GEOLOGICAL SURVEY OF WYOMING
MINERAL REPORT-UNDATED IRON

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EXCERPT
FROM

REPORT

OF

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GEOLOGIST

UNION PACIFIC SYSTEM

ON

RAWLINS, WYO.

IRON ORE
[illegible]

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SUMMARY AND CONCLUSIONS.

The chief points brought out in this report, and which are judged to be pertinent to the commercial possibilities of the Rawlins Iron Ore Deposit, are briefly summarized, as follows:

1st. Iron ore, of the variety known as red hematite exists in commercial amounts and potention reserves in the "Rawlins Paint Mine".

2nd. This mineral has inherent characteristics and field relationships which especially adapts it for, and favors its use in the preparation of red paint, rather than its utilization for the manufacture of metallic iron.

3rd. The reserves are immediately available, and are favorably situated, being sufficiently near Rawlins to insure a selective supply of mine laborers, and close enough to a trunk railroad to guarantee easy and efficient transportation of raw and finished products.

4th. Mining operations can be economically conducted either by shaft and drift, pit and glory-hole, or by a combination of those methods. With either method the net cost per ton should not exceed $2.00. There will be no difficulty experienced with ground waters.

5th. Judging from the market prices of the dry pulverized iron-oxide alone, it would appear that avery substantial joint margin of profit per ton should be realized from the exploitation of this mineral, after every element of cost has been cared for. The margin for the operating company should increase with the manufacture of other finished paint products.

RAWLINS PAINT" ORE

Near

RAWLINS, CARBON COUNTY, WYOMING.
INTRODUCTION.

This report deals with a deposit of iron oxide which is situated about 2-miles almost due north of Rawlins Station on the main line of the Union Pacific Railroad. The chief purpose of this report is to call attention to the geological relationship as well as the various inherent merits of the substance which makes it useful as a raw-product suitable for the manufacture of red paint.

The "Rawlins Paint-Ore", known also in the paint market as "Rawlins Red", derived its name from the city of Rawlins, the County seat of Carbon County, Wyoming, near which the deposit exists. Technically speaking, the mineral can be classified as an iron ore, of the kind generally known as hematite. This material has been mined intermittently for a period of 30 years. While some of the earlier shipments were utilized as a fluxing ingredient for lead blast furnaces, by far the largest output of the paint mines was utilized as paint-stock. Part of the material was used by the Union Pacific Railroad on its freight cars and road-way buildings. Some was used by various paint firms throughout the West.

The substances employed in the manufacture of paint are derived chiefly from three sources: 1st. Natural mineral pigments; 2nd. Pigments made directly from ores; and 3rd. Chemically manufactured pigments.

Group 1, or natural mineral paints, comprises ochre, umber, sienna, hematite, siderite, limonite, ground slate and shale, and whiting (ground limestone and calcite). The principal basis of metallic paints and mortar colors are the three ores of iron, hematite, siderite and limonite. Many other minerals or mineral products are used in the paint trade, such as many by- products.

Group 2, pigments made directly from ores, comprises zinc oxide, leaded zinc, oxide, zinc-lead, sublimed white lead, and sublimed blue lead.

Group 3, or chemically manufactured pigments, comprises the chemical products-basic carbonate white lead, litharge, red lead, orange mineral, lithopone, and ventitian red.

So far as the Rawlins Paint-ore is concerned it is evident that it belongs wholly to Group No. 1, and may be used as paint with little or no treatment aside from mining and grinding to the disired fineness.

The physical nature of the raw material, just as it is received from the mine, suggests that it may be employed as a paint. Indeed the material similar to this, but taken from other localities, has been used extensively as a paint-base just as it was taken from the ground. The paint ore, especially the softer varieties, has a greasy feel like talc, and when rubbed upon a flat surface, it adheres and spreads out like paint itself.

LOCATION

The area involving the "paint-ore" deposits proper, constitutes the northerly sloping flank of a low easterly plunging mountain spur, which was produced as a direct consequence of the Rawlins Uplift. The workings may be reached easily from the Station by driving over a good auto-road which swings around the base of the spur. This road joins Rawlins with the Lost Soldier Oil Regions some 40-miles to the north. Mine operations, and explorations suggest that the deposit is wholly embraced by cornering quarters of Sections 4, 5, 8 and 9 Township 21 North, Range 87 West.

GENERAL DESCRIPTION & HISTORY.

The ore masses occur in one formation, the Carboniferous (?) which, by reason of composition, offers by far the most susceptible condition for a commercial deposit of this nature.

Notwithstanding the fact that several openings have been made for the extraction of the ore, the enclosing rocks are remarkably similar in their lithology, making it possible to discuss the pigment-bearing bodies essentially as a unit. The ores which have been reported a few miles to the northwest are, for convenience, assigned to the same formation, and they are believed to have been formed under conditions very closely related to those which were responsible for the "Rawlins Paint deposit".

KINDS OF ROCKS IN THE FORMATIONS.

In the simplest terms, the iron formation consists essentially of locally enriched interbanded layers, having varying proportions of iron oxide (mainly hematite), silica and lime, and combinations of these. Colleco-tively the material is called "paint-Ore". This substance becomes pure hematite by local enrichment, largely by the leaching out of the silica, and to a less extent, by the introduction of iron-oxide. In places the hematite is hard and resistant, having a slate-gray to bluish color, and irregular granular fracture. Stalactitic masses are at times observed. The larger part, however, is of the soft and powder-like variety. Occasionally concret-ionary and nodular masses, of irregular form and size, appear in the soft varieties of the hematite. Similar eggshaped masses, which are highly siliceous in make-up, exist in the limy members enclosing the ores.

Shales and limy sandstones are closely related to the ores, and it is not always an easy problem to sharply differentiate the ores themselves from the rock formations in which they are embedded. There are accordingly, complete gradations between the country-rock and the ores. This relationship is strongly suggestive of replacement by the iron oxide. Local phases of the paint formations are, sideritic and hematitic charts and shales, lime and iron carbonates, ferruginous quartz rocks, rarely sulphide, and several other rocks which are derived from the foregoing varieties. All of these phases are found, but in considerably varying proportions. In general they cllectively represent but a fraction of the marketable material. One of the most significant variations with reference to the origin of the ore, is the presence of siliceous concretions in the limy shales and the hematite concretions in the midst of the soft ores.

SHAPE AND SIZE OF THE ORE-BODIES.

Althoughthe structural features of the country-rock, which encloses the ore, are very simple, the ore masses in and of themselves are very irregular in form. The drifts and rooms occasioned by the mining operations do not give the true and reliable conception of the shape and attitude of the paint-ore masses. Field observations suggest that they may be roughly tabular in a horizontal plane, tabular in an inclined plane, linear, lense-shaped, and almost any combination of these.

