

# GOLD IN MICHIGAN

## REFERENCES AND PHOTOCOPIES OF SELECTED OUT-OF-PRINT PUBLICATIONS OF THE MICHIGAN DNR GEOLOGICAL SURVEY DIVISION

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### GOLD IN MICHIGAN

By R. C. Allen

Taken from Publication 8, Mineral Resources of  
Michigan-1911  
Published by the Michigan Geological Survey

Mr. Geo. A. Newett of Ishpeming, formerly  
Commissioner of Mineral Statistics of Michigan, gives in  
his report of 1896 an interesting and full account of the  
discoveries and the mining of gold in Michigan. No gold  
has been produced in the State since the closing of the  
Ropes Mine in 1897, except an unknown amount  
obtained by a reworking of some of the tailings of this  
mine. In recent years no attempts have been made  
toward a resumption of operations at the old prospects  
which were located following and as a result of the  
Ropes discovery, nor have new gold deposits been  
searched for.

In this volume it seems proper to introduce in part Mr.  
Newett's account of gold mining not only for the  
historical interest which it has but also as a reminder that  
a resumption of gold mining in this State is a future  
possibility, vague as it may appear at present. The  
occurrences of gold ores as described by Mr. Newett are  
characteristic of the Lake Superior region in general, as  
are also the unsuccessful attempts at mining them. The  
ores of the Ropes Mine are native or free gold in a  
gangue of quartz occurring in veins in peridotite in  
Keewatin rocks. The occurrence is not dissimilar in  
general to those in the Porcupine district of Ontario  
where success in a large way seems about for the first  
time to be realized, if attained which will be all the more  
noteworthy in view of the long list of utter failures and  
near failures in past years in attempts to mine gold in the  
Lake Superior region. The following is a quotation of the  
essential parts of Mr. Newett's account written in 1896 to  
which reference is made above.

#### Discovery of Gold in Michigan

As early as the time in which Dr. Douglass Houghton,  
Michigan's first State Geologist, was engaged in the task  
of examining the Upper Peninsula rocks, it was known  
that gold existed in this portion of the State. Dr.  
Houghton, upon one of his brief trips from the camp at  
which he was temporarily located, secured enough gold  
to fill an eagle's quill. The gold, as remembered by  
those who saw it, was very coarse, and the doctor said  
he had obtained it from the bed of a little stream of  
water. The unfortunate drowning of Dr. Houghton  
occurred before he had disclosed the secret of the  
whereabouts of the discovery. Those who accompanied  
him during his work in the Upper Peninsula are not clear  
as to the exact place in which the camp was located at

the time, and many points have been chosen as the correct one. It is generally believed that the spot was not far from where the most active work has since been done in the way of developing the gold-bearing veins of this region.

In January, 1864, Dubois & Williams, analytical chemists, of Philadelphia, Pa., in assaying specimens of quartz for silver, from the Holyoke silver district, eight miles north of the present city of Ishpeming, were surprised to find gold, the quartz holding it at the rate of several hundred dollars per ton. They reported this, but little attention was given the story, and no searching resulted.

The first discovery that led to anything of practical kind, and the one from which has sprung all that has been done in the Michigan gold fields, was made by Mr. Julius Ropes, of Ishpeming. This gentleman, a chemist, had noticed the presence of the metal in numerous rock samples he had taken, and he finally located a vein of quartz from which all subsequent excitement has resulted. This was in 1880, and the location was the south half of the northwest quarter of Section 29, 48-27, three miles northeast of Ishpeming City. It was in a range of serpentine rocks, and near the edge of a wet swamp. A company was formed, the fee of the mineral having been first purchased, and here

## The Ropes Mine

the first gold mine in the State of Michigan, was opened. It was not started on the spot at which the original find was made, but high ground, about 850 feet farther west, was selected, and here a shaft was sunk, a small mill erected, and the first milling work was done in 1882. Since then the mill has been increased in size, and at one time 65 heads of Cornish stamps were dropping.

The Ropes was unfortunate in that it lacked sufficient funds to carry on its mining work as it should be done in order to secure the best results. In its earlier history there were many different managers who had charge of the business, and few of them were experienced in the work of milling. Like most gold mines, the Ropes had its peculiarities, and much time and money was expended in becoming familiar with them. About the time the best methods were learned, and the money had been spent, the people grew tired, the few assessments levied discouraged them. In 1896 they were mining and milling a ton of rock for about \$1.85, which was certainly doing remarkably well considering the small amount treated per day, about 65 tons.

The Ropes rock is a hard one to stamp. It contains considerable talcose slate, this being sticky and soft, acting as a cushion under the heads. The rock has to be stamped fine, a 40-mesh screen being used, and the tonnage per head is small as compared to mines where a rock of different nature is met with. With all this understood, the management certainly made an excellent record, and deserved a better financial condition under which to labor.

The Ropes ore formation possesses a width of from 30 to 50 feet, and is made up of talcose slates in which the ore occurs in lenticular form and generally running transversely across the formation. Lenses are found in all imaginable positions, but the general course is as described. These lenses are made up of narrow bands of quartz and slate, and the minerals associated with the gold are galena, iron pyrites, gray and yellow copper ores. Occasionally one sees a speck of free gold, and at several places in the mine small vugs containing considerable free gold were found. At one such place about \$400 worth of the native metal was taken. Generally, however, the ore bodies have been of low grade, the average yielding something like \$2 or \$3 per ton. Could the mine have been opened up differently, and a selecting of the rock made, this average could have been considerably improved.

There is one shaft to the 15th level, a vertical depth of 850 feet. To the 12th level the lode has a slight dip to the south, but from this point to the present lowest level it inclines slightly in the opposite direction, the wells being nearly vertical. The ore lenses have a pitch to the west. The bottom of the first main lens was found at the 5th level, that of the second at the 9th, and in 1896 they were working upon the fourth lens in the bottom levels, the work here being entirely upon the east side of the shaft whereas in the upper levels the stoping was done to the west. In the lens encountered on the 16th level, the slate mixture is almost entirely missing, the vein being almost solid quartz, and giving an average of about \$6 per ton, this showing a better and stronger vein than has been found at any other point in the mine. The shaft does not reach to the bottom of this level, but stops at the 15th. An incline shaft was sunk at a distance of 150 feet east of the main shaft to secure the ore of this level. The hoisting was done from this sub-shaft by a small engine. They carried this shaft down until the shape of the new lens was determined. They had an idea that its westward pitch would carry it under the line of the main shaft, in which case the latter would have been continued downward and the lens would have been mined from this avenue. As the pitch of all the ore bodies thus far encountered has been westward, it is fair to argue that the position of this would prove no exception to the others.

The finding of ore of better quality, and in larger body than has heretofore been met with is particularly encouraging on this lowest level. It speaks well for the persistence of the gold, and offers substantial reasons why the Ropes should have been given a better show than was accorded it in the way of money to do business with.

A small territory was worked upon. A length of 550 feet on the trend of the lode embraces it all, and from this there was produced \$605,056.95 worth of gold and silver. This is the gross yield, and I give it to show that there is gold in the rock of this mine. This embraces the product from the commencement up to the first of January, 1896. The gold is generally free milling. What

concentrates were saved were sent to Aurora, Ill., for treatment. Frue vanners were employed for the concentration. The bulk of the gold is held in the "quick" in the mortars and on the copper plates, the common form of amalgamation being observed.

An advantage the mine has is the "solid walls that need no timbering and the freedom from water. In the 16th level not a drop of water came from the level. The vein was stoped out on the overhand plan. The ground was drilled by machines. About 35 men were employed in 1896.

Another point of vantage was the cheapness with which the water supply was secured. The source is the Carp river something more than a mile distant. Here a dam was constructed, and, with a four-foot fall, a pump was operated by a turbine wheel that furnished all the water the mill needed, and the supply is ample for any future demand that may be made under a prosperous condition of things.

At the point where gold was first found by Mr. Ropes on this property, the vein was narrow, but very rich, giving about \$200 per ton, by assay. There is the territory lying between this and the shaft at the mine upon which practically nothing has been done in the way of exploration and where there should be something valuable disclosed by practical testing of the ground. The fact that the ore lenses in the mine pitch to the west, and that gold was found on surface so far east, is an encouraging sign.

Several years after mining work was discontinued by the Ropes Gold & Silver Company, Mr. W. H. Rood, of Ishpeming, erected several large vats and attempted to reclaim the gold in the tailings that had been wasted into the low ground immediately north of the mill. The cyanide process was employed, and the work was just fairly started when the death of Mr. Rood put an end to it. Several thousand dollars had been reclaimed and Mr. Rood stated that he was making a profit. Unfortunately, no one took up the cyaniding after this time. The plant was in the nature of an experiment and demonstrated the fact that the tailings could be successfully treated. Had the cyanide plant been operated simultaneously with mining and milling activities it might have enabled the company to secure the margin of profit necessary to success.

The product for 1895 was valued as follows: Gold, \$34,838.69; silver, \$1,373.16; Total, \$36,211.85.

Two miles and a half west of the Ropes mine, on Section 35, town 48, Range 28 is

## **The Michigan Gold Mine**

This property has produced some of the finest specimens of free gold ever seen. Many of these yielded gold at the rate of \$160,000 per ton. Indeed, so rich were they, that they offered too great a temptation to the miners who were employed there, and the trunk of one enterprising fellow who was all ready to take his

departure for Europe was looked into and found to contain over two thousand dollar's worth of gold treasure, secured from this property when the eyes of the bosses were not upon him. How many thousands were stolen is not known, but there probably were many of them. This property was its busiest in 1890, and for a time there was lively trading in its shares. At a depth of about 80 feet in two shafts that were sunk, the gold had diminished to such a degree as to dishearten those who were conducting the exploration and work was abandoned. A little was done in 1895, but nothing of value accomplished. It consisted principally in making a test of some of the rock already mined.

The Michigan has several veins crossing its lands, and it was upon the largest of these that the work was done, although gold was found in the smaller ones. The veins are in diorite, differing in this respect from the Ropes. Their trend is nearly east and west, and they observe a nearly vertical position. There is little or no silver, and the gold where found is free milling, there being little mineral in the rock aside from the gold. The rock stamps freely, and under the ordinary Cornish head a large amount could be treated daily.

During the months of January, February, and March, 1890, the mine produced \$12,675.35 worth of bullion, and this was the time when the excitement regarding it ran highest. The total yield is valued at \$17,699.36. With the great diminished percentage of gold in the bottom of the exploring shafts interest also waned, and all work was finally abandoned, and those who invested in the shares of the company were out the money put in.

The shafts of the Michigan Gold Company were less than 100 feet in depth. What another one hundred feet would have shown can but be conjectured. The property was well equipped with machinery, there were several creditable buildings, and everything was in shape in 1896 to resume work on short notice.

## **The Gold Lake**

This prospect is immediately west of the Michigan on lands belonging to the Lake Superior Iron Company. The latter company sunk a shaft, and secured many fine specimens, after which they leased it to the Gold Lake Company, by whom it was worked for a time in a very quiet manner. Specimens rich in gold, and comparing favorably with those from the Michigan, were secured. This vein is also in the diorite, and felsite shows in places cutting through the diorite. The vein "pinched" out at a depth of something like 60 feet, and its continuation was not sought beyond a few feet where it was lost sight of.

## **The Superior Gold Mining Company**

did some work on the northeast quarter of northwest quarter of Sections 35, 48-28. This was immediately east of the Michigan property, and the vein was in the diorite. Some fine specimens were secured, A but the

work was given up soon after it was begun. The vein is said to have been cut out by the diorite.

## The Peninsula Mining Company

made up of Detroit, Michigan capitalists, did some work under the above title on the southwest quarter of the southwest quarter of Sections 25, 48-28. A shaft was sunk 70 feet. The quartz here is in granite and is in small stringers. Free gold was seen, and the company figured that they could treat all the granite impregnated with this quartz. Numerous assays were made and the company reported these to be satisfactory. They have not done anything in the way of equipping the property.

Other properties were worked more or less, the Grummett, Swains, Mocklers, Grayling and Giant being prominent at the time the excitement was at its height, but all work has stopped. These were all on the Michigan range.

## The Dead River District

One of the most promising territories for the existence of gold is known under the above title. In the sixties there was great excitement in the field due to the discoveries of silver secured from the Holyoke mine, but the lead did not prove rich enough in the more precious metal, and all work was finally abandoned.

This district begins in the Dead River valley starting about eight miles north of Ishpeming and extending northward to Lake Superior. The particular portion of this field as thus far exploited can be located by a line drawn centrally through it from east to west, which line would agree with the line of town 49. The eastern terminus can be placed at Lake Superior. Westward it extends several miles. The honor for first bringing this district to the attention of the people of the State was accorded Julius Ropes, who made his initial discovery here in June, 1890.

In town 27 there is a spur that leaves the main range, going at a sharp angle to the northwest. This is locally termed the north range, and the one from which it diverges, the south range. The south range appears to be the principal gold bearer so far as tests of the rock have been made. In width the range altogether is about three miles.

Small quartz seams are innumerable. The seams of quartz run in size from an inch to several feet, and many of them are gold-bearing. The predominating minerals are copper ore, iron pyrites, galena, and sometimes zinc. No refractory ores are discovered. Tellurium has also been found in a trachitic greenstone, and it is reported from no other portion of this region.

The configuration of the surface of this field is attractive. The granites and traps sometimes rise to a great height, forming deep defiles, reminding one of the canyons of the west. The schists and softer rocks have been gouged out, making the surface very rugged, full of

gulleys and corresponding hills. It certainly is an attractive region, and one that has not commanded the attention from gold hunters which it deserves.

Following the discovery of Mr. Ropes in this field, a company was organized that secured options on a large tract of land and conducted explorations on Sections 35, 49-27 under the title of

## The Fire Centre Mining Company

Two shafts were sunk upon different veins in the granite, and were carried downward about 100 feet. At this depth there was a diminution of gold in the rock and the company ceased operations much to the disappointment of the many who were interested. As in the case of other explorations in this region, those who undertook development work were unfamiliar with gold mining. They were too easily discouraged.

In the summer of 1892 a trial lot of rock was treated in the Ropes gold mine mill. This consisted of 254 tons, and from it were produced \$2,063 worth of gold, about \$8.12 per ton, a most gratifying result. The gold was 69\*7 fine, and the percentage of saving in the mill, including concentrates, was 76.7, showing the free-milling qualities of the rock. The latter stamped very freely, much more readily than that of the Ropes mine. The Fire Centre Company ordered a Crawford mill, which was set up and proved an utter failure. In the fall of 1898, the shafts having changed from pay quartz to barren work was stopped, and the place has been abandoned. I consider this the most promising of the several gold fields in this region, and believe if it has skilled men to direct operations a success would be achieved. The tract is a large one, and little or nothing has been done.

I have been shown rich specimens that are said to have been taken from Baraga County, and from near Lake Michigan. Nothing is now being done in that section.

Two miles north and east of the Ropes, Edward Robbins, of Ishpeming, found gold in the summer of 1895, and obtained many fine specimens showing the native metal.

This gold is associated with the iron ore-bearing formation.

## Gross Value Bullion Michigan Gold Mines

Ropes Gold and Silver Company	\$605,056.95
Michigan Gold Company	17,699.36
Fire Centre Gold Mining Company	2,063.00
Other prospects	820.00
Total	<u>\$625,639.31</u>

## Placer Gold

Placer gold from the fluvio-glacial deposits of the State has been reported from a number of localities, some of

which are well authenticated. The source of the gold is doubtless in the gold-quartz veins which are known to occur widely distributed in the Archean rocks of the Lake Superior region.

What gold there is in the glacial drift of the Lower Peninsula has been transported from the north in the same manner as other materials of the glacial drift and should be put in the same category as "float" copper, and "float" iron ore, as being no indication whatever of the existence in this part of the State of the original source of the metal. Very lean placers may result from concentration by stream action of the gold particles in the glacial drift but we have no proof that any of the deposits reported have any value, commercially, nor is it thought that any of them either known or unknown are valuable. To produce a workable concentration from the widely scattered particles of gold which are in the glacial drift of the Southern Peninsula would require a sorting by water action of such magnitude and completeness as to be wholly beyond the probabilities.

Chances in favor of the occurrence of valuable gold placers in stream gravels of the pre-Cambrian area of the western half of the Upper Peninsula are decidedly greater than elsewhere in the Paleozoic areas of the State for the reason that in the pre-Cambrian rocks are the only known or even probable original sources of gold in this State and the drift in some parts of this area is mainly of local origin. Yet even in these areas the possibilities of the occurrence of placer "pay dirt" are sufficiently meager to discourage prospecting with any hope of commercial reward.

