.21
Resulting profit	$18321.79

The Number of men working on the mine may be thus summed up.

No of Miners working for the Company	151	
" " " by contract	170	
No of Men at work in Rock House	49	
" " " " by contract	6	
No. of men tramming rock	6	
" " " " by contract	4	
No of Teamsters	18	
No of general surface hands	54	
" " " Contractors	44	
No wood choppers by contract	37	
No of Carpenters	12	
" " Smiths	10	
" " Engine drivers and firemen	16	
" Stamp Head runners	4.	
" " " feeders	12.	
Machinist and helpers	4.	
Copper washers	18.	
Cooper	1.	
Superintendents	14.	Total
Contractors building Houses	50	680

The mine has been working about 1½ years and is not yet fully Equipped. They are now at work making many buildings for dwellings for the men and also for the mine. The shaft houses are not all finished yet; by next Autumn the mine will be in full running order unless they do not succeed as well as they expect. When that time comes, the expense will be lessened and the resulting copper will be more, for they will have much more stoping ground open and hence will stamp much more Copper.

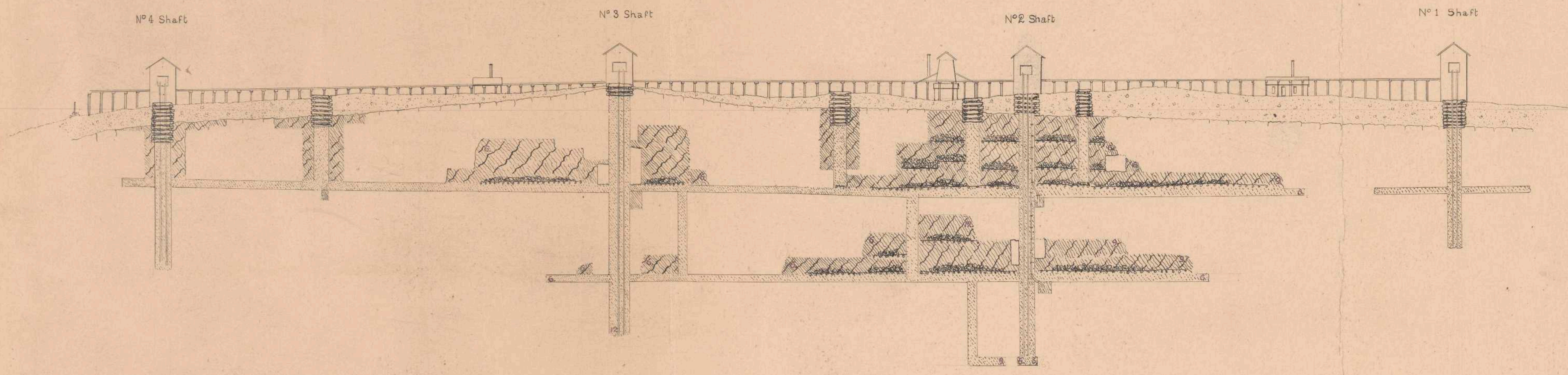
Robert H. Richards.

August 1868

Longitudinal Section of workings of the Calumet Mine

showing the amount of stoping, drifting, and shaft sinking, completed, up to August 1868

drawn by
Robert H. Richards



Description

Represents Drifts now open

" Levels

" Ground opened by stoping

The red numbers show the n° of men stoping drifting or sinking

Scale of 100 feet to 1 inch