REPORT
TOMAHAWK-BLACK DIAMOND GROUPS OF GOLD MINE
LA PLATA COUNTY-COLORADO

By
Ross D. McCausland

Report furnished by: Ross D. McCausland.
1- The two groups comprise 32 patented claims and 9 unpatented claims with a total combined acreage of about 480 acres. Steps are being taken to locate 9 more claims to the south and west to round out the block and protect the fissures towards the south and acquire ground for tailings disposal. This will then make a block of mineral ground with over 600 acres.

2- There is over 7,500 feet of underground workings, including eight tunnels, two shafts, one raise and many drifts and crosscuts together with numberless small open cuts and shallow pits.

3- Shipping ores of rather high grade have been produced from six different fissure veins and some milling grades from the Kate Deposit. There are more than twenty fissure veins shown on the property, all of them worthy of some exploration work and development. Past production has been close to one Hundred Thousand dollars, most of which was extracted and shipped in the early nineties. Accurate records are not available.

4- The reason for the closing down of the mines and the abandonment of all work except by casual lessees was the failure of the owners to find a treatment method that would handle the ores. Two mills were tried out but the best extraction was less than thirty five percent. The ores are of the gold telluride type associated with a small amount of sulphides and neither amalgamation, cyanide or gravity concentration methods would make a commercial saving.

5- Present day flotation treatment offers an efficient as well as cheap method for concentration of the gold values in these ores; and the concentrate can be roasted, then cyanided and the gold bullion shipped direct to the mint.

6- Assured ores, including five dumps and one ore shoot on the Clydealdale vein give a tonnage of 100,650 tons of ore with a gross value of $1,008,000.00.

7- Probable ores in the veins figure a total tonnage of 458,000 tons in five different ore shoots and with a gross value of $4,675,000.00.

8- Possible ores in the productive veins and in the many unexplored veins offer almost unlimited possibilities.

9- Operating costs should be low on account of the soft rocks and gouge accompanying the ores, the number and proximity of the veins, and the contour of the country that makes possible the development of large tonnages by adits and tunnels of short length.

10- Estimated costs for Mining, Development, Milling, Marketing and General amount to $4.50 per ton. Mill extraction on dump ores is figured at 80% and on freshly mined ores 90%.

11- Using these figures the probable profits show as follows:-

<table>
<thead>
<tr>
<th>Assured Ores</th>
<th>$352,362.00</th>
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<tbody>
<tr>
<td>Probable Ores</td>
<td>1,408,500.00</td>
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Total $1,760,862.00

In this report the above figures have been set in two for reasons of safety and conservatism and the resulting amount of $668,561.00 is deemed quite dependable. These ores represent the fissure vein system only.

12- The Kate deposit has dimensions of 2,200 feet by 600 feet and the surface outcrop represents a vertical height of over 500 feet. This means a tonnage of 30 million tons in the exposed section and 30 million tons for each 100 feet of additional depth. The big question on this deposit is what will it average as a whole? It is too large and too rough for hand sampling to give accurate
informations. It is cut by wide fissures and zones of shearing that will without doubt furnish enormous tonnages of ore that will average better than $2.00 per ton. Assays from many points away from these zones run from 90 cents to $2.00 per ton. So the actual commercial value of the deposit as a whole depends upon the proportion of the richer zones to the area of lower values.

It is our belief that the deposit will average better than $2.50 per ton if mined as a whole and on a scale of work not less than 1000 tons per day this should be profitable. If experiment shows that much of the mined ore can be rejected by sorting and thus bring up the grade of the ore milled as well as reduce the tonnage milled, it is quite certain to be profitable. This method is in use at the Alaska Juneau and it has made ores of less than $1.00 per ton very highly profitable.

A drift should be driven throughout the length of the Kate deposit at the lowest point practical and all of the rock run through the mill as a sample and test. This is the only safe method of arriving at the average value of the deposit. That such work is warranted can be seen from the fact that at $2.50 per ton there would be a gross value of 75 million on the surface alone. This work not recommended, however, until the property is on a paying basis from the ores of the fissure veins. Such a drift would aid the development of the veins also as it would cut at least fifteen of them south and west of any present work.

13- Capital required to equip the property and to carry out the development and rehabilitation plan as detailed in the body of this report, amounts to $250,000.00. Of this amount $100,000.00 is set aside for overhead, taxes etc. and payments on the property. This will put the property on a production basis of 100 tons per day with a modern and up-to-date milling plant, power plant, compressed air plant, ample housing facilities, transportation equipment, tools of all kinds, assay office and in fact everything needed for efficient operation the year round.

The development of the Kate Deposit and deeper work on the fissure veins can be done from profits on the operation; or additional funds can be provided to carry out this work in less time.

CONCLUDING REMARKS

The profits available amount to nearly four times the capital requirements without taking any consideration of the Kate Deposit or the many undeveloped portions of the veins that have shown production or the as yet unexplored veins numbering fifteen or more.

Any one of the fissure veins can make a mine of ordinary size and productions. The combination of such a large number of gold bearing veins of such size and extent on the same property; coupled with a gold bearing deposit of almost unheard of dimensions, makes this a property of practically unlimited possibilities. It stands unique and alone in the writer's 35 years of field experience.
The Tomahawk-Black DIamond groups of mining claims are located in the southwestern corner of the state of Colorado, in the California Mining District of La Plata County. The general district is known as the CHUR CH MAR BASIN and is Colorado's greatest and most extensive mineralized area, including as it does such well-known camps as Creede, Rico, Silverton, Telluride, La Plata, Lake City and many others.

The claims lie on the west side of the La Plata River about six miles up the canyon from the local camp of May Day and on a small tributary known as Basin Creek. A good county road runs down the canyon and connects with one of the main state highways at Esperus, which is situated on the Rio Grande Southern Railway and a distance of twelve miles from the Tomahawk. A private road connects with the county road, running down Basin Creek a distance of a little over one mile.

Durango lies southeast of the mines 37 miles distant and is the principal supply town of the Basin. Good federal and state highways connect with other Basin towns and with Gallup, New Mexico on the A.T. & S.F. R.R.

TOPOGRAPHY

Basin Creek rises just northwest of the property lines in a glacial cirque or basin about a mile in diameter and flows through the property in a deep, almost impassable gorge and drops down to the La Plata River in a series of small falls that carry it from an elevation of nearly 12,500 ft. down to about 9,800 at the river.

The largest part of the property lies in the basin and on the steep slope to the northward where it reaches the divide between La Plata River and Bear Creek and on down the Bear Creek slope for a distance of three thousand feet. The surrounding walls of the basin are nearly vertical cliffs and ridges well above timber line and several peaks tower to altitudes over 12,000 feet. Below the cliffs in most places there is a mass of slide rock or talus beds that reach down to the creek gorge or close to it and cover the outcropping rocks.

Ridges and flats not covered with talus have some timber grass and mountain shrubs; the timber is mostly spruce and some of it is large enough for mining purposes. On the lower slopes and along the La Plata River there is an abundance of raw timber, both spruce and fir and three of the claims take in some fifty acres of this timber land.

The entire area is very rough and steep and snowslides are numerous during the winter months. Only a few flats and ridges are located in places safe for buildings or outside mine structures. The character of the ground makes all mine development possible through tunnels and adits instead of the more expensive shafts. From the Basin Creek camp to the surrounding ridges a vertical height of 1,500 feet is available for tunnel development.

Basin Creek supplies ample water for all mining and milling purposes and considerable power could be developed with short supply lines. Winter conditions, however, would probably make diesel or steam power cheaper than the water power.

MINING CLAIMS

The Tomahawk group consists of 32 patented claims covering an irregular rectangle of approximately 500 acres. The adjoining group of the Black Diamond contains nine unpatented claims of about 150 acres. Openground of value to the groups and lying on the south and southwestern sides can be located to the extent of some 200 acres more. This would give a combined area of around 680 acres of
mineral land.