In the Annual Report for 1906, D. A. C. Lane quotes a letter from W. M. Courtis of Detroit giving localities from which placer gold has been reported. Some of these occurrences have been authenticated.

Mr. Courtis says: "At Lowell and along the Grand River there is gold in a certain channel that crosses the river near this place. This gravel is composed of a different kind of pebbles from the gravel found in the high banks along the river which rise in some places two or three hundred feet above. The gold in the Grand River begins at Maple River and was found down to Ada Creek and probably down to the lake, no gold being found in the most favorable bars above the former place.

"These high bluffs are stratified in some places, at others irregular deposits. None of these strata would pan gold even taking the ferruginous seams, the most promising, except in the lower seams a few colors were found.

"The gravel in the old river channel seems sufficiently rich to work with dredges in some parts where the land is not too valuable and as this old channel apparently comes from the northwest. There seemed to be a steady increase in the colors of gold as depth is gained - pans running from four to thirty colors. The total average of all out tests was about three cents per cubic yard, though very little digging was done, only taking up the mussels and panning the gravel. The estimate of three cents included all the barren dirt that was tested, barren

gravel that overlays the old bed and is not any criterion of what the river channel would run, which should be tested with six holes. The gold was much coarser than I would suspect, some of it being like mustard seed.

"I thought it had been "salted" but I walked out a rod or two from the shore, dug up the mussels and alone washed the dirt. Here I got but one to four colors to the pan. This gravel contains a large amount of black, magnetic sand, iron, garnets, zircons and is analogous to those deposits worked in Russia which in their richest parts yield from two to four dollars per cubic yard."

The following is a list of the places where gold is said to have been found in the gravel:

Washed by myself:

Maple River, Ionia County  
Lowell, Kent County  
Ada Creek, Kent County  
Grand River, below Lyons, Ionia County  
Flat River, Ontonagon County  
Iron River  
Ishpeming Marquette County

Reported discoveries:

Birmingham, Oakland County  
Union City Branch, to the S.E. and S.W. (?)  
Marcellus, St. Joseph County  
Burr Oak, St. Joseph County (pyrites likely)  
Grand Haven, Ottawa County  
Allegan, Allegan County  
Greenville, Montcalm County  
Howard City, Montcalm County  
County Line, Newaygo County  
Muskegon River, Newaygo County  
Whitehall, Oceana County  
White River, Oceana County  
Elbridge, Part, June 7, 1906  
Little Sable River, Manistee County  
West Summit, Wexford County  
Manistee River, Manistee and Wexford Counties  
Walton, Kalkaska County  
Rapid River, Kalkaska, Kalkaska County  
Leelanau County, Near Lake  
Antrim County, same river (nuggets, reliable)  
Boyne River, Charlevoix County  
Little Traverse, Emmet County  
Victoria Copper Mine (large nugget)  
Ishpeming district, near gold mines at points south of Gogebic Iron Range.

The following places were reported but believed to be only pyrites:

Caro, Tuscola County<sup>o</sup>  
Cheboygan, Cheboygan County<sup>o</sup>  
Alpena, Presque Isle County<sup>o</sup>  
Caseville, Genesee County<sup>o</sup>  
Flushing, Genesee County<sup>o</sup>  
Near Fargo, St. Clair County  
T.8N., R.14E. (\$6.00 per ton ?)



NE¼/SE¼ Sec. 33, T.49N., R.42W., Tr. Aug.  
15c Ag.

°Iron pyrites, examined

In addition to the above localities Dr. Lane reports the finding of a nugget on bed-rock at Williamston, Ingham County, by Mr. Taylor, and a statement that Mr. Jos. B. Seager has washed as many as 20 colors to a pan in the Huron Mts. where the drift is of local origin.

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## RESOURCES INVESTIGATIONS

*Barton, P. B. Jr. & Simon, F. O., 1972*

### GOLD

#### *Gold content of Michigan native copper*

Native copper and native silver from the Keweenaw area, Michigan, have been found by P. B. Barton, Jr., and P.O. Simon to carry surprisingly low amounts of gold, in parts per billion. The White Pine copper ores in the Nonesuch Shale, which W. S. White interprets as outflow points for solutions similar to those that mineralized the Keweenawan amygdaloids, are likewise low in gold. Thus, gold appears never to have been present in significant amounts in the ore fluid, or perhaps to have been precipitated prior to and possibly down dip from the copper. In either case, a further study of the gold distribution in the native copper might disclose a gradient in gold content enabling an evaluation of the probability of mineralization at greater depth.

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Progress Report Number \_\_\_\_\_ State of Michigan

DEPARTMENT OF CONSERVATION  
P. J. Hoffmaster, Director

GEOLOGICAL SURVEY DIVISION  
G. E. Eddy, State Geologist

## GEOLOGY OF THE ISHPEMING GOLD RANGE

*By R. M. Denning*

PREPARED IN COOPERATION WITH  
THE MICHIGAN COLLEGE OF MINING AND TECHNOLOGY  
1948

The results of the field work done on the Ishpeming Gold Range in the 1945 and 1946 field seasons are contained in this report. The purpose of this work is to determine the regional and particularly the structural geology as an aid in the search for additional ore. In the summer of 1945, A. N. Macintosh, assisted by Layton G. Binon and Willys Manthel as compassmen, established base lines and began the geological mapping of the area. The writer joined the party on September 1, 1945, and from

October 1 until November 1, 1945, continued the work alone. He continued the work during the months of July and August, 1946, with the assistance of Layton C. Binon as compassman.

The area included in this report is the major part of the Ishpeming Gold Range, namely sections 29 and 30, T 48 N, R 27 W, and section 25 and parts of sections 26, 35, and 36, T 48 N, R 28 W, which lie northwest of the town of Ishpeming, Marquette County, Michigan.

For the mining history of the Gold Range, a record of the work-done by the Michigan College of Mining and Technology, the Michigan Department of Conservation, the Michigan Geological Survey Division, and the U. S. Bureau of Mines up to 1943, and a bibliography of the region, reference should be made to the paper by A. K. Snelgrove, entitled ISHPEMING GOLD RANGE.<sup>1</sup>

1. Snelgrove, A. K., Ishpeming Gold Range in Progress Report, No. 10, State of Michigan, Strategic Minerals Investigations in Marquette and Baraga Counties, 1943, by A. K. Snelgrove, W. A. Seaman, and V. L. Ayres, prepared in cooperation with the Michigan College of Mining and Technology, 1944, pp. 47-55.

### Topography

The area is for the most part covered by second growth hardwoods. While the relief is not great, probably not exceeding 100 feet, the topography is rather rugged in a few places. The general trend of the numerous discontinuous ridges is east-northeasterly. Much of the region is covered by cedar and alder swamps. The more rugged areas provide ample outcrops/ but in the low swampy tracts, outcrops are practically absent.

### Field Procedure

The mapping was done from brushed-out, taped section lines, which served as base lines. Eight stations to the mile were established on the north and south boundaries of the sections. North-south lines connecting these stations were traversed, advantage being taken of roads and trails where possible. Much of the area between traverses was mapped in, especially where scarcity of outcrops made the geology uncertain. East and west lines were mapped on the north and south section boundaries. Detailed mapping was carried out where it seemed especially advisable. Most of the section corners and quarter corners were located.

The traverses were paced and run by dial compass, except that during cloudy weather a Brunton was used occasionally in regions of known low magnetic variation. Two north-south lines were established by solar observation, one on the east and one on the west end of the area. The compasses were constantly checked against these, and new correction tables were made when needed. Dip needle readings were taken at intervals of not less than forty stations to the mile. Several needles of different balance were employed. These were checked daily against several check stations. Both the Lake Superior model and the ordinary Gurley needles were used.

## Results of Dip Needle Work

It was found that the peridotite, especially where thoroughly serpentinized, produced high dip needle readings. At one locality, readings were found comparable to those obtained on the iron formation near the observation tower on U. S. Highway 41 near Michigamme. At a few places on the peridotite, magnetic variation up to 180° was observed.

High readings, not however of the magnitude observed on the peridotite, were obtained on some of the uralitic diabase dikes.

The dip needle did not seem to indicate the contacts between graywacke and chlorite schists. Hence the usefulness of the dip needle in this area is, in the writer's opinion, limited. The peridotite forms prominent outcrops, as also does the uralitic diabase. The dip needle does not seem to be sufficiently sensitive to be of much value where data is most needed, namely in the large tracts devoid of outcrops. A typical dip needle profile is reproduced in Plate 3.

## Geology of the Ishpeming Gold Range

The results of the mapping are shown on Plate 1. A cross section is reproduced on Plate 2. It will be noted that only those outcrops actually seen are indicated on the map. However, the general location of inferred contacts is shown.

The important rock types of the area are briefly described in the following paragraphs. The younger rocks are described first. While the writer believes the sequence to be correct, the correlation suggested is only tentative. The tentative correlation is referred to the sequence of A. E. and W. A. Seaman<sup>2</sup>.

**Quartz monzonite.** This rock is the so-called granite of the region. The "granite" is medium grained, gray, locally pink, and shows very few dark minerals. It is exposed for the most part in low scattered outcrops. Some schistose basic inclusions may be seen, as at an outcrop 1/4 mile W of the north end of Gold Mine Lake. The chief constituents are quartz, orthoclase or microcline, and intermediate plagioclase (andesine). The first two mentioned minerals are anhedral, while the plagioclase is euhedral to subhedral. Some biotite and secondary chlorite are present. Apatite and magnetite occur as minor accessory minerals. Most of the feldspar is quite thoroughly sericitized. Some calcite is present. The grain size varies from about 1/8 to 1/2 inch. It is evident from the crushed and bent feldspars and quartz showing wavy extinction, that the rock has been subjected to considerable crustal movement. Numerous chloritized shear zones are present. This granitic -- or more properly, monzonitic -- rock is probably of "Superior" age. Information of a decisive nature concerning the origin of this rock was not obtained during this investigation. It is not impossible that it may be a granitized sediment.

**Pegmatites and quartz veins.** Near the northwest corner, Sec. 25, T 48 N, R 28 W, east-west "pegmatite" dikes up to three feet in thickness may be seen cutting fine grained chlorite schists. Both the schist and "pegmatite" are cut by milky quartz veinlets. The "pegmatite" at this locality is not essentially different from the granitic rock. A mile or more east of the main mass of quartz monzonite are pegmatites composed largely of quartz and some microcline. These pegmatites do not seem to differ, except in the presence of microcline, from the milky quartz veins of the metalliferous deposits. Some of the quartz vein shave a sugary texture of interlocking grains. Small crystals of a zoned pyroxene-like mineral can be seen in some thin sections of the milky veins and in the adjacent country rock. These grains differ from ordinary pyroxene in optic sign and in orientation. They were not further investigated. Some of the quartz veins show relatively coarse, megascopically dark green, chlorite (1/16") grains in masses up to several inches across. They are no doubt the result of hydrothermal alteration of basic rock fragments. Host, if not all, of the quartz veins, especially when the presence of scheelite is considered, seem to indicate that the mineralization is intimately related to the granitic rocks, probably the "Superior granitization."

**Peridotite.** The most conspicuous rock of the Gold Range is peridotite or serpentine derived from peridotite. This rock is responsible for most of the prominent bluffs and ridges of the region. Microscopic study shows all of the peridotite to be serpentinized. The typical mesh structure, resulting from the alteration of olivine, is shown to a greater or lesser extent in all of the sections studied. Practically no original olivine remains. The major constituents of the rock are antigorite, serpophite, and chrysotile. A large amount of carbonate, some of which was proved to be dolomite, is present. Magnetite is practically always present. No chromite was definitely identified. The peridotite, on fresh fractures, is dark green, while weathered surfaces are yellow to brown. Where sheared, the serpentine is schistose and highly talcose, and contains numerous veins of chrysotile. It is probably of Sibley Age.

**Uralitic diabase rocks.** A number of dikes striking for the most part a little N of E are diabasic in texture and contain, in addition to laths of plagioclase, large amounts of amphibole and occasionally some unaltered pyroxene. The amphibole, usually very fine grained, occurs up to ¼ inch long. It is an alteration product of the pyroxene, and in the hand specimen is fibrous and dark green. In thin section it shows a peculiar blue green, green; and yellowish pleochroism; probably it is near hornblende in composition. The rock contains a relatively large number of small cubes of pyrite. The amphibole, formed at the expense of pyroxene, is called uralite -- hence the name of the rock. This rock has been designated by some geologists as metadiabase. Small amounts of chlorite and magnetite are present. This rock is believed to be Post-Eozoic, Pre-Sibley, probably Clarksburg.

*Acid and intermediate dikes.* The dikes falling into these categories are for the most part highly altered, so that it is difficult to decipher their original constitution. The feldspars are usually altered beyond recognition. Some of these dikes seem to have been felsites, and others, dacite porphyries. Still other dikes have been altered to a fine, dense chlorite. These dikes have not been differentiated in the mapping. They are Post-Eozoic, Pre-Sibley (?), in age.

*Quartzite.* Several exposures of quartzite are rather prominent topographical features of the region. This quartzite is white, gray, or reddish in color. Some thin beds of dark quartzite occur in the graywacke. Cross-bedding is a notable feature of the outcrop near the southeast corner of Sec. 30, T 48 N, R 27 W. Several lenses of gravel-sized material occur in this outcrop. The rock for the most part is rather vitreous. Near the northeast corner of Sec. 25, T W N, R 28 W, the quartzite is more sericitic than at the last mentioned outcrop. A prominent feature of this outcrop is a ten-foot bed of quartz conglomerate, containing poorly rounded vein quartz pebbles. At this outcrop the quartzite is interbedded with a few thin layers of arkosic material. In thin section the quartz grains show some secondary growth, which tends to produce a structure of interlocking grains. A few grains of microcline occur, as well as a little finely divided muscovite. No heavy minerals, other than some iron oxide, were noted in thin sections. Several persistent topographic ridges devoid of outcrops are heavily strewn with quartzite boulders. It is not impossible that these ridges may follow quartzite ledges, although this is difficult to reconcile with the recent glaciation so obvious in this region. The age of the quartzite is uncertain, as no older or younger formations are exposed adjacent to it. Probably most of the quartzite is Ajibik. Perhaps the outcrop showing the quartz conglomerate Mesnard.

*Graywacke.* Some outcrops of graywacke were observed. Only in a few places was it found possible to obtain strike and dip. For the most part the graywacke is highly altered, closely resembling and often indistinguishable from an older chlorite schist. An exposure near the south-east corner, Sec. 29, T 48 N, R 27 W, of conglomerate is believed to represent the base of the graywacke. This conglomerate contains sub-angular pebbles up to several inches across of granitic and chloritic rocks. The fine grained chloritic ground mass contains quartz, chert, highly sericitized feldspars of various kinds, and quartz and carbonate veinlets. This rock has been called tuff by several geologists. The graywacke is probably Kitchi.

*Chlorite-Amphibole schist.* Many outcrops of fine grained green schist occur. Some of this schist is a metamorphosed phase of the graywacke. Probably a considerable portion belongs to the Keewatin schist. These two similar appearing formations -- similar because much of the graywacke was derived from the Keewatin -- are intricately crumpled and faulted together, particularly in the central part of the region. Except for

the conglomerate and readily identified graywacke mentioned in the above paragraph, these two formations are not distinguished, but are mapped as greenstone. It may be that some other highly altered chloritized rocks have been included with the greenstone. The term greenstone is used in this report to include what is probably Keewatin schist, undistinguished Kitchi sediments, and possibly highly altered dikes.

*Structure.* The region mapped is, broadly speaking, an anticline. The north limb of the anticline is well defined by north dipping quartzites, and the south limb, by south dipping quartzites. A large portion of the core is covered by swamps and cannot be observed at the surface. These swamps and the principal streams may owe their presence to the existence of underlying rocks which offer little resistance to weathering and erosion, or to crushed and faulted zones, probably in slaty or schistose rocks. That portion of the core that can be directly observed is composed of graywacke and greenstone highly contorted and intermingled. The peridotite seems to be intrusive into the greenstone schist and sediments. While the schist and sediments are cut by the dikes mentioned previously, the peridotite was not observed to be cut by any dikes. The granitic rock for the most part lies in the western part of the area. It is not exposed continuously, but only in scattered outcrops which rise slightly above the general level of the land. The granitic area was not mapped in detail. Three traverses were run into it in Sec. 26, T 48 N, R 28 W, as indicated on the map.

