0590 0008

270

Item #18

UNITED STATES SMELTING REFINING AND MINING COMPANY

For _____ May 28th, 1942

Mr. F. S. Mulock, Vice President and General Manager
of Western Operations,
United States Smelting Refining and Mining Co.,
Newhouse Building, Salt Lake City, Utah.

RE: PRELIMINARY REPORT UPON THE MANGANESE DEPOSITS OF:

Drum Mountain, Juab County, Utah
Black Eagle, Lander County, Nevada
Black Rock, Lander County, Nevada
Black Diablo, Pershing County, Nevada
Tonnage, Grade and Availability.

Dear Sir:

In two letters from G. Temple Bridgman, Executive Vice President, Metals Reserve Company, addressed to Mr. Rice, both dated February 25, 1942, Mr. Bridgman called our attention to the Black Rock, Black Eagle, Black Diablo and Drum Mountain deposits, and requested that we make a survey of the mining and metallurgical problems involved in the recovery of manganese from these deposits with a view to our submission of recommendation as to mill capacity, flow sheets, accompanied by "detailed approximate estimate of the construction costs involved. We were both in the East at the time. As soon as matters could be arranged I employed M. B. Kildale, formerly of International Smelting Company, now of Stanford University, to cover the geology of the deposits, and detailed our own engineer, Mr. W. Frank Walthall, to give all of his time to this work. We now have in hand adequate maps and sections demonstrating the geometry of these deposits insofar as surface observation, present workings and diamond drilling done by the Bureau of Mines make it evident. Check channel samples were taken. The geology of each area and workings was mapped and sectionalized by Mr. Kildale; and a very considerable amount of information determining the ways and means and cost of operation obtained by Mr. Walthall.

The location of these deposits is indicated upon the attached map.

ESTIMATES BY M. B. KILDALE

DRUM MOUNTAIN - 33 Miles Northwest of Delta, Juab Co., Utah:

| | Tons (Short) | Mn % |
|---|---|---|
| 1. North Area or Ward Lease (Predominantly Oxide Ore): | | |
| Assured | 51,500 | 18.5 |
| Probable (additional) | 29,500 | 17.92 |
| Possible " | 8,500 | 17.35 |

COPY

Approximate Analyses:

| Mn | Fe | Insol. | SiO2 | P. | S. | MgO | As | Pb | Zn | CaO |
|---|---|---|---|---|---|---|---|---|---|---|
| 21.3 | 10.0 | 30.0 | - | 0.175 | Tr. | - | o.49 | 0 | 0 | 1.9 |
| Composite of 3 samples of Oxide Ore: | | | | | | | | | | |
| 26.9 | 11.1 | 27.2 | 22.8 | 0.180 | Tr. | 0.22 | 0.59 | 0 | 0 | 1.9 |
| Composite of 2 samples of Carbonate Ore: | | | | | | | | | | |
| 36.62 | 7.5 | - | 3.0 | 0.059 | 2.17 | 0.97 | 0.19 | 0 | 0.37 | 1.75 |

2. South Area - Staats Property (Predominantly Carbonate Ore):

| | Tons | Mn % |
|---|---|---|
| Assured | 120,000 | 17.6 |
| Probable (additional) | 20,000 | 15.03 |
| Possible " | 10,000 | 15.03 |

Approximate Analyses:

| Mn | Fe | Insol. | SiO2 | P. | S. | MgO | As | Pb | Zn | CaO |
|---|---|---|---|---|---|---|---|---|---|---|
| 14.8 | 4.6 | 31.6 | - | 0.242 | - | 0 | 0.226 | 0 | 0 | - |
| Average of 15 Bureau of Mines D.D. Holes reported in carbonate ore: | | | | | | | | | | |
| 13.95 | 5.547 | 33.13 | | 0.225 | | | 0.234 | - | - | - |