Three of the claims lie along the east banks of the river and cover a thickly wooded area with valuable timber. These are separated from the main groups by about a mile and one half.

The unpatented claims are owned by Mr. Agust Ekburg and were located by him and have been in his possession constantly so that the titles are in good condition.

NEARBY MINES

The Tomahawk-Black Diamond groups are surrounded on all sides by properties that have produced or are today producing gold and silver ores of shipping and milling grades. Many of these with records of past production have been closed down for years and some of them have been in more or less continuous operation by owners of leases for a long time. Recently many of the idle mines have been taken over by new owners and are being put into shape for more development and production.

To the south are the Copper Hill, Honey Dew, May Day, Idaho and Lucas; westward lie the Red Arrow, Boyle, Ida Stafford Century, Belle Hamilton and Allard; to the north and immediately at hand are the Tip Top, Mountain Lily and Small Hopes while farther away lie the Cumberland, Columbus, Beanie G. and Baldoon; eastward are the Lewis Mountain, Gold King, Durango Girl, Bulldozer and Shoe Fly.

All of these mines have had some production of high-grade gold and silver ores. Many others of less importance because of little development are located all through the La Plata range, and no doubt there are as many more as yet undiscovered.

HISTORY

Accurate and reliable historical information on the properties under consideration is hard to obtain as the original locators are long since dead and gone and the many claims in the groups have passed from hand to hand singly and in groups. The data herein has been obtained largely from Mr. Ekburg who has been on the ground since the first operations were started in the early nineties. He worked for the original locators and then staked out for himself the present Black Diamond claims which he has operated in the usual prospector's manner by hand and without any definite plan of development.

The first claim located in the Basin Creek section was called the Little Kate and was staked close to the creek on what is known as the Kate deposit. This is a large, well mineralized area of altered rocks at the contact of a diorite stock. The surface ore was oxidized and a five stamp mill was erected and operated by water power from the falls above. The surface ore was amenable to simple treatment by amalgamation and the little mill did fairly well as long as the surface and thoroughly oxidized ore held out. In this high altitude however, oxidation extends only a few feet and within two years or less the operations were closed because the mill could not treat the primary sulphide ore encountered at a depth of only ten to twelve feet below the surface.

Considerable exploration work was done then on several of the fissure veins within the diorite stock itself and here some very high grade shipping ores carrying tellurides of gold were opened up. One shaft sixty feet deep shipped over thirty thousand dollars in less than sixty days. Another chimney of high grade was opened on another vein higher up the mountain and this produced about forty thousand dollars. The chimney was lost in driving a long crosscut to intersect it at a lower level.
Meanwhile other claims had been located all around the Little Kate and small workings were made all over the mountain slopes. In 1904 Eastern parties organized the Tomahawk Company and combined the claims that now comprise the Tomahawk Group. This company built a twenty stamp mill with tables and vanners and proceeded to do a lot of development work on the fissure veins. About 7000 feet of underground work was done in cross cut tunnels, drifts and raises and considerable ore was exposed but most of it was of low grade and could not be shipped. The company tried every method known at the time in the treatment of ore in their little mill but the best saving that could be made was less than forty percent of the contained values in gold and silver.

Very little was known about telluride ores in these days and while the cyanide process was known, it could not treat the mixed sulphide and telluride ores. Plain gravity concentration was a failure because the tellurides slimes very easily and floated away with the tailings. The company finally gave up in 1911 and the property was idle for some time. Later on various leasers tried to open up high grade shipping ore in the same and other veins and some small shipment were made from time to time but nothing of any importance.

Mr. Ekburg persisted with his efforts on his own claims and at times leased parts of the Tomahawk group. In the years 1924-1926 he made several shipments from the Ground-hog tunnel on the Clydesdale vein. This was from an ore shot blocked out by the company but at a higher level. These shipments netted Mr. Ekburg from $23.00 per ton to as high as $100.00 per ton at the smaller and gave him cash with which to carry on the work on his own claims. In 1926 he made a small shipment from the E.J. vein on the Tomahawk group taken from the surface under the slide rock. This ore he sorted to a product that netted him $189.00 per ton.

In the year 1934 a group of Oklahoma men thinking they wanted to try out gold mining, took an option on the two groups and went to work with only three men and no equipment other than hand tools. After spending about five or six thousand dollars without seeing any great fortune in sight they abandoned their lease and option and returned to their own state and the oil game.

Such, in brief, is the story of the Tomahawk and Black Diamond groups, and it is quite a familiar story in all mine camps with local variations of course. Many a successful operating mine of today has passed through quite similar circumstances, only to finally come into the hands of real operators with real finances and so eventually to a profit making business.

The writer of this report examined the Tomahawk casually back in 1920 and considered it a remarkable mineral occurrence that was worthy of a well planned development test. Mining was at a lowebb and capital difficult to interest and so the idea was forgotten for the time. Last year the price of gold having given gold mining a boost, and fifteen years of work in the La Plata region given the writer a much better understanding of the ores and ore types, the Tomahawk group appeared to be a very promising field for investigation. We spent all summer and fall until the snow came, carefully studying the geological and structural conditions of the property and the immediate area surrounding, surveying, mapping and sampling and getting all possible information as to the commercial possibilities of the section. The report herewith is the result of that study.

**GEOLOGY, GENERAL**

The La Plata Mountains, like the Rico district, is a local domal uplift on the southwestern flanks of the San Juan Mountains. The local uplift has undoubtedly been caused by an underlying igneous magma that erosion has not yet exposed. The surface volcanic series that covers large areas to the north, as at Silverton and Telluride, if ever present in the La Plata district, has long since been eroded away. The present outcropping rocks are the sedimentary rocks ranging from Tertiary Age up to the Carboniferous, and into which have been intruded a multitude of sheets, sills, dikes and irregular stocks of igneous rocks of the intermediate types. Monzonite and diorite porphyry form most of the sills and dikes and pegmatite, monzonite and diorite make the larger masses of the stocks.
The sills and dikes have caused little, if any, metamorphic action on the enclosing rocks. Around the stocks, however, there has been considerable alteration of both the sedimentary and igneous rocks. Silicification has been quite general and alteration of calcarceous rocks to garnet beds is common over wide areas. The dark colored minerals of the stocks have been changed to light colored minerals like sericite, muscovite and talcose minerals over wide zones near the contacts with both sediments and other igneous rocks. In these contact zones can be found many varieties of unusual minerals common to the contact-metamorphic rocks only.

Alteration has been so extensive and complete in the central area, where most of the stocks occur, that identification of the formations is highly speculative. The sediments in these areas can only be judged from the position of the nearest unaltered beds where fossils and physical characteristics can be identified.

**GEOLOGY, Local**

The Tomahawk-Black Diamond properties lie between a large monzonite stock on the south and the largest stock of diorite in the district to the north. A large part of the ground covers the southern and western contacts of the diorite stock and extends over into the stock itself.

The sedimentary rocks between the two stocks consist of the La Plata sandstones outcropping on the highest ridges to the west. This is underlain by some 500 to 600 feet of Dolores beds or Red beds, altered here to a dirty green color and with the brown beds of garnet showing distinctly. Below this formation is about 1000 feet of the Cutler formation, containing sandstones, grits, shales and a few impure limestones.

All of these beds have many interbedded sheets of porphyry both monzonite and dioritic, and these are connected by numerous very irregular small stocks and dikes. In the vertical cliffs the lighter color of the dikes makes them distinguishable from the surrounding rocks.

The southern and western limits of the diorite stock are quite irregular in outline and tongues of diorite extend outward into the sediments for many feet from the main mass. This jagged contact is exposed plainly along the canyon of Basin Creek where the contact is first on one side and then on the other. Several large dikes of an unknown length branch off to the northwest from the diorite stock especially up the mountain side towards the divide and on the Bear Creek slope.

