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Item 6

REPORT

on

THE BRUCITE DEPOSIT

of

H. E. SPRINGER

for

COLONEL HENRY BRECKINRIDGE

of

NEW YORK CITY

by

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of

Reno, Nevada.

AT REQUEST
of
MR. LEON SHORE

Reno, Nevada.
Aug. 26, 1929.

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ATTACHED HEREWITH:

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THE BRUCITE DEPOSIT OF H. E. SPRINGER

LOCATION and ROADS

The Brucite Deposit of H. E. Springer is in the northwest corner of Nye County, Nevada, and is 2 miles easterly from a point six miles north of Kelly's Well on the road between Kelly's Well and the old mining camp of Downeyville. (Reference - U.S.G.S. Topographical Map of the Tonopah Quadrangle)

It is 30 miles in a N 30 deg. E direction from its natural supply point on the railroad of Luning, Nevada. A desert road runs northeasterly from Luning over the Gabbs Valley Range to Kelly's Well a distance of 28 miles and thence northerly to either Broken Hills or Lodi Valley.

The road makes a steep ascent from Luning at 4500 ft. elevation to the summit of the Gabbs Valley Range at 6500 ft. elevation in 10 miles, and descends to Fingerrock Wash in Gabbs Valley of 4500 ft. elevation in 10 miles more. This 20 miles of road is good desert road over a firm earth or rock. (Reference - U.S.G.S. Hawthorne Quadrangle.

The road from Fingerrock Wash to six miles north of Kelly's Well, a distance of 12 miles, crosses and follows up Gabbs Valley. It is but a fair road over wash and soft earth that will rut deeply under steady truck hauling. A firm bottom can be secured by the use of gravel hauled from pits close to the road. For illustration, the valley road from Broken Hills to the Lincoln Highway, 20 miles north was gravelled about three years ago to speed up and cheapen the transportation of lead ores from Quartz Mountain, near Broken Hills, to the railroad at Fallon, and is an excellent road.

The branch road to the camp and lower deposit of 2 miles is as yet but a poor temporary road following up a draw and ascending 800 ft. to the deposit in this distance. The total distance from Luning is 34 miles by road.

By auto travel the deposit is accessible from Reno by travelling the National Lincoln Highway for 118 miles easterly, thence 20 miles southerly on

gravelled road to Broken Hills, thence 20 miles southerly over rough desert road to the deposit, a distance of 158 miles, made easily in 6 hours travel.

OCCURRENCE OF THE BRUCITE

The brucite deposit occurs along a contact of massive granite and a dolomitic limestone. It outcrops in an upper gulch and also in a lower draw 1100 ft. easterly. The larger outcrop in the gulch was discovered and located first and is known as the "Upper Deposit", while the smaller deposit is known as the "Lower Deposit".

The deposits were covered by lode locations. The mineral claims on the Upper Deposit are the Gloria and the Gloria No. 1 to No. 5 inclusive, and on the Lower Deposit the Gloria Extension and Gloria Extension No. 1 to No. 6 inclusive. The important claims were all located early in December 1927. Your investigation of title will give all the data as to location claims, location work and assessment work.

The claims are but roughly located, unsurveyed and poorly monumented, and unplatted. In past years the same ground has been located and monumented with locations dating from over 10 years ago to the more recent Quartz Mountain boom of two years ago. In my limited time on the ground I found no evidence that any conflicting locations were being actively maintained, but a survey of the claims with amended locations, and a close investigation of possible conflicts with lode or placer claims should be made before any substantial cash payment is made.

I made a rough Brunton survey of the claims to ascertain the fact that the locations covered the Upper and Lower Deposits, and to give me the necessary data with which to make a rough sketch map of the claims, the deposits, and the important granite and dolomitic limestone contact. A copy of this map is incorporated in this report, likewise large scale maps of the Upper and Lower Deposits to show in detail the development work of trenches and shafts, and the points at which samples were taken.

The development work to date on the Upper Deposit consists of trenches across the mineralized area on the granite and limestone contact, and a shaft 50 ft. deep sunk on the brucite outcrop in the gulch. These trenches cover an area of approximately 200 ft. wide and 1200 ft. long.

On the Lower Deposit there is a shaft 50 ft. deep and a small quarry cut in the brucite close to the point of outcrop, with trenches across the deposit, covering in all an area 300 ft. wide and 400 ft. long.

