

R E P O R T

C H R O M E P R O P E R T I E S

S i t u a t e d i n

J o h n D a y D i s t r i c t

Owned and Controlled

By-

M E T A L S E N G I N E E R I N G C O.

Mr. Louis H. Mills, President  
METALS ENGINEERING CO.  
Portland, Oregon.

Dear Mr. Mills:

Pursuant to your instructions for a detailed report on the Chrome properties owned outright and under contract to the METALS ENGINEERING CO., situated in the John Day District in Eastern Oregon.

The writer has spent weeks in this territory in a personal examination of the geology of the district as well as an individual examination of the many different deposits of Chrome in that district. He attempts to set out herewith a very conservative statement regarding these deposits as well as to give you the information on all the items which should be considered in an operation of this kind.

Generally speaking, the physical and geological conditions surrounding this district for the economical development and production of Chrome ores I consider to be very favorable.

When you take into consideration the conditions surrounding other known Chrome districts in Oregon, northern California, Washington and Montana, and compare all of the items that go into making up the cost of production and successful operation, one finds that the John Day district certainly is equal in every respect, and in a number of instances, far exceeds these other known districts.

CHROME HISTORY OF JOHN DAY DISTRICT

During the late World War, when the Government took command of the production of the base metals for the benefit of the Steel interests of this Country, the first District that had the attention of the Government engineers in respect to Chrome was the John Day District in Eastern Oregon.

This District apparently had been recognized for some time prior to this by the Government and other engineers who were more or less familiar with the large deposits of Chrome of this District; and it was perfectly natural, when the Government's demand became acute for Chrome, that the first production efforts by the Government turned to this District.

The records show, and the information gathered from individuals who were associated with the Government and the owners of the different deposits in this District, conclusively prove that there was a very substantial tonnage shipped out of this District from these individual deposits during this War operation; in fact all the information that is available indicates that the tonnage actually shipped was greater than from any other District on the Pacific Coast.

The writer knows from personal knowledge that in a number of Districts in the west, Chrome was mined by the Government but was never shipped because of the impossible transportation facilities in those days. This condition does not exist in the John Day District, due to the fact that there is good highway transportation and the climatic conditions favorable for the large portion of the year for successful operation and production.

LOCATION OF THE JOHN DAY DISTRICT AS TO RAILWAY & HIGHWAY TRANSPORTATION

The John Day District is situated in the John Day Valley of Eastern Oregon and is reached by a series of improved State Highways from Portland, Oregon via the Columbia River to Arlington; Baker City in Eastern Oregon; and from Ontario in the extreme East part of the State of Oregon; Union Pacific Railway from Portland through Eastern Oregon and on East operates a branch line from Arlington, Oregon to Condon, Oregon, Condon being approximately 80 miles from the center of the John Day District by improved State Highway. Union Pacific also operates a branch line from Ontario to Burns and from Burns to Seneca, which is the end of the line known as the Burns Branch of the Union Pacific Railway. Seneca is 21 miles from the small town of John Day, on the John Day River, which is practically the center of the John Day Valley.

The John Day District is an old district, having been one of the first places in Oregon where Gold was discovered. It is served by several lines of daily automobile stages, telephones and electricity. Daily mail service is supplied and the District is easily accessible by highway to any of the trading centers, Baker, Oregon, or to Portland via Condon, or to Portland via Prineville in Eastern Oregon.

There is no Chrome district that is known of by the writer in any of the western States, where the physical conditions (and particularly transportation) is more accessible than it is in this particular District.

CLIMATE

The climate of this District and of Eastern Oregon is almost ideal for at least 9 months of the year, with little or practically no rainfall. In the winter months, with a few exceptions, there is very little snowfall in the valleys. As you gain altitude, you do come into a snow country and particularly so where the majority of the Chrome Deposits are found. However, with rare exceptions, the snowfall in this section would not in any way interfere with a going operation even though you used the quarrying method of opening up and operating these Deposits.

There is an abundance of water in the John Day River and in the majority of cases there is ample water and timber at the Deposits for all operating conditions, except possibly a large milling installation at any one of the individual properties, which would not seem practical in an operation of this kind, because ultimately in this operation you would decide upon a Central plant for all the properties situated on the John Day River, probably at John Day, Oregon.

PROPERTIES OWNED AND CONTROLLED BY THE METALS ENGINEERING CO.

PINE CREEK CHROME PROPERTY,	embracing 20 acres			
BURNT RIDGE	"	"	"	20 "
PITTSBURGH	"	"	"	60 "
CHROME RIDGE	"	"	"	40 "
SPRING RIDGE	"	"	"	20 "

PROPERTIES CONTROLLED BY THE METALS ENGINEERING CO.

RECORD MINE CHROME PROPERTY,	embracing 100 acres			
RAY RANCH	"	"	"	320 "
MARK & THOMPSON	"	"	"	60 "
DEWEY CHROME	"	"	"	20 "
AJAX CHROME	"	"	"	60 "

PROPERTIES WHICH ARE UNDER NEGOTIATION FOR CONTRACT BY THE METALS ENGINEERING CO.

DRY CAMP    DAYVILLE    LAYCOCK    SILVIES    RAYMOND

Properties in the first group, which are owned exclusively by the METALS ENGINEERING CO., and the properties in the second group, held by the METALS ENGINEERING CO. under contract, are the properties which will be discussed and reported upon in this Report.

All of these properties, as mentioned above, with the exception of the Record Mine, are immediately adjacent to, and to be operated from, a Central Point, namely, John Day, Oregon.

The average distance of these properties from this Central point, including highway and private road to individual properties, is 13 miles.

The distance from this Central point (John Day, Oregon) to Seneca, Oregon (the terminus of the railroad and the loading point) is 21 miles on the State Highway, so that you would have an average haul of 13 miles from all of your properties to the Central point

of milling and reduction Plant for concentrating ores and you would have a distance on crude or shipping ores from the properties direct through the Central point to Seneca of 34 miles.

The properties above mentioned in the John Day District are all within Grant County, Oregon, with the exception of the Record Mine.