The entire region is extensively faulted. The major thrust faults strike east northeasterly, parallel to the prominent ridges. Numerous minor cross or adjustment faults were observed in many places. While the major faults are indicated on the map by single lines, it is, of course, understood that these lines represent fault zones which may in some cases be hundreds of feet wide. A distinction is made on the map between inferred and actually observed faults. No pretense is made that all the faults are shown on the map, but the general pattern is well established.

*Mineralization.* The mineralization is not confined to any one type of rock. Gold ore is found in, or intimately associated with, quartz veins. These veins occur in fault zones.

At the Ropes Mine, N W 1/4 Sec. 29, T 48 N, E 27 W, the ore occurs in a prominent fault zone which extends from some point west of the mine to Deer Lake. It is about 300 feet wide and dips about 90°. Within the fault zone, talc schist and chlorite schist are found. The gold bearing quartz veins occur within the shear zone. Broderick<sup>3</sup> considers the chlorite schist to be of Keewatin age, states that its thickness increases in depth, and reports that it, and not the peridotite, is host to the gold mineralization in a zone surrounding the quartz veins. The sections of this chlorite schist examined by the writer do not contain amphibole. Most of the other greenstones examined contain abundant amphibole.

Considerable amount of the wall rock of the veins is silicified. Much carbonate, some of which was proved to be dolomite, is present in the veins and surrounding rock. The gold is closely associated with pyrite. Other minerals present include chalcopyrite, tetrahedrite, and scheelite. Microscopic examination revealed the presence of small amounts of tourmaline in some of the quartz. According to reports, the ore carried some silver.

At the Grummet and the Breitung prospects, in the N 1/2 of the N W 1/4 of Sec. 36, T 48 N, R 28 W, the vein consists of sugary quartz. Under the microscope the grains can be seen to be interlocking. At the Grummet, the wall rock is highly altered (chloritized) felsite porphyry on the north and sheared greenstone on the south. At the Breitung the wall rock is a sheared greenstone, part of which may have been derived from a dike or graywacke. The vein is banded in a direction parallel to the walls. Pyrite is sparsely disseminated in the vein, and to some extent, in the wall rock. Some chalcopyrite is present. Aggregates of dark green chlorite are incorporated in some milky quartz specimens taken from the dump. In thin section small grains of a pyroxene-like mineral may be seen in the quartz and wall rock. Perhaps the most interesting mineral present is scheelite. Previous investigation<sup>4</sup> seems to indicate that the tungsten is not sufficiently abundant to constitute a commercial ore. The amount of gold present is very little, up to .01 oz. per ton being the maximum reported. The trend of the vein, the sheared and altered nature of the rock, together with the abundance of slickensided surfaces, seem to indicate that the mineralization followed a fault zone. South and east of the Grummet a uraltic diabase dike, striking north of east, and in excess of fifty feet in thickness, occurs. This dike may have served, at least, in part, in localizing the mineralization. A similar dike, striking about E-W, occurs north of the Breitung. Rather extensive trenching has failed to reveal other veins of economic interest. Dip needle readings across the veins at both of these properties, taken at five pace intervals, showed no significant change.

At the Grayling prospect, S E 1/4 Sec. 26, T 48 N, R 28 W, the vein is rather similar in attitude and character to that just described. The country rock is sheared greenstone, containing amphibole and chlorite and the pyroxene-like mineral alluded to at the Grummet prospect. The mineralization is very limited. South of the westernmost pit on the north edge of an open swampy cleared depression is a timbered shaft. Neither exposures nor dump can be seen in its immediate vicinity.

The Bjork-Lundeen prospect, W 1/2 Sec. 30, T 48 N, R 27 W, is located in a uraltic dike and greenstone. Trenches and pits extend from the W 1/4 post of Sec. 30, a distance of about 1/4 mile east. A little over a 1/4 mile south of the easternmost trenches mentioned above, another set of trenches occurs, the two areas connected by a trail to the west of which is a swamp, to the east of which are outcrops of greenstone and uraltic

diabase. No mineralization was noted in the quartz veins other than a little pyrite. Some small crystals of magnetite are present in the uraltic rock. The quartz veins are coarser grained than at the Grayling or at the Grummet. At the southernmost trenches mentioned a barren north-south sugary quartz vein about 18 inches wide occurs in the greenstone.

Relations at the Peninsula Exploration, S W 1/4, Sec. 25, T 48 N, R 28 W, are somewhat more complex than at the above described localities. The workings, consisting of several pits or shallow shafts and trenches, are located on a roughly elliptical plug of quartz monzonite. This plug is about an eighth of a mile long and about half as wide. Its long axis trends north 45° east. Some greenstone schist containing dikelets of quartz monzonite parallel to the schistosity can be seen at the contact. Some graywacke is exposed in contact with the quartz monzonite at the north east end of the outcrop. Greenstone, which may be highly altered basic dikes, is exposed on the north side of the outcrop. The quartz veins for the most part lie on the periphery of the quartz monzonite. The vein at the northern shaft contains microcline and vugs of adularia (?). Some of the veins exhibit the sugary banded texture referred to in the discussion of the Grummet prospect. Some sulphides are present. Pyrite, chalcopyrite, and small amounts of galena were observed in samples taken from the dump. Some coarse green chlorite was found in and adjacent to the quartz veins. About an eighth of a mile west of the quartz monzonite plug, several trenches and test pits are located in quartz veins in the greenstone. These workings do not seem to be of any possible commercial importance. In the vicinity of the Peninsula, a number of quite large graywacke boulders of angular shape occur. They appear not to have been transported far from their original position.

Because of limited time in the field, the writer's observations at the Michigan Gold Mine, N W 1/4 of the N E 1/4 Sec. 35, T 48 N, R 28 W, were confined to an examination of material on the dumps and to the study of a few scattered outcrops. The quartz veins contain pyrite, chalcopyrite, small amounts of molybdenite, and scheelite. Silver and bismuth minerals have also been reported. Highly altered rock, dacite porphyry, felsite, and a uraltized basic rock, as well as greenstone schist, were observed on the dump. While all of these rocks were observed, in place on the property, the general relations were not worked out. The Michigan ranks second to the Ropes Mine as a gold producer. Some coarse chlorite occurs in the veins. The general strike of the several veins is E-W.

2. Seaman, W. A., Summary of the Geology of the Marquette Iron Range, in Progress Report No. 10, State of Michigan, Strategic Minerals Investigations in Marquette and Baraga Counties, 1943, by A. K. Snelgrove, W. A. Seaman, and V. L. Ayres, prepared in cooperation with the Michigan College of Mining and Technology, 1944, p. 11.

3. Broderick, T. M., Geology of the Ropes Gold Mine, Marquette County, Michigan, Bulletin of the Michigan College of Mining and Technology, New Series, Vol. 18, No. 2, June, 1945. (Reprinted from ECONOMIC GEOLOGY, Vol. XL, No. 2, March-April, 1945)

## Potential mineral resources of the region other than gold.

Asbestos (chrysotile) is abundant in the serpentinized peridotite in or near the major fault zones. A number of prospects exist in the area, showing cross fibers up to four inches in length in scattered veins. Some long fiber asbestos has also been found. To date, the appearance of the prospects is not very promising for commercial exploitation. It might be advisable to explore the buried area of the peridotite to the east of the Ropes Mine, where it is more intensely sheared.

Talc is rather abundant at the Ropes Mine. The specimens observed by the writer do not seem to be of very high grade. At least one pit has been sunk in the talc.

Verde antique (serpentine) has been quarried about a quarter of a mile west of the Ropes Mine. While this material appears to be of good quality and abundant, work was discontinued a number of years ago. Other Verde antique operations in the area were long ago discontinued.

Scheelite and silver occurrences are mentioned under the heading of gold.

## Suggestions for exploration.

While neither the Ropes nor the Michigan mine operations attained substantial proportions, development of a profitable producing gold mine in the region seems well within the realm of possibility.

From 1881 through 1897, 215,000 tons of ore, yielding \$647,902.37 was milled. Later an additional \$54,929.38 was recovered from tailings. About 90% of these values were gold, the remainder silver. Potentially the mine contains over one and one-half million tons of \$5.00 ore disseminated in the schist.<sup>5</sup>

For reasons previously mentioned, the writer believes that the quartz monzonite ("granite") is intimately connected with the mineralization, whether the "granite" is a true igneous rock, or whether both mineralization and the "granite" are simply manifestations of a general granitization process. The mineralization has followed major fault zones. The type of host rock probably is of little importance as a factor in the localization of the gold-bearing veins.

In prospecting for gold, efforts should be made to explore veins (or pegmatites) that follow the major fault pattern. Such faults might be evidenced by low swampy areas, streams, and beaver ponds. Such areas, it must be remembered, might owe their existence merely to rocks of low resistance to erosion or weathering. Areas adjacent to dikes probably would also be favorable as the later mineralization might follow the contacts of such rock.

In carrying out gold exploration, the possibility of finding commercially valuable scheelite should not be overlooked.

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# MICHIGAN GOLD

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PREPARED IN CONJUNCTION WITH RESEARCH  
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## INTRODUCTION

Gold mining has been conducted sporadically in Michigan for many years, and there have been many reported occurrences of gold. The object of the present paper is to summarize the occurrence of gold in Michigan.

## MODES OF OCCURRENCE

Apparently there are three modes of occurrence of gold in Michigan: (1) vein deposits; (2) placers; (3) glacial deposits. Of these three types, only the vein deposits have yielded commercial production.

## REPORTED LOCATIONS

Gold deposits have been reported from many parts of the State, but the vein deposits, so far as at present known, are concentrated chiefly within the region lying in general north of Ishpeming and Negaunee, in the Upper Peninsula. This region is sometimes referred to as the "gold area." The location of known prospects in this area, obtained from published reports, is shown by the accompanying map (Fig. 1). The individual prospects are as follows:

1. B. and M., SW $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 21, 48-27
2. Brown and Case, W $\frac{1}{2}$  of NE $\frac{1}{4}$  Sec. 36, 48-28
3. Canal Company, NE $\frac{1}{4}$  Sec. 36, 48-27
4. Coon Mine, NE $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 35, 49-26
5. Daniels Mine, NE $\frac{1}{4}$  Sec. 30, 50-26
6. Fire Centre Mining Co., SW $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 35, 49-27
7. Giant Location, SE $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 36, 48-28
8. Gitchigamme, W $\frac{1}{2}$  of NW $\frac{1}{4}$  Sec. 36, 48-28
9. Gold Lake, NW $\frac{1}{4}$  Sec. 35, 48-28

10. Grayling Gold and Silver Co., SE $\frac{1}{4}$  of SE $\frac{1}{4}$  Sec. 26, 48-28, and S $\frac{1}{2}$  of S $\frac{1}{2}$  of SW $\frac{1}{4}$  Sec. 26, 48-28
11. Grummet Location, NE $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 36, 48-28
12. Holyoke Silver Mine, NE $\frac{1}{4}$  Sec. 2, 48-27
13. Kreig, NE $\frac{1}{4}$  Sec. 6, 49-26
14. Lake Superior Gold Co., E $\frac{1}{2}$  of NE $\frac{1}{4}$  Sec. 35, 48-28
15. Michigan Gold Mining Co., NW $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 35, 48-28
16. Mockler Brothers, SW $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 35, 48-28
17. (No name given), Sec. 33, 48-28; Sec. 18, 48-27
18. Peninsula Mining Co., SW $\frac{1}{4}$  of SW $\frac{1}{4}$  Sec. 25, 48-28
19. Phillips Gold Mine, NE $\frac{1}{4}$  Sec. 30, 48-27
20. Ropes Gold Mine, S $\frac{1}{2}$  of NW $\frac{1}{4}$  Sec. 29, 48-27
21. Saux Head Mine, NW $\frac{1}{4}$  Sec. 6, 49-26
22. Superior Gold Mining Co., NE $\frac{1}{4}$  of NW $\frac{1}{4}$  Sec. 35, 48-28
23. Swain's Location, NE $\frac{1}{4}$  of NE $\frac{1}{4}$  Sec. 36, 48-28

In addition to the vein deposits within the "gold area" north of Ishpeming and Negaunee, vein deposits have been reported from other locations, as follows:

### Marquette Range, southwest of Palmer

N $\frac{1}{2}$  Sec. 1 (?), T46N, R27W

### Gogebic Range, near Lake Gogebic

NE $\frac{1}{4}$  of Sec. 28, T47N, R43W

### Gogebic Range, southeast of Wakefield

Sec. 23, T47N, R45W

### Menominee Range, south of Quinnesec

Lot 4, Sec. 7, T39N, R30W

Lot 1, Sec. 8, T39N, R30W

Placer and glacial deposits have been reported from both the northern and the southern peninsula. In the northern peninsula, deposits of this type have been reported chiefly within the "gold area," especially along the Yellow Dog River. Many instances of gold in gravel deposits along streams have been reported elsewhere. These were listed in 1906 by W. M. Curtis<sup>1/</sup> as follows:

### "Washed by myself"

Maple River, Ionia County  
Lowell, Kent County  
Ada Creek, Kent County  
Grand River, below Lyons, Ionia County  
Flat River, Ontonagon County  
Ishpeming, Marquette County

### "Reported discoveries"

Ionia and Hillsdale (brass mistaken for gold)  
Birmingham, Oakland County  
Union City Branch, to the S. E. and S. W. (?)  
Marcellus, St. Joseph County  
Burr-Oak, St. Joseph County (pyrites likely)  
Grand Haven, Ottawa County  
Allegan, Allegan County  
Greenville, Montcalm County  
Howard City, Montcalm County  
County Line, Newaygo County

Muskegon River, Newaygo County  
 Whitehall, Oceana County  
 White River, Oceana County  
 Elbridge, Hart, June 7, 1906  
 Little Sable River, Manistee County  
 West Summit, Wexford County  
 Manistee River, Manistee and Wexford Counties  
 Walton, Kalkaska County  
 Rapid River, Kalkaska, Kalkaska County  
 Leelanau County, near Lake  
 Antrim County, same river (nuggets, reliable)  
 Boyne River, Charlevoix County  
 Little Traverse, Emmet County  
 Victoria Copper Mine (large nugget)  
 Ishpeming district, near gold mines, perhaps good  
 placers.

"Believed to be only pyrite"

Cheboygan, Cheboygan County  
 Alpena, Presque Isle County  
 Caseville, Genesee County  
 Flushing, Genesee County  
 Caro, Tuscola County  
 Near Fargo, St. Clair County  
 T.8N., R.14E.  
 N.E. ½ S.E.¼ Sec. 33, T.49N., R.42W.

No doubt there have been many other "discoveries," in addition to those recorded by Mr. Courtis.

1/ Geol. Survey of Michigan for 1906, (1907), pp. 581-84.

## RELATIVE IMPORTANCE OF TYPES OF DEPOSITS

Based upon commercial production to date, it would be said at once that the vein deposits are by far the most important of the three types of deposit. It seems highly probable that any future exploration and development will establish this as a fact. However, it must be admitted that some workable placer and glacial deposits might be located, but it appears most likely that any commercially profitable deposits of this type will be found within, or in close proximity to, vein gold areas.

## THE VEIN DEPOSITS

Descriptions of the vein deposits in the meager literature available are vague and unsatisfactory, but there seems to be general agreement regarding a few points. Nearly all descriptions indicate that the gold occurs in the native form, usually in quartz veins and in some instances in the wall rock adjacent to those veins. The minerals most frequently mentioned as associates of the gold and quartz are pyrite, chalcopyrite, pyrrhotite, chlorite, tourmaline, and dolomite. A complete list of all minerals noted in various descriptions follows:

Native gold	Quartz
Pyrite	Chlorite
Chalcopyrite	Tourmaline
Pyrrhotite	Dolomite
Sphalerite	Calcite
Galena	Pink carbonate
Magnetite	Epidote
Molybdenite	Feldspar
Chalcocite (?)	Tremolite
	Actinolite
	Pyroxene

There appears to be a considerable amount of variability in the individual occurrences, as may be seen from the following condensation of descriptions found in different reports.

B. and M. - Free gold in quartz vein 18 inches wide. Kitchie slates overlies vein.

Coon Mine. - Vein 5-6 feet wide carries "good copper ore." Ore minerals: gold ore with pyrite; copper ore; sphalerite; galena.

Fire Centre Mining Co. - Quartz veins in granite. Diminution of gold at 100 feet.

Giant Location. - Quartz vein follows north side of felsite and cuts diorite; appears to have well marked walls. Diorite along vein walls much corrugated and decomposed. Apparently two felsites represented, a black and a brown one. Vein contains chalcopyrite, pyrite, sphalerite.

Gold Lake. - Quartz vein in diorite. Felsite cuts diorite. Vein pinched out at depth of 60 feet.