Along the south contact of the stock and Basin Creek the contact rocks have been greatly brecciated, crushed and altered for a distance of over 2,000 feet long by six to eight hundred feet wide. Sedimentary rocks, porphyry sheets and also the diorite have been affected by this crushing and it was caused by the strains set up in the cooling mass of the stock when it settled from contraction.

**Fissures and Faults**

Considering the structural conditions outlined above, it is not at all surprising that a very great number of fissures have been formed within this area. The enormous strains set up by the intrusion of the two stocks, followed by the cooling strains caused by shrinkage of the large masses would necessarily form many fractures and fissures both within the cooling igneous rocks and in the surrounding sedimentary rocks. One would expect these fissures to form in a series more or less parallel to the contacts and to both the long and short axes of the stocks and we find that this is true.

Within the diorite stock we find two sets of fissures, one striking northeast, the direction of the long axis, and the other set striking northwest with the short axis. Also another set with a strike more or less east and west or parallel to the south contact of the stock. Close to the diorite but out in the sedimentary formations we find the fissures running in a northeasterly direction with this contact of the diorite and branching fractures heading in towards the contact.
The Black Diamond system of veins is of this last type. The northeast set of fissures apparently continue southwest towards the monzonite stock for the deep gashes in the high cliffs above mostly trend in that direction. However they have not been opened up or prospected to any extent on the monzonite side of Basin Creek and so much slide rock covers the surface, it is impossible to examine any outcrops of the actual fissures.

To the north the fissures continue throughout the entire diorite area and several adjoining properties have worked on the extensions of the same fissures worked in the Tomahawk group. The fissures in the diorite particularly have a tendency to branch off from the main fissure and form a network of smaller fractures connecting the paralleling main fissures. This also happens near the intersections of crosscutting fissures so that the diorite stock is a more or less closely meshed network of large fissures and smaller fractures. The same branching tendency is noticeable in the Black Diamond system where the Black Diamond is the largest and main fissure but has at least three prominent fissures branching off from it towards the contact of the diorite.

The fissures themselves, most of which are now veins with quartz and ore filling, do not appear to be fault fissures and little movement of the walls can be recognized. This is of course natural to the type of fissures found within the diorite mass, but it is quite unusual to find so little faulting as is evident in this area. Only one real post-mineral fault has been found and this cuts the Black Diamond and White Diamond veins at a very small angle and shows a displacement of less than forty feet. Further development work in the veins outside of the diorite will likely show up much more faulting. In other parts of the La Plata mountains post mineral faults are very frequent and have been the cause of many a lost ore shoot.

The fissures run in width from a few inches up to thirty feet, with an average of around three to five feet. The core of the average fissure vein is now composed of quartz and ore minerals, mostly gold with a small amount of silver and small amounts of pyrite and lesser amounts of chalcopyrite. On each side of the quartz is a wider zone of altered diorite in which is found smaller stringers of quartz and fine grained pyrite and still farther out is a gouge streak of varying widths but on both walls. The altered diorite is quite soft, much lighter color than the unaltered wall rock. The gouge is very soft and mushy and can be picked out with a hand pick quite easily. It is usually of a white or light gray color but at times shows a brown and reddish color. Where the brown color occurs the gouge is generally gritty and granular and then often carries good values in gold.

The altered diorite and the gouge is, I am convinced, due to action of the mineralizing solutions or ore magma and not to any movement of the walls. The same condition is found in the very small fractures less than an inch wide where the fracture has been filled with quartz or pyrite or both. This condition indicates a highly aqueous and perhaps gaseous ore magma that was able to penetrate the walls of the fissures to a greater extent than usual. This would account also for the rather narrow quartz core of most of the veins, compared with the width of the altered country rock on each side.

All of the fissures are nearly vertical, having dips of less than ten degrees.

ORE OCCURRENCE

Ores of the Basin Creek area show three distinct types. First the ores in the fissure veins entirely within the diorite stock; second ores in the fissures outside of the stock and cutting the sedimentary formations together with the sills of porphyry; and third ores of the crushed and brecciated zone along the contact and contained in all of the rocks that have been subjected to the crushing action.

The ores of the first two types are quite similar in every respect. The values are in the quartz and in the sulphides and even the thinnest seams, if they carry either quartz or pyrite, carry gold and silver. Shoots of pay ore are found in lengths from fifty feet up to many hundred feet and small chimneys of higher grade ore occur at some of the intersections. These shoots appear to have
a dip to the west and south, or towards the contact of the diorite where the veins are within the stock. Shoots in the Black Diamond system of veins seem to be bounded frequently by cross-cutting dikes.

There are so many veins and so few of them have been developed to any great extent, it is impossible to work out any definite conclusions. Intersecting veins frequently show higher values close to the intersections and often pockets of really high grade ore. Not all intersections opened up underground show this enrichment but those that do may be of either acute angle or wide angle divergence. The intersection of the Groundhog vein with the Little Jane vein formed a high grade chimney in the Little Jane vein and yet the Ground Hog vein is practically barren. The two cross at an angle close to ninety degrees.

The vein that shows the most high grade ore and the longest pay shoot is the Little Jane vein with a strike of North 70 East. Nine hundred feet to the south is the Cast-away vein with the same strike. Only two cuts have been made on this vein on either side of the river bluffs. A six inch quartz streak in one assays $55.00 per ton; and the whole vein four feet wide runs $15.00 per ton. The White Diamond vein another parallel to the Jane but some 1300 feet to the north, also shows considerable high grade and an outcrop in the high cliffs assays $68.00 three feet wide. Two veins between the Jane and the White Diamond run in the same direction but have had no work on them at all. Intermediate and between the Jane and the Castaway veins lie the Tomahawk vein and the Clydesdale vein, with strikes of North 60 East and East-West. These two veins have had the greatest amount of development work and show large ore bodies of lower grades but good commercial milling ore. They converge towards the east and apparently come together near the eastern boundary of the property as shown on the map. Here some open cut work indicates a large body of ore with quartz showing 10 to 15 feet wide and assays running to $92.00 per ton on the surface. The east drift on the Tomahawk vein at the lower level was headed for this intersection but still lacks some six to eight hundred feet.

Two strong veins striking north 70 West, the Yuba and the Corruda have not been developed; but the intersection of the Yuba vein with the Clydesdale is suspected of causing the 600 foot Clydesdale ore shoot.

There are several veins with a strike of North 45 East such as the Ground hog, Surprise, Side Cut, White Rose and several unnamed. These seem to be nearly barren although a little ore was taken from the Surprise vein.

Apparently the real ore veins are the ones that strike the nearest East and West, with the North 70 degrees East ones carrying the richest ore. Nothing is known about the veins running North and West also they are strong enough to warrant some work being done on them to determine their possibilities.

The 3rd type of ore is the crushed zone ore body and is known as the Kate Deposit. There is no sign of metamorphic replacement, but simply a filling of the small seams and cracks formed by the crushing action. Apparently the crushing proceeded the formation of the fissures, because the fissures cross the seams in all directions and show much higher grade ore than in other parts of the deposit. It is probable that the fissures were the main channels for the ascending ore magma and through them reached out into the brecciated rocks of the deposit.

About one half of the deposit is altered and crushed diorite or the stock border and the balance include porphyry sheets, sandstones, gneiss and shales of the Cutler formation. No limestones are involved in the horizon that outcrops but at lower levels lines of the Cutler and also the Horma formations will without doubt be included in the crushed zone. The lines will probably show much more alteration than do the outcropping rocks and may be replaced by the ore magma and form much larger and better grade masses of ore. The effect of limestones and all calcareous strata on the ore veins throughout the La Plata mountains is very marked and persistent. Whenever ore veins pass through such strata there is always a decided increase in gold and silver values and usually an increase in the size of the vein and ore. High grade ore running into dollars per pound is quite common.
For this reason much better values may be expected in the Kate deposit at the lower horizons where limestones are abundant. Even the diorite may be favorably affected where it contacts these horizons as the metasomatic action is very likely to be quite strong and spread over much wider areas.