These trenches, 3 ft. to 10 ft. deep are all bottomed, generally through a thin layer of surface soil, in either hydromagnesite or brucite. These trenches and the two shafts make an impressive showing of the immense tonnage available of these uncommon magnesium minerals. The accompanying kodak views convey this same impression.

The only shipments made from the property have been small lots for experimental purposes. A road has been graded out to the Lower Deposit and an open cut started from which steady shipments could be made.

MINERALOGY

Three minerals of magnesium occur in quantity on the property. They are, 1st, magnesite, the carbonate of magnesium; 2nd, hydromagnesite, the mixed carbonate and hydrate, and, 3rd, brucite, the hydrate.

Magnesite ($MgCO_3$) is a white mineral of a hardness of about 4 and a specific gravity of 3, and with a carbonic oxide (CO_2) content of 52.4 and a magnesium oxide content (MgO) of 47.6%, or a metallic magnesium content of 28.6%.

It usually has the appearance of an unglazed porcelain and breaks with a distinctive conchoidal fracture.

This mineral occurs all along the mile of granite and limestone contact on this "Brucite Deposit", as loose surface boulders from fist size to head size. The development work to date on the Upper and Lower Deposits has not shown any magnesite below the surface in trenches or shafts. However, a 20 ft. trench on

the most southwesterly claim, Gloria No. 5, and over 2000 ft. along the contact from the Upper Deposit, discloses a nearly solid exposure of magnesite and hydromagnesite.

Hydromagnesite ($3MgCO_3$ plus $4\ Mg(OH)_2$) is a light white mineral of 2.2 gravity. It is a relatively rare mineral. Dana's System of Mineralogy gives a few occurrences and states that at Hoboken, N. J., the "brucite sometimes changes on exposure to hydromagnesite". The chemical analysis is 36.3% carbonic oxide, 43.9% of magnesium oxide, and 19.8% water of crystallization.

At the Lower Deposit there has been found a limited amount of beautiful crystals of hydromagnesite, but as a rule it occurs over large areas as a soft white earthy material mixed with earth right at the surface and containing lumps of brucite in the deeper trenches.

Brucite ($Mg(OH)_2$) is a relatively rare mineral. It has been found and identified in several localities accompanying other magnesium minerals either in serpentine or dolomitic limestones, either as crystals or massive. It has a hardness of 2.5 and a gravity of 2.35 and varies in color from a grayish white to blue or green; a few patches of bluish crystals occur in this deposit, but the occurrence is one of the massive form. It has a waxy to pearly lustre. The composition of brucite is 69% magnesium oxide and 31% water, or a metallic magnesium content of 41.4%.

It has not been previously reported in easily mined quantity and purity to be of commercial value although it does occur in quantity in the Keystone Deposit in Stevens County, Washington, where it is stated that "a rather large amount of brucite occurs along this fault in association with a narrow igneous dike that cuts into the magnesite area". (Eng. & Min. Journal, Nov. 26, 1927, Some Geological Features of Washington Magnesite Deposits.)

In answer to a telegram concerning a reported occurrence of commercial brucite near Logan, Utah, Mr. Wm. Peterson wires me that it occurs in small un-

commercial quantities as thin lenticular masses on a quartzite and dolomite contact.

On this Springer Brucite Deposit under consideration, the brucite actually outcrops in place over a limited area in a steep gulch at the Upper Deposit for a total distance of only about 500 feet in length and about 25 feet wide. It outcrops over an equal area as scattered boulders. Such a boulder on the Lower Deposit lead to the discovery and development of this Lower Deposit after that of the Upper Deposit.

The outcropping brucite is of the massive variety but it has a white surface coating of hydromagnesite and was passed over for years as a white limestone. Trenches cut in the hydromagnesite in the vicinity of the outcropping brucite disclosed brucite directly under the hydromagnesite, thus greatly extending the known area of brucite. Two fifty foot shafts sunk at outcrops of brucite disclosed brucite for the full depth, leaving unsolved the question as to what depth it may continue to.

The large tonnage of brucite already disclosed at both the Upper and Lower Deposits practically on the surface ready for open cut mining is sufficient incentive to give careful consideration to its possible economic use as a source of magnesium oxide or metallic magnesium, particularly because its magnesium oxide and magnesium content is 1.45 times that of magnesite, the usual ore of magnesium, making it an exceptionally rich magnesium ore.