Grummet Location. - Banded quartz vein encloses layers of country rock. At places vein consists of dolomite, chlorite, and quartz. One of wall rocks is felsite. Felsite later than veins is also described as present. Wall rock impregnated with dolomite and quartz which run in narrow seams parallel to the walls of the vein, the seams sometimes mineralized with pyrite to a remarkable extent. Chloritic rock associated with vein has very peculiar structure and jointing, and has been called both diorite and felsite.

Lake Superior Gold Co. - Narrow quartz vein contains a considerable amount of gold. Vein walls are diorite and felsite, but toward west side of workings felsite seems to cut vein. Vein not well marked, but broken and capricious. Several small, stringer-like veins, some in diorite, others in felsite.

Michigan Gold Mining Co. - Quartz vein, described as persistent and containing much free gold. Molybdenite associated with vein. Vein in diorite, but felsite dikes cut vein. Diorite walls of vein decomposed to chloritic material. Horseshoes of diorite in vein, as well as decomposed diorite walls, impregnated with mineral matter.

Mockler Brothers. - Quartz vein, containing fibrous tourmaline, seems to follow contact between granite and diorite for some distance, then cuts into diorite. Diorite is schistose, foliation running about parallel to its junction with granite.

Peninsula Mining Co. - Granite closely approaching a felsite contains irregular stringers and patches of quartz, rarely any veins. A diorite is associated with the granite. Minerals described as present are: some free gold, quartz, tourmaline, chlorite, dolomite, pyrite, pyrrhotite, calcite, epidote, chalcopyrite, sphalerite.

Ropes Gold Mine. - Ore formation, said to have a width of from 30 to 50 feet, described as talcose slates in which ore occurs in lenticular form generally running transversely across the formation. Lenses consist of narrow bands of quartz and slate. Minerals associated with gold are galena, pyrite, chalcopyrite, chalcocite (?). Country rock also described as serpentine and diorite. Shafts described as sunk in serpentine, one shaft to a depth of 850 feet. Lode developed for 400 to 500 feet along vein, and described as wider and more regular with depth and richer toward the west end.

Superior Gold Mining Co. - Vein contains quartz, dolomite, tremolite, actinolite, calcite, chlorite, fibrous tourmaline, free gold, chalcopyrite, pyrrhotite, and pyrite. Vein described as cutting diorite and cut by felsite. Diorite altered to chloritic, slaty material along vein walls.

Swain's Location. - Quartz veins cut diorite. Some felsite also present, but relationship to veins not stated. Diorite adjacent to veins is schistose and chloritic, alteration extending into diorite some two feet on north side of vein but only a few inches on south side. In part of area, quartz vein fractured and cut through in every direction by veins of dolomite. Minerals present are quartz, magnetite, pyrite, chalcopyrite, feldspar, dolomite, tremolite; also chlorite and pyroxene in some small quartz veins. Main vein is very irregular.

In addition to the foregoing descriptions of vein deposits, one description of such a deposit on the Gogebic Range, near Lake Gogebic, was given by A. P. Swinford<sup>2/</sup> in his report for 1883. No further mention of this deposit has been found in subsequent reports, yet Mr. Swinford's account appears to be favorable enough to warrant repetition here. Referring to work of the Summit Exploring, Mining and Manufacturing Company, he stated:

"The same company was, at the time my notes were taken, sinking a shaft in a belt of dark chloritic schistose rock, which is highly siliceous, and charged with free quartz and iron pyrites, and which is shown by analyses to be rich in gold and silver. This shaft is located in the north half of the northeast quarter of section 28, town 47, range 43, 1,100 feet west and 300 feet south of the northeast corner of the section.

The metalliferous belt dips at an angle of about 75 degrees to the south, under what at first appeared to be a regular hanging, but which is really a part of the vein or belt, which at this point is at least 60 feet wide. The shaft, which at the time of my visit had reached a depth of about 15 feet, showed two seams of the same rock largely decomposed, which is apparently much more heavily charged with the precious metals--the one next to the hanging being from 6 to 8 inches and the other from 8 to 12 inches wide, and both in conformity with the hanging. Specimens taken from a depth of 14 feet in the shaft show considerable lead-silver, which is considered a favorable indication. The shaft is located in the north side of a hill (which rises to an elevation of 125 feet above drainage), about 150 feet west of where the vein outcrops, and beyond which it has been traced eastwardly, by test-pits and trenches, a distance of 450 feet. It is the intention of the company to give the vein a thorough test, to which determination they have been encouraged by the assays herewith appended, and which were made from samples taken from across the bottom of the shaft at a depth of only 7 feet:

No. Sample	Silver	Gold	Total
1	None	None	None
2	\$10.00	None	\$10.00
3	8.50	Trace	8.50
4	11.00	\$ 7.00	18.00
5	7.50	12.00	19.50
6	7.70	30.00	37.70
7	7.70	36.50	44.20
8	15.00	40.00	55.00
9	10.00	34.00	44.00
10	12.00	30.00	42.00
11	15.00	40.00	55.00
Average	\$ 9.50	\$20.80	\$30.30

"This is certainly a good showing, and, considering the great width of the metalliferous belt, the expectation of a paying mine seems almost certain to be realized. Of course, it will require a practical test to settle the question beyond doubt, the assays, favorable as they are, being by no means conclusive proof that the vein carries the precious metals in paying quantities; they can only be accepted as the very best evidence possible upon which to found such a belief, and as such they have already served the purpose of attracting the favorable attention of experts and capitalists whose research promises to be most thorough and conclusive."

<sup>2/</sup> Ann. Report of the Commissioner of Mineral Statistics of the State of Michigan for 1883, (1884), pp. 98-100.



## GENERAL GEOLOGY

Very little is known about the general geology of the gold area. A very small part of the area is shown on maps published by the United States Geological Survey,<sup>3/</sup> and on those maps is designated as part of the Northern Basement Complex, thought to be composed of rocks older than Huronian. A blue-print map issued by the Michigan Geological Survey shows Middle Huronian rocks (Ajibik Quartzite and Siamo Slate) present in part of the area. However, no geological map has been made of the greater part of this region.

In 1905, A. C. Lane<sup>4/</sup> described briefly the geology of the Michigan gold area. Comparing this area with the Lake of the Woods, Rainy Lake, and Seine Gold Mining regions of Canada, he stated, in part:

"The general geological conditions are quite similar to those north of Ishpeming, the Ropes and Lake Superior Mines, a gold region where gold mining is now suspended . . . Now the gold region of Michigan is located in exactly similar conditions. Running west from Marquette and passing but a mile or two north of Ishpeming and Negaunee and bounded and overlain unconformably by the basement conglomerates of the regular iron bearing series of Negaunee and Ishpeming on the south and cut into by the granites on the north, and by a great many other igneous rocks, including some important masses of peridotite, is a series of green, largely volcanic, rocks, which correspond in composition and geological position to the Keewatin of Canada and the Lake of the Woods. They are known as the Kitchie and Mona schists by the U. S. Geological Survey, the two terms indicating merely different degrees of alteration. In this series the gold product of Michigan, amounting to over half a million dollars, has been found."

<sup>3/</sup> C. R. Van Hise and W. S. Bayley, The Marquette Iron-bearing District of Michigan: U. S. Geol. Survey Mon. 28, 1897, Atlas; C. R. Van Hise and C. K. Leith, The Geology of the Lake Superior Region: U. S. Geol. Survey Mon. 52, 1911, maps.

<sup>4/</sup> Sixth Ann. Report of the State Geologist, 1904, (1905), pp. 155-158.

## FUTURE DEVELOPMENT

In view of the scarcity of exact information regarding known or partially developed gold prospects, and the lack of detailed geological knowledge of the area, any statement regarding future development of the gold region is very hazardous and would be nothing more than a guess. The only one thing that seems certain at present is that a detailed geological map of this region should be made as soon as possible, as it would furnish valuable aid for any future work. At the present time the Calumet and Hecla Mining Company is undertaking work on the former Ropes property, and the results of this venture may be expected to furnish some information as to the probable future of the area. This work would be greatly aided by the preparation of a geological map of the area. Such a map would also make possible a much

more comprehensive and certain test of the possibility of commercial production.

In connection with future development, it may be pertinent to cite the opinion expressed by A. C. Lane in 1904.<sup>5/</sup> He stated, in part:

"But I believe there are yet chapters to be written. Such competent and impartial judges as Newett and Layton have expressed the opinion that the Ropes could be a paying mine. If it had had, as many of the copper mines have had, half a million to start with, it might have paid dividends, worked continuously and opened up ahead. Our field has hardly been tested. We have seen that these rocks in which the gold occurs are extremely old. It is also probable that the disturbances which led to the concentration of the gold are very old, certainly before the last ice age, which has probably removed the most friable and easily crushed and richest part of many of the lodes, probably before the formation of the Lake Superior sandstones, and quite possibly earlier yet.

"It is therefore not beyond the bounds of probability that the gold of the eroded part of the veins may have collected in rehashed glacial gravels, or at the base of the Lake Superior or Potsdam sandstone, as quarried in Carp River, or even in yet older conglomerates.

"I am informed that up in the Lake of the Woods region and in other places in Canada the glacial gravels yield almost enough to pay to work, and it is liable to be so here."

<sup>5/</sup> A. C. Lane, Op. cit.

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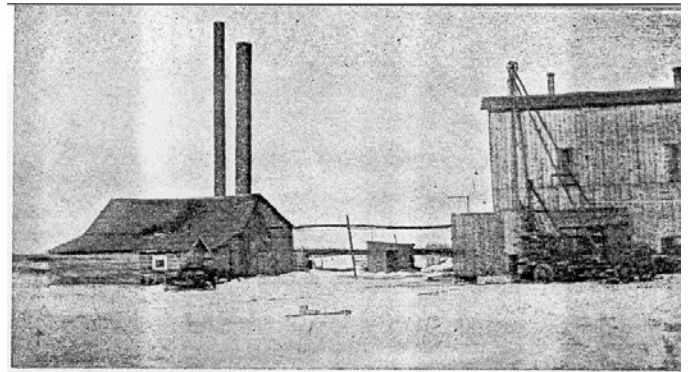
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## Michigan's Mythical Gold Mines

By Franklin G. Pardee  
Geological Survey Division

Michigan Conservation, November, 1945



Where over \$200,000 was spent in sinking shaft in search for gold near Alpena.

THE ONE GENUINE gold mining myth in Michigan goes back to the days of the first State Geologist. As we have the story, Douglass Houghton left camp one day in the company of an Indian and when he returned he carried with him some specimens of rich gold ore. A short time after this Douglass Houghton was drowned and he either did not make any notes of the location of this gold ore, or they were destroyed with him. In any event, no one ever knew where Douglass Houghton got this rich ore.

Without doubt this legend contains grains of truth as over \$600,000 in gold has been taken from the Ropes Mine in Marquette County and a spectacular specimen of gold ore from the Michigan Mine in the same locality was exhibited at the World's Fair in Chicago in 1893. There have been many explorations for gold in the hard rocks of the Northern Peninsula but this paper is concerned with the gold mining "myths" of the Southern Peninsula.

In 1914, R. C. Allen, then State Geologist, wrote a paper on "Gold in Michigan." After reviewing the gold mines and prospects in the hard rock areas, he listed the reported occurrence of gold in about thirty places in the southern part of the state. All these so-called discoveries were from the sand and gravel beds above the solid rock and represented the location of one or two samples of material containing some small amounts of gold—for example, a small nugget or perhaps a few colors in a pan of gravel. Since that time there have been many other reports of gold being found in the glacial overburden but, like the former ones mentioned by Allen, none was of commercial importance.

The glacial overburden of Michigan no doubt carries a tremendous amount of gold worn off the hard rock hills of northern Michigan and Canada but by the very nature

of these glacial deposits this gold has been scattered and distributed all over the state. It is possible to imagine that somewhere there may be a concentration of gold of commercial importance in the Southern Peninsula, probably along some glacial river bed, but to date no occurrence of this sort has been reported. The chances for a concentration of this character are remote and it would be like looking for a needle in a haystack to search for such a deposit.

The underlying strata of the Southern Peninsula are undisturbed sediments, and gold mines in rocks of this type are usually found where the sediments have been broken or altered by igneous activity (molten rock which has forced its way into other rocks). With no signs of igneous rocks or action in this part of the state, the reporting of gold occurrences in Southern Michigan in large quantities is always looked upon with a great deal of skepticism.

About 1924 we received reports in the Survey office on an "important gold" occurrence in Alpena County. We thought at first that someone had hit a concentration in the shale and had mistaken the pyrite which is found in this shale for gold. Pyrite is a mineral that is yellow in color and it has been mistaken for gold so many times that it is often called "fool's gold." When we found that gold was reported from the limestone of that area we felt that a careful checkup was in order. This investigation was started and finished (so we thought) by a careful examination of the district—some accurate sampling followed by assays by some reliable chemists. We thought that by showing the negative results obtained by our work that the gold excitement would die down but unfortunately that was not the case. We found shortly that the gold not only was absent in the original rock, but the only real gold found was put there by artificial means. Actually some dental gold was put into the rocks which were used for assay. It took some time to bring this condition to light and in the meantime we had to deal with "a wonderful method" for the extraction of gold. The chemist for the Alpena group reported a "new process for recovering the extremely finely divided gold" that was missed in the assays made by the best laboratories in the country. This idea of a finely divided gold explained why the gold could not be seen in the rock and offered a plausible story to the uninformed who put up the money. Before the smoke blew away there had been a lot of drilling done, an experimental mill setup, and a shaft sunk. This latter enterprise expended over \$200,000 getting down about 230 feet. This shaft found nothing but a large amount of water and the money spent to sink it has been completely wasted. This is unfortunate as \$200,000 is a lot of money but this sum is only about one-half of the money wasted looking for gold in that area.

The shortest report which has ever been presented to the Michigan Geological Survey was the result of this gold mining "boom."

A mining engineer by the name of Wright was sent from Canada to look at this so-called gold deposit. He had

not been there many hours before he saw the true situation. For some reason he suspected that a copy of any telegram sent would be obtained by one of the promoters. In order to confuse the issue he sent a garbled statement to his office that he knew would be understood by the person to whom it was addressed. It is reported that Wright's wire went something like this: "Too near fresh water. Smells like fish."

Mr. Wright shortly afterward came to Lansing and reported his experiences to our office. It was not long after that an examination of the district by someone in the Geological Survey office was ordered.

Dr. W. I. Robinson made the trip and spent a couple of days around the so-called mine. He had been asked to report by wire as soon as possible and remembering the experience of the Canadian engineer, decided to word his telegram in a manner that would not give any information except to the person receiving it. He succeeded and the wording of his wire, "Wright was right," has become a by-word in the Michigan Geological Survey when an examination is made of some property which will not stand up under careful scrutiny.

After a year or so this excitement at Alpena died down. The reports of all the investigations, the lack of funds, and the departure of certain individuals from Michigan all contributed to this end. We in the Geographical Survey thought that the "Alpena Gold Fields" or, as the area was called in one prospectus, the "Alpena Rand," was dead, but we were far from correct. We had no idea at that time of the effects the depression and the increase in the price of gold would have on the search for this metal. Once the price of gold went up, it was obvious that this boom would revive the "Alpena Rand" but there was no one who would have predicted the rash of "gold fields" that broke out over the Southern Peninsula. Gold was reported in "astonishing quantities" from the so-called Vernon, the Ortonville, Perry, Montrose, and Grand Rapids "gold fields," to mention just a few, but in no place has accurate sampling shown any gold. While on the subject of the Alpena district, however, it may be well to complete the Alpena story.

The renewal of activity at Alpena was started, as far as we can find out, by a report of an engineer who claimed to have been in all the large gold fields of the world. He wrote a learned report which if analyzed carefully by anyone who knew the first thing about geology showed itself to be only a lot of geological terms put together in such a way that they meant absolutely nothing. He was followed by and we think was working with another engineer who wrote an impressive looking report on this district. This second engineer had an address on lower Broadway near the financial district in New York City and a list of previous jobs and titles that made him appear to be one of the pillars of the mining profession. The second engineer did not even visit the district but based his whole report on one or two samples which were sent to him from this area. His report also contained a lot of geological "double talk" which meant nothing but

provided him with a stipend of \$2,500 from the persons who hired him to do their work.

This latter engineer worked with a chemist who not only discovered another new process for the recovery of this very fine gold but described this particular type of gold ore in his report by the suggestive name of "micronic" gold. We were able to get this chemist into an assay laboratory where we were sure of the purity of the chemicals and where he could direct the procedure for the analyses of the samples according to his method without touching any of the materials or chemicals. He obtained no gold either natural or "micronic" by his new process, nor did we get any by the standard method which was run on these samples at that time. This chemist left Michigan rather abruptly, forgetting to leave us his forwarding address. Needless to say, no mine has ever been found or developed in this Alpena area. The money spent in this territory for this development has all been lost.