The horizontal dimension must be reckoned in terms of a thousand feet, while the vertical dimensions are less than fifty feet. Word was given the writer, direct from those who had worked in the mine at various times, that the richest ore was found in pockets, pod-shaped masses, lenses, and other irregularly shaped masses. Some of these were large, being more than 20-feet in greatest dimensions, and from which many hundreds of tons of pure "paint-ore" were extracted. It is therefore apparent that the shape and size, and structural relations of the Rawlins "paint-rock" are of wide variety.

Such a view fits in nicely with the proposed origin of the ore itself. In a large way all the ore may be considered as being limited to a limy-shaly stratum which has been replaced more or less completely by the iron-oxide. The ore-bearing solutions doubtless traversed the stratum along joint planes and zones of crush, and found replacement especially easy at points of relative purity.

Certain beds, because of their selective property or because of some other factor of control yielded to replacement. If such a view proves to be correct, one would be in a position to anticipate greater horizontal dimensions in the ore than vertical. Such a view has practical application in the mining of the ore. If this view of the ore, and also its origin proves to be correct, then one would expect to find additional large reserves of untouched "paint-ore."

PHYSICAL CHARACTERISTICS OF THE ORES

The "paint-ore" ranges from the massive hard blue materials through ores which are partly granular and earthy. There is no very sharp difference between the hard ores and the soft ores, when considered from the standpoint of paint-stock. The soft earthy portion, however, makes up the bulk of the desirable material. The hard chunks often exhibit surface markings which suggest movement. Much of the soft earthy hematite exhibits a physical property not unlike that of talc, soap, or graphite. When rubbed slightly it soon presents a smooth shining surface.

Under the microscope, the hard blue ores when finely pulverized show angular grains of hematite, with small amounts of semi-transparent angular grains of quartz. The earthy red variety, especially that with a greasy feel, shows numerous small flake-like grains with some angular grains of silica.

The quartz grains in both forms of the ore really represents a small fraction of the whole, and it is this mineral which gives a gritty quality to the paint stock.

As far as could be ascertained from a microscopical examination of the paint-ore, there is no chemical compound which would tend to become altered and decomposed so as to impair the quality for paint use. On the other hand, the abundance of pure hematite, in its chemical state of stable equilibrium, practically insures its durability when used as a paint.

The largest quartz grains observed by the writer in the virgin ore, are less than 1-millimeter in diameter. When pulverized the quartz grains often show scalloped boundaries similar to that of broken glass.

The mineral density of the ore ranges from less than 3.5 to 5.0, and averages about 4. 3. The pore space in the ore is variable ranging from 1% to 20%, averaging about 10%. The free moisture held in the pore space averages about 2%. The cubic dimensions of a ton of the hard paint ore is about 8 cubic feet, and for the soft earthy ore is about 15 cubic feet.

As far as could be ascertained from those who worked in the mine, no difficulty was experienced in winning the ore, except its great weight. The ores are remarkably free from acids and other chemical compounds which ordinarily have an injurious effect upon tools and machinery. The protective covering of the paint-rock effectively prevents rust, even when it is not mixed with oil, or other liquids employed in the manufacture of paint.

The hard ores, while readily pulverized, cause wear upon the grinding machinery. The soft ores on the other hand tend to clog the machinery parts. Both types of the paint-ore, when pulverized, present no difficulty in ordinary screening operations. A large part of the earthy ores require no screening, and this part can be separated in the early stages of treatment, thereby increasing capacity.

GEOLOGY (STRATIGRAPHIC).

In describing the general character and succession of the rocks in the area under consideration, one need only to begin a short distance north and west of Rawlins, where Pre-Cambrian crystalline rocks outcrop as conspicuous masses of reddish coarsely crystalline granite. The weathered forms in the granite exhibit rough topography, and in some of the small canyons scenery of unparalled beauty greets the eye.

Resting directly upon the granite is a thick massive formation of coarse sandstone to pebble conglomerate which has become highly silicified and hardened. Pebbles in it are often ½" in diameter. This formation gradually passes into a finer and more nearly uniform quartzite, which has just enough iron oxide in it to impart a pinkish

The stone has been extensively employed in building construction, to which use it is admirably suited. Some of the most outstanding buildings in Rawlins have been constructed of this stone.

The upper beds of this terrane consist of a layer of porous quartzite which is highly rated as a grinding-stone stock. Favorable mention was made at the Worlds Fair on a stone which was placed upon exhibition from this bed. The quartz grains, making up the stone, are very sharp-angled, and when they come into frictional contact with steel a rapid cutting effect is produced. The rock is "free splitting", and is uniform in texture. Although search was made for fossil evidences, none were found, therefore the exact geologican age could not be established with certainty.

Above this are other sandstones and shales with associated limestones. These lie conformably upon the coarser beds below. These are also the beds which contain the iron ore known as "Rawlins Red". The age of these beds is not known.

Resting directly upon these beds a short distance to the north-east is a massive impure limestone in which was found a single fossil (Productus) which tentatively places it as Carboniferous in age. Since the iron-ore formation is below this bed of known age, it is designated for the time being as Jurassic.

GEOLOGY (STRUCTURAL).

Of more immediate and practical importance in relation to the distribution of the ores, are the structural conditions which determine the location of the ore-bodies.

The iron deposits are embraced in beds which form the east flank of a dome structure which has an outcropping granite core. The entire eroded structure is designated in Wyoming Geology as the "Rawlins Uplift". The beds dip away from the granite core in all directions. On the east side the dip is not constant, but varies from a few degrees to about 10 degrees.

Possibly an average would be 6-degrees east and north. A short distance west of the iron-ore outcrop is a normal fault along the east side of which the beds are more highly tilted. No other faults were noted in the field, but they doubtless do exist. Their presence, however, would not adversely affect the iron-ore deposits.

It is not at all likely that the replacement took place across the stratification planes in the beds. On the other hand it is more reasonable to assume that the chemical processes, resulting in the deposition of the iron ore, would follow a given stratum. If this be true, those who conduct the mining operations should look with favor upon possibility of the ores running with the beds, rather than in directions across the formations. Such a clue should add materially to the likelihood of discovering additional paint reserves.

TOPOGRAPHIC RELATIONS OF THE ORE BODIES.

The ore-deposits are associated with gently dipping sedimentary beds. As previously stated they are related to a stratum which has considerable limestone present as part of its mineralogical make-up. So far as these deposits are concerned they are located on a slightly elevated portion of the east flank of the eroded dome. They can be properly referred to as occupying the lower middle portion of the main slope.

