

REPORT
on the
MINERAL DEPOSITS AT KOKOMO
TEN-MILE DISTRICT, COLORADO.
by
George Welsh Danahy, E. M.

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Foreward: Pursuant to instructions, I have visited the chief of the mineral bearing properties of the Ten-Mile District and herewith submit my report of the conditions as I found them during the week ending Oct. 21, 1934.

The text of this report is to cover only the general surface conditions of the various properties visited which are being combined under one management. The mines have not been worked for many years and the underground workings are on so vast a scale that each property must be taken up separately and covered in supplementary reports. It can be seen, therefore, that any estimate as to underground tonnages available at this time can only be made after many weeks of exhaustive study following the opening up of the mine entrances some of which are under water.

The object of this preliminary report is to give the owners an idea of the value of the surface equipment and tonnages already mined, so that they may have these assets before them in figuring their development campaign.

Location and Geographic Relations: The Ten-Mile District of Colorado lies between meridians 106 degrees, eight minutes and 106 degrees, sixteen minutes of longitude west from Greenwich and the parallels 39 degrees, twenty two minutes, thirty seconds and 39 degrees, thirty minutes, thirty seconds of north latitude. It covers an area of 55 square miles.

It adjoins on the north and western portion of the area represented on the map of the Mosquito Range Sheet VI of the Leadville Atlas, Monograph XII, district immediately north of the Continental Divide, which here runs east and west, connecting the Mosquito Range with the northern part of the Sawatch Mountains. It is bounded on the east by the steep western slope of the Mosquito Range.

Drainage: The drainage is northward into Blue River excepting the southern portion which drains into Eagle River.

Elevation: The elevation reached at some of the mines of the district are among the highest to be met in the West. The valleys lie at elevations of 10,000 to 11,000 feet above sea level. Two mountains attain snow capped heights, Jacques Mt. the highest in the quadrangle, 13,235 feet and Fletcher Mt. nearby in the Mosquito Range, at 13,917 feet.

Soil: The soil supports in places a considerable growth of coniferous trees of the hardy alpine variety, which sometimes, especially in the northwestern portion forms a forest covering sufficiently dense to obscure rock outcrops.

Towns and Railroads: The main valley of the Ten-Mile River which flows from south to north, rises in a fine glacial amphitheater just south of the quadrangle. In the upper part of this valley, the early towns of Robinson and Kokomo, a mile apart, were founded. They were, at one time, served by two railroads, the old Denver, Leadville, and Gunnison R.R. and the Denver, and Rio Grande R.R. At the present time, one railroad, now the Colorado Southern, serves the district by a well constructed narrow gauge road. The towns mentioned are 15 miles north of Leadville on this railroad, the latter being a smelting center.

That portion of the area which drains into Ten-Mile River is in Summit County, and the much smaller southwestern portion which drains into Eagle River is in Eagle County.

History and Early Development: Gold placers were discovered by venture-some prospectors in the early sixties--Ten-Mile--in an air-line from the settlement of Breckenridge. There was no important mining development until 1878. In this year, a very considerable number of more or less oxidized bodies, with ochreous outcrops, of pyrite, galena, and sphalerite were opened along the eastern slopes of Ten-Mile Valley, in stratified limestones. The most important finds were in the Robinson Mine. Here, ore to the value of over \$6,000,000 was mined. The total output for the district as near as can be found by the examination of old records, was over \$40,000,000.

From 1880 to 1890, after the oxidized ores had been mined most of the properties closed down. The lower grade sulphides were found to be unprofitable to treat in the costly roasting, concentrating, and electro-magnetic plants that had been erected. Since that time, modern methods have been developed so that the lower grade sulphide ores may be treated profitably. Severe climate has held back operations.

General Geology: The geology of the district is rather complicated. It is not necessary here to go into it in detail except to give briefly the general characteristics. The reader is referred to Folio #48, written in 1898 by Samuel Franklin Emmons, U. S. Geologist, for a detailed report of the numerous rock formations.

Suffice it to state, that the Mosquito Range is a recent uplift on the flanks of the older Sawatch Range. Paleozoic and Mesozoic sediments, with inter-bedded or intrusive sheets of igneous rocks, are numerous, the whole being pushed up into corrugations of folds, then broken by faults.