The chemist referred to above was also mixed up in the development of some of the other so-called "gold areas" of the Southern Peninsula. In fact there is an interrelation between all these mythical gold developments and to discuss these stories and areas fully would take too much time. They all follow a similar pattern in that somewhere in the story there appears a chemist or assay office that obtains results that cannot be checked by reliable laboratories. It would be charitable to say that these assays showing large amounts of gold were due to improper sampling or improper work in the assay office but the difference between the results obtained in these assay offices and those by reliable laboratories is so great as to make only one conclusion possible—that the figures are reported much higher than the actual results. The reason for this is obvious. A laboratory charges a fair price for making a gold assay. If a person sends a sample of material from his farm or property and receives the answer from the laboratory that the sample contains no gold, he pays his bill and forgets the whole thing. If, however, gold is reported in the sample, he starts looking for other samples and runs up a bill at the laboratory which is impressive in its size. His activity has furnished some money to the laboratory which may or may not go through the motions of making analyses before the misleading results are sent out. Multiply this procedure by even a small number and you can see how an unscrupulous laboratory can make money even in a state where gold mining is not an important industry.

The Montrose district or area is a typical development of one of these mythical or promotional gold mines and a description of this area and a statement of a few of the things that have happened will serve as an illustration of all of the developments that have been taking place within the last 15 years in Southern Michigan. These promotions are often called "pocket mines"—not because the gold is found in pockets in the earth but because the profits come entirely from the pockets of the investors.

There is no record of just how this area was first brought to our attention but the first stories told of gold ore being found at Montrose that assayed from \$20 to \$100 a ton. This was too good to pass up and a couple of trips were made to inspect this "rich deposit." The area of this "Montrose field" was about six miles square lying about two miles northwest of the town of Montrose, Saginaw County. The topography is level, but the streams have cut down about 20 feet below the average elevation of the ground. The river bank showed the soil to that depth to be glacial till with occasional large rounded boulders, with the bulk of the material fine enough to be classed as clay. It was along these river banks that the first "gold" was found by the excited promoters and it was here that the first sampling was done. An oil well test near Montrose showed about 80 feet of glacial till above the ledge in this vicinity.

A talk with the people connected with the development of this "gold district" brought out their reason for testing this area and, as we expected, "some old settler had talked with an Indian chief who got gold from somewhere around here," but it was not until these particular people came along that anyone had found the source of the Indian's "gold." We saw assay reports running up to \$100 per ton but our panning failed to show any gold colors and our samples (carefully watched) were sent to reliable assay offices which reported at best only a trace of gold. All this in spite of the fact that we took our samples from close by, or from the same holes that gave the big returns to the promoters of the district. In one instance three samples were taken in a most careful manner, crushed, ground thoroughly, and quartered. One quarter of each sample was sent to the laboratory that was constantly reporting large values. The other three quarters were sent to well known laboratories. The results were as follows:

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By Weight:	Laboratory A	Laboratory B	Laboratory C	Laboratory D
Sample 1	0.01 oz.	0.015 oz.	0.010 oz.	0.20 oz.
Sample 2	0.005	0.005	Trace	0.60
Sample 3	0.008	0.008	Trace	0.35
In dollars per ton of ore (gold at \$35 per oz).				
Sample 1	\$.35	\$.53	\$.35	\$7.00
Sample 2	.18	.18	None	21.00
Sample 3	.28	.28	None	12.25

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Laboratories A, B, and C were reliable laboratories but laboratory D was the one that always got the high value to "lead on" the investors. Incidentally laboratory D charged about twice as much as the others for each assay which is another indication of the character of this institution.

At about the same time another four samples were also sent to laboratory D which was able to obtain such interesting results. Three of these special samples were made from material given to students at the Michigan College of Mines for their laboratory work. These

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## THE ROPES GOLD MINES

*By George A. Newett*

Ishpeming

samples had been assayed many times and their values were well known. The reports by laboratory D for these three samples were all high and in no case closer than 18 per cent to the correct results. The fourth sample was made up of gold free sand which was used in the College of Mines laboratories for testing their chemicals. The return on this sample from laboratory D was \$89.60 in gold and \$.27 in silver per ton—an astonishing result but one which clearly showed why this organization was in business.

By the use of these high assay returns the promoters in the Montrose area were able to sell quite a little stock and create a market in leases. They were also able to make some money for themselves but none for the persons who backed them up with their cash. We reported the facts to the newspapers, and the Michigan Corporation and Securities Commission also did what it could to stop these promotions and the prospecting for gold finally stopped. However, some of the promoters got the idea that the area contained free mercury. As everyone knows, free mercury is a substance which would not stay in any one place very long and it is absurd to think of it being found in the soil which has been moved by the plow, or broken up by the roots of plants and trees and otherwise disturbed many times. However, the promoters insisted that mercury occurred in this Montrose area and it was not until they had used up all the money they could lay their hands on in the erection of two "Rube Goldberg" mills for the recovery of mercury that they finally quit.

It has been said that the discovery of gold or oil will disturb the equilibrium of the most conservative Scottish banker and people of Michigan who put their money into these "gold" enterprises with the hope of getting rich cannot be blamed too much as many business men have invested their funds with little investigation. However, we hope that, in future, anyone finding gold on his farm, or receiving assays showing large amounts of gold in samples sent to some laboratory, will stop for as many minutes as may be necessary, look over the situation very carefully, and listen to the advice of persons who have spent some time in the study of deposits of this character.

The State of Michigan has long been renowned for its mines of copper and iron ore, its deposits of coal, salt, gypsum, talc, graphite, feldspar, quartz, and other minerals and metals, and it has had some notoriety as a producer of gold, the metal that has the greatest attraction of mankind, and for which individuals and nations strive, for which much blood is shed, and which is recognized as the chief offender in the list of the roots of evil. It is the basis of our currency, and for it there is always a ready market, with rarely ever a surplus to interfere with greater outputs.

The existence of gold in the Upper Peninsula of Michigan has been known for a long time. So far back in our history as the days when our first State Geologist, Dr. Douglass Houghton, was examining the rock formations of this region, gold was talked about as occurring here, and there is a story often told of how the Doctor exhibited an eagle's quill filled with the metal. The exact spot from which he obtained the gold was never located; it was while in camp at some place between Ishpeming and L'Anse that he exhibited this gold to his companions. The unfortunate death of the Doctor, who was drowned in Lake Superior while on that exploring expedition, prevented the publication of the facts concerning his discovery.

In January 1864, DuBois & Williams, analytical chemists of Philadelphia, in assaying specimens of quartz from the old Holyoke mine located several miles north from Ishpeming in the valley of the Dead River were surprised to find gold, the quartz assaying at the rate of several hundred dollars a ton in this metal. They reported their findings back to representatives of the Holyoke Company but no attention was paid to it, as there was no thought that gold existed in that section.

It is interesting to note that many years later the Fire Center Gold Mining Company did some work near that location and took several thousand dollars' worth of gold from a prospecting shaft sunk in the granite, in which there were many small stringers of quartz. It is also important that there were quartz veins of this character holding gold in small amounts at other places on the property of the company, but they were not sunk upon nor given any practical tests to determine their real extent or value.

It remained for one of the pioneers of Marquette County finally to locate a real gold mine, and to prove that gold did occur here in considerable quantity. This credit belongs to Mr. Julius Ropes, who came to this county in 1858, and to Ishpeming 1867. Mr. Ropes was a chemist, had a good working knowledge of geology, and a great love for the rocks and for all nature in general.

As a chemist he had a great variety of determinations to make. In those days the mining organizations did not maintain laboratories as now. There was no such thing as phosphorus, and about all the furnacemen demanded was an ore that gave the desired quantity of metallic iron. The assaying was done by Mr. Ropes, who was also postmaster, and conducted his laboratory work in a little room at the rear of the postoffice main room. In his capacity of chemist he was called upon to determine the mineral contents of a great many kinds of samples, and among these there would occasionally be brought in by some woodchopper pieces of what the choppers thought was petrified wood. There used to be discussions among the choppers who were providing wood for the charcoal kilns of those days as to whether there could be any such thing as petrified wood, and Mr. Ropes was generally sought because of his skill in determining things geological and mineralogical to decide the controversy. He found the "petrified wood" to be asbestos, and he went into the hills where it was found to learn more about it; it was while on one of these exploring trips in the late seventies that he found outcrops of verde antique marble in the massive serpentine range that traverses several sections in towns 47 and 48, ranges 27 and 28. Formerly it was thought that there were no serpentine rocks in this county aside from an exposure at Presque Isle, but Mr. Ropes proved they existed prominently in the Ishpeming field.

I well recall how Mr. Ropes used to polish specimens of marble from the verde antique deposits. They were very beautiful and he spent much time in grinding and rubbing them. In some of these chromic iron running as high as 8 per cent was found. The story of the marble range is a highly interesting one. Many parties took a hand at its development, but in nearly every instance the work was conducted by men inexperienced in marble quarrying. At one time a deal was about consummated between Julian M. Case of Marquette who became interested, and a group of London capitalists whereby a very large sum was to have been paid for one of the properties producing these verde antiques. He took to London a lot of samples that had been sawn and dressed and that made an exhibit at the World's Fair held in Chicago. An exhibit was also made at the New Orleans exposition.

Today this marble range is receiving skilled attention, and the quarrying and shaping and polishing give promise of making a very important industry for this district. The marble has no equal for interior decorative purposes. The waste is being crushed in the American mine concentrating mill, the product being employed for grits in the manufacture of roofing, the green color of the marble being what the roofing manufacturers have long been looking for.

I make mention of this marble range and the attention devoted to it, as it was through its existence and exploration that the first gold mine operated in the State of Michigan was found.

In the fall of 1880, while Mr. Ropes was further exploring the marble range, he ran across a small vein of quartz that looked favorable for silver, and taking several specimens back home, he tested them and found they held both silver and gold, but not in commercial quantity. This made him all the more eager to learn more concerning the serpentine range, as his books told him that the serpentines held not a few gold mines throughout the country.

On the 17th day of May, 1881, Julius Ropes stuck his exploring pick into a moss-covered rock that proved to be a quartz outcrop. Its character immediately interested him, and on assaying specimens taken he found they gave him \$21 per ton in gold. The vein was a small one but it gave him courage to look further, and at every opportunity when his business permitted he sought the serpentine hills in search of the precious metal, and soon afterward discovered the outcropping that led to the opening and development of the Ropes gold mine.

Iron Ore gave the first account of the find in its issue of July 23, 1881, a few weeks more than forty years ago. The discovery was made in section 29, town 48, north of range 27, west, four miles north and west from the city of Ishpeming.

Assays of the rock from the discovery point gave as high as \$442 a ton, the values being principally in gold. That was good enough to warrant a celebration. The news of the discovery flew rapidly and there was some excitement concerning it, but not nearly so much as would have been aroused had the find been made in the gold fields of the west. There it would have meant a stampede from all the neighboring camps. Here it was received with many doubts, and it is not of record that any one rose earlier than usual on the morning after to rush out and prospect for other veins. The land thereabouts was principally owned by large corporations, and as one could not stake out claims after the fashion of the gold and silver regions of the far west, there was no incentive for any undue exertion. Every one wished the discoverers might meet with great fortune but comparatively few seemed to care to go out into the hills to search for like places and conditions.

The original discovery point of the Ropes mine was in low ground, with considerable water in a nearby swamp; it was concluded to start the first shaft on an elevated place, and one was selected about 1,200 feet away where the vein outcropped, although the surface samplings gave much less in gold and silver. Here several shafts were started, being located on the vein, and finally all excepting one of these was discontinued. It was decided that one would serve the needs of the company, which had been organized under the title of the Ropes Gold Mining Company, with 80,000 shares. This main shaft was called the Curry, in honor of one of its chief supporters. Mr. Curry was a miner who had worked in many places in this county, and who had been employed at the old Holyoke silver mine in the late sixties.

The Curry shaft had reached a depth of 30 feet when the first mill was ready for stamping. This was a five-stamp mill built by Frazer and Chalmers, Chicago, whose mills were in general use throughout the gold and silver mining sections.

The clean-up from the first month's run showed they had saved \$14.85 per ton from the ore treated, which was very encouraging. From this month's run the amalgam was smelted and the first precious metal bullion train ever driven in the State of Michigan made the trip from the mine to the National Bank in Ishpeming where the bullion was exchanged for money based on the assay value of the product. The writer had the pleasure and prominence of assisting in retorting the amalgam and riding into town on this train, if we can dignify a buckboard and a team of bronchos as a "train".

It proved that there was gold in the hills of the Upper Peninsula.

The little mill was started on the 7th day of August, 1883.

The first month's run was on 100 tons of ore.

The amalgam held \$704.62 in gold and \$98.81 in silver, the balance value being represented by the concentrates. The tailings showed \$9.00 gold and \$2.72 silver, a total of \$11.72. There was no oil flotation in those days.

Work progressed steadily and in 1887 the annual yield of gold and silver amounted to \$43,156.85, of which amount \$4,653.92 was silver. Captain Richard Trevarthen was in charge of underground work. Julius Ropes was president, S. S. Curry, Superintendent; the directors were J. Ropes, S. S. Curry, W. F. Swift, W. H. Rood, Dr. W. T. Carpenter, all of whom, with the exception of S. S. Curry, now a resident of Ironwood, have passed to the great beyond.

In February, 1888, an important improvement was made in the starting of a turbine located on the Carp River, about a mile east from the mine, where a dam gave a head of our feet and a Knowles pump was operated that supplied the stamp mill with all the water needed. The river is still there, but it has greater dams now.

In 1888 the mine yielded \$34,930.66 in gold and silver, an average of \$3.42 being saved from the tons of rock treated. Frank Moore, Marquette, was added to the list of directors and E. B. Howard of Ishpeming was treasurer.

Both have passed away since then. There were at this time 45 stamps in operation.

The product for 1889 amounted in value to \$57,684.75.

In 1890 the mill had increased to 65 stamps, a new mill having been built containing 40 stamps, and soon thereafter work in the old mill was discontinued. The new mill was constructed by George Mennie of Ishpeming, now residing in Bessemer, Michigan. Joseph Sellwood was manager. He was one of the earliest of the contractors in the Cleveland iron mine,

Ishpeming, and later made a fortune on the Gogebic, Michigan, and Mesaba, Minnesota iron ore ranges. He was the superintendent and Clarence R. Ely, the secretary.

The mine ore deposits decreased in value and size below the 12th level, and the ores were more difficult to treat. There was considerable talc mixed with them which interfered with the mill work. Frue vanners were used in connection with the regular concentrating tables connected with the mortars, and various other devices were experimented with in saving the fines, but at this there was a considerable loss in the tailings. The finances of the company were not equal to the proper equipping of the plant for the best results in saving of mineral. An assessment was called, but not very generally paid up, so that in July, 1897, the mine and mill were closed and never reopened. Later the plant and property were sold at public auction and was bid in by Price McKinney, and is now the property of the McKinney Steel Company. The mine buildings and residence dwellings were sold to the highest bidders, and thus went out Michigan's most promising gold mine.

In the fourteen years in which it was wrought it yielded \$647,902. This was a pretty good record considering the fact that those who operated the property were generally strangers to gold mining and milling; there were not the facilities for close saving of values such as we have today, nor were there such competent machines for ore production as we now have.

The mine was opened to the 16th level, the shaft opening at the 15th the total depth to the bottom of the incline connecting with the 15th level being 850 feet. The ore of the 16th level was rehandled at the 15th level.

The quartz of the vein carried considerable talcose matter in places, the gold-holding minerals being gray and yellow copper ores and iron pyrite. Free gold could frequently be seen in the quartz, and occasionally there would be small vugs in which native gold, crystallized, would be found. In one of these about \$400 worth of gold was taken, and the specimens were very beautiful. The vein, or lode, occurred in a metamorphic schist, principally magnesian. The foot was a greenish-gray talco chloritic slate, the hanging a soft steatitic somewhat calciferous, schist. The south horizon was an eruptive serpentine, these flanked by quartzite which overlies the iron ore beds of this region. On the north the schists are in close contact with diorite and granite.

The ore of the Ropes occurred generally in lenticular masses of varying size. In some places the ore bodies would be 40 feet thick. The walls generally stood well without timbering, and very little water was made.

I can say that there was ore in the bottom of the deepest workings when work was stopped. The walls of the vein were nearly vertical in the bottom of the mine.