While the middle part of the slope, in general would seem to be the favored locality for such deposits, this is by no means an invariable rule to follow in warranting one to look only at such and not elsewhere for future reserves.

As the development of the ore-bodies is a function of the free circulation of water, it is believed that the association of the ore-deposits with relatively porous gently dipping beds is significant. It would not follow that the ore-deposits should for this reason be confined entirely to the points where the beds slope, although this seems to be the general rule in this particular vicinity. Also it is to be remembered that the concentration of the paint ores has not taken place entirely in relation to present topography, but that when the deposits were concentrated, the topography was more or less different, and that, therefore the deposits now found independent of diagnostic topographic elevations may still have been developed under control of beds which have long since been removed by erosion.

ECONOMIC GEOLOGY
COMMERCIAL RESERVES, TYPES, TONNAGES.

One of the most difficult problems with which the economic geologist has to deal, is that of making trustworthy computions as to reserves of mineral in the ground from the superficial openings at the surface. This is due mainly to the fact that the factors which supplied the favorable conditions for the deposit are only partly known at best.

More financially disastrous mistakes have probably been made in mining by supposing that because certain conditions hold good in one region, they must hold good in another, than from any other one cause. Each district is a law unto itself in the localization of its ore deposits, and no district can be properly understood until it has been thoroughly studied.

History of mining districts is replete with instances where a mine has been abandoned because of the failure of the Ore, when upon careful and more extensive studies, reserves equal to or greatly exceeding that found in the abandoned mine have been discovered.

The openings in this mine have been visited many times with the idea of obtaining a correct conception of the reserves. The impression one receives is that an abundance of ore remains, and that such will amply justify favorable consideration. Citizens of Rawlins who have worked in the mine, say without reservation that an abundance of ore still remains in the mine, and that it is immediately available.

Coinciding with such statements as these, are the very favorable observations any one can make by an inspection of the workings, where the paint-ore occurs as a solid bank where the roof has not caved. The side walls of the drifts show good ore, and the same facts are noted with reference to the supporting pillars.

ORIGIN OF THE ORES OF THE RAWLINS PAINT DEPOSIT.

In considering the origin of the ores of iron in the Rawlins district, the observer is first impressed with the variety and abundance of evidence for the secondary concentration of the ore. Whatever the ultimate nature and source of the sediments, the observer is left in no doubt that the iron ores owe their present characters to the concentrating agencies of the atmosphere and the hydrosphere. These very processes can be seen in operation today. The surface concentration will be first discussed to clear the way for consideration of the primary nature and source of the iron formation, though this means departure from strict geological and chronological sequence.

SECONDARY CONCENTRATION OF THE ORES.

General Statements. The secondary alteration of the iron formation to rich paint-ore has been both chemical and mechanical, and under conditions of weathering, on the one hand, or folding and deep burial and proximity to igneous intrusion on the other. The essential changes in the development of the ores have been effected under weathering conditions. After the ores were once formed, alterations effected by dynamic action, igneous intrustion, or re-deposition as fragmental sediments, were modifying factors which tend to change the character of the ore-deposits, but adding little to their size and volume.

Every modification or alteration which takes place in a deposit of this nature, whether or a chemical, or of a mineralogical, or of a mechanical nature, tends, ultimately to one final end—that of concentration and the purification of the iron mineral. This general process with all the reactions involved is called "metamorphism".

It requires only the most general field observation to bring out the fact that the iron formations are being and have been rapidly altered by percolating surface (meteoric) waters carrying oxygen, carbon dioxide and other constituents from the surface, and that the present characteristics of the formation are considerably different from those of the same formation when they first became dry land. Now the beds consist mainly of hematite and associated paint-rock compounds. Fortunately, the alterations have not everywhere gone far enough to completely obliterate all of the original phases of the limy strata. Gradations may be observed between original lime and shale beds through impure ferruginous limestones to the dominant alteration products - hematite and paint-ore.

The former are found in protected places and on the external margings of the ore-body, while the latter are in the richest orepockets in the mine where the percolating oxidizing waters have had greatest freedom of flow. There are gradations from the ferrous compounds of an unstable nature to the most stable and resistant iron minerals known. Even the rich pockets of iron-ore retain textures and structures which betray their derivation from more simple and impure materials. The most conspicuous ear-mark is to be found in the preserved forms of ironconcreations so commonly found in the rich ores.

The secondary alteration of the original ferruginous limestone and shale beds, to the present hematite (paint-rock) involve: (1) Oxidation and hydration of the iron minerals in place; (2) leaching of the silica, and (3) introduction of secondary iron oxide from other parts of the strata. No. (1) is usually far advanced before (2) and (3) are conspicuous.

All these changes tend to make the ore richer as time passes by, but it is believed that the principal step in the enrichments of the ore takes place in connection with the removed silica, although it is also possible that the introduction of iron-oxide is very important. The alteration of the iron minerals is facilitated by small amounts of acids which are carried by percolating waters. Precipitation of the iron from ferrous solutions may be caused (1) by direct oxidation to limonite, or (2) by reaction with alkaline carbonate, producing iron carbonate, which in this form in the presence of oxygen alters almost immediately to hydrated iron oxide, or (3) by loss of carbon dioxide.

The oxidation of the iron compounds goes on much more easily and rapidly than the removal of the silica. If sufficient time is given, and the other necessary favorable conditions exist, almost any part of the impmm enclosing rock may become ore. An epitome of the story for the formation of the ore is told in almost any hand specimen which may be selected from the waste pile of the mine workings.

Quartz (silica) is ordinarily regarded as practically insoluble in surface waters. A megascopic examination of the ores leads one to believe that quartz is taken into solution under ordinary weathering conditions to a larger extent than is generally recognized, and that it is apparently stable because it is usually associated with more soluble constitutents. In the portions of the ore-deposit which are best exposed, it is noteworthy that the silica content is the lowest, and that in parts where weathering has not progressed to any appreciable extent the silica runs highest. The latter points are found in the deepest bore holes.

The mechanical concentrations of the ores have taken place largely by the slumping down of the materials as they have become exposed. While of a negligible amount it really adds to the process of concentration. There is a tendency also to eliminate pore space by this method, particularly where the slumping has been most active.

From this discussion it is at once evident that the upper portions of the iron-deposit will be the most nearly pure. (free from silica etc) It is further evident that the geographical extent of this particular grade of iron-ore will be more nearly horizontal rather than extending down the dip. In other words the zone of rich ore will be found in a more or less well defined band paralleling the outcrop of the altered bed.