This same favorable action of the limestones and calcareous strata should be found along the Black Diamond vein system as the veins are followed downward into the lower formations. The present development happens to be almost entirely in thick porphyry sheets and so the effect of changing formation can not be observed.

The surface of the Kate deposit is so uneven and rough and the area so large, that is impossible to ascertain by ordinary hand sampling, no matter how thorough, the average value of the deposit as a whole. Samples taken in crushed area but away from any sheathing, fissuring or shearing, vary from ninety cents to one dollar and fifty cents. But the zones of fissuring and sheathing are very numerous and form a large proportion of the deposit; many of them reach widths of fifty and one hundred feet. Such zones will assay from three dollars per ton up to fifteen dollars per ton. Smaller fissures in the deposit, such as the Castaway vein which passes through the deposit near its southeastern limit, carry quartz veinlets that assay over fifty dollars per ton.

In as much as the whole deposit would have to be mined on any large scale operation, it can be seen that the actual proportion of the higher grade zones to the wider and more extensive zones of low grade would have to be quite accurately determined in order to arrive at an average value of the whole deposit. This determination can not be made by any method of hand sampling under the conditions found on the surface. The only way is to drive a tunnel throughout the length of the deposit, with crosscuts to the lateral boundaries every fifty or one hundred feet and run all of the ore extracted from this work through a mill for a sample. This would give a true and accurate value of the entire deposit at that horizon.

It is the writer's belief that such a sample would show a value around three dollars per ton or better and this value would make the Kate deposit worth many millions of dollars. If the deposit did not average up to say two dollars or more per ton, it is certain that the zones of higher grades would furnish an enormous tonnage of good profitable ore that could be mined by shrinkage stope methods as in the smaller fissure veins.

ORE MINERALS

The gold of both the fissure veins and the deposit occurs as a telluride of gold and practically no free gold is found except on the surface. The telluride is distributed in the quartz and in the iron pyrite in very minute particles, generally invisible to the naked eye. When a high grade piece of the ore is roasted, the minute bubbles of yellow gold can be detected with a glass very plainly. They appear scattered rather uniformly throughout the quartz and in a less amount in the pyrite. A pan concentrate of the sulphides shows a decided increase in gold value but does not account for nearly all of the gold contained. This indicates that much of the gold is in the quartz itself.

Heavy streaks of iron pyrite often occur in the quartz and in the altered diorite without any quartz. The finer grained sulphide frequently carries over two ounces of gold but the coarse crystallized sulphide carries much less. A very small amount of copper sulphide comes with the iron pyrite, in the form of chalcopyrite but the average copper content is only a small fraction of one per cent. Other sulphides are scarce except near the divide and over on the Bear Creek slope, where the veins carry a little lead sulphide and more copper.

In the deposit the iron sulphide forms in rather large crystals especially in the sandstones and shales, but where it comes with the smaller quartz seams it is fine grained as in the fissures.
The silver mineral has not been determined but the amount of silver is quite small and unimportant. Gangue mineral is limited to quartz alone but the quartz varies considerably in the different veins. In the Black Diamond and White Diamond veins the quartz shows a banded structure with black, white, brown and green bands. In the Little Jane vein the quartz is a chocolate brown color of very fine grain structure and spotted with small white and green quartz having the lustre and appearance of chalcedony. The quartz of the Tomahawk and Clydesdale veins is usually black or brown in color and of a coarser texture.

DEVELOPMENT

Underground development work on the two groups amounts to about 7,500 feet not taking into consideration the many open cuts, shallow pits and short assessment tunnels. Much of this work is now inaccessible due to caves, broken timbers and backed up and accumulated water from years of idleness.

The Tomahawk Tunnel is the lowest of the vein workings, and its portal is located at an altitude of 11,000 feet. It is several hundred feet northeast of the creek and is driven in a northeasterly direction as a crosscut tunnel to intercept the Tomahawk and Clydesdale veins. At approximately 1200 feet from the portal the Tomahawk vein was cut and about 100 feet farther in the Clydesdale vein was cut. An 800 foot drift east on the Tomahawk vein runs to the intersection of a cross vein, probably the Side Cut vein and stops. One good ore shoot 150 feet long is shown in this drift but the objective, the intersection of the Clydesdale Tomahawk and Gastaway veins, still lies some 600 feet ahead.

A drift to the west on the Clydesdale vein attains a total length of around 1200 feet and shows an excellent ore shoot 600 feet long that starts at the intersection of the Yuba vein with the Clydesdale. No drifting east on this vein has been done on this level.

The Groundhog Tunnel portal lies up the mountain in a northwest direction and at an elevation of 11,260 feet. It also starts off as a crosscut tunnel but cuts the narrow Groundhog vein a short distance in and then follows it in a northeasterly course until it cuts the Tomahawk, the Clydesdale and the Little Jane veins. The Tomahawk vein is cut 600 feet from the portal; the Clydesdale vein at 650 feet and the Little Jane vein at about 900 feet. No drifting has been done on the Tomahawk vein in this level. An east drift on the Clydesdale runs 300 feet in the same ore shoot shown on the lower level with good ore still in the face. No drifting west has been done. The tunnel cuts the Little Jane vein and a raise connects with the Jane tunnels about 250 feet above. No drifting was done on the Jane vein. Several short crossouts were driven northwest from the Jane vein probably in search of the Surprise vein.

The three Little Jane tunnels lie almost due north of the Groundhog tunnel portal and 250 feet higher. These tunnels were driven on the Jane vein to intercept a very high grade chimney that outcropped at the surface. The tunnels are short and only about forty feet apart vertically. They are connected by stops that worked out the ore chimney. This chimney was underground stopped down about 75 feet below the lowest tunnel. The raise from the lower Groundhog tunnel connects with the chimney of ore at about this level but the ore pitched to the west and was missed on the lower level. Evidently the miners figured the ore shoot to have a vertical position.

Some 1500 feet northwest of the Tomahawk tunnel portal and about 180 feet higher in elevation, is the Little Kate tunnel. This is driven at or near the northwest limit of the Kate Deposit and was driven when the original Kate stamp mill was in operation. It starts as a crosscut in the northwest direction but gradually turns to the north and east and ends in a drift on one of the many converging veins that occur at this point. Including the crosscut to the north the work amounts to a little over 500 feet. The first 100 feet from the portal and the 250 feet to the east is all in deposit ore that averages between six and seven dollars per ton. The north crosscut gets into unaltered diorite with no values until it cuts a northeast vein without name. No drifting was done on this vein.
Many open cuts, pits and shallow tunnels were driven into the broken surface above and below the Kate tunnel and it was here the surface oxidized ores were found that were first milled. All of these are caved or filled with slide rock now but the scattered dumps of ore indicate a considerable amount of work.

Up the hill to the east about seven hundred feet lies the old K.P. shaft. This was sunk on the little Jane vein to a depth of 65 feet on a high grade streak that netted the original locators over thirty thousand dollars. The shaft is now filled up with slide rock but many pieces of the rejects from the sorted ore can still be found. The pay streak was only a few inches wide but averaged from $800 per ton up. The balance of the vein, about four feet wide assayed a little better than $17.00 per ton. Water in the bottom of the shaft stopped the old timers from proceeding deeper.

Along the river banks below the old mill building are a number of short tunnels and open cuts most of which are closed from saving. One on the Castaway vein shows the pay ore four feet wide averaging $16.00 per ton and a six inch streak of quartz assaying $35.00 per ton.