In all the years the property was operated, only about 500 feet in length on the strike of the vein was worked, and it was known that the vein was well mineralized for a

length of more than 1,500 feet, as there was this difference in length of vein between the original discovery point and where the final shaft was sunk.

During the time the mine was active it was visited by hundreds of experts who were associated with gold mining enterprises throughout this and other countries, and in no instance did one of them fail to express the opinion that the Ropes was not unlike many other gold producers that were operating successfully. It had all the ear marks of the very best gold mines, and its ores were richer than those of the Homestake Treadwell Island, and other mines more prominent as dividend earners. The Homestake is still working at a profit but the Treadwell was put out of business by the encroachment of the sea due to earthquake.

May it not seem quite possible, or even probably, that some day the Ropes mine will again be active, and under a new order or things pay well for the investment necessary to its revival?

After the Ropes property had been purchased by Corrigan McKinney & Co., Mr. Price McKinney visited it and was looking about when he saw one of the workmen with a sheet of heavy copper in his hand. Asking him what he was going to do with this he was told that there was a hole in the room and the copper sheet would make a good patch for it. Mr. McKinney told the man to select some other material, as something about the copper caught his attention. Later he disclosed several old copper plates that had been used in connection with the mill and that were similarly coated with amalgam. This proved upon removal to be heavily charged with gold so that several thousand dollars' worth of the metal was this obtained, which totaled enough to go a long way towards the price paid for the property at the auction sale. All the other copper plates had been silver plated originally.

Later the Trebilcock brothers of Ishpeming bought the old buildings, including the mill, and they obtained a neat sum from amalgam found under the old mortars. I mention these incidents to further accentuate the fact that those who were conducting this enterprise were not skilled gold milling men. Had they been they would not have permitted these values to escape in the manner in which they did.

After the mine was closed there was a cyaniding plant erected for the treatment of the tailings, and several thousand dollars' worth of gold was secured, but there was little profit in the reclamation and the work was finally stopped. There is a big tonnage of tailings in the swamp that, with oil flotation and modern devices for saving the fines, might show a good margin of profit in working over this tailings accumulation. W. H. Rood conducted the work of the cyaniding mill for a time. In the computation of value of the product of the Ropes Mine I have not included the items incident to the findings of the amalgam on the old plates by Price McKinney, the amount recovered by the Trebilcock brothers nor the values secured from working over the

tailings, as I could not get the exact amounts of these operations. They would add several thousand dollars to the sum I have given in the foregoing.

There was a shaft with a single skipway, a ladder and pumpway, a shaft house 30x40 feet in which was placed a Gates rock crusher having a capacity of 30 tons an hour. There were two mills, the latest and newest being 86x84 feet. In this were 40 stamps, eight batteries of five each, and each stamp weighing 850 pounds. The mortar tables were silver electroplated. There were eight Frue vanners. Power was provided by a 235 horse power Corliss engine and a Rand compressor, steam being generated in Haxtun boilers. The mine hoist was a Frazer and Chalmers, five-foot drum. There was a carpenter and blacksmith shop, an assay office, warehouse and barn. There were also several dwellings for employes. The picture presented in connection with this paper shows the mill buildings.

Due to the showings that were made at the Ropes and the persistence of the vein as it was sunk upon and followed on its strike, there was started some prospecting on the range, generally to the westward of the Ropes. The Michigan mine was discovered on section 35, town 48, range 28. Work was started here August 15, 1887, under direction of F. P. Mills, then superintendent of the Cleveland mine of the Cleveland Iron Mining company, Ishpeming, who was a son of Ishpeming's first mayor who had been in charge of the Cleveland mine as its agent for many years. Here a deposit of wonderful richness was found near the surface in a vein of sugar quartz. Samples assayed at the rate of \$50,000 to the ton of rock, but, unfortunately, the tons were not. The vein outcropped across a forty acre tract and several test pits were started on it. A law suit was started against the operators who claimed priority rights for lease, but this was decided in favor of the Michigan company. Work was continued until the winter of 1887 when a shaft had been sunk to a depth of 77 feet. The vein still held at that depth, being about 10 feet thick, but the gold had given out and work was suspended. On the 15th day of May following, work was resumed at another point on the vein where another strike of great richness was made, assays running better than \$100,000 to the ton, and again the tons were lacking.

From this find the writer took a hundred pounds of specimens to Chicago and exhibited them at the general offices of the Chicago and Northwestern Railway Company where reporters from the various newspapers were asked to come in and examine them. I think I could have sold a million shares at a fair price had I been in the promoting business so eager were the many visitors to purchase an interest. All the leading men of the wheat pit were there and hundreds were clamoring for information and shares. The newspapers the next day were filled with glowing accounts of the great discovery in Northern Michigan. As a result of this trip the railway company built a spur line from Ishpeming west, paralleling the gold range and ending at a station it



named "Golden." Over this line the Michigan Verde Antique Marble Company is shipping marble from its quarry, so that it accomplished some good, and the railroad has been further projected to Michigamme, 25 miles distant to the westward. The Michigan quartz vein occurred in this diorite. For some distance on either side the walls of the veins take on a schistose character, due to chemical action, the depositing of Chemical acids probably at the time the quartz flowed in and filled the crevices.

At the Ropes there was every evidence that the vein was formed by igneous and chemical forces. There were no marks of stratification, indicating the quartz to be placed in beds, and everything opposed that theory. The gold was placed there in a chemical state, flowing upward through the great fissure, being deposited in solution. The lime was in its proper form; the gold, also, the crystal had theirs, and the work of metamorphism had been performed. The conditions indicated great permanency.

The Michigan gave out in its holding of gold, work was stopped and later the property was secured by a new Organization and the vein worked for its silica. That, too, was given up many years ago, but the quartz vein is still there, and who can say what may be in it hundreds of feet or a dozen feet lower than the level which the shaft reached?

The Lake Superior Iron Company, in a location near the Michigan and on its own lands, found several very rich pockets of free gold in a sugar quartz vein, in 1887, beginning work in August of that year. It sank a shaft 50 feet and ran a drift from the bottom of this, and in that distance several small but very rich pockets of gold were met with. Then the vein pinched, work pinched, and was soon thereafter discontinued.

Following the discovery on the property of the Lake Superior Iron company, Captain Wm. H. Johnston, superintendent of that company, took from the prospect shaft a pailful of the quartz in which the gold was contained. He took this to the office of the Lake Superior company, where he showed it to Mr. Charles H. Hall, agent, who at once asked that Mr. Ropes be invited in to see the collection. It had been decided to say nothing publicly about the find until the shaft was properly fenced in so that the rich rock might not be stolen. Accordingly Mr. Ropes was sent for and, on his arrival, when he saw the display, threw his arms above his head and said: "Didn't I tell you there was gold in this section. Here is proof of it." He was very much excited and immensely pleased. He was asked to make an assay from the lot, and in selecting the samples he omitted some of those that were extremely rich. Captain Johnston had moistened the quartz with water before Mr. Ropes came in and this brought out the gold more prominently than it would have appeared in the dry rock. As Captain Johnston expressed it to us, the rock looked as if it had been drenched with yellow mustard, so plainly did the gold stand out in it. Mr. Ropes made his assay, and the

results showed it held gold at the rate of more than \$44,000 a ton.

This property was located next to the Lake Superior Iron Company's prospect. It had for its president Dr. Joseph Vandeventer, for many years one of the firm of physicians who conducted the Ishpeming hospital, and who is now living in Leesburg, Va. Mr. C. R. Ely was secretary and treasurer. The vein was the same as that worked by the Lake Superior and the Michigan company, and showed the same characteristics, but did not show any such rich pockets as its neighbors. It closed work in 1888.

Detroit parties headed the Peninsula company. William B. Moran of Detroit was president; Fred T. Moran secretary and treasurer. Richard Trevarthen was the mining captain. The vein was located on the southwest quarter of the southwest quarter of section 25. It was better known as the "Sanson" prospect, work having been started by John Sanson of Ishpeming, who had been dead many years. Charles T. Fairbairn, now one of the leading men in the Republic Iron and Steel Company, had charge of the exploration for a time. The formation was entirely different from that of the Michigan vein, the mineral being disseminated through a formation of great thickness, and could be termed lowgrade. A shaft was sunk 30 feet and a tunnel ran into the side of the hill. It was considered a "likely" place but work was stopped herein 1888.

Ishpeming and Negaunee men combined to operate the Mockler, which was located on the southwest quarter of the southwest quarter of Section 35. A small vein of quartz in the diorite was followed only a short distance when work was suspended. There were places where free gold was found, but there wasn't enough of it for a commercial success.

Julian M. Case and some gentlemen from Detroit did some work for gold on the northwest quarter of the northeast quarter of section 36. A shaft 30 feet in depth was sunk and specimens showing free gold were taken out, but they were too few.

This organization had a powerful name and it started out to make good. Its lands were located on the southeast quarter of the northwest quarter of 36, which was a favorite section, as will be seen from the description. Interested in this prospect were George and Albert Raymon, H. J. Payne and George W. Parmlee of Chicago, John McDonald of Iron River, and J. M. Malloy of Ishpeming. The latter still resides here and is connected with the Chicago and Northwestern railway, as he has been for about 40 years. The best assay recorded gave \$10.40 per ton. Little work was done.

Eldred Robbins and George H. Arthur conducted explorations for gold on the northeast quarter of the southwest quarter of Section 31. Eldred Robbins was the father of Doctors Eldred Robbins of Ishpeming and Nelson Robbins of Negaunee, and was a well known explorer for minerals in this country. Peter E. Gingrass was owner of the fee of the land explored by the

Michigan, Superior, Grummett and other companies. Maurice J. Finn conducted explorations of the range and was backed by lower Michigan capitalists, and altogether there was a considerable prospecting movement during the late eighties but in no instance, unless in the case of the Ropes, was work prosecuted far enough to fully determine the real value of the lands so far as the gold was concerned. Veins have their barren stretches, and to this there are no exceptions that are known. Greater depths might have proved more than one good mine, and it might not. The question is still unsolved.

So far as I have been able to secure authentic figures the records prove that there was produced from the various mines and prospects gold and silver to the value of \$668,484.73, to which can be added several thousand dollars as afterward mentioned in this article. This does prove that there is gold in our hills and suggests that all of it has not been taken.

I think it fitting that here I make brief mention of the man who was chiefly instrumental in calling the attention of the people of this region to the precious metal values of our county as well as to the beautiful marble now being quarried here.

Mr. Julius Ropes was born in Newbury, Orange county, Vermont, April 22, 1835. He came to the Lake Superior country in 1858 engaging in mercantile business at Harvey, near Marquette city. Two years later he engaged in the drug business with Mr. Stafford in Marquette and in 1867 came to Ishpeming to take charge of a store the firm conducted in this city. Mr. Stafford sold his interest in this in 1868 when the firm consisted of Dr. B. S. Bigelow and Julius Ropes. Mr. Ropes continued in business until 1878 when he disposed of it to Fred P. Tillson. During this time Mr. Ropes had been postmaster for a term of years. October 12, 1867, he married Miss Eunice L. Rane of Marquette, from which union there were two sons and two daughters. Mr. Ropes died April 14, 1904, leaving the family mentioned.

Julius Ropes was one of God's noblemen, and none ever lived who possessed a more kindly disposition. He sought the minerals of the hills and the valleys because of the love he had for the work. The thought of riches never occurred to him. He had only friends, because he was the friend of every man. He had high ideals and great love for the good and beautiful. The work he did among the hills of marble is now bearing fruit, and in the days to come this county will find itself still more indebted to him for his great energy and unswerving faith.

The pictures herewith presented of the Ropes mine mills will serve to show something of the equipment when the mine was at the height of its success, and may prove valuable in the days to come when there will be steps taken to unwater the old shaft and test the mineral formations in which it is sunk. I believe that time will see this accomplished. Of the men who were directly associated with this enterprise few are now alive. The

last mining captain Thomas Robbins, died several years ago. He was a believer in the merits of the property and insisted that it showed enough in pay mineral to have warranted the continuance of the work.

Read at a meeting of the Marquette County Historical Society at Lake Michigan, in August, 1921.

TABLE I  
PRODUCTION RECORD OF THE ROPES GOLD MINE

Year	Gold Recovered			Silver		Total	Per Ton	Per Ton	Tailing Loss	
	Tons Treated	Amalgam	Concentrate	Free Milling	Concentrate					
1883	100	\$704.62	\$126.14	830.76	\$98.81	\$74.00	\$172.61	\$8.98	\$1.72	\$9.82
1884*	60*							15.00*		
1885	5,413			23,552.21			2,878.55			
1886	6,959	29,661.33	8,838.60	38,499.93	1,591.63	3,062.29	4,653.92	5.53	.67	1.90
1887	10,216	26,031.57*	8,099.09*	34,930.66*	Included with gold			3.42*		1.20 about
1888	16,855	41,140.11	11,205.83	52,355.94	1,621.39	3,709.42	5,330.81	3.10	.32	1.33 "
1889	31,365	72,841.54	17,216.86	90,060.40	3,345.57	6,309.48	9,655.05		3.18	Not given
1890	31,578	54,681.88	16,450.82	71,132.70	2,037.71	6,397.86			2.45	" "
1891	21,355	53,635.45	10,125.15	63,760.60	1,909.34	6,116.05	8,025.39		3.36	" "
1895				34,838.69			1,373.16			
1896	No information									
1897	16,686	29,747.61*	8,977.81*	38,845.42*					2.32	
Mine suspended July 1897										
Total Production - 647,902.37 in Gold and Silver      Gold predominating - 80%										
Product 1884 said to have been 60 tons yielding about \$15.00 per ton										
NOTE: *Includes silver.										

## GOLD IN MICHIGAN

The occurrence of gold in Michigan has been known ever since the time of Douglass Hough ton, the first State Geologist. He brought some specimens of gold ore back to his camp while on one of his exploration trips to the Upper Peninsula. His untimely death shortly after prevented his disclosing the location of his discovery or any facts about its importance. It is generally believed that the location of the camp was not far from the place where gold was found in later years.

An analysis was made in 1864 of some specimens of quartz found near Ishpeming which showed gold was present in the quartz. Nothing came of this reported find of gold until 1880 when Mr. Julius Ropes located the gold vein that was afterwards to become the Ropes Gold Mine. This vein was discovered northwest of Ishpeming in the south half of the northwest quarter of Section twenty-nine, Township forty-eight north, Range twenty-seven west. This was worked for a number of years, has a shaft to the 15th level but mining was done below that through a winze to the 16th level. The gross yield of the Ropes Mine is reported to be \$605,056.95 in gold and silver.

The Michigan Gold Mine was located in the same territory in Section thirty-five, Township forty-eight, Range twenty-eight. This property produced \$17,699.36 from workings not over one hundred feet in depth. Some very fine specimens of free gold were found in the Michigan Mine, some analyses of which ran over \$100,000 to the ton.

Just west of the Michigan Mine was Gold Lake Mine which was not as extensive as the other two as the vein pinched out at a depth of 60 feet. Two other mines, the Superior in Section thirty-five, Township forty-eight, Range twenty-eight, and the Peninsula in Section

twenty-five, in the same township were started about this time, neither of which were of any particular importance.

The Dead River area north of Ishpeming was the scene of other gold discoveries. This river basin is located about eight miles north of Ishpeming. The Fire Center Mining Company put down two shafts in Section thirty-five. Township forty-nine north, Range twenty-seven west. This gold discovery is also credited to Mr. Ropes. Work was started here in 1892 and abandoned in 1898. Some of the ore found here was run through the mill at the Ropes Mine with very encouraging results.

There have been a few other reported occurrences of gold in the Dead River area but none of these have developed beyond the stage of prospects. With cessation of work at the Ropes, Michigan and the Fire Center mines interest gradually dropped in the possibility of finding a profitable gold mine in the region and little prospecting has been done in this part of the country since 1900. This does not mean that this area does not contain profitable deposits of gold and silver but merely indicates that the old ventures were not able to survive under the conditions that were in existence at that time.

The Ropes Mine was inadequately financed and had to use crude methods of mining and extracting the ore. It is quite probable that if opened up at this time with good management and with the present knowledge of mining and metallurgy, the operation would have been a commercial success. It seems very likely also that all the rich gold veins have not been located and careful geological work and intelligent prospecting may discover some veins as rich or richer than those already known.

Gold has been reported in other parts of Michigan but there has been no occurrences that compare in importance with the discoveries around Ishpeming. Most of these other reported finds of gold are placer or stream deposits. It is possible that workable deposits of placer gold may be found in and around the Ishpeming area but it is very unlikely that any gold of commercial importance will be found in the stream gravels of the lower peninsula. The distance of the Lower Peninsula from any rocks that carry gold in primary deposition is so great that the chances of placers there are very remote.