Because of the fact that atmospheric weathering is mainly responsible for the character and purity of the ore, one would expect to find the desirable ore itself most prominently developed within its zone of action, and naturally, this will be relatively near the surface. In some regions the influence of weathering extends to great depths - it should be anticipated in these mines, because of the physiographic development of the region as a whole, - but the drill-hole records show that the weathering effects, especially the removal of silica, has not proceeded far down the dip of the ore-beds.

PART TWO

PRACTICAL CONSIDERATIONS OF THE DEPOSIT.

MINING FOR PIGMENT VERSUS IRON-ORE.

MINING COSTS.

The reasons why this ore can be profitably mined for paint materials and not for iron making are briefly these. In order to bring the cost of production results.

It is believed that if the first coat could have been correctly prepared its quality would equal the two and three coat work. The satisfactory covering quality of the paint seems to warrant the statement that, except in rare instances, two and three coat work is not justified.

By inspection of the various exhibits, it is at once obvious that the best appearing results are obtained by the more finely pulverized pulps. Such exhibits present a smooth velvety surface, but even this is not absolute proof that such preparations will be the most resistant and durable.

Since very fine grinding is expensive (200-mesh and finer), it would appear that a substantial reduction in the cost of preparation would be effected by adhering to the limit of 150-mesh preparations. Market demands may demand finer pulps.

It should be stated that fine grinding is not as expensive now as formerly, due in large part to refined methods and new discoveries. Small grinding units are available which are guaranteed to grind such ores as these at the rate of one pound per minute to 200-mesh at a cost not to exceed $.002 per pound for power consumption when electricity sells for $.08 per K. W. Such costs are entirely reasonable.

RAWLINS PAINT USED IN THE ARTS

Probably the first use made of the paint from the Rawlins Deposit was upon buildings in that city. Its merits were soon discovered, and it became widely known as "Rawlins Red" in the paint markets. Early users pronounced it far superior to all pigments or other grades of paint then upon the market, either in this country or that which was prepared abroad.

When the Brooklyn Suspension Bridge, New York, was constructed, it is recorded that after a thorough investigation it was decided to employ "Rawlins Red", for protecting the steel. From 1907 to 1910 the writer lived in New York City, and during this period had the privilege of making metallographic studies of steel preservation in certain members of this bridge, and also oF observing the character and direct effect of metallic paint corrosion. An unusual opportunity was afforded to observe the protecting qualities of this renowned paint. In many areas the outer surface of the paint film was dulled and roughened by the partial tendency of the paint vehicle to enter solution. The surface of the metal covered by the paint was ina perfect state of preservation, and there was no corrosion, except at points where physical abrasion had removed the paint film. In protected p places on the bridge, the paint (Rawlins Red) was as fresh appearing as if it had been applied but a year or so previous.

The writer also observed tin-roofing in Rawlins which had not been painted but once in 30 years, and the paint was still intact. Several shingle roofs were painted with this paint and although some of the shingles are entirely gone the parts protected by the paint are still serviceable even though the roof was painted 25 years previous.

The same general statement can be made by the Union Pacific Railroad Company which organization employed the paint extensively for coverings on freight cars and roadway bridges and buildings. It has also found wide use as a paint for all forms of structural steel, filler for linoleums and oil cloth, filler for sand lime brick and mortars for pressed brick work, for covering tin and corrugated iron roofing, tanks, and for a stain used in coloring cement. For those uses it is reasonably safe to state that few substances have such unqualified merit.

PREPARATION OF THE PAINT STOCK
Method of Treatment

The treatment of the ore, as carried on in this region formerly, simply consisted in selecting and crushing the ore to a fine powder, in which state it was sold to be properly mixed with oil. It is not known for certain what proportion if any, was calcined prior to grinding.

The ore was carted from the mine to the mill where it was dumped into bins. It was then broken up with sledges to a suitable size and crushed. The types of machines, and the degree of crushing were facts not ascertained.

The ore was shipped partly in the dry state, and later on, it was ground or mixed with oil for the market. It is stated that when shipped dry it was a source of trouble in soiling and otherwise marking up the floors of the cars. When shipped, ground in oil it is reported the bulk of the pigment settled to the bottom of the container, and separated from the vehicle in which it was originaly suspended. This made it difficult to utilize because of the necessity of frequent stirring.

POSSIBLE MIXTURES WITH OTHER PIGMENTS

Possible variations and shades in the color of the paint are obtained by addition of other ingredients. For certain classes of work shades considerably different from the red is desired. Because of this demand it becomes necessary to plan on introducing additional minerals to secure the desired results.

A few hundred feet from the mine workings is a pure limestone bed which offers possibilities, both as whiting and as an adulterant for obtaining tone variations in the red ore. Likewise gypsum is not far distant and this mineral can also be employed for the same purpose. With the readiness of obtaining these supplementary minerals, it would appear that the entire series of color variations through the reds, browns chocolates etc. etc., are capable of being made, the red ore simply serving as a base. Such substances are frequently employed to render the softer shades and tints which are desired on the market. In the proportions used these simple substances do not seriously interfere with the quality of the final paint product.

VALUE OF ROASTING AND CALCINING THE ORES

In roasting a given pigment there are certain chemical changes wrought in the final product which, from a paint standpoint, are desirable. One of the most conspicuous changes is the partial elimination of water, and the carbon dioxide which may be molecularly held in the paint substance. There are other volatile compounds, but these represent the chief ones which have a marked effect upon the resulting quality of the ore. These changes may be visible, or they may not be at all observed. Usually, however, the change is very distinct particularly with reference to the modification by oxidation.

When those compounds are liberated, the resulting mass is far more porous and it is susceptible to pulverizing methods to a far greater extent than in its original condition.

Aside from the mechanical improvement to the product there is always a chemical change which is beneficial, largely because compounds are formed which are known to be more stable. Chief among these are the higher oxides and the carbonates, with some sulphates if sulphides are present. The sulphates tend to produce sulphuric acid which compound can be leached out by means of water. In the case of the iron bearing minerals the higher oxides are almost always produced.

If complete oxidation takes place, as in the case of profound weathering, none of the objectionable compounds are found in the paint ores, and further oxidation, by means of calcination, will rarely take place. The natural product as well as the artificial product is most valuable when it has been thoroughly oxidised. This is true because the paint stock is then more stable, and distinctly more resistant to the action of solution and decomposition.

The chemical changes are frequently attended by physical modification in color. The black sulphides, if they are present are converted to the red oxides of iron. Likewise some of the lower oxides are converted into the higher oxides, and this step is accompanied by a corresponding change of color. Ores which are thus roasted are susceptible of control, regarding the degree of color desired. When pulverized and thoroughly ground in oil the pigment is less likely to settle out from suspension. The oil also has a better chance to percolate into the pore-space of the pigment, largely by reason of the chemical change wrought in the ore itself.