Underlying these sediments, we find the pre-Cambrian Complex consisting of granites, gneisses, mica-schists, and amphibolites, with a considerable development of pegmatite veins traversing them in every direction. Younger or dike rocks are chiefly diorite-porphyrines and rhyolites.

In the vicinity of Leadville and southward, the displacement has been distributed along a number of more or less parallel fault planes, on which the upthrow is almost invariably to the east. North of Leadville, this movement has been concentrated on a single plane, the great Mosquito Fault, which has a direction nearly due north along the western face of the Mosquito Range as far as the northern edge of the area included in the district being described, then bends sharply westward, following a northwest course along the southwest base of the Gore Mts. nearly to Grand R.

East of this fault, the overlying sediments have, for the most part, been removed by erosion, exposing the pre-Cambrian Complex. West of the fault plane, the post-Cambrian sediments, with their inter-bedded igneous sheets, dip at gentle angles away from the Sawatch Uplift and are more or less plicated and broken in the neighborhood of the Mosquito Fault. Some areas east of this fault, contain a crystalline complex, probably Archean. Cambrian quartzite rests on this crystalline complex near the fault.

The post-Cambrian sediments west of the fault, with which we are concerned, are of a numerous variety, consisting of rocks of Cambrian, Silurian, Carboniferous age allied with many with local terms. All are cut by eruptive porphyries and rhyolites. One of these latter formations, the Maroon Formation, contains the chief ore deposits of the district. It is a bedding of grits, consisting of calcareous and argillaceous material--coarse gray and red sandstones shading off into conglomerates with many irregularly developed beds of limestone. In depth, the red color gives way to greenish gray. The base of this formation is taken as the Robinson limestone, at the Robinson Mine, and the top of the formation, the Jacque Mt. Limestone. The ore deposits occur, generally, in some of the limestone strata although they extend into surrounding formations. Wherever there is found an eruptive porphyry in the Maroon Formation there is heavy mineralization.

Character of Ore Deposits: The ore deposits are prevailingly, pyritic. These consist of the bisulphide, pyrite and marcasite, with sometimes pyrrhotite (the yellow iron) or monosulphide. The pyrite ores alone are generally of too low a grade for exploiting. Associated with them, however, or by themselves, are less extensive accumulations of galena (lead sulphide), sphalerite (zinc sulphide), carrying silver, In some cases, other silver ores, sulphides, antimonides, and arsenides, occur. Taken together, these are the commercially valuable ores of the district. The manganese spars, rhodochrosite and rhodonite are frequently associated with them.

Types of Ore Deposits: There are three principal types of ore deposits.

- (1) Narrow ore shoots having a general northeast direction impregnating and replacing the upper part of the Robinson limestone on either side of a series of vertical fractures and faults. These consist of a coarsely crystalline aggregate of galena, zinc blende, and pyrite, with rhodonite calcite, barite, and quartz as the chief gangue minerals. The silver

values are found chiefly in the galena, some in the zinc blende.

(2) Ocherous outcrops of oxidized pyritous ores carrying some galena and zinc blende with varying values in silver. This type of ore is of better grade in the zone of oxidation and shades off to much leaner ores in the sulphide zone.

(3) Ore in a series of transverse fissures crossing the strata at right angles and having a north 60 to 70 degree easterly strike. These deposits belong to the class of fissure vein deposits, but, owing to the peculiar geological conditions, they present a rather unusual phase of this type of deposit. The outcropping rocks consist of coarse sandstones with some thin shale beds of the Maroon Formation with sheets of intrusive porphyry. The deposits are on fault planes cutting the beds at right angles and with a dip of 80 to 85 degrees northwesterly. There has been some faulting since deposition, throwing the upper portion of the veins southwestward or down the hill toward the town of Kokomo. Parallel fault planes, contain ore, which shows the necessity of frequent crosscuts. Oxidation extends to the six hundred foot level where the ore turns to sulphides of lower grade. The unaltered ore consists of galena, zinc blende, and pyrite with sulphides and antimonides of silver. Calcite here is the most important gangue mineral. The ore is a replacement of the country rock with the spar between "spar veins".

The ore in these transverse fissures is much richer in silver and gold than the replacement deposits in the limestones but not as important commercially because the veins are smaller.