GEOLOGY

The brucite deposit occurs along an irregular granite and dolomitic limestone contact as shown on the accompanying geological map. This contact in the vicinity of the Upper and Lower Deposits of brucite is roughly in the form of a horseshoe with the deposits as the sides of the shoe, and the granite in the center and the limestone outside the shoe. On the toe of the shoe, float magnesite occurs but if the brucite occurs here also it is covered deeply by granite boulders and wash.

The contact south of the Upper Deposit swings abruptly from a northerly and southerly course to easterly and westerly, and at about 600 ft. swings back again to a northerly-southerly course. Along this contact clear to the big gulch on Gloria No. 5, there is float magnesite, and also hydromagnesite at the sagebrush roots.

Across the gulch one can see this same contact. Mr. Springer states that he has followed it for miles but found no sign of magnesium minerals. Viewing this contact across the gulch I gained the impression that the bedding of the limestone has a northerly-southerly strike with a 45 deg. dip to the west and that the contact has also a dip to the west but steeper, giving an overhang effect to the granite.

The limestone in the vicinity of the brucite deposits has been quite highly mineralized. There is a fair showing of lead and zinc ores to the east of the Upper Deposit that is being developed. Farther still to the east is an occurrence of scheelite tungsten ore, once leased by Mr. Springer, and now being developed by a strong tungsten producing company.

Just west of the Lower Deposit on the Gloria Extension No. 2 a showing of iron oxide on this granite limestone contact was once located and worked on because, as Mr. Springer states, it carries low gold and silver values. The old camp of Downeyville, 3 miles north, was an early day producer by smelting ~~ex~~ lead and silver ores.

I have referred to the contact as one of granite and dolomitic limestone. Limestone like calcite is calcium carbonate. Dolomite is a distinct mineral, of a combination of calcium and magnesium carbonates in the proportion of 54.5% and 45.5% respectively. Many limestone beds contain some dolomite, giving a magnesium content. I took samples of the limestone close to the brucite on both the Upper and Lower Deposits and the analyses to my surprise showed this contact material to have a somewhat higher magnesium content than dolomite, and it at least would be termed dolomite rather than dolomitic limestone or limestone. I regret that I did not take a wider range of samples in the adjacent so-called limestone to as-

certain if it is not perhaps a dolomite for some distance back from the contact at least. Possibly the samples I took might on petrographic slides show it to be limestone impregnated with magnesite, due to its closeness to the contact.

Limestone subjected to high heat and pressure from contact with intruding igneous rocks is marbleized. The limestone in the vicinity of the Brucite Deposit is close to a marble in texture. One of the old camps in this vicinity was known as Marble.

Dr. J. C. Jones, geologist, who inspected the Brucite Deposit with me in June of this year, and who has made a petrographic study of the rock and mineral specimens I took on this examination, states that judging from his limited work so far, the granite is intrusive in the dolomitic limestone, causing its marblization, and the heat, pressure and moisture caused an intense alteration of the dolomite, producing the brucite. In other words, it would be geologically termed a contact metamorphic deposit. This theory would give hope of the brucite extending to depth along the contact.

If this be the method of origin I would explain the absence of lime (calcium oxide) in the brucite by the theory that the heat of the intrusive granite drove off the carbonic acid gas from the dolomitic limestone leaving the oxides. The calcium oxide being a much more soluble base was carried away in solution at the time of or soon after the granitic intrusion.

The hydromagnesite and brucite, judging from narrow cuts, apparently have a sharply defined contact with the granite, while the contact with the limestone appears irregular. This limestone contact is important from a dilution standpoint and should be investigated by exposing this contact in solid formation at several points.

While the granite does not appear to finger out into the brucite, there is a greenish dark fine-grained igneous rock that cuts through both the brucite and limestone in occasional dikes. These dikes are narrow, as a rule, from 1 foot to

8 feet wide. I noted a flat dip on two of these and one followed the bedding planes in the limestone.

I also noticed in the hydromagnesite in the cut on Gloria No. 2 a dike of light feldspathic rock such as I noticed frequently in the granite.