SPECIAL ADVANTAGES FAVORABLE TO ROASTING.

In the manufacture of paint materials it is very desirable to make provision for meeting the numerous demands of the market. There will always be more or less opportunity to improve the quality of certain natural pigments by heat treatments of the stock prior to the various stages in grinding the materials to an impalpable powder. The heat treatment of the several raw products is a department by itself, and it is ordinarily a complex process because of the difficulties and nice adjustment required of heat control in producing the end products. At Rawlins this drawback is practically entirely overcome due to the cheap rates and ready accessibility of natural gas. Abundant supplies for all practical purposes passes the property at a short distance . The pipe line connects the Mahoney and Werts gas domes with the refinery at Parco, and a branch line from the main line extends to Rawlins.

This ideal type of fuel, and its nearness to the point of consumption are factors which should interest any paint company because of the special advantages which it offers. This fuel is susceptible of nice control, and almost any paint product known can be manufactured in conjunction with the Rawlins Red. Then too, this fuel can be utilized for power purposes at the mine and mill plants. Electric power is likewise available at a reasonable distance. These are factors of great significance, to a prospective industry which may be started up in this region, and it is believed that this factor will receive consideration by any organization which contemplates a paint business in this locality.

Another advantageous feature which comes about by roasting the pigment is the increased capacity of the grains to absorb and retain air and oxygen. Accompanying the calcination of the pigment, under the free conditions found in the roasting furnace, is a notable expansion in volume of the pigment itself. It becomes fluffy sponge-like, lighter in weight, and attracts by chemical selective properties, several times its volume of free atmospheric air and oxygen. This peculiarity ceases as the cooling process ends, and the gases remain permanently with the pigment until it is mixed with linseed oil at which time a secondary chemical reaction takes place between the imprisoned gases and the oil, whereby the latter is oxidized, causing it to dry in such a manner as to insure durability, and long life to the paint film.

MIXING PROPERTIES OF THE PIGMENT.

The Rawlins Red Pigment mixes readily with boiled linseedoil in practically all proportions. To ascertain additional data upon this desirable property, portions of four representative samples were critically examined under a high power microscope, primarily to determine if the physical property of the individual grains offered any special feature which would explain this phenomenon . The examination readily showed that a large proportion of the grains were tabular, flat, and flake-like in form. This was more particularly true of the earthy samples, and those which presented a shining appearance.

Apart from these two microscopic features, there was nothing about the ore which is essentially different from the appearance of any hand specimen taken at random from the ore-deposits. The natural greasiness of the ore itself, coupled with the fineness of grain in its natural state, is mainly responsible for its behavior with reference to its affinity for Linseed oil.

GRINDING CHARACTERISTICS.

As far as the problem of grinding is concerned the ore presents no qualities which will render it difficult of being pulverized to the requisite degree of fineness. It is a fact, however, that fine grinding is always more expensive than coarse grinding, and it is obvious, furthermore, that for the best qualities of paint the grinding should be exceptionally fine. It is recommended that the final degree of fineness be accomplished in the dry or wet (water) state prior to the actual admixture with oil. Linseed oil, like many other vegetable oils, tends to break down and actually wear out by excessive mechanical attrition and grinding in the presence of any finely divided mineral substance.

If it is finally decided to grind in the wet state, then it may be found necessary to dry the resulting mass by utilizing natural gas or some other form of heat. Grinding wet will materially add to the value of the pigment, since it will reduce losses by dusting, and it will tend to eliminate any soluble compounds which may be found in the ore. Such a method will also assist materially in obtaining the ultimate degree of fineness, since advantage of floatation can be made use of in the classification of the grains.

Great emphasis is placed upon the necessity of obtaining a product which is exceptionally fine-grained. It is possible that a higher market price can be obtained for such materials because of the stronger tendency to remain in suspension in the oil.

There are at least three methods of preparing the paint for market. Lst: As a dry powder. This cost will be the lowest of all. The higher grades should be finer than Portland Cement, and it should be shipped in packages for wholesale use, not exceeding 100-lbs. each. The packages should be of such construction as will insure no loss of the pigment, and thus prevent soiling of articles with which it would come in contact through shipment. There are upon the market bagsa and other suitable containers which will give the desired results. Smaller amounts can beplaced in metal containers of various sizes to meet the market demands.

2nd: The pigment can be shipped in containers with just enough linseed oil to insure proper mixture for direct application as paint. Wooden barrels, or metal drums of suitable size would meet the wholesale and retail demands.

Both of these may be returnable for refilling upon some such basis as that governing the return of gasoline and petroleum containers.

It is believed, however, that this method of shipment will always result in more or less dissatisfaction due to the tendency of the mineral pigment to settle out of suspension thereby accumulating on the bottom of the container. The more finely ground the pigment is, the less will be the tendency for this action to take place. Here, again, the writer urges that the final grinding be carried to such a point that the mechanical mixture will approach a colloidal solution state. By way of explanation it is due the reader to know that a colloidal solution is a state of matter supposed to represent a degree of subdivision into almost molecular dimensions, dispersed in a solvent. Good examples of this is ink, muddy waters which will not settle. Physical changes of temperature (i.e. freezing) alters the condition in both of these solutions, and the solid matter settles out. This phenomenon is familiar to all.

With the advent of synthetic paint oils, and the various other substitutes (petroleum derivitives) it becomes increasingly difficult to maintain any pigment in suspension over long periods of time when these solvents are employed.To counteract this the paint industry has learned to offer such suggestions as "stir well", " shake well", etc., before applying the paint. The significance of this is apparent to anyone having had experience with paints in general.

3rd: There is an additional method of placing the pigment upon the market which has merit. This is in the form of a thick paste. Many other related mineral paints are marketed this way. The umbers, the siennas, the vermillions, etc., are all shipped in this form. Thinning to the requisite degree for use is accomplished when the product is applied. This form of shipment offers one of the best modes in which the pigment can be shipped and placed upon the market. It is obvious that in this case very fine grinding is not absolutely essential to marketing the product. Since the grinding is an important element of cost it may be partlsy eliminated by this means.

The particular form in which the pigment is placed upon the market is a matter to be settled by the company which enters upon its manufacture. The above suggestions are given merely to indicate that many of the difficulties of former manufacture can be eliminated, thus greatly increasing the sale of the finished product.

SPREADING CHARACTERISTICS.

It has been previously stated that the Rawlins Red has very desirable features in its covering power. It spreads readily, covers well with but one coat, and presents a smooth attractive surface. The explanation for this is partly of a physical and partly of a chemical nature of the pigment.