In conclusion, on the types of ore deposits, it can be stated, that there were two periods of faulting, one before and one after mineralization; that the deposits are in the sedimentary deposits and included porphyry sheets; that the best deposits are in the hills immediately adjoining Ten-Mile Valley, on the west, with the town of Kokomo in the center. Beginning at the town of Robinson and the Robinson Mine, where we have replacement deposits in the Robinson limestone, the ore zone follows the western contour of Ten-Mile Valley around the town of Kokomo to Jacque Mt., with its transverse fissure veins.

The most important ore bodies are on the ridges or spurs known as Sheep Mt., Elk Ridge, and the south slope of Jacque Mt. These ore bodies have produced only a comparatively small proportion of the ore that has been developed, only the higher grades having been shipped under the previously existing conditions. It remains for modern practice to remove and extract the enormous amounts of the low grade pyritous ores, partially developed, which still remain untouched in the mines. They will prove extremely profitable to work by modern methods for great advantage may be taken of the large amount of development work that has already been done in proving up the deposits. In this portion of Colorado, wherever there is an intrusive mass of porphyry there is a large concentration of metallic sulphides.

The Kimberly Group: (See Claim Sheet)

The Kimberly Group of patented mining claims is the most northerly group in the combination. It consists of 39 claims, mill and equipment. It is on a siding of the Colorado Southern R.R. The tracks are still down and the grade is in fair condition. Searls Creek passes the door of the mill and runs parallel to the railroad as far as the town of Kokomo, three quarters of a mile.

Development: This group of claims is the one developed by the American Metal Co., of New York, about ten to twelve years ago. It is a large property but was not large enough alone to support a milling plant of 300 or more tons per day. It is reported that the company named, after spending some \$100,000 in driving a long development tunnel, 2700 in length to tap the ore bodies on their dip, drifting, and effecting connections with other known workings, gave the property back on their bond and lease to the former owners. They tried to effect a combination of interests, such as the present combination and failed. Therefore, they quit.

In running this crosscut tunnel, and making lateral connections with nearby properties, a large amount of low grade mill ore was developed. It is still in the mine as they had not figured on a milling plant until such a time as tonnage estimates were available. Only such ore as was in the way of development, was removed. It is now on the dump at the tunnel mouth just above the mill that was built by the former owners. This ore pile contains about 5000 tons of commercial ore (at present prices). It has been sampled by myself, by taking shovel cut samples, half way down the dump, to equalize sizing of the material. The average assays are as follows:

Gold----	0.06 oz per ton		
Silver----	1.7 " " "		
Lead----	0.7 % " "	Value \$	6.94 per ton
Zinc----	4.5 % " "		

This is a fair grade of mill ore for a modern selective flotation plant. There is considerable waste in this dump as it is development ore. In mining operations it can be taken out cleaner with a value as follows:

Gold----	0.09 oz per ton		
Silver----	2.50 " " "	Value \$	9.19 per ton
Lead----	2.00 % " "		
Zinc**----	4.10 % " "		

This sample was obtained by throwing some of the waste out of the \$6.94 sample.

A grab sample of known zinc ore on the dump gave:

Gold----	0.08 oz per ton		
Silver----	7.40 " " "	Value \$	25.46 per ton
Lead----	0.7 % " "		
Zinc----	27.5 % " "		

(See Production Map attached for mined values from this and surrounding territory.)

Kokomo Metals and Bishop Groups: (See Claim Sheet and Production Maps)

These two groups are taken together as each owns a certain interest in part of the claims involved. The groups in combination consist of 30 patented claims, adjoining the Kimberly Group on the South and Southwest and cover a good part of the territory shown on the small development map attached, of the Ten Mile Mines. The present combination of claims holds a part interest in other claims of the Ten Mile Group but are not included on the claim sheet.

Development: As shown on the Ten Mile Mines Map, these claims are developed by four tunnels. They are at a higher elevation than the main tunnel development on the Kimberly Group. The latter drains this territory. The main or Ten Mile Tunnel is 2650 feet in length. It was driven some years ago to develop the ore found along the large dike which crosses the property. There had been a number of shafts sunk on the dike but the ore found was bunched. Not understanding the geology and the nature of the ore deposits, replacement deposits in limestone, it was thought that the dike was the mineralizer. This intrusive dike, however, had intruded the deposits in the sediments and the ore contained was found to be drag from same. When the tunnel was driven it struck the dike on its dip but passed over the ore in the underlying limestone. Later, diamond drill holes were put down at the points A, B and C. In hole A, 9 feet of \$36.00 ore was cut at a depth of 150 feet. In hole B, 3 feet of ore was cut at a depth of 115 feet. This ore ran \$40.00 per ton. In hole C, at a depth of about 125 feet, 7 feet of \$36.00 was cut. It was attempted to develop this territory by winzes but a heavy flow of water was encountered and the work discontinued. Now, as stated above, this territory is drained by lower tunnels.