Dr. Jones terms the light colored dikes aplitic dikes and the dark colored dikes lamprophyric dikes. My reference text, Pirsson on Rocks and Rock Minerals, states that "such dikes are commonly found associated with larger intrusive stocks of granite, syenite and diorite, where these have become exposed by dissective erosion. They are in origin subsequent to the main mass which they accompany and are found cutting it and the surrounding rocks, not only in the form of dikes but also in intrusive sheets. These two rocks are termed complementary because taken together they represent the composition of the main masses they accompany."

The above statement confirms the hypothesis that the granite is intrusive in the limestone and classes the dikes as a part of the granitic intrusion and not of separate origin.

In the Lower Deposit about three of these black dikes occur right in the brucite in the upper part of the deposit and would have to be mined with the brucite of that particular section. Due to the distinctive black color this material could be sorted out to waste by the power shovel and by a picking belt. These dikes probably have a flat dip and might play out at shallow depth. Of course if this is so, others might come in.

The Upper Deposit is relatively free from these dikes. One prominent one follows the outcrop of brucite in the gulch, and another occurs near the top of South Hill. A narrow one lies close to the shaft and shows up near the bottom of the shaft.

As a whole these dikes can be considered as an interesting geological feature but of small consideration in the problem of mining the brucite.

The evidence of the weathering of the brucite to hydromagnesite seems conclusive. This is a loss of water content and an absorption of carbonic acid

which would be natural to expect on the desert. The weathering of hydromagnesite to magnesite would be just a continuation of this process and the scattered magnesite on the surface only appears to confirm this hypothesis.

The brucite tends to weather in rounded boulders with a hydromagnesite coating. Some of the magnesite boulders have a recessed curved surface as though once a shell over another material. This evidence seems to confirm the idea of the alteration of brucite to hydromagnesite and thence to magnesite. These geological theories, whether right or wrong, are of great importance in sizing up, first, whether the brucite will continue upon development at depth or whether it will be a shallow deposit, and, second, whether it will continue as brucite or turn into hydromagnesite and magnesite instead of brucite with increasing depth.

Petrographic slides, Dr. Jones states, show minute veinlets of hydromagnesite in what appears to the naked eye to be pure brucite. The same material when treated with acid for analysis fizzes with the escape of carbonic acid to such a surprising extent that one is inclined to magnify the hydromagnesite content in it for on analysis it is nearly pure brucite. At depth even this small carbonic acid content might not be present.

Whether the lime content will increase with depth is a most important question. If the lime has been extracted by surface leaching, it would increase in the brucite with depth. The brucite is too compact and rock like to give much credence to surface leaching. In my opinion if lime was present in any quantity it was leached out at the time of formation of the brucite by subterraneum waters or vapors, and therefore should not increase but little if any in percentage with depth.

ECONOMIC GEOLOGY CONCLUSIONS

If one were to estimate the value of the Brucite Deposit by the brucite actually in sight on the property at the present time it would be based necessarily upon a relatively small tonnage.

Estimates of tonnage in sight now would vary greatly between the best of engineers since no tonnage is blocked out on four sides and an engineer must make certain assumptions as to the continuity of the brucite in breadth and depth. The very cautious engineer will assume but little while the optimistic engineer will assume much.

I have made my estimate of assured tonnage as follows;

On the Lower Deposit I grant a width of 180 feet, a length of 320 feet and a depth of 50 feet. This assumed depth is proven at but one point, but it is at about the lowest point on the deposit. These dimensions give 2,876,000 cu. ft. which divided by 14, for the approximate number of cu. ft. to the ton, gives 200,000 tons.

On the Upper Deposit, I only include in my estimate the brucite between the trench at the shaft in the gulch and the first trench to the south, Trench No. 1 South, just above the Gloria Location, where in both cases the brucite is exposed in the trenches for nearly their full length and with a shaft in the gulch at the lowest point, and an outcropping line of brucite between the two trenches. This gives a width of 140 feet, a length of 280 feet and an assumed depth of 50 feet to correspond with the depth of the shaft, or a total of 1,960,000 cu. ft., or 140,000 tons.

This estimate gives the greater tonnage of assured brucite to the smaller Lower Deposit but this is because of more trenches carried down to the brucite below the hydromagnesite.