The lower Black Diamond Tunnel is located 1100 feet north west of the Little Jane tunnels and at a little higher elevation. Its portal is in a large slide-rock area and the tunnel is caved at the mouth. It is a crosscut for about 150 feet when it cuts the White Diamond vein and then in 25 feet more the Black Diamond vein. A drift on the White Diamond is carried North 70 east for a distance of 700 feet. The last 200 feet is a rich ore streak from 4 to 6 inches wide that averages 5 ounces gold. The shaft lies between two crosscutting dikes. Besides the narrow high-grade streak there is from two to ten feet of altered country rock that runs from $6.00 to $7.00 per ton.

Drifting on the larger Black Diamond vein was done for only about 100 feet and the drift did not reach the point where the White Diamond shoot commenced. However milling values were encountered over widths up to 16 feet. One of the reasons for no little work on Black Diamond vein is its size and the need for heavy timbering on account of the great width of altered country rock.

Another tunnel on the Black Diamond vein is up the steep slope at an elevation of 15,000 feet. This tunnel is also caved. Here the post mineral fault is in evidence and in this tunnel and the White Diamond tunnel above the fault zone puzzled the miners and they drifted on the fault instead of the vein, wondering all the time what had become of their vein quartz.

Several short tunnels and one 200 feet long above 12000 feet and close to the divide have been run into the hill only to encounter the fault and lose the vein. In 1936 Mr. Edburg drove nearly 200 feet on what he thought was the White Diamond vein, using heavy timber to hold up the tunnel which was driven in fault gouge and breccia with no quartz or vein material showing at all. The portal of this tunnel actually started on a piece of the vein itself probably a chunk dropped down by the fault slip, but within a few feet the work entered the fault. The writer found the faulted end of the vein on the east side of the tunnel.

Close to the divide the slope is very steep, almost a bluff and here both the Black Diamond and White Diamond veins show plainly on the surface at many points. The fault cuts down the same bluff in a nearly vertical plane and moves the veins about 55 feet. The resulting mixing has been too much for the miners and in every place of work here they have lost their vein and taken to the fault zone. The fault strikes only a few degrees from the vein strike and so the direction seems all right and they follow ahead at a loss to know what happened to their ore. The map with this report shows the action of the fault clearly.

On up on the divide and down the Bear Creek slope both veins are plainly visible and many shallow pits have been dug on them. They continue with well defined walls for an unknown distance. The quartz shows an increasing amount of lead and copper as the veins run northward. Several more branches break off from the White Diamond vein in a more easterly direction and towards the diorite contact. None of these branch veins have been opened up except down the slope quite a
Near the east boundary of the Tomahawk ground at an elevation of about 12000 feet several open cuts were opened up last year in an attempt to discover the actual intersection of the Clydesdale, Tomahawk and Castaway veins. The real junction was not opened up but each vein showed a great increase in width and in the amount of quartz. Indications point to a large orebody at this point and even the surface quartz here runs better than $200.00 per ton. This section should be developed by a crosscut tunnel down the slope from the outcrops, or the Tomahawk east drift should be continued to reach it.

ORE RESERVES

In estimating the ore reserves under the present conditions of the property, we will consider as positive ore only the dumps and the one ore shoot on the Clydesdale vein that is opened up on two levels about 250 feet apart. The rest of the many ore shoots indicated by actual drifts on the ore, shafts, raises and winzes will be classed as probable ore. In these cases the openings are scattered both as to horizontal and vertical position and many of the openings are not accessible without considerable repair work. The very general, extensive and persistent occurrence of the gold values throughout the area of the large diorite stock, both within the stock and along its boundaries, coupled with the facts that at the lowest levels opened the veins and values are better than at the higher levels, makes it quite certain that the so called probable ore will actually develop in greater quantity and value than estimated.

The diorite is undoubtedly the ore making rock of the whole district. In other words, the mineralising magma or solutions followed immediately after the intrusion of the diorite masses and was derived from the same source, no doubt an end differentiation product of the same magma. The most numerous and productive mines have been found within diorite or around the edges of diorite stocks and large dikes and sills of the same rock. This holds true of the entire central and northern part of the range and the only exceptions are the May Day, Idaho, Irons and Red Arrow mines which lie on the extreme outskirts of the La Plata dome, some distance away from the intrusive stocks, and they are all a different type of ore deposit, also showing the same character of gold and silver tellurides.

That the tellurides continue in depth is well proven on Lewis mountain just east of Basin Creek. Here the Ashland or Tombrook vein has been opened at the surface and also in a tunnel 1400 feet below the outcrop. This vein cuts right through the narrow part of Lewis Mt. diorite and makes good ore both in the diorite and on each side. No change in character or value of the ore was found in the 1400 foot level.

The Basin Creek veins are located in perhaps the most favorable structural position of any in the entire district, and this holds good for the fata deposit as well as the fissure veins. Very little of the ore has been eroded away and the veins and deposit look good for great depth.

These prefaceing remarks are inserted here for the purpose of explaining somewhat the writer's attitude and view in figuring the probable orebodies. That I am enthusiastic over and believe strongly in the future of these two groups is an assured fact; but that I am justly warranted in this attitude I believe is fully backed up by the many and most favorable facts that my years of study in the La Plantas have brought to light.

There are five dumps on the Tomahawk property that are quite valuable. They contain the rejects from the sorted ores that were mined in the early days of the development and exploration work when only ores of $100.00 per ton or better could be transported out to market.

-10-
Three small dumps at the Little Jane tunnels contain an estimated tonnage of 2,260 tons with an average value of $36.00 per ton. Two of them assay $18.00 per ton and the third $48.00 per ton. This makes a gross value of $84,260 for the three dumps. They can be handled by means of the raise from Groundhog tunnel up to the Little Jane workings.

Just west of the old Tomahawk mill building is a dump with 5,000 tons estimated tonnage valued at $6.00 per ton. This dump ore came from the east drift on the Tomahawk vein and was considered too low grade to handle especially as the mill was making such a poor saving. Fortunately they did realize that the ore might be of value later and so put it by itself and free from being mixed with cross-cut rock of no value. This dump gives a gross value of $30,000.

All about the old Kate surface workings are dumps of very irregular shape and size. They come from open cuts on the surface and short cross-cut tunnels driven into the deposit when the first stamp mill was trying to handle the oxidized surface ores. The tonnage here is figured at 2000 tons and this is very conservative. The value at $6.00 per ton agrees with sampling in the cuts and the long tunnel. This gives us a gross value of $12,000.

The total gross value of the dumps, available for treatment is $104,260.00.

Dumps on the Black Diamond and White Diamond and also the Groundhog are so mixed up with slide rock and waste from work on the faults that they are of no value.

**CLYDESDALE BLOCK "C"**

This block of ore is indicated on the map on the vertical section along the Clydesdale vein. The lower ore Tomahawk tunnel drifted on this shoot a distance of 600 feet to the west of the crosscut. No drifting was done eastward so the extension of the shoot east is not known. 260 feet above the Tomahawk level in the Groundhog tunnel a drift on the same level has been run to the east for a distance of 300 feet. The east face of this drift assays $10.00 over a width of 2$ feet, so the east end of the shoot has not yet been reached. The west face has not been driven any distance from the tunnel but assays the same. In figuring the tonnage of this shoot we have used 600 feet as the length, 2$ feet as the width and 460 feet as the vertical dimension. This takes in from the Tomahawk level to the surface and 100 feet below the Tomahawk level, or an addition of 22% of the known vertical extent of the shoot.

Calculated at 15 cubic feet to the ton, this gives us a tonnage for Block "C" of 90,400 tons. At $10.00 per ton gives us a gross value of $904,000.00 for the block.

For positive ore available for treatment, then we have a total of 100,660 tons with a gross value of $1,008,260.00.