NOTE: This short description of the occurrence of gold in Michigan is condensed from the report on this subject that was published in Mineral Resources for Michigan for 1911. A full account of the occurrence of "Gold in Michigan" is found in this report.

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## 14 Years of 24 Karat Mining

*by Tom Segall,*

*Geology Division, &*

*Glenna Segall,  
MNR Magazine*

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This is the only known photo of the Ropes gold mine near Ishpeming, as it was in the late 1880's.

**Y**ep! There once was gold in them thar hills in Michigan's Upper Peninsula. One mine was probably as productive and as ornery as most any of our western El Dorados. And in fact, friend, there may still be gold up there in them hills!

The first gold mine in Michigan was dug on a discovery located just north of Ishpeming in Marquette County. It was named the Ropes Gold Mine after its founder and major owner, Julius Ropes. He was a canny prospector who started hunting for gold in the region after woodchoppers uncovered an unusual deposit of asbestos. Asbestos is sometimes found in association with gold-deposits. Ropes heard about the asbestos and began to poke around in the region. On May 17, 1881, he sank his miner's pick into a rock outcrop which turned out to be loaded with gold and silver. He kept hunting in the same location and soon found more outcrops, some assaying out as high as \$442 of gold per ton. News of the Ropes find was published in the local paper, but oddly didn't seem to stir much interest. Perhaps local residents thought it just another pie-in-the-sky gold scheme. Others, however, decided it was on the level, and investors came forth steadily.

Soon after, the Ropes Gold Mining Company was organized with 80,000 shares of common stock. The first shaft was dug on an elevated location about 1,200 feet from the main vein outcrop. The main shaft was called the Curry in honor of one of the mine's chief supporters, S. S. Curry. By the time the shaft had reached a depth of 30 feet, the first crushing mill was completed and ready for stamping. This was a little

"five-stamper" built by Frazer and Chalmers of Chicago. The ore came out of the mine as lumps of rock. The crushing mill reduced all of this material to a fine powder, which was then put through a water trough, or sluiceway. The gold and silver, being heavier, sank to the bottom. In that way, most of the rock dust could be skimmed off the top and the "amalgam" in the bottom of the sluiceway could be collected for smelting in the company's small furnace. After the material was melted in the furnace, it was cast into small bars, and a few days later a team and buckboard headed for the National Bank in Ishpeming, loaded with three armed guards and the precious bullion. It was Michigan's first shipment of gold and silver. At the bank, it was weighed, and calculations showed that in the first month about 100 tons of ore crushed by the stamp mill had produced \$704.62 in gold and \$98.81 in silver. The tailings—rock material left after the bulk of gold and silver was removed—had been sifted a second time to produce an additional \$9 in gold and \$2.72 in silver, for a total of \$815.15, all from 100 tons of ore! At today's prices, that doesn't seem like much, but back when dollars were real dollars, that was Big Stuff. The owners were excited, the local residents were astonished, and word drifted throughout the Midwest that a minor, but important new strike had been made.

Work at the mine progressed rapidly after this first recovery, and year by year the yield of gold and silver kept coming out of the Curry shaft. By 1887, the average annual yield had reached \$43,156, of which amount \$4,654 was silver. The mine was proving a very prosperous venture for its officers and owners. Just for the record, it should be noted that Captain Richard Trevarthen was in charge of underground work, Julius Ropes was president, and S. S. Curry was superintendent. The board of directors included W. F. Swift, W. H. Rood, and Dr. W. T. Carpenter, as well as Ropes and Curry.

In 1888, these men expanded the mine's operations by construction of a dam on the Carp River about a mile east of the mine. This provided the mine with all the water it would need for its sluiceways. Also, the stamping operation was expanded from five stamps to 45 stamps, so production could be increased very substantially. These raised production in 1889 and 1890 to an average of \$57,685 annually. A new mill also was built containing an additional 40 stamps, and some of the older stamps were discontinued at this time.

Through most of the 1890's, the mine continued to prosper, but by 1897 production began to fall off and costs of mining were steadily increasing. The ore deposits increased in size and value below the 600-foot level, but the ore became more difficult to recover and process. Finally, in June 1897, conditions had reached a point where costs were higher than income and so, sadly, the crew was told the mine would have to close down. It had reached 800 feet into the earth to extract \$647,902 in gold and silver over a 14-year mining history. That was a very successful record considering

the fact that those who operated the property had started as strangers to the business of gold mining and milling.

After the mine closed, the property was sold several times, and a few owners even reopened operations briefly. In all these later attempts, however, the main vein was increased only about 500 feet in length, and none of the attempts proved very successful.

The Ropes was not unlike many other gold producers that were operating successfully in those days, and it had all the earmarks of being one of America's very best gold mines. Its ores, in fact, were richer than those of the Homestake, Treadwell Island, and other mines that proved more prominent in America's gold mining history. Recently, with gold reaching record high prices, the Ropes mine has been sold again, this time to the Callahan Mining Corporation of Darien, Connecticut. At present, the company has adopted a wait and see approach to whether or not the mine will be reopened. William A. Nicely, secretary of the Callahan Company, has stated that the mine might be opened in the future, depending on results of geological exploration on the 80-acre parcel of land.

The Ropes, however, was not Michigan's only gold mine. A second glory hole that became well known was the Michigan Mine, also located in Michigan's Upper Peninsula, about five miles west of Ishpeming. It was started on August 15, 1887 by F. P. Mills, superintendent of the Cleveland Iron Mine, at that time the principal operation of the Cleveland Iron Mining Company at Ishpeming. A deposit of unbelievable richness was found near the surface in a vein of sugar quartz. Samples assayed out to a value of \$50,000 per ton! Unfortunately, there weren't any tons of such rock and the find appeared to be a single instance of one small but valuable deposit of gold. Nonetheless, work continued at the site until the winter of 1887 by which time a shaft 77 feet deep had been dug. The vein of quartz ore held, being about 10 feet thick, but the gold had thinned out and work was suspended. In May, 1888, work was resumed at another point on the vein, with another strike of great richness being found, assays running better than \$100,000 to the ton! But again, the tons were lacking and the vein thinned out. However, specimens from this find were taken to Chicago and exhibited at the general offices of the Chicago and Northwestern Railroad. As a result, the company built a spur line westward from Ishpeming, paralleling the "gold range" and ending at a station named "Golden." Finally, however, the Michigan quit entirely and work was stopped. The vein had played out. Later the property was purchased by another company and worked for its silica deposits.

Michigan also had several other smaller mines. We even had a mythical mine. Around 1924, reports were received in the Geological Survey Office of an "important gold occurrence" in Alpena County. Geologists realized at once that something was wrong. It sounded as though someone had struck a concentration of yellow material in a shale formation and had mistaken pyrite for

By A. K. Snelgrove, W. A. Seaman, and V. L. Ayres

## ISHPEMING GOLD RANGE

*By A. K. Snelgrove*

### History

Although gold was first discovered in Northern Michigan in the eighteen 'forties, it was only in the last two decades of the past century that output of this precious metal figured at all significantly in mineral statistics. This meager development has been variously explained as due to: Lack of gold resources, preoccupation of the local mining industry with the abundant iron ores, ineptitude of early operators, inadequate financing, erratic or submarginal character of the deposits, and inaccessibility of the supposedly most favorable prospecting territory in and south of the Huron Mountains.

Numerous discoveries of gold quartz veins were made in the area north of Ishpeming, following the finding by Mr. Julius Ropes, of Ishpeming, in 1881, of the deposit which later became the site of the Ropes Mine. In 1845 Dr. Douglass Houghton, Michigan's first State Geologist, had detected gold in a stream bed, presumably near Ishpeming, but details were not disclosed for fear his exploration party might desert its survey work, and knowledge of the exact location passed when Houghton was drowned in Lake Superior later in the same field season. Another early indication of the presence of gold in Marquette County that was not immediately pursued was the determination in 1864 of this metal in assaying quartz for silver from the Holyoke silver property, eight miles north of Ishpeming. Gold finds reported subsequently to 1880 included not only those in quartz veins but also numerous placer or stream deposits, some of which were in the glacial drift of the Southern Peninsula. A list of localities is given by Allen (1).<sup>\*</sup> However, only the Ropes Mine, with a production record between 1882 and 1896 of \$605,056.95 in gold and silver, or over 95 per cent of the State's entire output of these associated precious metals,<sup>\*\*</sup> can be considered as having gone beyond the development stage. In 1896, Newett (5) published the gross value of bullion from other Michigan gold mines as follows: Michigan Gold Company, \$17,699.36; Fire Center Gold Mining Company, \$2,063.00; other prospects, \$820.00 (Gold at \$20.67 per oz. -Ed.). To serve the gold range the Chicago and North Western Railway built a spur line west from Ishpeming and terminating at a station called "Golden" (10).

The Michigan gold district failed to share in the spectacular gold developments in other parts of the pre-

gold. Pyrite is a mineral often found with shale. It's bright yellow in color and has been mistaken for gold so many times it's often called "fool's gold." In this case, however, the gold deposit was supposedly found in limestone deposits in that area. Now gold ore occurs almost solely in "igneous" rock forms—those where great heat has melted the rock and the gold into complicated masses. Limestone is not that kind of rock, being sedimentary, or rock that has been formed by settlement of fine materials in underwater deposits, where such deposits are buried under many later layers of material thus causing great pressure which finally forms them into rock slabs. So the idea of a gold strike in Alpena County sounded to geologists like a hoax. An investigation was started, but no gold was found. After that, everyone expected the excitement would die down, but that was not to be the case, and several more rumors and announcements of gold strikes continued to be heard. In a few cases, unsuspecting individuals, with big pictures in their heads, gave up their hard-earned cash to fast-moving promoters. They had to learn the hard way about the practice of "salting." Salting is usually accomplished by loading a shotgun shell with gold dust and then shooting it into a vein of rock. Back in those days of gold fever, a promoter with half a dozen gold-dust shot-shells blasted around into a small rock formation could usually convince half a township to turn loose its cash, meantime asking everyone to keep news of the find—and the promotion—very, very quiet "so claim jumpers don't beat us to it." Naturally, once the investors had invested, the promoter left on the first train west.

During the Great Depression of the 1930s, one-gallon prospectors again roamed across both peninsulas of Michigan, looking for the answer to their dreams, but none ever struck it rich, or even found dribblets of the yellow metal. Is there a big, rich vein of gold still down there somewhere beneath Michigan's topsoil? No one knows for sure, but our past history at least offers the possibility. In any case, most of us will just have to wait and see.

Cambrian Canadian Shield, especially in Ontario and Quebec, perhaps because of early local disappointments.

Appreciation of the price of gold in the nineteen 'thirties led to renewed interest in the Ishpeming Gold Range and a small production resulted from exploratory work and retreatment of tailings (12). In 1933 this amounted to 9.68 fine ounces, valued at \$247.00 (Gold at \$25.56 per ounce.); in 1934, 58.63 fine ounces, valued at \$2,049 (Gold at \$34.95 per ounce); and in 1937, 51.44 fine ounces, valued at \$1,800 (Gold at \$35.00 per ounce).

Private Canadian and Michigan interests in the nineteen thirties geologically mapped the area included in townships 48 and 49 north and ranges 26 to 28 west as part of a prospecting program in a region in which surprisingly little official geological data are available, although silver-lead-zinc-deposits, iron, talc, chrysotile asbestos, and verde antique marble are also known to be present.

The Calumet and Hecla Consolidated Copper Company of Calumet, Michigan, some years ago acquired the property and all outstanding stock of Ishpeming Gold Mining Company, owners of the Ropes Mine, but was forced in 1942, by governmental regulations restricting gold mining, to defer plans for operations (12).

The field work carried out in the Ishpeming Gold Range in connection with the present investigation consisted of examining as many of the numerous old surface workings and dumps as could be located, with a view to finding tungsten, molybdenum, and other ores. Much of the work was done at night, using the ultraviolet lamp to detect fluorescent minerals. At one prospect, the Grummet, the old workings were de-watered, and old trenches cleaned out and others dug. This work was done in cooperation with the U. S. Bureau of Mines.

In the following discussion no attempt is made to list all known gold occurrences in Marquette County. Instead, Allen's treatment of this subject (9) will be brought up-to-date insofar as new developments at three properties are concerned, with comments on geological features having relevance to the future of the district. Such new data as are available on the lead-zinc-silver-gold deposits of the Dead River Basin are presented in the last section of this report.

\* Numbers refer to bibliography on Michigan gold at the end of this section.

\*\* This does not include the silver from the copper mines of Keweenaw Peninsula.

## General Features of the Gold Deposits

The geological setting of the deposits was described by Lane in 1904 (6) as follows: "Running west from Marquette and passing but a mile or two north of Ishpeming and Negaunee and bounded and overlain unconformably by the basement conglomerates of the regular iron-bearing series of Negaunee and Ishpeming

on the south and cut into by the granites on the north, and by a great many other igneous rocks, including some important masses of peridotite, is a series of green, largely volcanic, rocks, which correspond in composition and geological position to the Keewatin of Canada and the Lake of the Woods. They are known as the Kitchi and Mona Schists by the U. S. Geological Survey, the two terms indicating merely different degrees of alteration. In this series the gold product of Michigan . . . has been found."

The gold in general occurs in quartz veins or lenses, less often in the pyritized wall rocks. "All the veins in the Gold Range vary much in width; some are in places only a few inches, and then swell out to a width of four or five feet, and some are even eight feet wide" (4). In addition to free gold, of which many spectacular samples are reported, the mineral associations recorded in the literature, include quartz, tourmaline, chlorite, dolomite, pyrite, pyrrhotite, calcite, epidote, feldspar, tremolite, magnetite, chalcopyrite, sphalerite, tetrahedrite, and sparse molybdenite. In this investigation, the tungsten ore mineral, scheelite (calcium tungstate), and associated powellite (calcium tungstate and molybdate) were discovered at several properties; bismuthinite (bismuth sulphide) was found at Michigan Gold Mine, a little fluorite was observed in a north-south striking vein in Sec. 26 T48N, R28W, and a little bornite in Sec. 25, T48N, R28W.

Felsite and diorite dikes, some of which are said to be post-ore (4 and 9) were encountered at several prospects.

Parker, in an account written during the period of operations (3), noted the regularity of strike of the veins in a direction almost east-west, their steep dips, and an offsetting to the north or south by faults.

The greatest depth of ore indicated by drilling at the Ropes property is over 1,500 feet.

Disregarding unimportant traces of gold in the iron formation, the youngest formation penetrated by the gold quartz veins is the Siamo slate, as at the Billings-Murdoch prospect, E 1/4 Sec. 20, T46N, R27W.

## Ropes Mine

The Ropes, Michigan's premier gold mine, is located in the S 1/2 of the NW 1/4, Sec. 29, T48N, R27W. (See Plate 4 for index map) Sixteen levels, to a vertical depth of about 850 feet, were worked between 1882 and 1897. Parker, in 1888, published a geological section (3).

According to Broderick (14), "The ore mined occurred in nearly vertical quartz lenses cutting diagonally across a vertical tabular body of Keewatin lavas and volcanic fragmentals separating two bodies of peridotite. The Keewatin and immediately adjacent peridotite are strongly sheared, the former being chloritized and the latter serpentinized and steatitized. In the vicinity of the quartz lenses the Keewatin is silicified, sericitized, and carbonatized. . . . The quartz veins carry tetrahedrite,

pyrite, chalcopyrite, and minor amounts of other sulphides, and the ore milled ran about .2 oz. gold and .9 oz. silver per ton, of which nearly one-third was lost in the tailings. Recent explorations have shown another type of ore occurring as a pyritic dissemination in schist adjacent to the quartz veins. There is about eight times as much ore of this type averaging .13 oz. gold and .6 oz. silver as there was in the quartz vein nuclei/.

Certain features of the Ropes deposit, mentioned by Newett (5), are included here because of their possible significance for other parts of the belt:

"At the 12th level the lode has a slight dip to the south, but from this point to the present lowest level it inclines slightly in the opposite direction, the walls being nearly vertical. The ore lenses have a pitch to the west. The bottom of the first main lens was found at the 5th level, that of the second at the 9th, and in 1896 they were working upon the east side of the shaft whereas in the upper levels the stoping was done to the west. In the lens encountered on the 16<sup>th</sup> level, the slate mixture is almost entirely missing, the vein being almost solid quartz, and giving an average of about \$6 per ton (With gold at \$20.67 per oz. -Ed.), this showing a better and stronger vein than has been found at any other point in the mine. . . . The finding of ore of better quality, and in larger body than has heretofore been met with, is particularly encouraging on this lowest level."