If for instance Trench No. 2 North and Trench No. 2 South on the Upper Deposit now in hydromagnesite had been carried down and had shown brucite across their length and to 50 feet in depth, which is a quite reasonable geological assumption, my estimate of tonnage on the Upper Deposit would be based on 350 feet of additional length, or more than doubled. I mention this as Consulting Engineer Mr. Richard L. Smith tells me that on his examination subsequent to mine he had a hole put down in each of these trenches and that they disclosed brucite.

This estimate of 340,000 tons of assured brucite I consider conservative for any failure to recover this tonnage from the areas considered could without doubt be made up from other areas now trenched in hydromagnesite only. This estimate is above 50 feet in depth, as being the deepest development from surface at the present time, but this is only a figurative limit as both shafts are bottomed in brucite.

If an estimate were to be made upon the assumption that brucite underlies all the hydromagnesite and magnesite along the mile or more of their outcrop with the chance of continuing to depth the possible tonnage becomes enormous, running into millions of tons.

The possibility of such a tonnage of such a pure high content magnesium mineral certainly justifies the drilling of this ground by diamond drills if satisfactory terms can be secured upon the property.

THE PURITY OF THE BRUCITE

The purity of the brucite as it can be mined is of primary importance. At present the basis of the use of magnesite is its reduction to magnesium oxide (magnesia) of high purity, with special emphasis upon a low content of calcium oxide (or lime). This is difficult to secure as lime and magnesia ~~oxides~~ are twin sisters in so many minerals and rocks, and it is especially difficult to find magnesia without any lime.

The trade requirements for first-class calcined magnesite for stucco work, refractory work, or metallic magnesium production is generally given as not over 3% CaO. (Consult Ladoo's "Non Metallic Minerals" for excellent data and discussion of the magnesite industry).

This requirement along with other chemical restrictions throws into discard many magnesite deposits and causes excessive sorting and care in mining the present operating properties. The insoluble or silica content, the iron oxide, and the alumina content must also be under 2% to 3% each in high class material. In refractory uses the iron oxide may run up as high as 5% to 8% but the calcium oxide

must remain low. This means that the mined magnesite must be nearly free of calcium oxide, and cleanly separated from contaminating earth, wall rocks or dike material. The inclusion of calcite, dolomite or limestone would be fatal.

The first samples that I took from this deposit within a month after its discovery analized as follows;

No.		Insoluble	Fe_2O_3	Al_2O_3	CaO	MgO
	Lower Deposit Trenches, (50 ft. lengths)					
1.	of Hydromagnesite.....	0.84%	0.37%	1.03%	0.75%	41.89%
2.	of Brucite.....	1.27	0.69	1.17	1.14	62.66
	Upper Deposit Surface, (50 ft. lengths)					
1.	of Brucite.....	1.31	1.16	2.54	3.17	57.46
2.	of Magnesite.....	1.22	2.23	1.85	1.82	42.70

These indicated a very high purity of the magnesium minerals over wide mining widths.

Returning in June of this year as mining engineer for the Nevada State Mining Bureau, I took a sample each from the bottom of the two fifty foot shafts to determine the purity of the brucite at that depth and also a sample across 20 feet in the newly cut trench on Gloria No. 5. The results were as follows;

		Insoluble	Iron and Alumina Oxides	Calcium Oxide	Magnesium Oxide
	Bottom of 50 ft. shaft				
A	Lower Deposit	1.62	3.71	3.17	59.28
B	Upper Deposit	3.34	4.92	4.68	51.60
	Trench on Gloria No. 5	1.02	2.75	4.63	41.66

These shaft samples did not indicate as high a purity as the trench samples nearer the surface. However, these analyses were made with single precipitations of the iron and alumina and the calcium and these are subject to correction (probably downward) upon more detailed method of analysis.

As a whole these samples indicated that the brucite was of high purity, and also the hydromagnesite and magnesite.

SAMPLING

One of the main considerations of this examination was to sample carefully

every exposure of brucite in trenches, cuts and shafts to determine if it was of uniform purity across and along the contact and on top and bottom of the shafts. It would be an ideal condition if this were so, thus making it a big open cut mining proposition without any selective mining or sorting.

However, there was the probability that the brucite near the dolomitic lime side of the contact might carry a prohibitive lime content and also the probability that tongues of unaltered or not completely altered dolomite might exist in the middle of the brucite, thus cutting down very materially the quantity of merchantable brucite.