The Record Mine is located in Baker County, Oregon, and would be an individual operation by reason of its location and the shipping point for this property would be Baker, Oregon, 60 miles by State Highway the majority of the distance.

In case of milling operations this property has ample water at the mine for any such operation.

### TOPOGRAPHY

The line between Grant and Baker Counties follows the divide between the headwaters of Burnt and Powder Rivers, which flow southeastward to the Snake River and the headwaters of different members of the John Day River system, which flow northward into the Columbia. The largest Chromite area (John Day) lies wholly within the drainage basin of the John Day River.

Topographically, this region is one of high relief, a part of the Blue Mountains of Eastern Oregon, which rise in some sections to over 9,000 feet and 8,000 feet respectively above sea level and which have numerous peaks 3,000 and 4,000 feet above the larger valleys. South of John Day lies the Strawberry Range, its north flank largely serpentine which has an east-west trend and parallels the course of the John Day for over 50 miles. The mountains are steep and rise to peaks or rounded shoulders.

### GEOLOGY OF THE DISTRICT

In this region two main series of rocks occur and older series of sedimentaries with some interbedded lavas cut by igneous intrusives and young lavas with associated sedimentary beds.

The sedimentaries of the older series are slates and shales with a small amount of limestone which are believed to be of late Paleozoic and early Mesozoic age. The whole series has been closely folded and today shows an east-west strike with a prevailing southward dip. The rocks are lacking in fossils, having been greatly disturbed by folding and faulting; consequently, it will be difficult to work out their structure detail.



Into these sedimentary rocks were intruded different kinds of igneous rocks. The most abundant igneous rock is a granodiorite, which occupies considerable areas both north and south of the John Day River. In places more basic igneous rocks, gabbro and peridotite (or their alteration product, serpentine) cut the sedimentary beds. The serpentine is the rock with which the Chrome Ore Deposits of the District here considered are almost exclusively associated. (Lindgren says:

"This rock, which is rarely found in Idaho and Montana, begins to appear in force as the Pacific province of intrusive rocks is reached. It forms large areas in the Eastern part of the Greenhorn Mountains at Susanville, and in the Strawberry Range south of Prairie and Canyon. At these places it is closely associated with Gabbros and allied rocks. This is so constant that one is forced to believe that the serpentine is an altered form of gabbro, perhaps also of peridotite, and that in its original state it was intruded simultaneously with the gabbros, diorite and granodiorites into the sedimentary series.").

(Lindgren, Waldemar, The Gold Belt of the Blue Mountains of Oregon; U.S.G.S. 22nd Annual Report pt. 2, p. 589, 1901.)

The younger series of rocks of Eastern Oregon is a succession of lava flows, mostly basalts, with beds of gravel, sand or clay, the finer of which have been considered lake beds. Through a large part of the region these lavas conceal the older rocks. After the flows of lava ceased, mountain-making forces became active and the lavas were folded and faulted. Streams began carving the surface to its present form. The present areas of older rocks in which the serpentines and their Chrome-Ore-Deposits occur, were either islands never covered by the sea of basalts or were bared by the erosion of the flows.

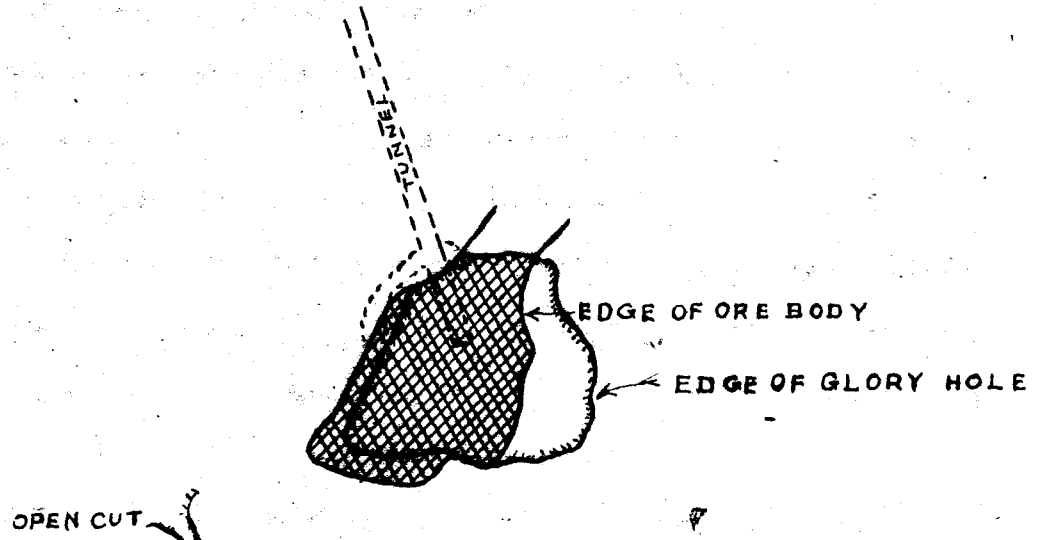
MODE OF OCCURRENCE OF THE ORE

There are two main modes of occurrence of the ore.