Calumet and Hecla Consolidated Copper Company, in its annual report for 1936, stated:

"Diamond drill core samples, breast and back sampling of old workings, and large scale ore sampling indicate that there is a good possibility of there being about one million tons of ore in the Ropes ore body, averaging .13 ounces gold and .70 ounces silver. How much more there may be below the old workings is not known, although diamond drilling showed the ore body to exist for over seven hundred feet deeper."

The writers visited the dumps of the main Ropes shaft and of the West Ropes Mine (1.7 miles apart by poor road) and were able to find very little scheelite at either place. At the main Ropes dumps the scheelite is pale yellowish white in color with bluish-white fluorescence; it occurs in 1 mm. grains disseminated in chloride sericite schist, on slip surfaces on this rock, and also in streaks over 1 cm. long in quartz veinlets. At the same dumps a few specimens were found to exhibit yellowish fluorescence which is attributed to disseminated powellite in quartz. The West Ropes dumps contain a little powellite in streaks 1 cm. long.

## Michigan Gold Mine

The Michigan Gold Mine, opened in 1887, is located in the NW 1/4 of the NE 1/4 of Sec. 35, T48N, R28W. Exploration was pushed in 1890 and a little more was done in 1895. The official production was \$17,699.36 (with gold at \$20.67 per oz.) but flagrant "high-grading" of spectacular specimens doubtless accounted for much

more. In the middle 'thirties, some further exploration was carried out and the old 10-ton mill was supplanted by a 100-ton flotation plant through which a total of some hundreds of tons of ore were run. The advisability of installing a flotation mill for this ore, which is said to be largely free milling and contains only a very small percentage of sulphides, may be questioned. The history of this property is one of prolonged litigation.

The workings are now flooded. The investigation of 1943 was primarily concerned with the occurrence of tungsten and molybdenum in the ore as determined by dump, ledge, and mill samples.

The main vein has been explored underground at intervals over 900 feet along its east-west strike. (See Plate 4) The property has not yet been carefully mapped geologically. Five distinct and more or less parallel veins were seen by the writers; the caretaker, Mr. Charles E. Secor, states that twelve veins can be recognized on the south half of the NW 1/4 of the NE 1/4 of Sec. 35.

The following geological account is abstracted from field notebook No. 88, 1890, of the late A. E. Seaman, in the files of the Michigan Geological Survey.

The vein seems to be divided by a horse of diorite most of the way to the surface. This horse is mineralized especially along the edges. Instead of running parallel with the walls of the vein, this diorite streak has an irregular course, causing the vein to narrow in one place and widen in another. The vein sometimes swells out and again narrows, but as a whole seems to hold a rather uniform width. Considerable schistose diorite is on the walls, particularly on the foot. This is filled in along the line of foliation with more or less quartz and is said to be "pay rock." At the west end of the first level a felsite dike which cuts off the vein was encountered and the work of drifting in that direction was temporarily abandoned, as about 12 feet of the hard felsite had to be cut before the vein could be recovered. The breast on the east end of this level showed up a good vein which was, how ever, somewhat narrower than at the shaft.

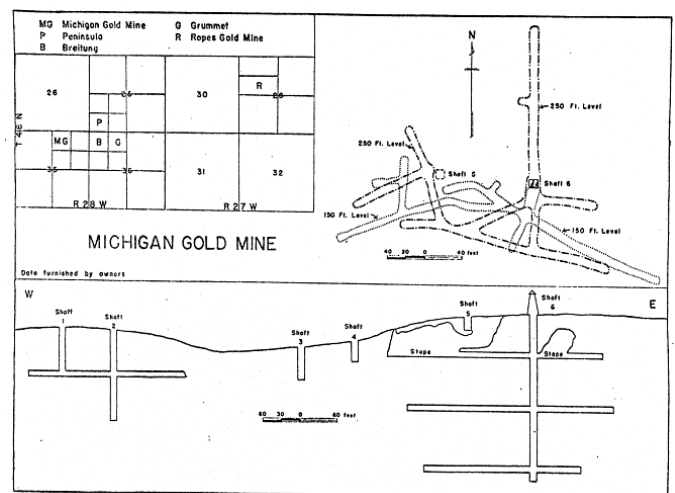


Plate 4. Plans and Section, Michigan Gold Mine.

The dip of the vein is somewhat variable, having gentle rolls but the average to the first level is about 76° while from the first level to the bottom of the shaft 25 feet below it is about 80° or at a slight turn toward the vertical. (It is not clear whether the present No. 2 or No. 6 shaft is referred to.)

On the dumps considerable quantities of felsite or quartz porphyry can now (1943) be seen, which is said to come, in part, from the longer crosscut at the 250-foot level, in which the caretaker reports a 47-foot shear zone with quartz veinlets.

According to Lawton (1), the width of the vein varied from 2½ feet at No. 5 shaft to 8 feet at No. 2 shaft.

Thirty-five samples were collected at the Michigan Gold Mine. Analytical results on these samples must not be regarded quantitatively as their purpose was to try to establish the presence and the particular associations of the valuable metals. Grab samples of mill products ran as follows: Sands from bottom of classifier 0.995 oz. gold per ton; flotation concentrates 0.30 to 0.47 oz. gold and 1.40 to 1.56 oz. silver per ton, 0.09 to 0.11 percent molybdenum, 0.038 to 0.18 percent bismuth, and 0.37 percent copper; feed to amalgam barrel 2.38 oz. gold per ton; amalgam barrel tailings 0.39 oz. gold per ton; mill tailings near mill 0.015 oz. gold per ton; mill tailings from the end of the pile remote from the mill 0.04 oz. gold per ton.

Bismuth-containing ore samples were found in a vein 20 feet south of No. 3 shaft (0.09 to 0.11 percent Bi). The bismuth mineral is tentatively identified as bismuthinite,  $\text{Bi}_2\text{S}_3$ .

Despite Parker's (3) report of "black antimonial silver" which with galena were said to take the place of pyrite at depth in this mine, no antimony could be spectrographically detected in any samples.

Grab samples from the dumps of three shafts and from two subsidiary veins lying north and south of the main vein, showed traces of molybdenum; the greatest amount obtained was 0.015 percent Mo. A concentration of molybdenite at the east end of the 250-foot level is reported by the caretaker.

Although few spectrographic traces of tungsten were obtained from the samples collected, several dozen specimens of creamy white colored scheelite, fluorescing bluish white, were gathered on the dump of No. 6 shaft. The scheelite occurs as grains, as much as one-half inch long, in quartz and subordinately in green schist.

Sampling of the workings for molybdenum and tungsten is necessary before any conclusion can be reached as to the economic possibilities of these metals in the ore of the Michigan Gold Mine.

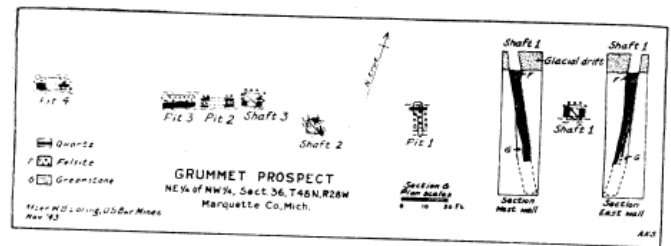


Figure 5. Geological Map and Sections, Grummet Prospect.

## Grummet Prospect

The Grummet gold prospect, in the NE 1/4 of the NW 1/4, Sec. 36, T48N, R28W, was located in the 'eighties and explored by three shafts, the deepest 62 feet, and by several pits and trenches. (See Figure 5 and Plate 4)

Of the numerous deposits in the Ishpeming Gold Range examined by the writers, the Grummet was discovered to contain the greatest concentration of scheelite. Arrangements were therefore made with the Minneapolis regional office of the U. S. Bureau of Mines to dewater the old workings and to sample for this strategic tungsten ore.

In the No. 1 or main shaft the quartz vein is 2 to 4 feet wide and dips northward at approximately 80°. The vein is exposed at intervals over a strike length of 240 feet in a direction S75°W. (See Figure 5)

Several trenches were dug in 1943 in an attempt to extend the known limits of the vein system but without success. Having in mind the existence of a number of parallel veins at the Michigan Gold property, three "forties" to the west, and the possibility of a difference in the magnetism of felsite dikes, with which the quartz veins are associated at the Grummet, as compared with the greenstone country rock, a series of dip needle traverses was run, with readings every 5 feet, north and south, in the immediate vicinity of the Grummet workings. A Gurley dip needle, Lake Superior model, was employed; no significant results were obtained.

The vein at the Grummet location consists mostly of sugary quartz, a transparent, even-grained, tight mosaic with individual grains less than one-sixteenth of an inch across. Locally the grains may be as much as three-eighths of an inch in diameter, or they may be lacking entirely and the quartz appears quite massive. If the quartz is massive a banding can be noticed due to differences in transparency. Films, plates, or blocks of the altered wall rock are rarely absent. Sporadically the vein carries cubes of pyrite with traces of chalcopyrite and of scheelite.

White silky veinlets of tremolite cut the quartz vein near the east end. Irregular veins of carbonate, mostly calcite but some with brownish weathering ankerite, are younger than the quartz and tremolite.

The wall rocks are much altered. Part, at least, was originally a felsite porphyry, now more or less sericitized, and part may have been a coarser "diorite" mylonitized



and changed largely to chlorite. These wall rocks are represented in Figure 5 as "Felsite" and "Greenstone" respectively. Both types are finely schistose, a light green bruise being the only megascopic evidence of the chlorite. The walls contain more abundant pyrite, some quartz lenses, and a little scheelite, and the secondary minerals chlorite, epidote, magnetite, leucoxene, and sphene.

The deposit appears to be of the mesothermal type. The absence of openings, the evenness of grain, and the lack of chalcedonic silica eliminate an epithermal origin; the lack of coarse texture and of minerals containing fluorine, boron, or phosphorus tends to exclude the possibility of deeper-seated mineralization. The fineness of the wall rock replacement, the abundance of chlorite, sericite, calcite, and pyrite indicate mesothermal conditions.

In ten preliminary dump grab samples of various mineral and rock association, some of which include bluish-white fluorescing scheelite, the presence of tungsten was confirmed spectrographically and chemically, some traces of silver, nickel, and lithium were determined, and gold assays running from 0.004 to 0.01 oz. per ton were obtained. Lithium was found in quantities less than 0.05 percent. The occurrence of scheelite, not only as a vein mineral, but also in some of the wall rocks, in quantities determined by the Jolliffe-Folinsbee method\* to approach commercial grade, warranted a thorough sampling of the deposit.

Fifty-one channel samples were cut from underground and surface. Spectrographic analyses revealed: Gold, none; tin, a small trace in 12 inches of greenstone schist from the footwall at Pit No. 3; tungsten, 7 large traces, 3 traces and 18 small traces; molybdenum, 1 very large trace (Shaft No. 2), 1 trace and 2 small traces; beryllium, 1 trace and 23 small traces; lithium, none; silver, 6 traces and 8 small traces; nickel, 9 traces; chromium, 3 traces.

Gold assays were made on all samples and were found to range from no gold in three samples, to 0.01 oz. per ton in one sample; in all other samples not more than 0.008 oz. per ton was present.

At the Michigan College of Mining and Technology, quantitative analyses for tungsten were made on all samples showing spectrographic traces. Check analyses were made by the U. S. Bureau of Mines. The results are given in the following table, which includes some additional determinations by the U. S. Bureau of Mines. (See Table 6).

All of the grades reported, with the possible exception of the grade on sample No. 30 (6 inches on the north wall of shaft No. 3 at 12 feet below collar) are below the present standard for tungsten ore.

\*Jolliffe, A. W., and Folinsbee, R. E., Grading Scheelite Deposits with an Ultra-violet Lamp: Canadian Institute of Mining & Metallurgy, Transactions, volume 45, pp. 91-98, 1942.

Sample No.	%WO <sub>3</sub>		Sample No.	%WO <sub>3</sub>	
	U.S.B.M.	M.C.M.T.		U.S.B.M.	M.C.M.T.
1	0.01		17	0.19	.2018
2	0.01		18	Nil	
3	0.01	0.0126	19	0.01	0.0038
4	0.01		20	Nil	
5	0.01		21	Nil	
6	0.01		22	0.09	0.1009
7	0.02		23	0.08	0.0631
8	0.12	.1009	23a	0.12	
9	0.01		24	0.01	
10	0.01		25	0.04	.0757
11	0.08	0.0504	26	0.10	
12	0.02	0.0076	27	0.05	
13	Nil		27a	0.03	
14	0.01		28	0.03	0.0631
15	0.01		29	0.01	
16	0.01		30	0.58	0.6027
			40		0.0038

Table 6. Tungsten Analysis of Grummet Samples

## Other Gold Prospects

In addition to the Ropes, Michigan, and Grummet deposits, numerous others of somewhat similar character were examined for scheelite, mostly with the ultra-violet lamp at night. Only in the east-west trending belt along which the Michigan Gold Mine and Grummet prospect lie (Plate 4) were traces of tungsten found.

At the Peninsula Mine, SW 1/4 of the SW 1/4, Sec. 25, T48N, R28W, several shafts and a tunnel are in what has been described as quartz stringers in a granite which approaches a felsite in character (4). A grab sample of pyritic quartz in a pegmatitic vein from the dump yielded 0.005 oz. gold per ton.

In Secs. 14, 21, and 23, T48N, R28W, are a number of quartz veins and pegmatites in greenstone and granite, to which the writers were guided by members of the Pepin family, owners of some of the land. No tungsten or gold was detected.

Immediately southwest of Michigan Gold Mine, traces of molybdenum (less than 0.01%) were found with tourmaline and epidote on a shaft dump on Cleveland-Cliffs Iron Company land. Still more molybdenum (molybdenite and powellite) was noted on the "forty" lying east of Michigan Gold Mine; assays of grab samples collected several hundred feet east in the NE 1/4 of the NE 1/4 of Sec. 35 ran from 0.12 to 0.63 percent Mo. Associated are small quantities of silver

(0.69 oz. per ton) and bismuth (0.16 percent). Somewhat further east on the Breitung property, in the W 1/2 of the NW 1/4 of Sec. 36, a 30-inch vein of quartz is exposed, striking S70°W and dipping 80°N; as at the Grummet a felsite dike parallels the vein which consists of sugary quartz with a little pyrite. No gold or tungsten was found spectrographically in samples from this 30-inch vein.

Two shallow shafts sunk for gold near the south boundary of Sec. 25, T48N, R28W are chiefly notable for small quantities of bornite associated with pyrite, chalcopyrite, and chlorite in quartz.

### Asbestos\*

At the Ropes Gold Mine property, in Sec 29, T48N, R27W, the country rock for the most part is serpentine. A ridge of this rock, forming the footwall of the gold deposit, extends south-westward and has been quarried for "marble" (verde antique) in the eastern part of section 30. At the nose of the ridge to the northeast of the mine several pits have recently been opened, exploring for asbestos. The asbestos is in seams in the dark green serpentine rock which is an alteration product of original peridotite. The seams are largely picrolite, a columnar variety of serpentine, not easily separable. The columns extend about 45° to the vein and are evidently due to shearing. Where the shearing is more intense the picrolite passes into chrysotile the white silky asbestos variety of serpentine, with the fibers parallel to the vein walls. The asbestos at this locality thus differs from the usual chrysotile, which is "cross-fiber." It has an advantage over the usual type in the length of the fibers thus produced-six or seven inches is a common length. A near-surface weathering product of the asbestos resembles brown cedar bark. Sufficient long-fibered white material is in the deposit to warrant further investigation.

\* By V. L. Ayres.

### Verde Antique

About 3/8 of a mile southwest of the Ropes Gold Mine, in the NE 1/4 of the SE 1/4 of Sec. 30, T48N, R27W, is the quarry of the Michigan Verde Antique Company, opened in 1914. Though the serpentine, veined by dolomite, is of pleasing pattern, and good material is abundant, the company apparently could not produce verde antique at a profit. The Chicago & North Western Railroad spur, finished in 1918, has since been dismantled.

Farther southwest along the serpentine belt, in Sec. 36, T48N, R28W, is the Williams quarry. This quarry was not examined. During the summer of 1943 the old cables were cut up for scrap.

## Conclusions

It seems reasonable to expect renewed interest and activity in the Ishpeming Gold Range after the war, provided gold is in demand. A thorough geological and geophysical survey of this area, where no doubt additional veins remain undiscovered beneath the drift, would facilitate the determination of possibilities for gold and perhaps also molybdenum, tungsten, and non-metallic mineral production.

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