From a physical viewpoint the grains are more or less tabular as recorded by the microscope. Since all surfaces to which paint is ordinarily applied are flat, it is apparent that the flake-like grain will naturally tend to parallelism with such surface. This phenomenon is greatly increased by the surface tension of the linseed oil, and also by the physical action of application.

Angular grains, because of their shape, and the distribution of the color molecules, are not subject to the influence of surface tension of the oil and therefore, they tend to assume any position with reference to the surface upon which they are placed. The flaky grains tend to overlap like the shingles upon a roof, while the angular grains simply abut together. Particle for particle the tabular ones require the least amount of vehicle (oil) for covering a given surface. The very thinnest grains when viewed under the microscope are opaque to the transmission of light. This explains the effective covering power of one application of the paint.

Because of the flatness of the pigment grains, there is a tendency or apparent affinity of these for clinging to all plane surfaces. The same statement is true of graphite, talc, soapstone, magnesia, chlorite, mica, and hematite etc., some of which have been employed as lubricants.

Since the broad side of the flake is exposed to the ravages of the atmosphere, it is plain why such favorable merit is made of the "Rawlins Red Paint".

ABSORPTION OF LINSEED OIL.

The amount of oil absorbed by the Rawlins Red Pigment is less than most paints due to the physical shape of the grains making up the pigment. It is a well known principle that oil sands which are spherical in form hold the largest amount of oil in the spaces between the grains, and that rocks which have flat tabular grains, like shales and clays, hold the least amount of oil. The same principle applies to the grains which enter into the composition of paint pigment.

The natural greasiness, due partly to the gliding planes in the mineral, is chiefly responsible for the ease with which the pigment unites with the oil. Ordinarily the oxides and oxidized compounds of the metals do not exhibit this property to any great degree, but this feature is strongly manifest in this pigment.

Although this property is evident it does not appear to be strong enough to overcome the tendency of the pigment to settle to the bottom of the containers.

For the paint manufacturer another advantage is also claimed for this pigment. It is generally known that the product needs no drier. Just why this is so is not known with certainty, but it is partly explained on the basis that the ore contains a sufficient amount to react with the oil, thereby fitting the paint for all out-door uses. This inherent quality makes the paint all the more desirable, and adds materially to its value and durability.

STABILITY OF THE PAINT AFTER APPLICATION.

To insure the durability of a paint product, it is very necessary to obtain within the paint itself, stable compounds. This inherent property gives quality to the paint. As previously pointed out, paints are subject o

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disappointment either from failure of the vehicle, or the pigment, or both to withstand the destructive action of the atmosphere, or the ravages of time.

Paints are subjected to such a wide variety and extreme range of physical and chemical conditions that it is a wonder to all that any paint could combine the characteristics which will insure qualities of resistance comparable to its make-up.

Paints may be subject, on the one hand, to the chemical solution and physical expansion effects of a blistering hot, moist climate; or on the other hand to the drying and contracting action of the arid parching desert. In conjunction with either or both of these forces, may be the destructive physical effect of freezing, or again, abrasion by wind-blown sand, frost crystals, and sleet.

Internally, paints should contain no chemical or mineralogical substances which will tend to change to other compounds, because it matters not how slight the change may be, such is always accompanied by volume modifications which tend to rupture the paint film.

Likewise there should be no chemical compound in the paint, which in association with moisture, either from the air or from the painted surface, will produce any acid having a corrosive nature, either to the surface, or to the paint film, or the several ingredients composing the paint itself. Likewise there should be no chemical compound or ingredient in the paint which would cause the film to peel off.

Studies thus far conducted upon the Rawlins Metallic paint, from the various angles mentioned, go to confirm previous experience with it, that it is a pigment which is chemically inert, and that because of its physical hardness it resists to a remarkable degree, the destructive action of atmospheric agencies, irrespective of locality, even though such is more or less charged with steam, carbon dioxide, water vapor, mineral and organic acids, smoke, and dust. This pigment, when properly ground, and thoroughly mixed with boiled linseed oil of first grade, answers in an admirable way to all the rigid requirements of a standard paint.

One writer (Mr. J. H. Pearson) has tersely expressed the same idea by saying that "as a paint for railroad equipment and structures—the produce from the Rawlins deposit—leaves nothing to be desired."

EXHIBITS OF PAINT SAMPLES

In order to more fully show the appearance of the paint-ore when applied, and also to obtain first hand information relative to possible grades; grinding characteristics; screening characteristics; mixing properties; covering qualities, etc. etc., four samples were secured and prepared as a paint base.

Each exhibit was prepared (except as noted later) by mixing the pulp with genuine linseed oil. At this juncture, the writer wished to state that S. H. Wiley, President of the Fredonia Linseed Oil Works Co., Kansas City, Mo. was kind in supplying one quart of Tiger Brand Oil for the work in question. To him special thanks are due, for without the genuine linseed oil the exhibits would have failed of their purpose.

It was believed that different degrees of fine grinding would yield different results, therefore each and all samples were ground in an agate mortar until the pulp would pass 100-mesh; 150-mesh; and 200-mesh respectively.

It was further believed that effects produced by one coat, two coats, and three coats would give variations in quality and appearance of the paint.

The following sheets, each representing a sample, with variations of fineness of grain as well as applied coats, are submitted. Other data pertinent to the deposit is likewise designated. The first coat employed oil reported to be linseed but which was later proved to be of petroleum extraction.

The first coat for each of the samples was mixed with linseed oil which is commonly sold upon the market. It was found that the prepared paint would not dry even though several weeks were given to the process. The two and three coats were prepared with the genuine linseed oil and these were attended with perfect drying

... occurs under the conditions found in this deposit, within the limits of market prices for smelting ores, mining must be conducted on a very large and extensive scale. Such a venture usually involves large investment in a great variety of general mine and open-cut equipment, and in addition it often necessitates the construction of an expensive railroad spur with its related loading tracks.

Under such a condition it is desirable to have large, and easily accessible, marketable tonnage. In fact the larger the tonnage and reserves the better. At the present rate of possible commercial extraction a deposit, to have merit, should yield ore for at least a 10-year period, and better for a 100-year period. In other words, there should be, as near as it is possible to estimate, a nice balance between the character of the initial investment, and the commercial yield or the profitable life of the deposit.

It is entirely within reason to predict, by means of the geological studies made of this particular deposit, that it falls far short of ever becoming a producer of large tonnage in the sense of supplying ore for iron making. This is not because of the character of the ore, but because of the limited reserves. The total amount of ore in sight, plus that which the geological structure is capable of containing within the zone of weathering, indicates that the deposits would be exhausted too soon to warrant such an expensive outlay as they required for iron mining proper. Furthermore the origin of the ore, and the attitude and thickness of the enclosing beds is likely to be such that a large quantity of limestone, sandstone, and shale would have to be removed either to win the ore, or to provide the head-room necessary for the regular operations incident to profitable ore extraction. Such conditions would render it doubtful whether ore, as it is found here, could ever be worked for iron alone, even if the quantity in sight were assuredly greater.