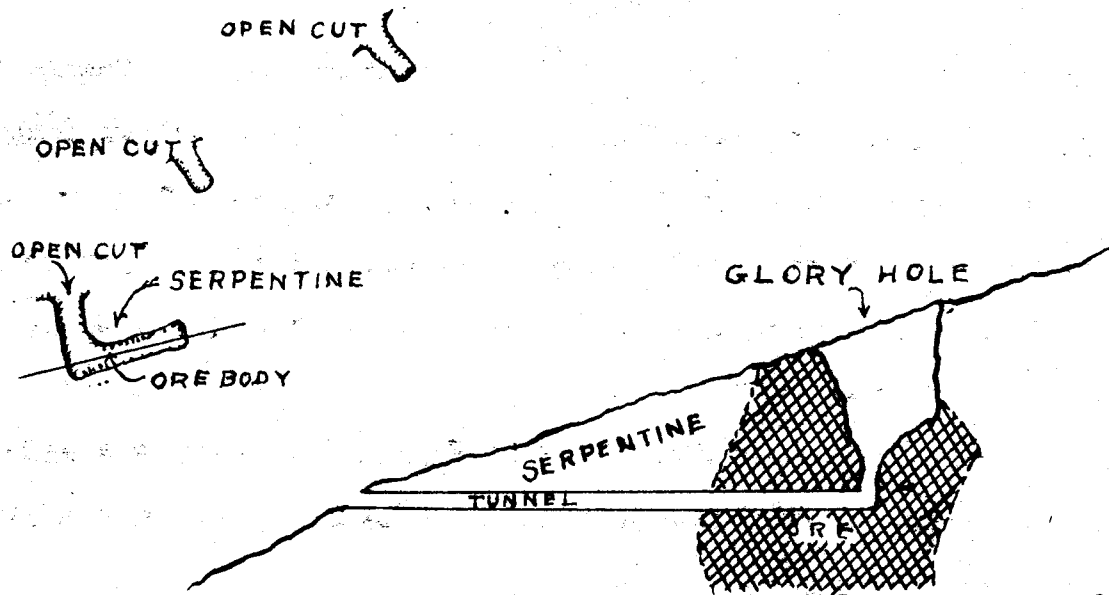
On most of the properties the Chromite is vein-like, lens-like, or kidney-like masses in shattered serpentine. The original rock has usually altered wholly to serpentine and its earlier character is a matter of inference. On other properties, especially those that include the larger mines, the Chromite occurs in vein-like or dike-like masses or in irregular bodies of considerable size, in a more or less serpentinized rock of basic character. This last rock, though jointed, is much less shattered and serpentinized than that of the other class. Practically all of the Chromite Deposits of Eastern Oregon belong to the first class, except some of those in the John Day area between John Day and Prairie City.

The Eastern Oregon Chromite Deposits agree with like deposits elsewhere in that they lie in serpentine country rock and serpentine is derived from basic rocks of the pyroxenite-peridotite series.

METALS ENGINEERING CO.  
PROPERTIES.



PLAN OF OPENING AND ORE BODY AT  
PINE CREEK MINE



SECTION OF ORE BODY PINE CREEK MINE

INDIVIDUAL DESCRIPTIONS OF THE DEPOSITS

Pine Creek Chrome Mine

The Pine Creek Chrome property is one of the largest deposits ever opened in the John Day area. It consists of one claim of 20 acres in surface area which covers the present proven ore bodies and is the key claim to a large serpentine Chrome-bearing zone. Other claims should be acquired, but the Pine Creek claim positively controls the mining operations of this particular mineral zone.

The property is located on the south slope of Bald Mountain, at the head of Pine Creek, a tributary of the John Day River, and is reached by a good mountain road 6 miles distant from the John Day Highway. It is 11 miles to John Day, Oregon.

Title

The property is owned by the METALS ENGINEERING CO. and is held by right of mineral location in compliance with Federal and State Mining Laws.

History

The Pine Creek Chrome Mine was formerly known as the Chambers Mine. Edward Chambers of John Day, Oregon, was the original locator. After his death, the property was relocated by others. The ground finally reverted back to the Government by failure of not performing the required annual assessment work. The ground was acquired by the METALS ENGINEERING Co.

This property produced 8000 tons of Chromite during the late War. This information was received from J. Andrews, foreman of the mine, during the operation.

Pine Creek Chrome property (continued)

Development

Development consists of a glory hole 150 by 40 feet. A tunnel at a depth of 40 feet connects with the glory hole. There are numerous pits and large cuts which have exposed two large deposits of Chromite Ore.

Ore Occurrence

Proven ore now developed on this property is in excess of 65,000 tons. It occurs as a dike-like mass of compact grained black Chromite in a shattered zone of serpentine. Present development and surface conditions of the zone indicate the possibility of a series of similar deposits. The writer is confident that future development will prove that the western end of the zone is the most highly mineralized and that when such development is completed, a tremendous tonnage of concentrating and shipping ore will have been developed. Diamond drilling the mineralized area of the property will quickly prove the property.

Transportation

There are improved roads and highways to the railroad shipping point.

Timber & Water

There is ample water for all mining and milling, also for domestic purposes.

Conclusion

There are numerous other features that might be mentioned, but I do not believe it necessary. However, I will say that immediate mining operations could be started and a production of at least 100 tons per day could be had of a good grade of shipping ore, which under present transportation conditions could be laid down at Atlantic Coast points at a profit. I am confident that this property

Pine Creek Chrome property (continued)

Will develop into one of the largest Chrome mining operations of the John Day area.

Burnt Ridge Chrome property

Property

The Burnt Ridge Mine consists of one claim of 20 acres in area located 1 mile south of Fields Creek, a tributary of the John Day River and is reached by a good mountain road 7 miles distant from the John Day Highway and 14 miles from the town of John Day, Oregon.

Title

The property is owned by the METALS ENGINEERING CO., and is held by right of location in compliance with the Federal and State Mining Laws.

History

No shipments were ever made from the property. Former owners put in a number of cuts and pits, proving that Chromite occurred in a shattered zone of serpentine for a distance of 200 feet.

Development

Development consists of cuts and pits which have exposed a series of irregular lenses in shattered serpentine. One of these lenses has been followed 125 feet in a westward direction along the top of the ridge. The ore occurs as a compact grained black Chromite which I am confident can be concentrated easily as the grains of Chromite are free from the gangue material.

Future development would be by quarry method. The topography of the property is such that this method of operation is the cheapest and best method for the opening up of the deposits.

Burnt Ridge Chrome property (continued)

Transportation

Improved roads and highways to railroad shipping points at Condon and Seneca, Oregon.

Timber & Water

Sufficient timber for large mining operation. Ample water for milling purposes.

Conclusion

The property is one that has real merit and on development I am confident it will prove to be a steady producer of shipping and milling ores of Chromite.

Pittsburgh Mine:

Property

Property consists of 3 unpatented mining claims, 60 acres in surface area. It is the largest property that works large lenticular bodies of Chromite in a vein-like deposit in serpentine. It is located 4 miles southeast of Canyon City, Oregon. Just below the crest of the east side of Canyon Creek valley, near the head of Quartz Gulch.

Title

The property is owned by the METALS ENGINEERING CO. and is held by right of location in compliance with Federal and State Mining Laws.