**LITTLE JANE BLOCK "LJ"**

The Little Jane has produced in actual shipping ores more than any of the other veins so far developed. The most western cuts on the original Kate workings seem to be on the Little Jane vein where it enters the deposit. 700 feet up the hill the K.P. shaft was sunk on it to a depth of 65 feet and produced $30,000 from a small very rich streak. This pay streak ran from $600 per ton up to several thousand dollars per ton. The rejects from the sorted ore from this vein, four feet wide, assay $37.00 per ton. Surface samples taken wherever the slide rock is thin enough to get at the vein outcrop show values never less than $12.00 per ton. In one of these places above the X.P. shaft a few feet, Mr. Bjurborg took 500 lbs of ore last summer and shipped it to the smelter for a sample. The smelter assay showed 5.60 ounces gold; 3.6 ounces silver; 88% insoluble; and 6.5% iron. Total value per ton $38.75 and gold was based on a price of $35.51 per ounce instead of $35.00. The smelter return sheet is appended to this report.

-11-
Still 750 feet northeast and up the mountain, the three Jane tunnels with connecting shafts and raises extracted some $60,000 worth of high grade ore from the same vein. The three dumps which are figured under positive ore, are simply the rejects from the work in the vein after the high grade was sorted out.

The vertical extent of the ore body here represented is something over 300 feet, from the outcrops at the Jane tunnels down to the open cut working at the Kate. The horizontal dimensions represented amount to 1500 feet. The width of the vein will average 4 feet. This gives us a probable orebody of 115,000 tons. Leaving out of consideration all together any high-grade streaks and taking the lowest average assays taken on the surface viz. $12.00 per ton-gives us a gross value on this block of $1,380,000.

No tonnage has been included below the lowest working on the vein and yet there is no reason to expect the ore to stop at this level for there is every evidence of its continuation downward to an unknown depth.

**TOMAHAWK EAST SHOOT**

Near the end of the east drift on the Tomahawk vein an ore shoot was cut 150 feet long. The quartz alone in the shoot ran better than $20.00 per ton and the vein over a 5 foot width carried an average of around $10.00. Estimating the back on this orebody to be 300 feet high and the average value of $7.00 per ton gives us a value of $150,000 of probable ore in this shoot. The face of the drift is still in ore at the intersection of a cross vein and its continuation eastward is undetermined.

**TOMAHAWK JUNCTION SHOOT**

Some six or seven open surface cuts have been made near the intersection of the Clydesdale, Tomahawk and Castaway veins and these cuts have opened up greater widths of vein quartz than at any other point on the property. The actual intersection has not been uncovered but each of the veins shows an abnormal width of ore and a very large orebody is indicated. The cuts extend over a distance of more than 300 feet and still the actual intersection lies ahead to the east. The wide converging quartz veins appear to be making the largest orebody of the entire fissure system. Samples of the exposed quartz assayed from six to twenty nine dollars per ton in gold. The Tomahawk east drift on the Tomahawk vein should cut this orebody by drifting eastward about 800 feet and would cut it at a depth well over 500 feet below the surface. As a probable orebody it is safe to estimate it with dimensions of 500 by 500 by 10 feet, for the individual veins show widths up to 10 feet. This would give us a tonnage of 200,000 tons. A value of $10.00 per ton is conservative and this gives us a total gross value of $2,000,000.

Other shoots on the Tomahawk vein are probable, in fact I believe the vein will average between five and six dollars per ton anywhere between the so-called pay shoots. The entire vein including altered country rock and quartz streaks often carries a width of 30 feet or better with the solid quartz varying from two to four feet and quartz seams extending several feet more into the hanging wall. A sample cut over a 25 foot width where the Groundhog tunnel intersects the vein gave results of $5.00 per ton.

**WHITE DIAMOND-“DI”**

The lower Black Diamond tunnel has a northeast drift along the white Diamond vein that exposes a high grade streak four to six inches wide and two hundred feet long that assay 85 ounces gold. The rest of the vein from three to ten feet wide of altered rock with small seams of quartz runs from $3.00 per ton to $7.00 per ton. For a 5 foot width this ore shoot may be safely estimated at $15.00 per ton value and figuring a 500 foot depth we have a probable orebody of 25,000 tons valued at $345,000.
The vein continues up the mountain to the divide a distance of one thousand feet to the top. Several small tunnels and some fifteen open cuts have been made in this distance and assays from cuts and outcrops run all the way from six dollars per ton to eighty-eight dollars. Estimating an average width of 3 feet, a length of 900 feet and a depth of 800 feet gives us 100,000 tons. And using a ten dollar value, we get a gross value of $1,000,000 in this probable block.

Black Diamond Vein

The Black Diamond vein like the Tomahawk has a very wide zone of altered country rock and gouge and being so much softer than the surrounding rocks, outcrops are hard to find. In the lower areas towards Basin Creek slide rock covers nearly all of the vein but in the cliff at the creek, it shows four feet wide in a porphyry sheet and runs five dollars in gold at this point. In the lower E. D. tunnel the drift did not reach the shoot cut by the White Diamond drift but the vein showed pockets of high grade ore and one assay 15 feet wide taken in the gouge and altered country rock showed $7.00 value. Some of the quartz taken from the dump assayed $121.00 per ton. An old tunnel within 250 feet of the divide is said to have shown some fine ore but the tunnel is caved completely and the dump has been scattered by snowslides. Small cuts on the steep slope near the divide have opened up the vein close to the fault and some of these assay good values. Down the Bear Creek side, talus covers most of the vein but it throws off considerable quartz in the slide rock and this shows an increasing amount of lead and copper sulphides. While we believe the Black Diamond vein will make a large tonnage producer when developed and probably show rich ore shoots like the other fissures, still there is not sufficient data at this time on which to base any estimate of tonnage.

There are several other veins such as the Castaway, Yuba, Gertrude, White Rose, Side Cut, Betty and Glanville that offer good chances for some orebodies but there has been only a little work or none at all on them to date.

Summary of Probable Ore

Summing up the preceding paragraphs on the probable ores of the vein system we get the following totals.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Tons</th>
<th>Gross</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Jane</td>
<td>115,000</td>
<td>$1,080,000.00</td>
</tr>
<tr>
<td>Tomahawk East</td>
<td>20,000</td>
<td>150,000.00</td>
</tr>
<tr>
<td>Tomahawk, Junct.</td>
<td>200,000</td>
<td>2,000,000.00</td>
</tr>
<tr>
<td>White D. &quot;D1&quot;</td>
<td>22,000</td>
<td>285,000.00</td>
</tr>
<tr>
<td>White D. &quot;D2&quot;</td>
<td>100,000</td>
<td>1,000,000.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>458,000</td>
<td><strong>$4,975,000.00 gross</strong></td>
</tr>
</tbody>
</table>

The structural, physical and mineralogical features of this deposit have already been described. The final question of its commercial and profit possibilities can be determined only with a considerable amount of expensive work and experiment. Hand sampling by myself and many others has simply indicated that there is a good chance of the deposit being of a grade sufficient to make it a profitable operation on a large scale. The great size of the mineralized zone is what makes it so attractive.

Being 2,200 feet long by not less than 600 feet wide, each 100 feet of depth represents a tonnage of 10 million tons. The creek bed from the lower limit of the deposit rises 500 feet to the upper limit; and the walls of the canyon rise from fifty to one hundred feet high. Thus there is at least 50 million tons included between the lower and upper limits of the deposit as exposed on the surface.
Last summer two of the U.S.G.S. geologists made a plane table survey of the deposit and incidentally took three samples at points where they made stations.

These points happened to be a places some distance from any fissuring or shearing and so represented parts of the deposit where values are the lowest. Their results agreed closely with my own and others. The three samples averaged ninety cents. They were taken from the exposed surface.

It has been discovered by actual test in many parts of the deposit, that the exposed surface rocks showing more or less alteration and oxidation, assay much lower in gold than the unaltered sulphides which occur within four or five feet of the surface. A surface sample that runs, say one dollar on top, will increase as much as four or five times at a depth of five feet. This may be just a coincidence, but it has happened several times.

Fourteen samples taken at various points on the deposit including five pits sunk to the unaltered sulphides along the creek bank and the Kate tunnel at the upper end of the deposit gave an average of $6.42 per ton. These samples without doubt favored the fissured and sheared areas but did not include some known high grade quartz streaks.