On the other hand, the Rawlins deposit is very fortunately situated, because when the right kind of ore occurs under the conditions found in this deposit, it is sufficiently valuable to paint manufacturers to bear the cost of mining by hand, — even at a slightly higher cost per ton — and haulage by truck to the main line of the Union Pacific Railroad.

Ordinary grades of iron ore, such as that smelted in the iron producing districts, are not entirely suitable for the manufacture of paint, and therefore it has been found that only a small part of the total amount extracted can compete with the grade which is found at this deposit. It is true that a small part of high-grade ore at some of the mines can be utilized for paint-stock, but the cost of segregating this from the regular run-of-mine, and also the fact that most iron mines have a ready market for their product, has thus far induced the operators not to encroach heavily upon the paint market demands. Furthermore, their troubles are numerous enough, in grading the ores to meet the very rigid blast-furnace specifications, without attempting to comply with the additional requirements of the paint manufacturers. It should be remembered however, that a considerable amount of high-grade ore that would otherwise be smelted, is actually sold by the operators and iron producers to paint concerns on account of the very attractive price such a grade commands above that which is received for the stock smelting ore. With open-cut and steam shovel methods the extraction cost per ton is very low. In some mines the cost seldom exceeds .18 per ton, and at Rawlins this should never reach $2.00 per net ton.

AMOUNT AVAILABLE AS RESERVES.

The amount of paint-rock still left in the deposit is a matter of very great importance, because it is upon a definite knowledge of the quantity of paint ore available that one can proceed intelligently to work out future plans for its economic exploitation. An additional factor of equal importance is that of the market demands for the finished product.

Thus far the mining operations have been very simple, because only slight depths have been attained, and limited exploration has been made along the outcrop. As far as reliable information could be obtained, none of the workings were sunk deeply enough to justify a second level. The total amount of ore already extracted probably does not greatly exceed 100,000 tons. This ore was probably of a grade which was most acceptable for paint use and was selected as being lowest in silica.

The ores which showed evidences of silica were the ones which were naturally shunned, as far as these could be ascertained, and this was largely because of the difficulties which were introduced in the grinding process.

The presence of silica would be detrimental, because if encountered in large amount, its physical hardness (being 5.6 to 6.5 while that of the hardest steel is about 7) would tend to grind away the pulverizing plates. On the other hand its presence would increase the capacity of any crushing device, because it is very brittle. Its presence in the paint-stock is not detrimental, being inert, stable, and resistant to all forms of solution and wear.

As a matter of fact the silica content of much of the ore still left in the zone of weathering, as well as that which is reported in the ore which exists between the lowest workings and the drill hole No. 1, is well below the chemical analysis of similar ore used extensively for paint purposes elsewhere.

It is estimated roughly that 1,200,000 tons of commercial paint-ore exists as reserves in this deposit. This amount includes that which will be left in the form of large pillars for support purposes. Assuming that 1,000,000 tons are available, and that one carload of 50-tons each would be mined each day throughout the year, the reserves would last upon this basis for about 50 years.

Under another heading a statement appears that fully one-million tons of marketable ore are still in the deposit, and that this is available. The writer feels that this is conservative, and that further exploration may reveal double this amount of reserves.

COMPARATIVE CHEMICAL ANALYSES.

A chemical analysis of a given substance makes it possible for one to obtain by inspection, a visual quantitative estimation, of the various ingredients which make up the bulk of that substance. Detrimental chemical and mineralogical compounds, as well as the economically useful and profitable ones can be observed in their quantitative and qualitative relati~~t~~onships.

Comparative data is likewise useful, for such often enables one to obtain a survey of toleration limits of the various ingredients composing the substance which yielded the analysis. It is evident, therefore, that the particular commercial process which is most applicable to the manufacture of a desirable product, is influenced, very largely, through the aid and information presented by means of analytical data.

The subjoined tabular scheme is presented in the hopes of showing in what respect the Rawlins ore compares with similar natural products which are mined elsewhere, and which are being placed upon the market for paint uses.

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9
Silica SiO_2	16.21	37.20	37.20	35.30	37.79	9.63	1.68	10.43	40.44
Alumina Al_2O_3	5.49	9.60	9.40	10.70	10.61	5.10	2.46	......	.....
Iron Oxide Fe_2O_3	44.50	43.30	42.70	43.30	41.28	80.30	93.30	53.82	5.33
Manganese Oxide MnO	1.19	.35..	1.40	1.83	1.27	.75	.65	......	none
Lime CaO	3.51	.10	1.70	2.00	3.00	.71	.38	1.46	7.91
Magnesia Oxide	1.08	3.25	1.70	1.91	2.03	.....	......	......	......
Sulphus S	.67	.95	.75	.78	.77	.....	......	......	......
Phosphorus P_2O_5	.02	.17	.14	.15	.14	.....	.....	0.0132	.0396
Carbon Dioxide CO_2	24.35	2.40	2.60	1/50	2.68	.61	.....	....	......
Water H_2O		.60	.60	.90	....	2.68	......	....	....
Sulphur Trioxide SO_3	....	2.38	1.88	1.95	1.94	....	.....	....	......
Metallic Iron Fe	....	30.30	29.90	30.30	28.90	....	.....	....	......
Loss	....	.....	.....	....	.....	....	.22	.15	......

No. 1. Crude paint ore from Lehigh Gap Pennsylvania.

Nos. 2, 3, 4, Furnished by Mr. Thompson, President Prince Metallic Paint Co, Lehigh, Pa. Paint Ore.

No. 5. Annual Report quoted from Pennsylvania Geological Survey for 1886.

Nos. 6, 7 Herman Harms, Salt Lake City, Utah. Samples of Rawlins Paint Ore.

Nos. 8, 9 U. P. Land Co. Rawlins Iron Ore from drill holes No. 1 and No. 2 August 1906.

In commenting upon the group analyses, probably the outstanding and most conspicuous feature of the entire series of ores, is the apparent simplicity of composition of those designated by Nos. 6, 7, 8 and 9, all of which were obtained from ores submitted from the Rawlins Paint Ore Deposits.

Another feature, which also evoked favorable comment from State Chemist Herman Harms, of Salt Lake City, Utah, is the very excellent percentage of iron oxide in Nos. 6 and 7, being respectively 80.30% and 93.30%. This value is almost 100% larger than the amount of iron oxide quoted from the eastern ores, which are extensively employed for paint uses. Probably the purity of the Rawlins ore is explained by more profound local weathering since the more easily soluble impurities do not appear to be present.