History

The property was originally located in the fall of 1917 by Joseph Beggs and J. McCorkle of Canyon City, Oregon. They immediately started development of the property and mining operations were carried on continuously during the late War and during this

Pittsburgh Mine (continued)

period its production was in excess of 17,000 tons. This information was secured from miners who had been employed at the property.

Development

The property was opened by the quarry method. The whole rock being quarried, the ore being taken out as the lenses were reached and the low grade ore and serpentine were thrown in the dump below the quarry.

There are 4 large open cuts to the east all showing a good grade of Chromite. Future development would be by the quarry method.

Ore Occurrence

The ore occurs as lenses which will average from 4 to 30 feet thick in a vein-like structure in shattered serpentine which is separated from the firmer rock on the north by a slickensided fault face striking N. 70° Wand 55°S. Float has been found eastward up the hill as far as a belt of coarser massive serpentine which makes a series of outcrops bearing N. 25°W. Between the massive serpentine and the shattered serpentine is serpentine breccia, cemented to a resistant rock.

The ore is a medium-grained black Chromite, which yields very readily to concentration. All tests to date have been satisfactory.

Transportation

Improved roads and highways to rail points at Condon and Seneca, Oregon.

Timber & Water

Sufficient timber for large mining operation. Ample water for milling purposes.



Pittsburgh Mine (continued)

Conclusion

Quarry operation could be started immediately at the property as the deposit is well opened at the quarry and a tonnage of approximately 275 tons of milling ore could be produced daily and by hand-sorting 125 tons of shipping ore.

The property on full development, I feel confident, will expose a tremendous tonnage of shipping and milling ore. Proven ore now developed on this property is in excess of 60,000 tons.

Chrome Ridge and Spring Ridge Chrome Mines:

Properties

The Chrome Ridge and Spring Ridge Chrome properties consist of a group of 3 claims, 60 acres in surface area, which are located in the same zone of mineralized serpentine. They are located in what is known as the Murders Creek belt of serpentine, which is about 11 miles long and 2 to 3 miles wide and bears a little south of west.

The properties are located on a good mountain road, 12 miles from Logwell, Oregon, a station on the Hines Logging Company's railroad. The railroad is a common carrier and connects with Union Pacific Railroad at Burns, Oregon.

Murders Creek Highway is within 1 mile of the properties.

Title

These properties are owned by the METALS ENGINEERING CO. and are held by the right of mineral location in compliance with the Federal and State Mining Laws.

Chrome Ridge and Spring Ridge Chrome Mines (continued)

History

The claims which the properties are made up of were originally located in the spring of the year 1918. I was told that approximately 1,000 tons of Chromite was shipped over the Hines Railroad during the late War. At the end of the War, the locators failed to keep up the annual assessment work as required by law. The property was re-located by the writer during the summer of 1936 and later assigned to the METALS ENGINEERING CO. outright.

Development

Development consists of inclined shaft, several open cuts and short tunnel. Total development is 750 feet.

Future development would be by a number of tunnels cross-cutting the mineral zone which crops in a north-south direction for 350 feet.

The Chromite ores of these properties occur in the form of irregular lenses in an extensive zone of broken serpentine. The Chromite is a more or less compact fine-grained black mass. Concentration tests of the ores were satisfactory and a high grade concentrate was made.

Timber & Water

There is ample timber for mining purposes. Water for milling purposes would have to be secured from Murders Creek, 1 mile distant.

Conclusion

The properties on full development will prove a sufficient tonnage to merit a real Chrome-mining operation. It is ready at present to produce steadily 50 tons per day of Chromite averaging at least 45% chromic oxide.

Record Chrome Mine:

- Property -

The Record Chrome Mine consists of a group of 5 unpatented mining claims, 100 acres in surface area, located near the headwaters of Desolation Creek, in township 9 south of Range 34 east in section 4 in what is known as the Olive Lake Mining District, and which is reached by a good mountain road and highway, 60 miles to Baker, Ore.

- Title -

The property is held by location in compliance with the Federal and State Mining Laws.

- History -

The property was discovered in the fall of 1917 by James LaRue, who operated it continuously during the late war. On his death, it was relocated numerous times until it finally fell into the hands of the present owners, R. I. Long and R. C. Begg.

These men told the writer that at least 1000 tons had been shipped of Chromite ore, averaging 46 to 51% chromic oxide, during the late war period.

- Development -

The development consists of a series of openings in shattered green serpentine. The largest opening has gone down 30 feet on a line of lenses that run N. 30°E. and dips 70°E.

The ore occurs as large kidneys or lenses in a vein-like structure over a distance of one-half mile. The shattered zone is approximately 300 feet wide and for the entire distance continuous outcroppings of Chromite occur.

The ore averages from 42 to 58% chromic oxide. Shipments could be started almost immediately, and there would be no difficulty in keeping the average of the shipping product up to 50% chromic oxide content.

Record Mine Chrome property (continued):

Future development would be by the quarry method.

- Conclusion -

This property has all the indications of developing into one of the largest if not the largest high grade Chrome mining operation in eastern Oregon, and possibly the West Coast. I am confident that if the property is diamond drilled, and it should be to prove it quickly, that a tremendous tonnage of high grade shipping ores will develop.

I see no reason why shipping of this ore could not be started as soon as the weather permits. The Chromite is about as clean as one ever comes in contact with, and is certainly of a good shipping grade.

Quarry operation should be applied at this property, as there is now developed in excess of 80,000 tons of milling and shipping ore.

About 300 tons milling ore daily can now be produced, and 170 tons daily of shipping ore.

The Ray Ranch Mine:

- Property -

The Ray Ranch Mine consists of 320 acres patented mineral ground, located 1/2 mile West of Indian Creek, a tributary of the John Day River, at an average altitude of approximately 2500 feet above sea level and is reached by a good auto road 3 miles distant from the John Day Highway. It is 6 miles to John Day, Oregon.

The Ray Ranch Mine (continued):

- Title -

The property has been in possession of the present owner, George Ray, of Prairie City, Oregon for the past 25 years. The property has no encumbrances.