TOTAL DRUM MOUNTAIN - NORTH AND SOUTH AREAS COMBINED:

| | Tons | Mn % |
|---|---|---|
| Assured | 171,500 | 17.91 |
| Probable | 49,500 | 16,75 |
| Possible | 18,500 | 16.09 |
| Assured | 171,500 | 17.91 |
| Assured and Probable | 221,000 | 17.65 |
| Assured, Probable and Possible | 239,000 | 17.52 |

Sulphur Content:

The tonnage and grade at Drum Mountain must be estimated largely from drilllogs of the Bureau of Mines, and the Bureau of Mines did not assay its cores for sulphur. An analysis of three channel cuts by Walthal of oxidized ore showed only a trace of sulphur. Oxidation is so complete that it is a fair presumption that in cleanly mined oxidized ore sulphur will be only a trace. However, underlying the orebodies, both oxide and carbonate, is a silicious shale ore shaley quartzite mem-

ber which is highly impregnated with pyrite and arsenopyrite so that any carelessness in mining might result in the introduction of sulphur and arsenic from this source. 20,000 tons of oxidized ore from the outcrops of the ore horizon in the South area shipped during the period 1924-1937, averaged as follows:

| | |
|---|---|
| Mn. | 27.5 |
| Fe. | 9.0 |
| P. | 0.300 |
| CaO | 1.5 |
| Zn. | Tr. |
| Insol. | 18.0 |
| S. | 1.2 |

Of this tonnage two cars of ore from the lowest limits of stoping containing considerable rhodochrosite, carried respectively, 1.58% and 3.20% sulphur. That these cars of less well oxidized material were markedly higher in sulphur is logical and probably indicates that the sulphur content of the carbonate ore will be higher than that of the oxidized ore. It may be in the range of 2% to 4%.

Relations Carbonate to Oxide Ores:

Though the Drum Mountain deposit is correctly divided into two areas, the South containing manganese predominantly in the form of carbonates, the North with manganese in oxide forms, the latter is simply the oxidation product of the former, and as in the case of the oxidation of any type of ore it is to be expected that there will be a considerable portion of transitional material. Should any metallurgical plant not be able to handle either type and the transitional material as well, inevitably some tonnage must be eliminated. For it is not likely that in partially oxidized material selective mining and sorting either underground or at the mill can effect a clean separation. At present very little of the carbonate material can be inspected since it is developed in drill holes the cores of which have been completely used for assay purposes by the Bureau of Mines. But the Bureau of Mines' logs indicate a fairly close association of carbonate and oxide material even in these holes in the predominantly carbonate area.

The Drum Mountain deposits are replacements of shaley limestone members in the Ophir shale horizon. Their attitude and extent is that of the bedding of that formation as it is faulted and folded, and cut by transverse fissures which themselves in the proximity of the replaced beds may also carry manganese ore. As thus far developed the ore bodies extend from the surface at low angles of 20-30° to vertical depths of 300 feet or less.

BLACK EAGLE - 44 Miles South of Battle Mountain, Lander Co., Nevada.

| | Tons | Mn. % |
|---|---|---|
| Assured | 49,000 | 12.27 |
| Assured and Probable | 70,000 | 11.96 |
| Assured, Probable and Possible | 83,500 | 11.68 |

Complete analysis of composite samples is as follows:

| Mn | Fe | Insol. | SiO2 | P. | S. | As. | Pb. | Zn. | CaO. |
|---|---|---|---|---|---|---|---|---|---|
| 12.8 | 4.0 | 59.6 | 59.3 | 0.018 | 0.1 | - | 0.0 | 0.0 | 0.1 |

BLACK ROCK - 18.5 Miles South of Valmy, Lander Co., Nevada.

| | Tons | Mn.% |
|---|---|---|
| Assured | 16,650 | 15.1 |
| Assured and Probable | 30,000 | 14.1 |
| Assured, Probable and Possible | 42,600 | 12.7 |

Complete analysis of composite samples is as follows:

| Mn | Fe | Insol. | SiO2 | P. | S. | As. | Pb. | Zn. | CaO |
|---|---|---|---|---|---|---|---|---|---|
| 16.0 | 3.5 | 62.8 | 60.0 | 0.027 | 0.05 | - | 0.0 | 0.05 | 0.1 |

BLACK DIABLO DEPOSIT - 24 Miles South of Golconda, Pershing Co., Nevada.