Shipments: The average of twenty shipments made from points along the dike is as follows:

Gold-----	0.176 oz per ton		
Silver-----	63.35 " " "	Value at present prices	
Lead-----	19.13 % " "		\$60.41
Zinc--	not listed		

Obtained from old mine records.

Shipments made from the Ten Mile Tunnel level

Gold-----	0.124 oz per ton	Value at present prices	
Silver-----	31.60 " " "		\$33.64
Lead-----	12.75 % " "		

A shipment of ore from the Smuggler #2 Shaft along the dike ran as follows:

Gold-----	0.2 oz per ton		
Silver-----	55.7 " " "	Value at present prices	
Lead-----	19.06 % " "		\$56.27

Uthoff Tunnel Group: This group of patented claims consists of seven together with 17 acres and improvements in the Kokomo Townsite. (See Production Map) It lies just to the southeast of the groups described above.

Development:

The development consists of a tunnel of 1700 feet or longer driven in to tap some of the known ore deposits in the bedded limestones, on their dip. Much ore was removed of about the average grades as those listed above. Very little could be found in the records regarding this property. The tunnel could not be entered due to ice, and caves at the portal. It is said to be in fair shape otherwise. The portal of the tunnel lies on the south bank of Kokomo Creek,

Wilson Group: The Wilson Group of 25 patented claims lies just to the Southeast of the Uthoff Group. It covers one of the most important locations in the ore bearing territory involved in the combination of interests. There is a mill building, in fair condition, on the ground and half of its present equipment, the primary crushing equipment may be used in rebuilding a milling plant along modern lines. The building is large enough to house a plant of 1000 tons. It is centrally located and there is a downhill pull to its bins from all the claims involved in the combination of interests.

Development: The property is developed by two deep mine shafts, the Wilson which is sunk to a depth of 1200 feet, and the Eldorado about 600 feet distant, which is vertical for 560 ft. There is then an incline from this level sunk to the bottom level on the Wilson. The shafts are connected by drifts on the 1100, and the 1200 foot levels. A crosscut from the bottom of the Eldorado Shaft has opened up the Well Known Robinson Ore Body. This ore body which cuts in under the Wilson Group is shown on the Production Map. Its output as far as can be determined from the old records is \$20,000,000. The Wilson and Eldorado Shafts have a production record of \$6,000,000. Nearly all of this production came from shipping grades of ores, the ore being sorted underground, hoisted and shipped to the smelters. Very little mill grades of ores were removed as milling operations were not successful and costly. Roasting and electromagnetic methods of separation were tried but milling operations soon came to an end with the drop in metal prices.

Dump Ores: The mill grades of ores that were removed during the development period at the Wilson and Eldorado Shafts are still on the dumps. The dumps are estimated to contain 45,000 tons of the value as follows:

Wilson Dump 29,400 tons Gold---- 0.02 oz per ton
Silver---- 1.7 " " "
Lead---- 2.5 % " "
Zinc---- 4.4 % " "
Value \$ 6.77 per ton

Throwing out some of the oversize gave:
Gold----Trace
Silver---- 4.5 oz per ton
Lead---- 5.6 % " "
Zinc---- 7.8 % " "
Value \$ 12.59 per ton

RAW Ore in the Mill Bins at the Wilson Shaft assayed:

Gold ----- 0.28 oz per ton
Silver ----- 5.0 " " " Value \$23.66 per ton
Lead ----- 4.4 % " "
Zinc -----10.2 % " "

and
Gold ----- 0.42 oz per ton
Silver ----- 4.00 " " " Value \$ 27.14 per ton
Lead ----- 5.1 % " "
Zinc ----- 8.5 % " "

(Cont'd)

This was "second grade" ore removed from the Wilson and Eldorado Shafts for milling. The tailings from their milling operations (5000 tons) run as follows:

Gold-----	0.10	oz	per	ton	
Silver-----	4.8	"	"	"	Value \$ 15.99 per ton
Lead-----	3.7	%	"	"	
Zinc-----	9.2	%	"	"	

This is a good grade of feed for a modern mill.