It is all a question of the proportion of the fissured and shattered zones and high grade quartz veinlets to the balance of the deposit that runs around one dollar per ton. I am inclined to believe from my own experience on the ground, that the entire deposit will average between $2.50 and $5.00 per ton. In this I may of course be badly fooled. However, it is certain that if the whole deposit does not average up, there will be many zones from ten to fifty or more feet wide that will furnish large tonnages of commercial grade ore.

If the deposit does average say $2.50 per ton there will be a gross value of $75 million just in the surface exposure. The lower zones in the limestone horizons should average much better and the effect on the fissures and shear zones should be more pronounced.

A drift from end to end of the deposit will be 2200 to 2500 feet long and besides cutting the deposit itself, will intercept three shear zones and some fifteen promising fissure veins. The depth at the face of this drift would be a little over 500 feet below the surface.

POSSIBLE ORES

The number of unexplored veins in the area and the continuation of the veins to the south into the sedimentary rocks and finally into the Monzonite stock offer almost unlimited fields for exploration work. In addition the many branch- ing dikes leaving the diorite stock to the northeast offer chances for good ore-bodies. Other crushed zones and shear zones of importance are liable to be found especially in the area around the Diorite Peak which has been little prospected. Depth on the fissures and on the deposit itself down into the limestones offers big opportunities for opening up further and better ores.

OPERATING COSTS

With the installation of modern power equipment of ample capacity mining costs should be very reasonable. The soft altered country rock together with the gouge on the walls of all of the fissures will make drilling fast and easy either with machines or by hand drilling. The consumption of explosives will be light for the rock breaks easily and can often be picked down. Even the crosscuts for development work will be easy driving for the diorite and surrounding rocks are so completely altered that nowhere is there found any really hard rock.

Development costs will be low due to the precipitous slopes and the fact that large tonnages can be developed in many different veins from the same level cross-cut. Drifts on the veins will have to be well timbered but there is ample mine timber supply close at hand and on the claims.

-14-
In the narrower veins such as the Clydesdale, Little Jane Castaway and White Diamond the ore can probably be broken and handled in open stopes with short stalls. In the wider veins such as the Tombhawk and Black Diamond, some method of cut-and-fill will probably have to be used. The footwall gouge and altered rock which is generally barren, can be used for fill. Mining of the deposit is a problem in itself and need not be considered at this time. If only the wide fissures and shear zones are mined, these can be handled by ordinary shrinkage stop methods.

Milling offers no unusual features. There is plenty of water at hand and with a little work tailings disposal is taken care of in the flats below the mill site. Power is the biggest item of cost and by installing diesel power this can be furnished at low rates.

My estimate of costs on the average fissure veins follows:

<table>
<thead>
<tr>
<th></th>
<th>Development</th>
<th>Mining</th>
<th>Milling</th>
<th>Marketing</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.50</td>
<td>2.50</td>
<td>2.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$6.50</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

These figures are based on a production of 100 tons per day. The development costs are high and I believe in most of the veins the mining cost can be reduced below the figure given. Milling cost can be reduced when greater capacity is attained.

The deposit on a scale of not less than 1000 tons daily could probably be handled at a cost of $1.50 per ton.

**PROBABLE PROFITS**

In estimating probable profits the above costs will be used except on dumps and on the Clydesdale and East Tombhaw orebodies. There is no mining costs against the dumps and 25 cents per ton will cover transportation to the mill. On the two orebodies mentioned the cost of development will be deducted as they are already developed.

**Assured Ores**

<table>
<thead>
<tr>
<th>Tons</th>
<th>Value Saved</th>
<th>Costs</th>
<th>Net</th>
<th>Total Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,250</td>
<td>20.00</td>
<td>2.75</td>
<td>17.25</td>
<td>28,522.00</td>
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<tr>
<td>6,000</td>
<td>4.50</td>
<td>2.75</td>
<td>1.75</td>
<td>94,500.00</td>
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<tr>
<td>90,400</td>
<td>9.00</td>
<td>6.00</td>
<td>3.00</td>
<td>271,200.00</td>
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<tr>
<td>20,000</td>
<td>6.75</td>
<td>6.00</td>
<td>0.75</td>
<td>18,000.00</td>
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<tr>
<td><strong>Total Net Profit</strong></td>
<td><strong>$382,082.00</strong></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Mill extraction on dumps figured 80% and on mine ore 90%.

**Probable Ores**

<table>
<thead>
<tr>
<th>Tons</th>
<th>Value Saved</th>
<th>Costs</th>
<th>Net</th>
<th>Total Net</th>
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<tbody>
<tr>
<td>115,000</td>
<td>10.50</td>
<td>4.50</td>
<td>6.00</td>
<td>424,500.00</td>
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<td>6.50</td>
<td>7.00</td>
<td>161,000.00</td>
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<tr>
<td>100,000</td>
<td>9.00</td>
<td>6.50</td>
<td>2.50</td>
<td>250,000.00</td>
</tr>
<tr>
<td><strong>Total Net</strong></td>
<td><strong>$1,405,500.00</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Then in case our tonnage estimates in some of the blocks do not work out as figured, or we are not able to meet the costs as calculated because of some unforeseen condition, let us cut our figures right in half.

This still leaves us with a net profit on assured ores of $166,131.00 and on probable ores $706,750.00, making a total of $868,881.00 that is pretty certain.

There remains the possible profits on the deposit or on the wide zones in it that are surely commercial.

At a value of $2.50 per ton and costs of $1.50 with an extraction of 90% there would be a gross profit on the ore above the surface of $2,600,000.00. Of course these profits would all be distributed or earned over a period of years and so would be reduced somewhat on account of the element of time involved.

PLAN OF OPERATION & DEVELOPMENT

In figuring out a plan for the development of the average mining property, the choice of method, scale of work and amount of development is usually quite limited by the physical conditions of the orebody and the grade of the ore. Most mines have a single orebody or at the most two or three that are confined to one ore or two veins. The conditions on the Tomahawk-Black Diamond group are so varied and so many and the extent of the available ground that is worthy of development and exploration is so great, that the operation can be financed.

A small scale operation can be carried on with the development of a single vein, without any milling facilities and with the idea of sorting and shipping the ores to market. Or a group of the veins can be developed and the ores treated in a mill, thus making available larger tonnages and the wide zones of mineralized rocks, a large scale plan could be put into effect at once. All things considered, the writer believes that a medium size operation, using the veins already developed and with some ore blocked and ready for mining, plus the dumps; and a mill of about 100 tons daily capacity; then a progressively growing plan of development and exploration work to finally include the large Kate deposit, will work out best in every way.

This plan will put the operation on a production and profit basis within a very short time; the metallurgical kinks can be worked out on the milling end, accurate testing and sampling of the deposit can be done gradually; best methods of mining can be worked out for the narrow veins, the wide veins and also the deposit; and at the same time blocking out of ores in as yet undeveloped veins and in lower levels of the present orebodies can proceed under a well organized campaign.

Expansion of milling and power facilities can take place as the conditions warrant and a steadily increasing operation with corresponding increase in profits can be looked forward to for a number of years.

The Clydesdale orebody and the dumps have in themselves sufficient tonnage to keep a 100 ton mill in steady operation for a period of three and one half years. Before the expiration of that time there should be ample tonnage ready for a mill of 250 to 500 tons per day.

The preparatory work necessary to carry out such a plan will involve the following steps:

1- Repairing and extending road
2- Installation of compressed air and electric plant
3- Erection of buildings to include bunk-house boarding house, assay office, warehouse, mill, shops and plant housing
4- Retimbering and repairing Tomahawk, Groundhog and Black Diamond tunnels and drifts
5- Repairing raise from Groundhog tunnel to the Little Jane workings
6- Driving of 250 foot raise from Tomahawk tunnel to Groundhog tunnel on Clydesdale vein ore shoot
7- Installation of mill equipment
8- Installation of one or two jigger-back trams.
9- Installation of small equipment and tools
10- Purchase of transportation equipment and snow handling machinery.