We are informed that the Golconda Mining Company or H. H. Chatwin, lessor of the Black Diablo property, has shipped about 20,000 tons of

30%-33% Mn. ore to the Columbia Steel Company at Provo, Utah; and that he has firmly contracted his entire production to Columbia Steel for some considerable period at 30¢ per unit. This would seem to remove the Black Diablo deposit from consideration as a potential source of tonnage for any metallurgical plant. However, Mr. Walthall has visited the property and his impression confirms the Bureau of Mines assumption of reserves of 75,000 tons remaining, of good grade ore (probably 30% Mn.), and of some tonnage of similar magnitude of much lower grade material which he estimates probably to be in the range of 5%-8% Mn. The Black Diablo ore is a very hard fine-grained intimate mixture of manganese either in silicate or oxide form, perhaps both, and silica. It consists of a dissemination of manganiferous silicious particles of the order of 5 to 10 microns. The Bureau of Mines on the basis of work thus far at its Salt Lake laboratory concludes that the ore is not amenable to any ore dressing method of concentration though the manganese appears to be to some extent soluble if leached with SO2.

To recapitulate, in the other deposits to which our attention was directed, Drum Mountain, Black Rock and Black Eagle, Mr. Kildale's sections and figures permit us to assume the availability of three types of low-grade manganese ore:

(1) A high phosphorous-arsenic-sulphur, low silica ore with manganese predominantly in primary carbonate form (South area of Drum Mountain).

(2) A high phosphorous-arsenic-iron, low silica, lower sulphur ore with 90% of the manganese in oxide forms derivatives at the surface and at shallow depths from the carbonate ore. (North area Drum Mountain.)

(3) A low phosphorous-arsenic-iron-sulphur, high silica ore with manganese entirely in oxide form. (Black Rock and Black Eagle.)

(3) form. (Black Rock and Black Eagle.)

| Type | Tons | Mn | Fe | Insol. | P. | S. | As. | Pb. | Zn. | CaO. |
|---|---|---|---|---|---|---|---|---|---|---|
| (Probable Ore) | | | | | | | | | | |
| (1) South area - Drum Mountain: | | | | | | | | | | |
| | 140,000 | 17 | 4.5 | 32.0 | 0.23 | 2.5 | 0.23 | 0 | Tr. | - |
| (2) North Area - Drum Mountain: | | | | | | | | | | |
| | 81,000 | 18 | 10.0 | 28.0 | 0.18 | 0.2 | 0.5 | 0.05 | Tr. | 1.9 |
| (3) Black Eagle-Black Rock: | | | | | | | | | | |
| | 100,000 | 13 | 4.0 | 61.0 | 0.02 | 0.1 | 0.5 | 0 | Tr. | 0.1 |

Though it would seem to be a fair presumption that the carbonate gangue of the rhodochrosite ores should include some siderite, Kildale states that he has observed none in specimens examined, and we have seen none. The approximate 10% iron content of the oxidized ores may be in part derived from pyrite and arsenopyrite, but some fraction may still be a derivative of siderite, which in small quantities is very difficult to detect, even by optical laboratory means.

Mr. Kildale's estimate of assured and probable ore at Drum Mountain I think liberal. In the light of present limited developments I would consider more of his "assured" and "probable" ore as "possible", but concur readily in his assumed total of assured, probable and possible ore. To allow for pillars in waste and fault gaps I would make a reduction of at least 20%.

No other deposits are known in the immediate vicinity of the above which could materially augment the tonnages here assumed.