- History -

Development of this property was started a few months prior to the end of the War in 1918. Float was gathered at numerous places and the Chromite ores so gathered in this manner were shipped to eastern Steel manufacturers. In gathering the ores, as the loose mantel rock was worked, two outcrops of dike-like bodies were noted at the surface of the bedrock. Cuts were made in these bodies but no mining of the chromite for shipment was attempted.

- Ore Occurrence -

The Chromite at this property occurs in a dike-like mass of considerable size. The host rock is not highly serpentized, but is basic in character and is derived from the basic rocks of the peridotite series. The ore is a compact grained black Chromite. Shipping ores will average 46% chromic oxide.

Ore bodies have not had their lateral extent proven and I believe that future development will prove the deposits to have a very strong western continuity.

A series of test pits along the east-west strike of the deposit would prove the lateral extent of the deposit, but to definitely and quickly prove the entire mineral zone, the entire 320 acres should be drilled, as Chromite is scattered practically over the entire area.

The Ray Ranch Chrome Mine (continued):

- Development -

Present development consists of three large open cuts and several small pits.

- Future Development -

Future development of this property would be by quarry method. The topography of the ground is such that the deposits as proven now by the present pits and cuts could be opened by a quarry at a very nominal expense and shipping of Chromite could be started almost immediately. However, such a quarry certainly would not prove the possible or probable tonnage of the property.

- Transportation -

A good road reaches the property from the John Day Highway, a distance of three miles.

- Timber & Water -

There is plenty of timber and water on the property for mining and milling purposes.

- Conclusion -

The property has great merit and on development I feel confident that it will prove to be one of the most steady producers of shipping and milling ore of Chrome in the District.

The Mark & Thompson Chrome Mine:

- Property -

The Mark & Thompson property consists of a group of three unpatented lode mining claims, 60 acres in surface area, located on the west side of Indian Creek, a tributary of the John Day River, about 3,000 feet above sea level, and is reached by a good mountain road 4 miles distant from the John Day Highway, which is a good automobile highway. It is only seven miles to John Day, Oregon, which is about 92 miles from Baker, Oregon, the principal supply point of the eastern Oregon mining districts.

- Title -

The property was located in the spring of 1918 by Wm. Thompson and John Marks and is held by right of location in compliance with the Federal and State Mining Laws. The original locators have been in continuous possession of the property since its location. The Federal and State Laws require that at least \$100.00 in assessment work be done annually until a patent is secured from the Government.

- History -

The owners shortly after the discovery of the property immediately instituted a plan of systematic development work and opened two deposits: one a short distance due west of Indian Creek and one northwest of the Creek. The deposit located due west of Indian Creek I will designate as the main deposit as the other is quite small. The main body was worked to an average depth of 35 feet. The smaller body was not worked to any great extent. The development work consists of a series of pits, large open cuts, three tunnels and a glory hole. Total development amounts to approximately 1800 feet.

The Mark & Thompson Chrome Mine (continued)

This development has proven the main ore body to be approximately 200 feet in length with an average width of 25 feet. The small deposit was not opened or mined to any extent. Mr. Thompson told me that the total production of the property was approximately 4,000 tons of ore which averaged 51% chromic oxide.

- Ore Occurrence -

Proven ore as developed on this property occurs as irregular in bodies serpentine. The serpentine or host rock is in large part massive though jointed and crushed in places. Chromite ore mined at this property and shipped during the War period (1918) was a very compact grained black Chromite. (However, I believe that future development will prove large tonnages of ores containing a medium grained black Chromite scattered uniformly through a matrix of green and brown iron stained serpentine and making up about one-half the rock). I found at the east end of the main ore body about 50 feet of such ore. The heavy black compact Chromite appeared to be blending into a medium grained ore. Concentration tests (mechanical) made from this type of ore were satisfactory and a high grade concentrate resulted.

The ore bodies now exposed have not had their lateral extent proven nor has the extent of the mineral zone containing the ore bodies been proven. I believe that future development will prove that the eastern continuity of the main ore body will far exceed that which is proven and exposed in the present workings. Further, I believe that if a systematic method of drilling of the mineral zone that thousands of tons of Chromite will be proven of a good concentrating grade.



The Mark & Thompson Chrome Mine (continued):

At numerous points to the east are found outcrops of the Chromite and Chrome float. There is at present tonnage in excess of 10,000 tons.

Future development would be by driving a tunnel from Indian Creek, a distance of 500 feet and a raise of approximately 200 feet to the present glory hole, this would permit the ore to be mined at several points on the strike of the deposits and would place the ore at a convenient point for haulage to the rail or mine points for shipment to the coast.

- Transportation -

Improved highway 4 miles distant which is open the year around.

- Timber & Water -

There is plenty of timber on the property for mining purposes for a long period of time. There is ample water for domestic use and milling purposes.

- Conclusion -

The property could be placed in operation almost immediately and there is no reason from a sound mining standpoint for a continuous immediate production of at least 75 tons per day of Chromite ore of a good shipping grade (at least 48% chromic oxide) why this could not be carried on for a long period.

The Ajax Mine:

The Ajax prospect consists of four claims, 80 acres in surface area, located one half mile west of the Mark & Thompson property and approximately 1 mile west of Indian Creek, a tributary of the John Day River, above sea level and at an altitude of 3500 feet. It is reached by a good mountain road 5 miles distant from the John Day Highway. It is 9 miles to John Day, Oregon.

- Title -

The property was originally located in the spring of 1919. The property was relocated in August, 1936 by George Ray, Jr., and is held by right of location in compliance with the Federal and State Mining Law.

- History -

No shipments were ever made from the property. Former owners put in a series of open cuts, proving that Chromite ore occurred in a shattered zone of serpentine for a distance of 300 feet.

- Development -

Development consists of six large open cuts and several trenches across the mineralized serpentine zone. This work has exposed a series of irregular lenses in shattered or broken serpentine. Two of these lenses or bodies, 10 to 25 feet apart, have been followed for 150 feet in a westward direction up the hill. The ore occurs as a medium grained black Chromite which I am confident can be concentrated easily as the grains of Chromite are free from the gangue material. Further, by panning the ore, an excellent concentrated product resulted.