The significance of this high iron-oxide content, together with the low silica content, are factors which have doubtless given the Rawlins Red such favorable mention in the paint market. The ores represented by Nos. 6 and 7 are most unusual to say the least, and it is not at all unlikely that important commercial reserves of this same grade still exist in the unexplored upper portions of the deposit where the influence of weathering has had full sway.

It is likewise desirable to call special attention to the analysis of Ore No. 8 of the table. The samples were obtained from a 6-foot bed of ore at a depth of 120-feet in drill hole No. 1. The iron oxide content is reported to be 52.58% which, while being much lower than that of Nos. 6 and 7 it is still greatly in excess of any other paint ore outside of Rawlins, the analyses of which could be obtained. With reference to the silica content this is likewise very much lower than ores Nos. 1,2,3,4 and 5, but is higher than Nos. 6 and 7.

Analysis No. 8 is extremely important because it has a practical bearing upon the question of reserves. As can be seen from the blue print (in pocket) this hole is well down in the flat, away from the base of the hill. The writer has been informed that the original workings were not projected in this direction, therefore it is within reason to assume, on fairly safe ground, that large reserves of ore remain untouched in the immediate vicinity of the drill-hole. Since the ore was satisfactory in the lowest workings of the mine, it is quite likely that as one would go in the direction of the drill hole, commercial reserves will be encountered. The distance embraced between the lowest workings and the position of Drill-hole No. 1, is sufficient to contain commercially important deposits of paint-rock.

YEARLY CONSUMPTION OF PAINT ORE.

Statistics regarding the consumption of Paint-ore are not available for recent years. It is known, however, that the total amount of pigment derived from the iron-oxide sources and used for all purposes greatly exceeds 50,000,000 pounds yearly. Its chief use is for railroad box-cars, structural steel, corrugated and flat roofing materials, with important amounts entering into the manufacture of linoleums.

ACCESSIBILITY OF THE PAINT-ORE

Referring to the Rawlins paint deposit, it is particularly favorably located for the ease of obtaining the product. The ore-body is within a very short distance of the Union Pacific Railroad, and the character of the country rock from the main line tothe deposit offers a splendid highway which is now well surfaced, and has a down-hill grade nearly the entire distance. There are no hills which would make truck hauls difficult. At the mine the ore can be secured at a moderate cost, either by shafts, or drifts, or by both. Unless the mining operations are planned upon an extensive scale, simple and inexpensive types of machinery could be employed for the initial extraction. A fair amount of ore can be obtained from the side-walls and pillars, especially if other types of mine support are employed to prevent caves.

OTHER SOURCES

Iron ores suitable for iron making are becoming a resource which are eagerly sought by the large operating companies, and it is safe to state that the deposits worth while are fairly under control

Nearly every important iron mine is characterized by the mineral "red Hematite".

To this extent, therefore, nearly every iron mine could become a paint-ore producer, and as previously stated, some of these mines are actually shipping the richest ore when conditions justify segregating this for paint-stock.

In this connection it should be stated that the deposits at Seminole Mountains, Carbon County, Wyoming, may yield ore suitable for paint manufacture. If such should prove to be true then a supply would become available for many, many years. The distance from rail, however, would likely be found to be prohibitive, if the material is mined for paint alone.

PUTTING THE MINE UPON A PRODUCTIVE BASIS

The problem of putting the mine property upon a producing basis is one which is to be solved largely by those who obtain the lease upon the mineral reserves. It may be entirely feasible to re-open the working places, and re-timber the caved-in areas. Such procedure would be rewarded by prompt and early returns upon the investment, primarily because early orders can be contracted for shipments of raw paint-stock.

On the other hand it may be more desirable to completely abandon all the previous workings and begin operations by projecting new tunnels, drifts, and shafts. This method would delay obtaining the ores at an early period, but such may greatly assist future production by reason of concentrated exploration. Such a method would likewise necessitate the purchase, installation; and operation of machinery and also equipment needed for the conduct of mining operations.

As to whether the property should ultimately be operated by open-pits, glory-holes, involving stripping methods, or whether by regular underground mining methods, is a question to be settled later. From a geological viewpoint it would appear that underground methods would have some preference because of the attitude of the beds, their character, and also the origin of the ore itself. The surface topography however, presents favorable conditions for easy storage, and efficient handling of stripped materials.

C O P Y

MR-UN-10

UNION PACIFIC SYSTEM
Department of Traffic

1416 Dodge Street
OMAHA, NEBRASKA

December 7, 1927.
H-2404-4200-42

SUBJECT: Industrial Development - Ore - (Iron) in Wyoming.

Mr. T. Joe Cahill,
Executive Manager,
Department of Commerce & Industry,
Cheyenne, Wyoming.

Dear Sir:

There is enclosed a report on the Rawlins, Wyoming, iron ore deposits commonly referred to as iron paint ore or "Rawlins Red".

Copy of another report on the Seminole Mountains iron ore deposits, together with numerous analyses. Estimate of the cost of metalizing certain iron ores with natural gas.

Extract from the State Mining Bureau Quarterly, April 1926, in regard to the electric smelting of iron ore.

In addition to these iron ore deposits, there are the well known deposits of titanic iron ore at Iron Mountain some 60 to 70 miles north from Laramie, Wyoming. Near Encampment, Wyoming, there is a prospect showing siderite, carbonate of iron.

Mr. T. S. Lovering of the U. S. Geological Survey, during the summer of 1926, completed a survey of the Seminole Mountain iron ore deposits, and it is assumed at a bulletin on the subject may be available also. So far as I know, it has not yet been published. It is understood that these properties are practically all owned by Mr. Harry P. Hynds, Cheyenne.

Attached to the Rawlins iron ore report is a sheet of oil cloth showing the appearance of Rawlins Red Iron ore when made into paint. Pigment was ground so that it contained nothing coarser than 200 mesh, then mixed with approved extender so as to bring the percentage of iron oxide to conform to railroad specifications. This pigment was ground in raw linseed oil properly thinned and correct amount of drier as turpentine added. This was painted on white oil cloth which was slightly rubbed with sand paper to remove the gloss so that the surface would be correct for application. This sample shows the application of one, two and three coats with proper drying time allowed between and indicates this ore can be satisfactorily used for making a paint.

Trust you will find the foregoing and enclosures of some interest.

Yours very truly,

(Signed) E. C. Hoag.

mR-UN-10

Estimated available tonnage Rawlins Red 1000000 to 1500000 with probability double that amount could be developed.

E.C.H.

7/23/28