## AVAILABILITY.

Mr. Walthall estimates that after installation of certain equipment these properties in their present state of development should be able to produce somewhat as follows:

| | |
|---|---|
| Drum Mountain | |
| North Area (Oxide Ore) | 75 tons per day |
| South Area (Carbonate Ore) | 25 tons " " |
| Black Rock | 100 " " " |

Necessary Equipment:

It is estimated that expenditures in necessary equipment will be assuming the contracting of trucking to mill or railroad points:

| | |
|---|---|
| Drum Mountain: | |
| North Area (Ward Lease) | |
| In Diesel powered, 1000 cu.ft. compressor, hoist, skip, rails, cars, drills, pipe, etc. | $24,000 |
| South Area (Staats Property) | |
| Substantially the same as above | 24,000 |
| Black Rock and Black Eagle: | |
| Mr. Walthall assumes that since these properties are both controlled by Western Alloys, Inc. and potential tonnages are individually too small to justify their separate equipment, that they should be worked in rotation, the Black Rock first. Additional equipment including Bulldozer, shovel, and camp facilities at Black Eagle. | 26,000 |

Further Development:

Certain expenditures in development estimated as follows would permit a material increase in the rate of production:

| | |
|---|---|
| Drum Mountain - North Area | |
| 675 feet of work | $10,000 |
| Drum Mountain - South Area | |
| 400 feet of sinking on incline | 10,000 |
| 500 feet of Level work | 7,500 |
| Black Eagle: | |
| In further drilling (700'), assaying, servicing, camp, etc. | 3,500 |
| Black Rock: | |
| In further drilling (300'), assaying, servicing, camp, etc. | 1,200 |

Production Rates and Periods:

It is estimated that in five months' time such expenditures should enable these properties to produce as follows, assuming adequate road and trucking facilities:

| | |
|---|---|
| Drum Mountain - North Area | 150 tons a day |
| Drum Mountain - South Area | 150 tons a day |
| Black Rock-Black Eagle (In rotation) | 200 tons a day |

The foregoing assumptions of probable tonnages at these rates of production would sustain operations as follows:

| | |
|---|---|
| Drum Mountain - North Area (Oxidized Ore) | 18 months |
| Drum Mountain - South Area (Carbonate Ore) | 31 " |
| Black Rock-Black Eagle | 17 " |

Possibilities of additional tonnages beyond these estimated are better at Drum Mountain than at Black Rock and Black Eagle. It is doubtful if even on further development Black Rock and Black Eagle production will exceed the "possible" tonnages assumed.

ROADS:

The above rates of production assume improvements in roads communicating with railroad points permitting their all year use, which Mr. Walthall after conferring with County authorities in each case, estimates would involve:

| | |
|---|---|
| Drum Mountain to Delta | $23,000 |
| Black Eagle to Battle Mountain, | 33,000 |
| or | |
| Black Eagle to Black Rock | 33,000 |
| Black Rock to Valmy | 15,000 |

## SUMMARY

ASSUME:

| | Drum Mountain North Area | Drum Mountain South Area | Black Eagle | Black Rock |
|---|---|---|---|---|
| Total Probable Tonnage | 81,000 | 140,000 | 70,000 | 30,000 |
| Grade | 18% | 17% | 12% | 14% |
| Expense in Equipment | $24,000 | $24,000 | $18,000 ($26,000) | $ 7,000 |
| Expense in Development | $10,000 | $17,000 | $ 3,290 ($ 4,700) | $ 1,410 |
| Expense on Roads by County, Federal Grazing Service, or Operators. | $ 8,400 | $14,600 ($23,000) | $33,000 | $15,000 |
| Total Above per Ton | $ 0.52 | $ 0.40 | $ 0.91 | $ 0.81 |
| Mining Cost per Ton Crude Ore (Assuming shovel for Black Rock and Black Eagle) | $ 4.00 | $ 4.00 | $ 3.00 | $ 2.00 |
| Royalties (Not included) | 12-1/2% of Gross Value | None | $ 0.50 per Ton | $ 0.50 per ton |
| Total per ton crude ore, on property: | $ 4.52 | $ 4.40 | $ 3.91 | $ 2.81 |
| Total cost per unit Mn. in crude ore: | $ 0.25 | $ 0.26 | $ 0.33 | $ 0.20 |
| Trucking Cost Per Ton Laid down at nearest H. R. Point: | $ 1.50 (Delta) | $1.50 (Delta) | $ 2.50 (Battle Mtn.) | $ 1.50 (Valmy) |
| Total Cost Per Ton crude ore f.o.b. R. R. Point. | $ 6.02 | $ 5.90 | $ 6.41 | $ 4.31 |
| Total Cost per Unit Mn in crude ore: | $ 0.33 | $ 0.35 | $ 0.53 | $ 0.31 |