In taking these samples of brucite I found it necessary to mail the samples. While the massive brucite is comparatively soft, it is exceedingly tough, defying a pick except where shattered by blasting as in the shafts. A few samples were taken also of the soft overlying hydromagnesite.

In all, there were 14 samples taken of the Upper Deposit and 15 of the Lower Deposit. Accompanying this report are large scale maps of the areas sampled showing the relative position of each sample which is amplified by the description given in the results of the sampling and analyses that follows later.

CHEMICAL METHODS OF DETERMINATION

The chemical determinations were made by good chemists under my direct supervision. However, to speed up the work I advised the usual method of lime determinations by its separation from the magnesia by the precipitation of the lime by oxalic acid but finding by checking that the great excess of magnesium in the samples caused these lime determinations to be erratic, the lime was then determined by a more detailed method of first precipitating with sulphuric acid in alcoholic solution as recommended for very careful work by W. F. Hillebrand, chemist for the U. S. Geolical Survey and Bureau of Standards. Also, I found that two precipitations of the small iron and alumina content were also necessary to free this precipitate from magnesium.

I mention these points because the percentage of these impurities is a very

important factor and there is a chance of unfavorable error in determining them if the chemical work is not carried out with great care and extra precautions. This should be borne in mind in comparing results from different chemical laboratories.

CHEMICAL ANALYSES

Sample No.	Description	Insoluble (Silica)	% R_2O_3 Iron and (Alumina)	% CaO (Lime)	% MgO (Magnesia)
	LOWER DEPOSIT				
L1	Trench #2 South West Side 6' cut	1.72	0.14	2.06	59.5
L2	Trench #2 South East Side 3' cut	1.32	0.44	8.25	52.9
L3	50-foot Shaft, Grab of dump	1.72	0.19	1.77	53.8
L4	50-foot Shaft, Bottom 22 feet	1.56	1.01	2.50	58.2
L5	50-foot Shaft, The 18' above L4	2.25	0.17	4.41	57.8
L6	Coarse Ore Pile from Shaft & Cut	1.68	0.76	1.96	52.8
L7	Trench #2 South, Hydromagnesite 50 feet	1.56	0.50	1.57	42.6
L8	Trench #5 North, 50 foot cut next to granite of hydromagnesite	2.14	0.17	1.18	41.7
L9	Trench #4 North West Side 6' cut	1.36	1.00	1.96	53.1
L10	Trench #4 North West Side 3' cut	1.22	0.75	3.71	60.4
L11	Trench #1 South East Side 16' cut	1.50	0.35	1.57	63.6
L12	Trench #1 South Cut West Side of Trench 18' cut	2.04	0.34	1.67	63.2
L13	Trench #1 North West Side 30' cut	2.24	Lost	2.90	Lost
L14	Trench #1 North East Side, next to granite, 3' cut	3.36	0.50	32.45	20.8
	"Limestone" near contact with brucite			12.31	34.2
	"Limestone" near contact with brucite			35.60	20.0

REMARKS:

Samples L-1 to L-13 were taken for ore samples, while Sample L-14 close to the granite was taken to illustrate that sometimes limestone lies between the brucite and the granite.

Sample No.	Description	Insoluble (Silica)	% R_2O_3 Iron and (Alumina)	% CaO (Lime)	% MgO (Magnesia)
	UPPER DEPOSIT				
U1	50 Ft. Shaft, Bottom 22 Ft.	2.62	0.16	4.61	57.1
U2	50 Ft. Shaft, The 20' above U1	2.00	0.50	2.06	61.6
U3	50 Ft. Shaft, Grab of Dump	3.00	0.60	2.94	60.6
U4	Trench #1 North, First 25' East of Shaft	1.94	0.72	1.38	61.8
U5	Trench #1 North, West 30' East of U4	1.46	0.48	0.98	57.8
U6	Trench #1 North, West 32' East of U5	1.10	1.14	2.06	61.6
U7	Brucite Outcrop, Gulch to Trench #1, South 186 Ft.	2.40	0.76	1.86	59.2
U8	Brucite Outcrop from T-#1-South for 75' North	1.68	1.32	0.19	57.0
U9	Trench #1 South East 10' East	0.84	0.98	0.49	63.6
U10	Trench #1 South Outcrop to 25' East	1.52	0.26	1.28	63.5
U11	Trench #1 South Outcrop to 17' West	1.60	0.22	0.88	64.9
U12	Trench #1 South Hydromagnesite above U10 and U11	0.98	0.94	0.59	41.7
	"Limestone" near contact with brucite			29.00	27.2

STUDY OF ANALYSES

Averaging the ore samples taken of brucite on the Lower Deposit, being Samples L-1 to L-6 Inc., and L-10 to L-13 Inc., the average is 1.7% Insoluble, 0.46% Iron and Alumina, 3.0% Calcium Oxide and 60.5% Magnesium Oxide.