The Ajax Mine (continued):

Future development would be by quarry methods. The topography of the property is such that this method of operation is the cheapest and best method for the opening of the deposits. Ore from the Ajax property would necessarily have to be brought down to the Mark & Thompson property. The property is so located that the ore would have to be brought to Indian Creek by tramway or road. If loading facilities were installed at the Mark & Thompson property, they could be used by both properties.

By systematic drilling of the property, I believe that other bodies of Chrome will be proven.

- Timber & Water -

Ample timber for immediate mine purposes is available. There is plenty of water for all mill purposes.

- Conclusion -

I am confident the property is one that has splendid possibilities for a real Chrome mining operation.

METHOD OF MINING OF THESE DEPOSITS

The location of these different deposits and the topography of the country and the manner in which the deposits themselves are laid down, make it possible to open up and develop these deposits by the Quarry method of mining.

Quarry method of mining is, of course, known to all operators as being the most ideal and inexpensive type of mining that is known. For this reason a development and operation of the properties will afford an exceedingly low cost of production in this development. In the majority of cases of these deposits, there is practically no overburden to be contended with. Further on in this report you will see from the individual descriptions and the sketches of the development already done on these properties, the recommendation of quarry operation is not only essential but is practical.

In the operation of these properties under the quarry method, the operators will undoubtedly determine one of two methods to be used, or it is not unlikely they may employ both methods to a certain extent and to advantage in this development and operation, namely: Quarrying from the standpoint of mine run, taking the entire production to a mill for reduction or concentration; second, selective quarrying operations, which means selective mining and more or less hand-sorting or belt-sorting of the high grade ores encountered in the large lenses for a direct crude ore shipment; the balance of the production going direct to the concentrating plant. This type of mining will probably increase your mining cost one-third.

COSTS

(a) A conservative estimate of the cost per ton under the quarry method of mine run should not exceed 25¢ per ton, plus 15¢ per ton

COSTS (continued)

for overhead, making a total of 40¢ per ton.

(b) The cost of selective quarry mining, as described before, would be approximately 75¢ per ton, plus an overhead of 15¢ per ton, which would mean a total of 90¢ per ton.

LOCAL TRUCK TRANSPORTATION FROM DEPOSITS TO CENTRAL  
POINT (JOHN DAY) AND TO SENECA, OREGON, RAIL DELIVERY  
POINT

As pointed out briefly in other paragraphs, the average distance from the John Day central point to all the different properties mentioned with exception of the Record Mine, is 13 miles. In the majority of instances this mileage is about 50/50 on improved State Highway as against mine roads from the highway to the deposit. These mine roads are in reasonable shape now but for a continuous operation they would have to be improved. We have the assurance of the State and the County that these mine roads will be improved at no expense to the operator.

Transportation of these ores from these deposits to the central/<sup>point</sup> and on crude ore from the deposit to Seneca, Oregon should not exceed, under contract hauling with a definite daily tonnage, more than 6¢ per mile; and in fact intimations on contract for hauling with reliable people with special equipment, who state that 5¢ per mile per ton with assurance of a steady operation, should be accomplished. This would mean that you would have a cost in your mine run, (milling concentrating ore) of 65¢ per ton from the deposit to the central point. On crude ore direct from the deposit to Seneca (a distance of 34 miles) the cost would be \$1.70 per ton. The cost of hauling concentrates from the central point milling plant to Seneca (21 miles) would be \$1.05 per ton.

This haul also to be done by contract.

Below is a conservative cost per ton production under the selective mining method for a delivery of crude ore f.o.b. Atlantic Coast ports:

Cost per ton selective quarry mining per ton	\$ .75
Overhead, interest, depreciation	.15
Truck haul from mine to central mill plant average 13 miles (5¢ per ton per mile)	.65
Haul on concentrates from mill at John Day to Seneca, Oregon (loading point) 21 miles	1.05
Rail haul Seneca to Portland via Ontario, Ore.	4.00
Dockage at Portland	.50
Water freight Portland to Atlantic Coast points	<u>6.00</u>
Total - - - - -	\$13.10

Below is a conservative cost of milling mine run Chrome:

Mining 2 tons Chrome ore @ 25¢ per ton	\$ .50
Overhead, interest, depreciation	.30
Truck haul 2 tons ore from mine to mill, average 13 miles (5¢ per ton per mile)	1.30
Concentrating 2 tons crude ore @ \$1.50 per ton	3.00
Truck haul 1 ton of concentrates, mill to Seneca, Oregon, 21 miles, (5¢ per ton a mile)	1.05
Rail, freight, Seneca via Ontario, Ore. to Portland, Oregon, 1 ton of concentrates	4.00
Water freight Portland to Atlantic Coast, 1 ton of concentrates	<u>6.00</u>
Total - - - - -	\$ 16.15

The above figures are based upon the approximate market of 48% chromium oxide ores, f.o.b. docks Atlantic Coast, of \$18.75.

The approximate sale price for concentrates f.o.b. Atlantic Coast, 60 to 100 mesh, running 60% and better, is assumed to be around \$23.00, this being based on a bonus of 37½¢ per unit above the 48% Chromium oxide used as a base for the sale of Chrome ores.

ANALYSES OF SAMPLINGS OF THE DIFFERENT DEPOSITS

Composite samples of all the properties mentioned in this report gives the following results:

CrO<sub>2</sub> 37.36  
FeO 13.03  
SiO<sub>2</sub> 5.71

This sampling should, and we feel it does, represent what we would call a straight-mine-run-quarry-operation, and should approximate the values at the heads of a milling operation.

The following detailed analyses of the individual properties which analyses attempt to show the average values of the deposits were made by the following people:

- (1) Dr. E. W. Lazell, Chemist, Portland, Oregon, from whom we quote:

"Mr. George M. McDowell,  
METALS ENGINEERING CO.,  
Portland, Oregon.