Upon the completion of the above the property will be ready for actual continuous production and then the work of real development and exploitation can proceed.

This formal development work should include the following distinct operations, listed in the order of their importance:

1- Extend the Tomahawk cross-cut to intersect the Little Jane, White Diamond and Black Diamond veins.
2- Extend the Tomahawk east drift to cut and open the so-called Junction ore shoot.
3- Drive the new cross-cut between the Groundhog tunnel and the Kate tunnel to intersect the Little Jane vein and drift east to connect with the raise to the upper Jane workings; continue the cross-cut to both the Diamond veins.
4- Drive a short cross-cut from below the Junction ore shoot to provide quick ventilation in the long east drift on Tomahawk vein.
5- Start another level 150 feet below the Tomahawk tunnel level to cut all veins up to and including the Diamond veins.
6- Develop a level above the lower Black Diamond tunnel to open up the White Diamond vein system where it shows such high surface values.
7- Develop the Castaway vein which shows fine values where it crosses the creek.
8- Start a development drift to cut the entire length of the Kate Deposit at the lowest level possible. This drift besides proving the deposit will cut all of the important veins at points where they have never been explored.
9- Explore the fissures to the south of the diorite stock in the sedimentary rocks and towards the monzonite stock.
10- Test the underlying limestone horizons below the Kate Deposit with diamond drill.

The above gives in two parts a comprehensive plan for the development of the two groups on a reasonable scale. The first part or preparatory step will place the property on an operating basis with adequate equipment to mine and mill 100 tons of ore daily and to do a small amount of necessary development.

The more formal plan of development work can be carried out according to the conditions of the company's finances. Either the profits from operations can be turned to this development work or the funds can be provided for on the start. The quicker the mines are put on larger scale operation the better but this cannot be done without adequate ore reserves blocked out ahead. The fact that there is a tonnage sufficient for over three years to start with, offers some leeway for making a definite decision on this future development.

CAPITAL REQUIREMENTS

To carry out the plans as outlined above will require the sum of $250,000.00 for the initial ore preparatory work and equipment and another $200,000.00 for the later campaign of development. As stated before, the funds for the development campaign can be supplied in part or in whole by the profits derived from the operation on a 100 ton daily basis; or the amount may be provided for in the original set-up.

Details of estimates for the use of the $250,000.00 follow. These estimates are somewhat high on some of the items and some money may be saved on them. However other needs may arise that have been overlooked, altho I have tried to cover everything.

-17-
Road work 5,000.00
Compressed Air plant 10,000.00
Diesel-Electric plant 35,000.00
Mill Machinery 20,000.00
Jig-back tramway 2,000.00
Buildings 10,000.00
Shop Equipment 2,500.00
Assay 1,500.00
Boarding House Equip. 1,500.00
Bank House Equip. 500.00
Office 1,000.00
Machine Shop 2,000.00
Air Drills & Access's 2,500.00
Small tools 1,000.00
Drill steel, mach's - hand 1,000.00
Ventilating Equip. 1,000.00
Mine cars 1,000.00
Air lines, pipe 2,000.00
Mine trucks 1,000.00
Ventilating pipe 2,000.00
Copper wire etc. 1,000.00
Trucks & tractor 5,000.00
Repair Tomahawk Tun. 5,000.00
Repair Groundhog Tun. 5,000.00
Repair Bl. Diamond Tun. 5,000.00
Raise to Jane workings 2.500.00
Raise to Groundhog 5,000.00
Freight, installation 10,000.00
Total 1,000,000.00

Overhead, Organization taxes and working cap. 100,000.00

SHELTER RETURNS- ASSAYS

American Smelting & Refining Co. Durango Plant Dec. 7-1925
Shipped by Gus Ekburg from Tomahawk
Weight 27,250 lbs. Smelter Lot No. 7441
Gold 1.70; silver 7.5; insol. 71%; lead 1.8%
Gross value per ton $38.76 Present value per ton $55.10

November 13th 1925 Smelter Lot No. 3649
Weight 22,660 lbs.
Gold .92; silver 5.6; insol. 79%
Gross value per ton $21.61 Present value per ton $36.61

November 1st 1925 Smelter Lot No. 3650
Weight 29,040 lbs.
Gold 1.81; silver 7.3; insol. 76.6%
Gross value per ton $40.82 Present value per ton $66.92

August 27th 1925 Smelter Lot No. 3552
Weight 23,160 lbs.
Gold 2.35; silver 8.9; insol. 72%
Gross value per ton $62.19 Present value per ton $89.10

All of the above shipments were made by Mr. Ekburg from the Clydesdale ore shoot
in the Groundhog Tunnel. The ore shipped was the quartz and pyrite from the vein
and these give a fair idea of what the quartz will run when sorted.

July 30th 1925 Smelter Lot No. 7963 Leadville Plant
Gold 5.80; silver 3.6; insol.66%
Weight 300 lbs.
Gross value per ton $189.73
This was a test sample shipped by Ekburg and taken from the Little Jane vein on the surface close to the K.P. shaft.

Miscellaneous samples by Mr. Ekburg:
- Little Jane vein—high grade quartz:
  - Gold 21.56; silver 12.8 value $773.95
- Little Jane vein—4 feet average from K.P. shaft:
  - Gold 0.50; silver 1.0 value $18.00
- Clydesdale vein—heavy pyrite ore:
  - Gold 2.16; silver 1.4 value $74.27
- Black Diamond vein—quartz ore:
  - Gold 1.66; silver 2.80 value $62.20
  - Gold 2.66; silver 4.40 value $94.10
  - Gold 2.68; silver 11.80 value $109.18
  - Gold 4.14; silver 4.60 value $78.40
- White Diamond vein—quartz ore:
  - Gold 1.42; silver 1.50 value $50.70
  - Gold 1.04; silver 0.8 value $36.90
  - Gold 4.70; silver 5.9 value $228.70

Samples taken by Clyde E. Becker, E.M. Sept. 14, 1934:
- Fines from Tomahawk dump: $3.20
- Quartz **: 10.18
- Quartz streak face Clydesdale vein in Groundhog drift: 38.00
- East dump Little Jane: 19.23
- Middle dump **: 47.24
- Lower dump **: 32.43
- Vein quartz from Jane shaft: 13.97
- High grade **.. **: 525.02
- Black Diamond (sorted quartz): 121.71
- White quartz from White Diam.: 63.64
- White Diam. outcrop above tunnel: 80.69
- 26 feet wide of quartz: 16.05
- Fines from Callaway vein out: 15.90
- Quartz streak **.. **: 68.90
- Kate Open cuts—five samples ran from 1.18 to 13.37—average: 4.30
- Kate tunnel north side: 7.70
- ** south side: 6.44
- Kate deposit unoxidized sulphides: 5.10
- Sulphide dump from Kate: 7.55

Samples and assays by Ross D. McCausland:
- Average Tomahawk dump: $6.90
- ** Kate dums: 6.15
- 25 ft. Clydesdale core shoot: 9.36
- Footwall gouge Clydesdale vein: 5.00
- Kate Deposit: 1.33
- all taken away from any fissures: 0.94
- Kate tunnel: 7.00

The assays on the deposit were from samples taken purposely in the worst looking parts of the deposit, in order to determine about what the content would be without considering the enriched or higher grade zones of fissuring.

(Signed) Ross D. McCausland
SHOWING STRUCTURAL RELATION OF FISSURES, LOSES AND DEPOSIT TO DIORITE AND MONZONITE STOCKS AND DIES. ONLY A FEW OF THE MAIN FISSURES OF THE TOMAHAWK SYSTEM ARE SHOWN.

EACH SQUARE = 7 / 4 MILES.