If we assume the calcium oxide is present as calcium carbonate, then the calcium carbonate would represent 5.4%, and the total impurities 7.56%, leaving the brucite with the included hydromagnesite as 92.44%. To give this amount the proportion of brucite to hydromagnesite would be as 5 to 1. It is this included hydro-

magnesite that gives the strong carbon dioxide (CO_2) on dissolving in acid.

The hydromagnesite is freer from impurities than the brucite, and it averages 42.0% Magnesium Oxide, which represents 95.6% hydromagnesite. Figuring the calcium oxide as calcium carbonate the impurities figure up 4.63%, which closely approaches a total of 100%.

Averaging all the brucite samples taken at the Upper Deposit of U-1 to U-11 Inc., the average is 1.64% Insoluble, 0.65% Iron and Alumina, 1.52% Calcium Oxide, and 60.8% Magnesium Oxide. Figuring the calcium oxide as calcium carbonate, the impurities total 5.21%, leaving 94.79% as brucite and hydromagnesite in about the same proportions as in the Lower Deposit.

The one sample of hydromagnesite indicated a slightly greater purity even than the similar samples of the Lower Deposit.

In the analyses work, the water of crystallization and the carbon dioxide content were not determined as they are an unnecessary refinement at this time and would unnecessarily increase the time and expense of the examination.

CONCLUSION BASED ON ANALYSES

The Lower Deposit samples of brucite ore did not average as high as the Upper Deposit, but included in the Lower Deposit samples were two samples quite high in calcium, both L-2 and L-10 being samples on the edge of the deposit and representing ore than could probably be left unmined.

As a whole then both the Lower Deposit and Upper Deposit brucite ore bodies are remarkable pure over their entire extent as opened up at the present time. It is truly a remarkable occurrence of magnesium ore. There is a large tonnage practically in sight now, but the deposits should be diamond drilled to ascertain if they are as enormous in tonnage and as high in purity as the surface showings and the geology indicate they are in order to properly estimate the necessary large expenditure of capital to mine, transport and treat it as cheaply as can possibly be done on a large scale. With these cost figures and a study of its metallurgical treatment and the

marketing conditions, a conclusion can be made as to whether the present time is opportune to launch such an enterprise.

(Continued on Page 16)

ECONOMIC CONSIDERATIONS

While the "Brucite Deposit" is on the Nevada desert in mountains sparsely covered with scrub pine, it is also in the Toiyabe National Forest and under Government regulations as to the cutting of timber for fuel or mining purposes.

There is no water developed on this group of claims. Just off of Gloria Extension No. 4 in the gulch at the "Brucite Camp" a prospector by the name of Brown has an excellent well that will furnish sufficient water for camp life use but probably not sufficient for mining and metallurgical work. A similar well could probably be developed on Gloria No. 5 or Gloria Extension No. 4. However, down in Gabbs Valley, 3 to 5 miles west and 600 to 700 feet lower, abundant water can probably be developed by wells at under a 100 foot depth as cattlemen have similar wells in this valley to water their stock.

The necessity for road improvement to the property has already been mentioned as an item of considerable initial cost to secure fairly cheap transportation costs to the railroad. Mr. Springer advocates laying out a new road to Luning to gain less travel in the Gabbs Valley wash and to secure a lower pass over the Gabbs Valley Range. It would not be practical to establish a new 30 mile road unless there was an assured large daily tonnage and sufficient saving to justify it.

The mine is in Nye County, Nevada, and subject to Nye County taxes; the road is almost entirely in Mineral County, which is a poor county and this road is rather an unimportant feeder, therefore, there is not apt to be much county help in keeping it in good repair unless the taxable metallurgical plant was placed at Luning.

It would be necessary to grade a road to the Upper Deposit but the more accessible Lower Deposit could furnish the required tonnage for a long period of time.