Dear Sir:

I report the analysis of eleven samples of Chrome Ore Concentrates obtained by panning the ore samples:

Lab. No.	Mark	Chromic Oxide	Ferrous Oxide	Silica
37260	Record Mine	41.86%	19.80%	1.25%
37262	Ray Ranch	51.19	24.19	2.12
37264	Pine Creek	34.40	16.26	2.04
37266	Mark & Thompson	34.80	16.45	2.26
37268	Dewey	36.63	17.31	3.24
37270	Burnt Ridge	31.26	14.77	2.84
37272	Pittsburgh	34.29	16.21	2.62
37274	Ajax	34.29	16.21	3.08
37281	Dry Camp	31.26	14.77	4.22
37283	Chrome Ridge	41.38	19.55	2.14
37285	Spring Ridge	41.37	19.49	3.18

Respectfully submitted,

E. W. Lazell, Ph.D.  
Chemical and Physical Laboratories.

(2) One of the large independent ferro alloys concerns in the East states as follows:

"Dear Mr. McDowell:

The following are the analyses of the samples received by Mr. Wood from Mr. Julian some time ago. These results were shown to you in Portland and are given to you herewith for your records:

Sample of Chromium Ore from Spring Chrome property -

Cr<sub>2</sub>O<sub>3</sub> - 42.83%  
FeO - 12.75

From Pine Creek property -

Cr<sub>2</sub>O<sub>3</sub> - 36.07%  
FeO - 13.90

From Howard property -

Cr<sub>2</sub>O<sub>3</sub> - 33.38%  
FeO - 13.61

From Dry Camp property -

Cr<sub>2</sub>O<sub>3</sub> - 43.06%  
FeO - 12.14

From Dewey property -

Cr<sub>2</sub>O<sub>3</sub> - 31.43%  
FeO - 14.12

(3) I quote from the analyses of one of the large laboratories of a large independent Steel concern in the East:

"Subject: McDowell Chromite Samples.

We have completed iron and silica determinations on the McDowell samples reported in memorandum of March 2, 1937. These are as follows:

Group 1 Samples	Mark	Chromic Oxide (Cr <sub>2</sub> O <sub>3</sub> )	Ferrous Oxide (FeO)	Silica (SiO <sub>2</sub> )
#1	Chrome Ridge Mine	40.76	13.05	4.36
2	Burnt Ridge Mine	21.04	11.13	1.88
3	Pine Creek Mine	35.82	14.55	2.68
4	Spring Ridge Mine	40.81	13.27	4.16
5	Pittsburgh Mine	33.90	15.62	3.72



Analyses of Chrome samples (continued):

Group #2 Samples	Mark	Chromic Oxide (Cr <sub>2</sub> O <sub>3</sub> )	Ferrous Oxide ( FeO )	Silica (SiO <sub>2</sub> )
#1	Chrome Ridge Mine	41.64	13.12	3.56
2	Burnt Ridge Mine	31.70	14.86	5.19
3	Pine Creek Mine	36.94	14.48	1.40
4	Spring Ridge Mine	41.84	13.12	3.20
5	Pittsburgh Mine	35.58	16.19	1.51

The purpose of showing the foregoing comparative samples is so that we may be sure that the analyses of our local people do represent a reasonably true situation of the value of the ores, having been checked by two large independent reliable sources.

(Note) It is not possible for the writer to give the names of the laboratories at this time who made these analyses; unless you, as President, feel at liberty in individual cases to use the names.

PRELIMINARY INVESTIGATIONS AND TESTS ON THESE ORES TO DETERMINE THEIR ADAPTABILITY TO MECHANICAL CONCENTRATION:

The Metals Engineering Co.'s engineer and metallurgist have made quite exhaustive preliminary tests on mechanical concentration, and these tests do indicate that the ores of the majority of the properties are subject to mechanical concentration.

F. N. BENDELARI, inventor and controller of the BENDELARI JIG, of Joplin, Missouri, who has so successfully concentrated the zinc/lead ores of Joplin, making two products (both lead and zinc), states that after a careful examination of these Chrome ores, he is satisfied that he can concentrate them by Jigging, but doing so would undoubtedly have to deslime the ores ahead of the Jigging operation. BENDELARI is anxious to make a very complete test on these ores to confirm the preliminary work.

MR. H. S. HANDY, noted Mill Metallurgist for the BUNKER HILL and SULLIVAN MINING COMPANY at Kellogg, Idaho, (who is one of the most successful men in the Northwest in his line) is now, and has been, making very thorough study of these individual ores for the purpose of mechanical concentration, and although his work is not complete, even as to the preliminary work, he does state that he feels he is far enough along in his preliminary work to make the statement these ores can be commercially mechanically concentrated.

These Chrome Ores all contain more or less of a magnetic iron, which does not appear to carry any chromium oxide associated with it. Therefore we had quite exhaustive tests made from a composite sample of all the ores of this district, by the

STEARNS MAGNETIC SEPARATOR COMPANY of Milwaukee, Wisconsin.

These tests showed conclusively by reducing the ores to 80 and 100 mesh that they were able to extract practically all the magnetic iron and a great deal of the silica and magnesia from these ores; and they considered (and we agreed) that their tests were very satisfactory and justify several hundred pounds of composite samples to be sent to them for further tests on a commercial basis.

The results obtained by these people on the Concentrates from this composite sample are nothing short of remarkable. (Samples of these results will accompany this report).

There is also being made a very exhaustive test immediately on two tons of ore shipped from all the properties in question to one of the large and responsible independent alloys concerns in the East. These tests have been conducted for several months and it will be still some weeks before they are completed, we are recently advised. We were also told that these ores respond to their theory of concentration, which is not mechanical, better than any ores they have treated from the Pacific Northwest.

(Note) It is obvious that we are not permitted as yet to divulge the name of this concern nor describe their method of concentration of these ores, for reasons that this information came to this office in the strictest confidence; but we have every reason to believe that these people will be successful in their form of concentration, which would give a Chromic Oxide Concentrate of nearly 90%.

Mr. E. G. HECKENDORF of Littleton, Colorado, a man of very large mining and milling experience, and one of the original locators and owners and developers of the CLIMAX MOLYBDENUM MINE of Climax, Colorado, with his Engineer (Mr. Bartlett of Colorado) spent weeks of time investigating all of the properties mentioned

in this report and others in the John Day District last Fall.