The foregoing table attempts to present the cost of moving manganese in crude ore to any central milling plant or to whatever market may be provided the operator. Although these figures are based upon a good many assumptions of conditions which do not yet obtain and upon human factors of direction and coordination beyond control, as an analysis of pertinent items they should make possible some decision as to compensation and procedure in dealing with the operators, if the MetalsReserve Company should wish to accumulate mined reserves of low grade manganese on the properties themselves, as suggested in recent letter from DeWitt Smith, or at nearest railroad points.

Once a decision is made that these ores are wanted, it would seem to be most desirable that mining be by the owners or operators themselves. Some of us (Walthall or Billings) could make occasional visits in an advisory way.

If the Metals Reserve Company should wish to act on its suggestion of buying ores stored on the properties, or at railroad points, I suppose it has in mind some system of estimation of tonnage and grade by a representative visiting the property, and of a preliminary partial settlement to be completed later when the ore is sampled at a milling plant. The first estimate and settlement necessarily would be a guess involving a large personal element of opinion and integrity. The Metals Reserve Company might have to have its own representative and sampler continuously on each property.

Lesser tonnages of higher grade ore could be set up. Higher metallurgical recoveries on better grade ore (when they are determined) may compel re-estimation oftonnages of a higher grade in the attempt to extract a maximum quantity of available manganese. Since patently these

deposits are not of commercial size and grade, and since therefore any exhaustive exploitation must depend upon some form of subsidy, emphasis should be upon the maximum quantity of manganese to be won from them, a matter probably to be determined by metallurgical recoveries on various grades of ore and whatever optimum of grade and tonnage may be set up once the metallurgical availability of the manganese in these ores is determined.

Yours very truly,

R N H

R.N. Hunt

RNH/G

Encls.

FREIGHT T RATES TO SALT LAKE VALLEY POINTS

File: 21-296

May 21, 1942.

MEMORANDUM - Mr. W. F. Walthall.

In compliance with your request of yesterday, we are showing below rates on ores and concentrates to Salt Lake Valley smelters, including surcharge:

ORES AND CONCENTRATES TO SALT LAKE VALLEY SMELTERS INCLUDING SURCHARGE:

| FROM | Min. Wt. | 5.00 | 8.00 | 10.00 | 15.00 | 20.00 | 30.00 | 40.00 | 50.00 |
|---|---|---|---|---|---|---|---|---|---|
| Delta, Utah | 100,000 | 1.10 | 1.10 | 1.25 | 1.50 | | | | |
| | 80,000 | 1.50 | | 1.50 | 1.75 | | | | |
| | 40,000 | 1.60 | | 1.85 | 1.85 | 1.85 | 2.23 | 2.49 | 2.76 |
| Battle Mountain, Nevada | 100,000 | | | | | 2.65 | 3.60 | 4.03 | 4.45 |
| | 80,000 | | | | | | 4.43 | | 5.54 |
| | 40,000 | | | | 4.20 | 5.36 | 5.95 | 6.53 | 7.11 |
| Valmy Nevada | 100,000 | | | | | 3.18 | 3.60 | 4.03 | 4.88 |
| | 80,000 | | | | | 3.73 | | | 5.54 |
| | 40,000 | | | | 4.66 | 5.83 | 6.41 | 7.00 | 7.58 |

Yours very truly,

(Sgd) OMAR O. VICTOR

Traffic Manager.

COPY