The mining of the brucite can be by the simplest and cheapest method of open cut mining with a very limited amount of stripping overburden necessary. Drilling for blasting can be cheaply done by churn drills, block holing by air drills and

loading into cars by small power shovels. The power plant would best be a Deisel engine plant.

There is a good chance that the hydromagnesite in the overburden might also be profitably marketed

Whether the calcining plant should be placed at the mine, or Luning, or on the Pacific Coast, depends greatly on what particular use is to be made of the brucite and where the final product is to be marketed.

THE MARKETING OF PRODUCTS TO BE MADE FROM BRUCITE, AND COMPARISON OF BRUCITE WITH MAGNESITE

At the present time the only commercial ore of magnesium is magnesite and the first step is to calcine it to magnesia, which is magnesium oxide (MgO). The large industrial uses are three in number; First, as stucco in building construction work for exteriors and floors; Second, as refractory furnace linings and bricks, and; Third, for the manufacture of metallic magnesium.

In the form of stucco the American magnesite producers are finding it increasingly difficult to compete with portland cement. In the form of refractory material the American producer must have a high protective tariff in order to compete with importations from Czeko-Slovakia and Greece. In the form of metallic magnesium, the industry is still in its infancy with two quite opposite processes in use. One secures the magnesium by treating magnesium oxide in electric furnaces and the other by treating the magnesium chloride of salt works bittern or waste, by electrolysis.

The sources of magnesite production in the United States are on the Pacific Coast in California and Washington. This magnesite industry rapidly built up during the war, is still suffering from over capacity and foreign competition.

Brucite as a source of magnesia has certain distinct advantages over magnesite of equal impurities and equal cost of production. This outstanding advantage is its 69% content of magnesia (MgO) compared with 47.6% for magnesite,

making it practically an ore one and a half times richer than magnesite in magnesia or metallic magnesium.

A second advantage is that impurities found in the brucite would after calcining be of much less final percentage than in magnesite. Thus 3.0% of calcium oxide (CaO) as carbonate in brucite becomes 4.6% in the calcined brucite, or final magnesia, while a similar amount in magnesite becomes 6.3%. Where purity of product is important, this is a marked advantage.

A third advantage is that brucite calcines to magnesia at a very much lower temperature than magnesite. I carried out many interesting metallurgical tests on this point and the economic use of brucite soon after the discovery of this deposit. The lower fuel consumption is but one of the advantages of this lower calcining temperature.

THE ECONOMIC VALUE OF THIS DEPOSIT

As to the particular value of this deposit of brucite, 30 miles from railroad in Nevada, the condition is this, in my opinion, that under present competitive conditions in stucco and refractory products the high magnesium oxide content of the brucite, its purity, its ease of mining, its low calcining temperature and other favorable points, is probably closely balanced by its cost of transportation to railroad, and the higher costs on the desert for labor, power, fuel and other supplies.

I have a great deal of data covering these points in my note books from previous investigations of this deposit and of magnesite properties and industries but the discussion and investigation of these points is without the confines of this initial mine report. Undoubtedly the financial interests asking for this mine report are well posted upon the competitive phase of production and marketing, or are investigating these points at this time.

CONCLUSIONS

My conclusions on the Brucite Deposit of H. W. Springer are,

First. It is a most exceptional deposit of magnesium ore as brucite in massive form is of rare occurrence and this brucite has a much higher content of magnesium than the usual ore of magnesium which is magnesite.

Second. It is an exceptional deposit in its large surface exposure of magnesium ore of high purity capable of being mined by low cost open cut mining.

Third. It is a deposit that, in my opinion, will respond very favorably to development along its length and at depth.

Fourth. It is a deposit handicapped by distance from railroad, its location on the desert, and its distance by railroad from industrial centers.

Fifth. It being a new ofe of magnesium, its metallurgy must be pioneered.

Sixth. It being an ore of magnesium, it enters into competition with the magnesite industry which is not an industry with a very bright future unless there is a great expansion in the use of metallic magnesium.

RECOMMENDATIONS

If satisfactory terms can be obtained I would recommend drilling this deposit as the present workings have but scratched its possibilities, and meanwhile making an intensive study as to whether it can be successfully exploited at the present time or reserved as a most valuable natural resource for the coming years of industrial progress.

_____ E.M.

Reno, Nevada.
Aug. 26, 1929