Mr. Heckendorf's statement to the writer and his associates was that after a series of tests for mechanical concentration over a period of a year on all of these ores, that these tests being made from a commercial standpoint, positively convinced him that these ores in this District were subject to mechanical concentration at a low cost and would conservatively produce a concentrate in excess of 60% chromium oxide.

I think it is fair to assume that although the tests mentioned have not been made in large quantities or from large tonnage, they are in excess of what we would call "laboratory tests" and the results do firmly indicate beyond a reasonable doubt and from enumerable sources that these ores of this District, and particularly from the properties mentioned, are subject to and will respond to concentration at a low cost, which will produce concentrates in excess of 60% chromium oxide, consistently.

\*\*\*\*\* CONCLUSION \*\*\*\*\*

The John Day eastern Oregon District is the oldest geological formation in the Northwest. In other words, there has been no secondary geological changes in this District. Therefore the country today is the same as it was originally laid down. Geologically, this District is very much different than that section of the country (known more or less as the Coast Range) where there has occurred several secondary geological replacements.

One must bear in mind Chrome Deposits by their very nature do not occur in valleys, or to a very limited extent in low altitudes. They are found principally in the higher altitudes and in the rugged sections of the country. Therefore they are not unlike in many respects the locations of the precious metals as to accessibility, mining conditions, etc.

The properties referred to in this report are not developed mines, from the meaning of that term. But they are developed prospects. Enough work has been done on them to prove that Chrome does exist in large bodies.

Shipment of large tonnage from this District during the late War proves these properties as to grade, the existence of large bodies of Chrome in lenticular form, and the manner of the future development that should be carried on.

The District, and the properties referred to, are exceptionally well located from the standpoint of transportation (both railway and highway) as well as Timber, Water, Climate, Labor, Supply Points, and General Physical Conditions surrounding an operation.

Weather conditions are equal (and in many instances) are superior to the average similar conditions in other mining districts.

The grade of the ores from these properties and the way the ores occur in these deposits (lenticular lenses) (instead of kidney lenses) as in most districts, and the whole geology of the formation of the district lends to the belief that there are large ore bodies that should develop and produce large tonnage of commercial shipping and concentrating ores.

These properties should be developed as a UNIT (except the Record Mine).

The Management should be prepared in the very near future to erect camps on the property and install on the properties mining equipment for quarry operations, with the idea of year-around operation.

These arrangements should be made and prosecuted as soon as the snow permits. There is no difficulty (once these properties are prepared for year-around-operation) by interference of snows in the winter time.

Selective quarry mining should be used, hand-sorting and shipping the high grade ores, stacking and milling concentrating ores until a definite mill process has been worked out and decided upon and a central location for this mill operation has been selected.

In this report I undertake to point out the advisability of selecting the small town of John Day (which in my opinion is the the central point, and which affords the physical conditions which go to make up an ideal location for a Central Milling operation).

All of the preliminary tests do indicate that the ores are subject to reduction. The exact process or method which ultimately is found to be best suited to these ores has not been determined. The writer does not desire at this time to indicate what his individual opinion is regarding this matter.

Further study should be made immediately from these preliminary tests by a competent metallurgical mill engineer.

The work of preparing the properties for a development should, in my opinion, go right ahead as early as possible to prepare the properties for continued operation and development and production.

We speak in this report of the different preliminary tests made on these ores, and particularly one being carried on by the Metallurgist of one of the large Eastern Alloy concerns; these tests being made on ores shipped them from these properties. These tests, as we understand them, are not based upon mechanical concentration, but are from an entirely different metallurgical theory. We understand that this new Process of Concentration has been carried on to a point where the metallurgists conducting them are thoroughly convinced it is not only practical but a success, and will produce Chromium Oxide Concentrate of from 85 to 90%. This is as against a mechanical concentration of from 58 to 63% chromium oxide.

Of course in this new Process, it will be privately owned and undoubtedly will be patented, but the writer is of the firm belief that it will be available for use under a royalty plan. We only point out this as one of the many instances where metallurgists and Eastern manufacturers are determined to solve for themselves the reduction of these Western Chrome Ores and

utilize these large deposits of known natural resources.

Our own investigation regarding markets for Chromium Oxide ores and Concentrates prove to us conclusively that an operation such as we have outlined in this report is not only sound but justifies the investment necessary to put the project on a sound commercial basis.

A large consumption of Chrome in this country, the continually increasing uses of it and the fact that 99% of this Chromium Ore is imported from foreign countries justifies the interest that large consumers of the East have been showing recently in the development and operation of these large Chrome Deposits in the West.

In most instances these interested Eastern parties have stated to the writer that their interest in these deposits in the West is based upon the uncertainty of the delivery from foreign countries, together with the fact that in purchasing from foreign countries, it was necessary to do so in cargo lots, and they feel that the time has now come when large consumers should turn to their own country in the development of its natural resources and own their own source of this material which can continuously be supplied to them without fear of interruption from world-wide conditions.

The tonnage reported that these properties show and can produce are, in the writer's opinion, most conservative. In fact so conservative that we have no hesitancy in saying that engineers' inspection (for the purpose of verification of facts) will more than justify our position.



We appreciate through our investigation that the Chrome situation in the United States is largely controlled by one corporation and its subsidiaries; however, the same investigation proves conclusively that a large number of so-called independent users, as well as users other than Steel and Alloys, are searching a new source of supply of Chromium Oxide, particularly in the form of Concentrates; material crushed to a very fine mesh is now finding a ready acceptance by the trade.


In summing up the whole situation as to the properties referred to in this report and the District in which they are located, as well as all the conditions surrounding their development and operation, justify the statement that this project is entitled to the most serious consideration; particularly so when you compare it with a number of Chrome Districts in the Pacific Northwest and the Pacific Coast.

\* \* \* \* \*

The writer has attempted to give you and your associates a clear picture of the Chrome Properties that are owned and controlled by the METALS ENGINEERING Co. and their possibilities for future development, both from the standpoint of mining and milling.

I hope that with this report that you will find the conservative answers to the many questions that have been under consideration for some time.

Respectfully submitted,

  
Chas. W. Julian

3-23-37  
Portland, Ore.