Water: The Wilson and Eldorado Shafts are full of water. Once pumped out they make 50 to 100 gallons per minute depending on the season of the year, more in summer than in the winter. There is a small amount of development work to be done to connect the Wilson workings with the Robinson Mine adjoining.

Robinson Group: This property adjoining the Wilson on the Southwest, consists of 21 patented claims, buildings and equipment. It is the famous old producer, formerly owned by Gov. Robinson (Ex-Gov.) of Colorado. It has been mined to a depth of better than 1700 feet on the incline. There were four main ore shoots that dip into and under the Wilson Group. Nearly all ores were shipped, the mill grades being left in the mine. The property has a production record of \$20,000,000. There are large amounts of mill grades of ores on the dumps of the average value of the district. As this property was not in the combination at the time of sampling, the dumps were not assayed. At present they are frozen and snow covered but show heavy mineralization. It is really not necessary to assay the ores of the district to determine if they are of commercial grade. If they show a fair sprinkling of lead and silver values they are commercial.

Development: There is a large amount of development work on this property. It consists of several working tunnels and inclines of over 1700 feet in length, and much lateral development. The property was acquired in order to expedite development work on the other claims in the combination and to acquire the dump ores that are available. The main working tunnel cannot at present be entered as it is caved at the portal. The Robinson property is also a connecting link between the Wilson Group and the 30% Group that adjoins the Robinson on the southwest. This property consists of 22 patented claims on proven ore bearing ground.

Other Development: On the Production Map, there is a shaft marked #8 or Dalzell Shaft. This shaft lies just Southeast of the Wilson Group and is east of a fault that cuts the formation and which parallels Ten Mile River. It was thought at one time that the ore bearing beds did not continue beyond this fault. The Dalzell Shaft was sunk to explore the territory east of the fault. This shaft is described in Volume 6, on pages 212 -- 219 in the Bureau of Mines Records for 1901-2. It is as follows:

The Ten Mile Leasing and Mining Co., owning the Champion, New York and Surplus Placer Claims, sunk a 1000 foot shaft, named the Dalzell, to explore the territory east of the New York Fault, for ore possibilities. The lower 300 feet of the shaft was in the fault zone, the upper portion cutting over 600 feet of sandstone. At 640 feet, the first ore zone was cut

extending for a thickness of 20 feet. At 920 feet, a drift was run easterly, cutting the same ore channel. The ore was not of shipping grade but 5000 tons of ore was shipped on which the shipper broke even. (Therefore, it is an ideal milling grade). At a 1000 feet in the shaft, a drift was started to tap the Robinson Ore Bodies but work was discontinued before this was accomplished. The Robinson Limestone was cut but the ore was not reached. The shaft was practically a dry shaft and is located only a hundred feet from Ten Mile River.

Note: This is the only development that has extended to east of the New York Fault that strikes parallel to the Ten Mile River. The fault swings the beds around slightly to the Southwest but ore bearing stratas are not cut off. The ore bearing beds in the Robinson and Wilson properties in this territory are all virgin. That they are of commercial grades has been proven.

Much of the information given in the above has been obtained from the Volumes of Records in the State Bureau of Mines of Colorado.

King Solomon Group of Claims: The King Solomon Group of Claims is a large group of 228 patented claims located on Ten Mile River several miles below the town of Kokomo. It is in the pre-Cambrian Formation, granites, schists, and gneisses.

Development: The property is fully equipped for large scale mining operations and is opened by a tunnel 6250 feet in length, extending from Ten Mile River southerly. Eleven narrow fissure veins have been cut. These veins contain good values in lead, zinc, gold, and silver and some copper. It is said that five more veins exist but the tunnel has not reached them. The equipment consists of a motor driven, eight drill compressor, a steam boiler plant and a full equipment of track, cars, air pipe, air receivers, and ventilation pipe extending the length of the tunnel. The tunnel is in solid rock and needs no timbering. It develops enough water for a small milling plant. The highway, powerline, Ten Mile River, and the railroad passes the portal of the tunnel.

(Signed)

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